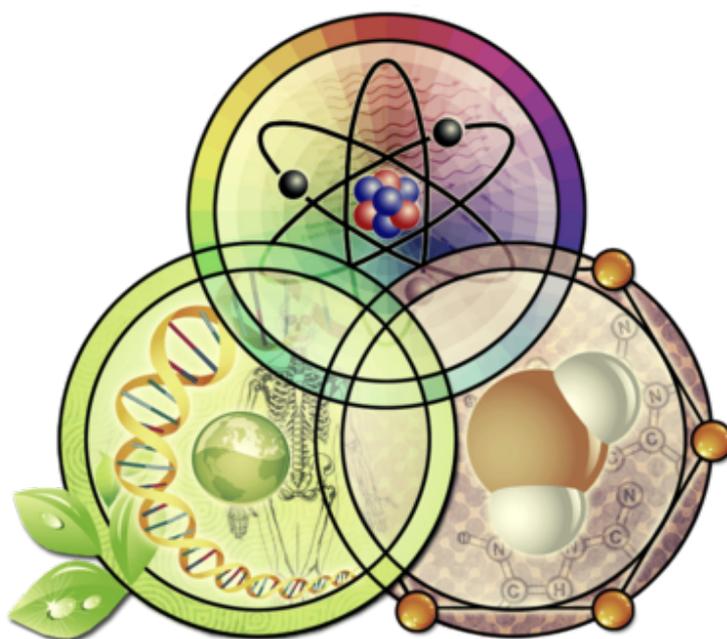

California State University,
Chico



15th Annual
College of Natural Sciences
Poster Session

Full Abstracts

WELCOME

This session was established to highlight research conducted by the College of Natural Sciences faculty and their student researchers. The session embodies the vibrant research environment of the College, and excitingly, several of these posters will also be displayed at CSU Chico's Gateway Science Museum.

AWARDS CEREMONY

CSU Chico faculty will select posters that they deem meritorious in the categories of Student Class Projects, Undergraduate/Faculty Research, and Graduate/Faculty Research. Poster session attendees will also select posters to be awarded the title of "People's Choice" within these categories. Awards will be presented to the winners in the student and faculty research categories during the awards ceremony at 3:00 PM. The awardees will receive a certificate, and their names will be added to a plaque displayed outside the College of Natural Sciences office in Holt Hall.

THANK YOU!

The poster session committee would like to extend their sincerest thanks to the faculty judges for their efforts. The committee would also like to thank all of the poster session attendees. This year's poster session committee members are:

- Carolynn Arpin (CHEM) (co-chair)
- Lauren Housley (NFSC) (co-chair)
- Rosio Huizar (NSC)
- Kate Hansen (NSC)
- Gayle Kipnis (NURS)
- Anna Petrova-Mayor (PHYS)
- Hannah Aird (GEOS)
- Edward A. Roualdes (MATH)
- Benjamin Van Dusen (SCED)
- Robert Dubie (BIOL)

POSTER SESSION SCHEDULE

Set up 9:15 am - 10:00 am
Open to General Public 11:00 am - 3:30 pm
Presenters at Posters 12:30 pm - 2:30 pm
Award Ceremony 3:00 pm - 3:30 pm

POSTER INFORMATION

Faculty

| ID | Author List | Title |
|--|------------------------------|---|
| F1 | Fay Mitchell-Brown | Promoting Cultural Competency through a Service Learning Project |
| <p>Abstract: Background The population of the United States (US) is becoming increasingly diverse and it is predicted that there will be a rapid growth in racial and ethnic minorities by the year 2060(2). Racial and ethnic minorities are a group of people that experience significant health disparities. Limited resources, inadequate access to health care, cultural barriers are among some of the restraints that often result in health disparities and contribute to the burden of diseases. The American Association of Colleges of Nursing (2018) acknowledges that nurses practice in diverse and multicultural settings and thus, must be equipped with the knowledge, skill and ability to provide culturally sensitive care to individuals in these settings. Cultural competency in nursing education is crucial to address the health care needs of diverse populations. To promote in the cultural competency in baccalaureate nursing program, a service learning project was undertaken to provide where students provide health care services in an underserved population in Oaxaca, Mexico. Theoretical Model The Process of Cultural Competence in the Delivery of Healthcare Services is a model that can be used in the health care setting to guide the development of cultural competence(3). The assumptions of this model are that cultural competence is a process where health care providers strive to provide care in the context that accommodates the clients' culture.</p> | | |
| F2 | Ben Van Dusen, Jayson Nissen | Equity in College Physics Student Learning: a Critical Quantitative Intersectionality Investigation |
| <p>Abstract: We investigated the intersectional nature of race/racism and gender/sexism in broad scale inequities in physics student learning using a critical quantitative intersectionality. To provide transparency and create a nuanced picture of learning, we problematized the measurement of equity by using two competing operationalizations of equity: Equity of Individuality and Equality of Learning. These two models led to conflicting conclusions. The analyses used hierarchical linear models to examine students conceptual learning as measured by gains in scores on research-based assessments administered as pretests and posttests. The data came from the Learning About STEM Student Outcomes (LASSO) national database and included data from 13,857 students in 187 first-semester college physics courses. Findings showed differences in student gains across gender and race. Large gender differences existed for White and Hispanic students but not for Asian, Black, and Pacific Islander students. The models predicted larger gains for students in collaborative learning than in lecture-based courses. The Equity of Individuality operationalization indicated that collaborative instruction improved equity because all groups learned more with collaborative learning. The Equality of Learning operationalization indicated that collaborative instruction did not improve equity because differences between groups were unaffected. We discuss the implications of these mixed findings and identify areas for future research using critical quantitative perspectives in education research.</p> | | |

Graduate/Faculty Research

| ID | Author List | Title |
|---|---|--|
| GF1 | Stephanie Aguiar, Kallie Griffin,Carolynn Arpin, David Stachura | Novel Antagonists of Growth Factor Receptor-bound Protein 2 (GRB2) Decrease Proliferation of Chronic Myeloid Leukemia (CML) Cells |
| <p>Abstract: Chronic myeloid leukemia (CML) is a disease that affects the normal growth of myeloid cells in the blood and bone marrow. In humans, 95% of CML cases are caused by a chromosomal translocation that inappropriately links the breakpoint cluster region (BCR) to Abelson murine leukemia viral oncogene-1 (ABL1), forming a mutant oncogene called BCR-ABL1. A protein that physically interacts with BCR-ABL1 is growth receptor bound protein-2 (GRB2), an intracellular adaptor protein involved in cell growth and differentiation. Specifically, BCR-ABL1 binds to a region of GRB2 known as the SRC homology-2 (SH2) domain. To prevent oncogenesis, we created four novel SH2 antagonists (NHD2-15, NHD2-92, NHD2-107, and NHD2-114) and tested their ability to prevent cell proliferation in the human BCR-ABL1+ K562 myelogenous leukemia cell line. The most significant growth reduction was observed 72 hours after the addition of 30uM of NHD2-15. Furthermore, adding drugs combinatorially (60uM NHD2-15, 30uM NHD2-114, and 1uM imatinib) to K562 cells showed over 2-fold growth reduction than with imatinib alone, which is the current frontline therapy for CML. We also chose to study our drugs effects on imatinib-resistant leukemia. Most patients become insensitive to imatinib treatment, so evaluating if these drugs treat imatinib-resistant leukemia could lead to successful clinical treatments. Our research provides more understanding for the mechanism of leukemia, which is still unknown, and could provide an alternative treatment for patients who develop imatinib resistance.</p> | | |
| GF2 | Payton Laurie, David Stachura | ccl44: a chemokine critical for normal hematopoiesis |
| <p>Abstract: Hematopoiesis is a complex and highly regulated system where hematopoietic stem and progenitor cells (HSPCs) differentiate into the numerous types of cells that make up mature blood. Understanding the genetic and molecular pathways involved in HSPC biology is an important step to treating many diseases associated with blood formation and differentiation. Due to the conservation of hematopoiesis and many of its genes in vertebrates we turn to zebrafish (<i>Danio rerio</i>) as a model organism. Three stromal cell lines from known sites of hematopoiesis were generated and shown to expand and differentiate hematopoietic precursors. With the use of RNA sequencing we compared transcript expression of these three stromal cell lines and generated a list of 447 genes that are likely important regulatory factors in the hematopoietic system. A highly expressed transcript from these cells was the chemokine (C-C motif) ligand 44 named ccl44. In order to test its effect on hematopoiesis, we performed knockdown experiments using morpholinos (MOs). Transgenic zebrafish lines with fluorescently labelled myeloid, erythroid, and lymphoid cells were injected with ccl44 MO and a decrease in those cell lineages was observed with flow cytometry, fluorescence microscopy, and quantitative PCR. Co-injection of MO and ccl44 mRNA rescued these deficiencies, returning cell lineage numbers and hematopoietic gene expression to control levels.</p> | | |
| GF3 | Drew Gilberti, Christopher T. Ivey | Natural history of <i>Disholcaspis eldoradensis</i> , a galling wasp of Valley Oak (<i>Quercus lobata</i>): distribution, nectar, and interactions with ants |
| <p>Abstract: Herbivores utilize a number of defensive strategies to avoid predation from attackers. The cynipid wasp <i>Disholcaspis eldoradensis</i> induces galls on valley oak (<i>Quercus lobata</i>) trees. The galls are distinctive for their secretion of nectar, which attracts ants, and the ants in turn may reduce parasitism of the gall-inducing larvae. The parasitoid species that attack the gall inducer have different physical characteristics that may influence what galls they can attack. A few non-mutually exclusive hypotheses have been put forward to explain the composition of parasitoid communities: (a) nectar interactions hypotheses, which states different levels of a food web will either directly or indirectly influence populations depending on nectar availability; (b) gall size hypothesis, which suggests gall size influences parasitoid communities due to variable ovipositors lengths among species; and (c) gall aggregation hypothesis which suggests clustering may make individuals more visible to predators but allows for a better utilization of nectar. I used a factorial experiment in which ant exclusion is crossed with a nectar treatment (removal, addition, or control), measured gall size, and recorded cluster size. Five hundred galls have been collected that will be reared out over several months. Any emergences will be identified for analysis.</p> | | |

GF4 Constantin Raether, Christopher T. Ivey, Jessica W. Wright, Victoria Sork Defense against herbivory by galling Cynipidae wasps in valley oak (*Quercus lobata*): tests of two hypotheses in a large common garden experiment

Abstract: Within plant populations, herbivory varies among individuals. How plant traits, including secondary biochemistry, plant density dependence, leaf phenology, and plant vigor, affect herbivore host selection remains a question for both ecologists and agriculturalists. I am testing two hypotheses to explain variation in herbivory: The Plant Vigor Hypothesis (PVH) and the Phenological Synchrony Hypothesis (PSH). I am examining the variation in abundance and diversity of galling insects in a large (6,500 tree) replicated valley oak (*Quercus lobata*) common garden experiment and testing the effects of plant vigor and leaf phenology. In addition, I am exploring genotypic variation in valley oak susceptibility to Cynipidae wasp. Preliminary data indicates a negative relationship between plant vigor and one Cynipidae wasps species, *Disholcaspis eldoradensis*, and phenological synchrony tests are ongoing. My study is among the first to experimentally test the influence of plant vigor and leaf phenology on Cynipidae wasp herbivory within this iconic California oak species.

GF5 Stephanie Parker, Don G. Miller III Spatial distribution of exuviae and rudimentary social behavior of the gall-inducing aphid, *Tamalia coweni*

Abstract: There are multiple traits we use to define sociality in insects. Often, we associate colonial insects such as bees, ants and termites, with eusociality. When we expand sociality to include defensive and hygienic behavior, we can analyze the varying levels of sociality in insects such as galling aphids. After inducing a gall on a leaf, the founding female aphid will raise multiple generations of offspring that live and feed inside the gall. Some species of galling aphids remove waste from the gall, a cleaning behavior. Analyzing cleaning behavior alone suggests that some aphids we consider nonsocial exhibit many of the same behaviors as social galling aphids. *Tamalia coweni* induces galls on manzanita species. Initial field observations indicate that *T. coweni* will methodically arrange their cast exoskeletons in clusters inside the corners of their gall on one species of manzanita, *Arctostaphylos viscida*, but do not engage in this behavior on another species, *A. manzanita*. This study seeks to quantify the spatial distribution of the exuviae, as well as the differences of gall size and shape between the two species of manzanita that may be driving this difference in behavior. This rudimentary social behavior would indicate an independent evolutionary origin of more complex sociality in *T. coweni*.

GF6 Andrew Overton, Donald G. Miller III Quantifying Moth Community Response to Fire in a California Chaparral System

Abstract: Anthropogenic change has led to an increase in global wildfire intensity in many areas of the world, and global climate models predict this trend to continue. Plant succession after fire is well documented, but there is a need to further study how animals respond to these changes in plant communities. In terrestrial habitats, lepidopterans (i.e. moths and butterflies) are studied as bioindicators of ecosystem health based on four criteria: (i) their well-defined taxonomy, (ii) the relative ease of surveying them, (iii) their wide distribution and host-plant specificity, and (iv) the concordance of lepidopteran diversity with that of other taxonomic groups. Furthermore, the order Lepidoptera contains more plant-feeding species than any other taxa in North America. I am testing the hypothesis that changes in moth communities parallel those in plant communities following fire. To test this, I am utilizing ten 15W UV night collecting traps to collect moths on a 24-hectare (59 acre) area of chaparral affected by a 2017 wildfire and two reference sites on the Tuscan Formation at the Big Chico Creek Ecological Preserve. Preliminary data suggests a difference in species abundance and species richness between the sites.

GF7 Ryan N. Nielsen, Isis G. Perez, David M. Keller miR-375 and ICER: A cAMP Mediated Double Negative Feedback Loop in Pancreatic Beta Cells

Abstract: Type 2 diabetes (T2D) is an increasing condition in our society and treatments are being heavily pursued, targeting potential environmental and genetic pressures. The area of study for this project is a microRNA called miR-375 which is overexpressed in people with T2D and has been linked to decreased insulin secretion and beta cell proliferation. Investigation into the transcription factor inducible cAMP early repressor (ICER) as an intermediate regulator of miR-375 was proposed because both were found to be regulated by cAMP pathway. Additionally, because of a sequence alignment showing possible binding of miR-375 to the ICER transcript we hypothesize that the two are in a negative feedback loop and under ideal conditions can regulate each other's expression. To study ICER suppression of miR-375, its expression was measured in INS-1 cells when exposed to the cAMP stimulating drug forskolin or infected with an ICER adenovirus (ad-ICER). Additionally, ICERs expression was measured in human embryonic kidney cells (HEK-293T) when co-transfected with a plasmid containing ICER and an α -ICER small interfering RNA (siRNA) using quantitative real time PCR. ICERs expression was increased in INS-1 cells treated with forskolin or with ad-ICER while ICERs expression was knocked down in HEK-293T cells when co-transfected with α -ICER siRNA. In the future we will be quantitatively measuring miR-375 expression via qPCR after ICER overexpression and conduct a luciferase reporter assay to test ICERs binding affinity to the miR-375 promoter.

Jamison Sydnor, Kelsey The Bacterial Community Associated with the Model
GF8 Dani, Cawa Tran Sea Anemone *Exaiptasia pallida*

Abstract: The sea anemone *Exaiptasia pallida* (*Aiptasia*) is a model organism for studying the symbiotic relationship between corals and photosynthetic dinoflagellates belonging to the family Symbiodiniaceae. With climate change driving ocean temperatures to rapidly increase, thermal stress is implicated as the primary culprit disrupting the cnidarian-dinoflagellate symbiosis. As dinoflagellates vacate their host in response to thermal stress, the symbiosis collapses, causing bleaching to occur. In the worst cases, large-scale bleaching events wipe out the framework for entire ecosystems. To address this increasingly dire issue, researchers have adopted a new approach to understanding these processes by shifting focus to the bacteria associated with *Aiptasia*. We hypothesized that the bacterial community associated with *Aiptasia* changes in response to thermal stress. Symbiotic and aposymbiotic (lacking algae) anemones were subjected to both control (27°C) and thermal-stress (34°C) temperatures to emulate their natural environment and bleaching threshold respectively. 16S rDNA gene sequencing was then performed to determine community composition and trends in bacterial abundance with respect to symbiotic state and bleaching progression. Distinct bacterial taxa are closely linked to symbiotic state, as well as either the animal itself or its seawater environment. Specifically, predominant genera (*Alteromonas* and *Pelobacter*) show notable changes in heat-stressed symbiotic *Aiptasia*.

Stephanye Frias, David M. Investigating the Effects of miR-375 on Insulin
GF9 Keller Secretion and Pancreatic Beta Cell Proliferation

Abstract: Over 30 million Americans have been diagnosed with diabetes, with 1.5 million Americans being diagnosed every year. Roughly 90%-95% of these diagnoses are Type 2 diabetes (T2D). Treatments are being heavily pursued, targeting potential T2D environmental and genetic pressures, such as genes, cellular pathways, and diet. An area of study has been that of microRNA-375 (miR-375), a microRNA that is overexpressed in people with T2D and has been linked to decreased insulin secretion and beta cell proliferation. To study the effect miR-375 has on insulin secretion, an insulin enzyme-linked immunosorbent assay (ELISA) was performed on INS-1 cells with a hsa-miR-375 mimic in different glucose concentrations to see if insulin secretion rates would change if miR-375 was overexpressed. Results showed that when a miR-375 mimic was present, insulin secretion rates were 10% greater in 0 mM glucose and 100% greater in 20 mM glucose than with a control. An insulin ELISA was performed on human islets with a hsa-mir-375 inhibitor to see if insulin secretion rates would vary in different concentrations of glucose; results showed that when the inhibitor was present we saw a 10% increase in 0 mM glucose, 70% increase in 1.5 mM glucose and a 20% increase in 12 mM glucose. To study the effect miR-375 has on beta cell proliferation, MTS assays were performed on MIN-6 cells with either a miR-375 inhibitor or mimic.

Harpreet Batther, Jochen A Hydrocarbon Seep Model of Large Bedded Barite
GF10 Nuester, Russell S. Shapiro Deposits in the Devonian Slaven Chert of Central-North
Nevada

Abstract: Large, sedimentary barite deposits comprise the major source for this mineral at a global scale, yet the genesis of the beds is still uncertain. Barite (BaSO_4) is an economic commodity due to its function as a weighting agent in drilling fluid. Isotopic compositions recorded in barite provide information on dynamic oceanic conditions over time. These abnormal deposits can also serve as analogues for redox reactions occurring on other planets. My study is focused on barite and limestone deposits located at the Clipper, Northumberland, Greystone, Dana, Mountain Springs, and Shasta open pit mines of the Roberts Mountain Allochthon in Nevada. Preliminary data support a model where barite is remobilized in organic-rich sediments, transported by methane seeps, and precipitated at or near the seafloor. Evidence of methane seepage is based on limestone with depleted $\delta^{13}\text{C}$ values (-27.31 to -31.65‰; n=13) and fossils of *Dzieduszyckiia* brachiopod known to have inhabited seeps. Sulfur isotope analysis shows $\delta^{34}\text{S}$ values of barite (n=34) elevated up to 20‰ above contemporaneous seawater (23‰). Together, these data indicate that the sulfate pool was influenced by microbial sulfate reduction associated with anaerobic oxidation of methane in a subsurface anoxic environment. Ongoing research is aimed at linking geographical and stratigraphic occurrences of barite and limestone with specific petrofabrics and isotopic trends. The goal is to detail the pathways by which geochemical cycles influenced barite formation and drove localized chemosynthetic ecosystems across the continental slope.

Alexis R Lopez, Andre
GF11 Bourret, Hannah M Aird

Locating Copper in the Moonlight (IOCG) Deposit,
Taylorsville District of the Plumas County Copper Belt,
California

Abstract: The Moonlight deposit of the Plumas County Copper Belt is an iron oxide-copper-gold (IOCG) deposit associated with the Lights Creek Stock. Few have studied the Lights Creek Stock and, of those projects, the Moonlight Deposit was largely ignored after being characterized as an IOCG deposit. Five drill logs were chosen to describe the Moonlight deposit, based on length of the core, grade of copper (>0.25 wt. %), and quantity of the remaining core. The drill cores were logged to compile a detailed lithologic description to fully characterize the alteration (minerals that have been changed by the introduction of fluids) and mineralization (minerals of economic value) assemblages. Assay data shows lower copper concentrations (<0.25 wt.%) from 0-40ft. and then an increase to (>0.25 wt.%) as depth increases, with intermittent zones of (<0.25 wt.%) at 60ft-80ft deep for four of the five holes. Detailed logging shows variation in mineralogy with depth: pyrite (1-5%) with subordinate chalcopyrite (1-3%) below 44ft., associated with tourmaline and specularite (specular hematite), and pyrite and chalcopyrite are found within quartz veins at 80ft. The mineralization of the deposit was initially dominated by high temperature fluids associated with magmatic fluids and non-magmatic fluids (hypogene enrichment) and was later overprinted by alteration that was facilitated by meteoric fluids (supergene enrichment). Characterization of the alteration and mineralization of the Moonlight deposit will help contribute to the model of formation for IOCG deposits.

Hannah Weinberger,
GF12 Kristen Kaczynski

Post-fire Plant Community Trajectory and Fuelbreak
Restoration

Abstract: As wildfires increase in extent and intensity, larger amounts of suppression tactics are utilized, including creation of fuelbreaks. Research on fuelbreak restoration is limited, so surveying can help inform best practices. We studied the 32-fire, located near Chico, and comprised of grasslands, Black Oak, Manzanita & Wedgeleaf vegetation communities. To assess post-fire recovery, we established plots in four vegetation types, stratified randomly based on three levels: burned, unburned, and disturbed fuelbreak. Sampling occurred 6-months post-fire. Sorensen Index results examining species presence/absence indicate burned Wedgeleaf plots were 44.3% similar to unburned Wedgeleaf, and burned Manzanita plots were 31.9% similar to unburned Manzanita. In the fuelbreak, these vegetation types did not have primary species of their respective unburned or burned vegetation type. Bray-Curtis Index results comparing similarities of species cover indicate Wedgeleaf fuelbreak plots were only 8.2% similar to unburned Wedgeleaf. Manzanita fuelbreak plots were only 5.3% similar to unburned Manzanita. This may indicate fuelbreak sites are on a trajectory away from original vegetation type. Regeneration of Manzanita and Wedgeleaf species on site occurs post-fire from the seedbank, so future recruitment in fuelbreaks is less likely. Additional research is necessary to better inform fuelbreak restoration practices. Research assessing experimental plantings of fire-adapted shrubs in fuelbreaks would be beneficial, due to these species being unable to regenerate in areas that remain unburned.

Katherine Jensen, Ed
GF13 Slattery, Lauren Housley

The Effects of Sulforaphane on Invasion Capacity of
Triple Negative Breast Cancer Cells Exposed to
Tumor-Associated Macrophages

Abstract: Triple negative breast cancer (TNBC) is characterized by high proliferation rates and increased likelihood of invasion and metastasis. Tumor cells and cells located in the tumor microenvironment (TME), such as tumor-associated macrophages (TAMs), interact through signals (e.g., cytokines) to promote cancer progression. Sulforaphane (SFN) is an isothiocyanate derived from cruciferous vegetables that has been shown to reduce tumor growth in animal models and decrease invasion markers in TNBC cells grown in isolation. However, TAMs in the TME promote tumor cell invasion, and it is unknown if SFN impacts TNBC cell invasion in multicellular environments. To determine SFNs potential in cancer treatment, it is critical to investigate SFNs effect on invasion capacity of TNBC cells grown under TAMs influence, not just grown in isolation. The objective of this study was to determine if SFN can reduce invasion of TNBC cells grown under the influence of TAMs. THP-1 monocytes (to be differentiated into TAMs) and MDA-MB-231 breast cancer cells were treated with SFN (15 μ M) or vehicle control (DMSO). To investigate invasion capacity, treated TAMs and TNBC cells were co-cultured for 48 hours in transwell plates and allowed to move through a layer of Matrigel, which represents the tumor basement membrane. T-tests were used to determine statistical differences between number of cells that moved through the Matrigel. This work will determine SFNs ability to affect TNBC cell invasion when TAMs are present, leading to future studies that investigate how to use SFN in the treatment of TNBC.

Caitlyn Trinca, Keiko Goto,
GF14 Seth Klobodu

The Association Between Traditional Food And Herb
Consumption And Breastfeeding Self-efficacy Among
Postpartum Women In Fiji

Abstract: There is limited information about perceptions and behaviors related to breastfeeding, especially traditional herb use, among Fijian women. Fijian Health initiatives currently recommend traditional food among lactating native and Indo Fijians. Therefore, it would be valuable to find a link between traditional food and herb use during the lactation cycle among breastfeeding Fijian women. The current quantitative pilot study examined factors associated with perceptions and behaviors related to breastfeeding among Fijian women. Twenty-Four Fijian women were interviewed to learn about their breastfeeding experience. Questions included breastfeeding practices, use of traditional herbs for breast milk supply, food consumption, breastfeeding efficacy and demographic characteristics such as age, education and ethnicity. Data was analyzed using descriptive statistics, as well as Chi-square tests. The average duration of breastfeeding was one year postpartum. All women used traditional herbs to enhance breast milk supply. More than twenty herbs for milk supply were identified. The most common herbs included lemongrass and seaweed. In addition to traditional herbs, some traditional food items such as taro leaves and ruro leaves boiled in water were reported for breast milk supply.

Undergraduate/Faculty Research

| ID | Author List | Title |
|--|--|---|
| UF1 | Kristen Rueb, Kallie Griffin, David L Stachura | Using CRISPR/Cas9 Technology to Ablate the Critical Gene <i>ccl44</i> During Embryonic Hematopoiesis |
| <p>Abstract: Hematopoiesis (blood formation) is the process by which hematopoietic stem and progenitor cells (HSPCs) differentiate into the many different cells that constitute mature blood. The zebrafish (<i>Danio rerio</i>) is an ideal model organism to use for the study of hematopoiesis because their blood development is similar to humans and they have high fecundity which allows us to look at a larger sample pool in a shorter time frame. In addition, the embryos develop outside the body in a transparent chorion making manipulation and observation easier. Our laboratory has discovered that the chemokine (C-C motif) ligand 44, <i>ccl44</i>, plays an integral role in blood development. When knockdowns were performed using morpholinos, a decrease in myeloid, erythroid, and lymphoid cells was observed. To confirm these findings we will use the clustered regularly interspaced short palindromic repeats and CRISPR-associated protein 9 (CRISPR/Cas9) system, which was adapted from a genome editing system in bacteria. CRISPR/Cas9 is an injectable enzyme that cuts double stranded DNA allowing us to remove targeted sections of the genome (in this case <i>ccl44</i>), causing a permanent mutation in the cells it edits. The model will have fluorescently labeled myeloid and erythroid cells, allowing us to observe whether proper blood development occurred and the phenotypic effects on embryonic development. Elucidating the role of <i>ccl44</i> in hematopoiesis will inform us about the evolution of the vertebrate hematopoietic system and could have clinical importance for treatment of human diseases like anemias and leukemias.</p> | | |
| UF2 | Brooke Hoffe, Kelli Thorup, Cawa Tran | Establishment of symbiosis in the sea anemone <i>Exaiptasia pallida</i> : Analyzing host specificity of dinoflagellate uptake under heat stress |
| <p>Abstract: The vast ecosystems of coral reefs depend on the symbiotic relationship between cnidarians (such as corals, sea anemones, and jellyfish) and dinoflagellates (algal symbionts). Due to changing environmental conditions, such as rising ocean temperatures, the symbiotic relationship can break down, leading to expulsion of algae. As a result of this breakdown in corals, the host tissue dies, leaving behind the calcium carbonate skeleton, a process referred to as coral bleaching. In this study, we utilized a sea-anemone model, <i>Exaiptasia pallida</i> (<i>Aiptasia</i>), to investigate algal colonization of cnidarian tissue. The goal of this study was to better understand the dynamics of algal uptake and proliferation while the host is experiencing heat stress. We hypothesized that heat stress will result in a decrease of initial uptake of algae, coupled with an increased selectivity, resulting in a slower proliferation of algae over time. Our results have shown that heat-stressed anemones take up algae and maintain them through 8 days; however, the symbiosis is not successfully maintained past this point, as the algae do not proliferate within host tissues. After 21 days, heat-stressed anemones do not contain any algal symbionts. Compatibility between the host and algae is even more critical under heat-stress than normal conditions. By investigating the cellular dynamics of symbiosis establishment under heat stress in a cnidarian model, this study enhances our understanding of how corals may potentially re-establish symbiosis after a bleaching event.</p> | | |
| UF3 | Illiana Cajias, Sarah Maciel, Skylar Tomasetti, David Stachura | Isolation and characterization of hematopoietic stem and progenitor cells |
| <p>Abstract: Hematopoiesis is the process by which all vertebrates generate blood. The process of blood formation starts with hematopoietic stem and progenitor cells (HSPCs), which receive signals to differentiate into all the mature types of blood cells that an organism needs to survive. While much is known about how HSPCs perform this task, not all of these signals are known. The main goal of our project was to characterize these HSPCs in order to identify the signals that they make and receive. <i>Danio rerio</i> (zebrafish) are an excellent vertebrate system to study blood development because of their fecundity, optically transparent embryos, and ability to be genetically altered. Most importantly, zebrafish are utilized to study hematopoietic diseases because their blood development is nearly identical to humans. Considering most blood diseases develop in HSPCs, we created assays to label and isolate these cells from zebrafish. These studies describe our isolation using fluorescence-activated cell sorting (FACS) of zebrafish blood followed by detection of lineage-specific genes. Now that we have identified these HSPCs, we will perform RNA sequencing to determine the genes they are expressing, as well as perform a mutagenesis assay to detect what perturbation in specific genes will cause during blood development. Understanding the molecular pathways that instruct HSPC formation and their biology is critical for treating and curing hematopoietic diseases like anemia and leukemia, and this project is the first of its kind to identify new genes potentially involved in this process.</p> | | |

Illiana Cajias, Sarah
 Maciel, Rebecca Belmonte, Effects of Different Wavelengths of Light on Zebrafish
 UF4 Samrat Thapa, David L Fecundity
 Stachura

Abstract: Danio rerio (zebrafish) are an excellent model to study because of their fecundity, external embryo development, and transparency during early development. This allows scientists to easily perform large-scale genetic and drug screens and then observe the effects on a living, developing organism, which is not possible with mammals. Because large numbers of embryos are required to perform these experiments, we investigated ways to efficiently increase zebrafish embryo production while not being overly invasive or using chemicals. Therefore, we investigated how different wavelengths of visible light would affect zebrafish embryo production. To perform these experiments, we mated wild type fish while exposing them to different wavelengths of light. Fish were exposed to 12hrs of no light, followed by 5hrs with different colored light treatments. Once this light cycle was over, we collected and enumerated embryo production. Results indicated that zebrafish exposed to varying wavelengths of light have no effect on embryo production. Embryo generation is not significantly altered by exposure to different wavelengths of light. With further studies and research, scientists can find other methods to increase embryo production without having to use chemicals or change their light/dark schedule. In turn, this will allow for further studies of the circadian rhythm of vertebrates, elucidate the effect of light exposure on molecular processes, and effect embryo production, which will make zebrafish an even better model organism for studying a multitude of biological processes.

UF5 Cora Piper, Cawa Tran Asexual reproduction of the sea anemone Aiptasia
 under artificial moonlight

Abstract: Asexual reproduction gives sea anemones and corals an evolutionary advantage, allowing them to reproduce in the absence of a sexual partner. Although sea anemones have been observed to increase their rate of asexual reproduction following a full moon, how reproduction may change under laboratory conditions has yet to be explored. We hypothesized that the sea anemone *Exaiptasia pallida* (Aiptasia), a model system for coral symbiosis studies, will effectively increase its rate of asexual reproduction and juvenile development in response to blue light imitating a full moon. To test this hypothesis, we observed the effects of different light conditions and the presence of algal symbionts on the rate of anemone asexual reproduction. In this study, we found that the rate of asexual reproduction of symbiotic anemones increased under blue light, but did not change under white light and no light. The goal of this experiment was to explore and develop a better understanding of asexual reproduction and development of sea anemones and corals. This study advances knowledge about the effects of moonlight on coral reproduction in reefs. It provides researchers studying Aiptasia the knowledge that varying light conditions from the environment can influence asexual reproduction, thereby developing a more efficient method of propagating this important model system for laboratory studies.

UF6 John Vang, Cawa Tran Phototropism in Animals: Symbiotic Sea Anemones
 with Photosynthetic Algae Bend Towards Light

Abstract: A way of sustaining a healthy coral population is by studying the organisms living within the marine ecosystem. The health of coral reefs depends on the relationship between corals and algal symbionts. *Exaiptasia Pallida* (Aiptasia) is a symbiotic sea anemone that is used as a model system for coral research. Sea anemones respond to different variations of light that affect their behavioral patterns, such as the way they reproduce and obtain energy. The algal symbionts use light to photosynthesize and sea anemones hosting these algal symbionts can potentially orient their bodies toward a light source in a process called phototropism. We hypothesized that symbiotic Aiptasia (with algae) will exhibit a greater degree of phototropism when exposed to a light source than aposymbiotic Aiptasia (without algae). To test this hypothesis, the sea anemones will be exposed to a light source from the top as the control and from the side to measure the degree of bending from their stalk to oral disk. The results showed that symbiotic Aiptasia express more phototropism than aposymbiotic Aiptasia. By investigating light responses in this sea-anemone model, we gain insight into mechanisms by which corals detect and respond to light, and the role of light in maintaining healthy reefs.

UF7 Victoria Coia, Kristen Gorman Identification of Novel Candidate Genes for Idiopathic Scoliosis

Abstract: Idiopathic scoliosis (IS) is a three-dimensional spinal deformity with no known cause. The disease affects up to 10% of the pediatric population, depending on curve severity. Although a genetic basis is accepted, human patient studies have failed to identify causative genes suggesting a heterogeneous, polygenic, multifactorial disorder. To study the causes of IS, we use an inbred lineage of medaka fish that has spontaneous heritable spinal curvatures that are similar to IS. Inheritance of curvature in medaka is recessive. We therefore hypothesize that genomic variants causing curvature will be homozygous for the curved parental allele among curved fish and heterozygous among normal fish. To identify candidate genes, the genomes of pooled curved and normal fish were sequenced and we compared variants. Bioinformatic analyses identified 6 genomic regions that are enriched for homozygosity of curved alleles. We interrogated each region using a combination of bioinformatic approaches. The goal of my research was to generate a list of candidate genes defined by variants whose genotypes match our hypothesis. Using EMSEMBL, we identified 1016 total genes. Each of these was examined in our sequencing data to see which had the desired haplotypes. We identified 338 candidate genes matching our hypothesis. To prioritize these genes for functional analysis we used DAVID and REVIGO. Results suggest enriched ontologies that could be related to an IS etiology. Future steps are to examine targeted genes for differential expression among curved and normal fish.

UF8 Tanya De La Cruz, Kelly Ewing, Steven Janssen, Kristen F. Gorman Characterization of CRISPR mutants in the scoliosis fish model

Abstract: Idiopathic scoliosis (IS) is a prevalent pediatric deformity with no known cause, defined by three-dimensional spinal curvatures. Although a genetic basis is accepted, genes that cause IS are unknown and the biological basis is a mystery. We use a medaka fish lineage having spontaneous heritable spinal curvatures that are similar to IS, as a model to find the causes. Knowing the cause of curvature in medaka will suggest new hypotheses for human studies. Our previous genomic and molecular studies suggest that the cMed gene family causes curvature through loss of function mutations. To prove this, CRISPR was employed to induce mutations that disrupt gene function for cMed2, cMed2b, and cMed3, three genes identified in our genomic analyses. For all mutations, we observed curved fish similar to the IS model, and noncurved fish. As the curved phenotype was variable in magnitude, for some fish we were uncertain whether they were slightly curved or normal. These fish were categorized as ambiguous. Genotypes for the ambiguous fish will be important for understanding the penetrance of mutations causing scoliosis. We hypothesize that the fish with curvature are homozygous for CRISPR mutations, while the normal fish are heterozygous. To test this, we extracted genomic DNA from multiple fish representing each mutation. For each mutation, we sampled phenotypically curved, normal, and ambiguous fish. We then amplified the region around each mutation. The genetic amplicons will be sequenced and analyzed manually.

UF9 Cameron Divoky, Kris Blee Localization of Fluorescently Tagged Proteins Phos32 & Phos34 in Arabidopsis thaliana

Abstract: Plants and animals rely on complex systems of regulatory pathways to cope with the various stressors faced throughout their life cycle. How an organism responds to physical damage, draught, viral infections or fungal pathogens determines the overall fitness of that organism. One family of proteins associated with stress responses in bacteria, Archea, fungi, and plants contain the Universal Stress Protein-A (USPA) domain. While the USPA domains function is known in some organisms, it remains unknown in plants. The *A. thaliana* genome contains 44 proteins with regions similar to this USPA domain and previous research has shown that these regions are normally found on the N-terminal end of protein kinases. Two of these 44 proteins, Phos32 and Phos34, have been shown to be phosphorylated when in the presence of *P. infestans* zoospores or xylanase. While the function of these two proteins remains unclear in *A. thaliana*, similar proteins found in fruit were shown to aid in resistance against draught. With little known about the Phos32 and Phos34 proteins of *A. thaliana*, the goal of this experiment was to determine both where in the root tip the proteins target and what subcellular components the proteins target. It is hypothesized that both of these proteins will be expressed throughout the root tip with exception to the very tip of the root cap and that the Phos32 protein will be targeted to the chloroplast, cytosol, nucleus, and membrane while Phos34 will only target the chloroplast of the cell.

UF10 Katherine Tucker, Russell Miocene Fossils of Blowout Mt. in Sheldon National
S. Shapiro Wildlife Refuge, Nevada

Abstract: The Miocene was the time when the climate shifted environments away from woodlands and toward the grassland landscapes seen today. During this epoch, northern Nevada was volcanically active and several calderas formed due to the migration of the Yellowstone hotspot. While the largest Miocene fossil sites in Nevada are well documented, the fragmentary nature of the deposits means that there are many other sites not well documented. This research project focuses on a new location in Sheldon National Wildlife Refuge consisting of volcanoclastic deposits and lake sediments capped by basalt. Surface fossils were collected along with geological mapping and stratigraphic columns. The fossils were identified to the highest taxonomic level through comparisons in the literature and Sierra Colleges collection. The fossils varied in condition from fragmented to whole and many of them showed signs that they had been chewed on before they were buried. There was a bias of preservation toward large, dense, unarticulated bones and the ends of bones (epiphyses). This is due to the dynamic environment of preservation. The orders present at the site include the Perissodactyla, Artiodactyla, Carnivora, Rodentia, Lagomorpha, and Proboscidea. The most common families found at the site are Equidae, Rhinocerotidae, Camelidae, Merycoidodontoidae, Palaeomerycidae, and Chalicotheriidae. Two taxa not previously known at this site belong to the Gomphotheriidae and Castoridae. As a whole, the deposits represent the border of woodland and grassland ecosystems within a dynamic volcanic landscape.

UF11 John Teixeira, Sophia Over expression of AT2G34060 peroxidase in
Sussman, Kris Blee Arabidopsis Thaliana

Abstract: Arabidopsis thaliana contains 73 class III secretory peroxidases. Not much is known about how these peroxidases affect plant development. Using Bioinformatics we were able to determine that the AT2G34060 peroxidase protein is expressed mostly in the root tips of the plant. We hypothesized that overexpression of the peroxidase will result in a smaller root mass. To test this we took the seeds of a transgenic plant that expressed the peroxidase two fold, and plated them on a dish with agar and kanamycin. We waited for selection to occur and then examined the root tips of the transgenic plants, measuring the number of cells in a square area to determine its mass.

UF12 Leann Skallerud, Don Miller Dendrochronology of Arctostaphylos manzanita and
Arctostaphylos viscida

Abstract: This project is a study of the annual growth rings of Arctostaphylos manzanita and Arctostaphylos viscida, two native species of manzanita found in Big Chico Creek Ecological Reserve. This study focuses on an area of BCCER that was affected by a wild fire about 20 years ago. Manzanita trees require fire in order to germinate, so this study incorporates fire ecology and dendrochronology. Only the cohort of trees that germinated after the fire are of a known age, whereas previous generations are of unknown age. In order to estimate the ages of the past generations, cross sections of deceased trees from all cohorts need to be compared. The cross sections of the past generations should show signs of the fire in their annual rings from about 20 years ago, which will be compared with the trees of known age. If the older generation's annual rings show evidence of fire coinciding with the age of the youngest generation, their ages can be accurately estimated. The samples collected are cross sections of the base of the trees which are referred to as "cookies," due to their disk-like shape. This is an ongoing project that has no expected end date.

UF13 Juan C Caravez Barajas, Compound A, The Elusive Degradate
David Ball

Abstract: Chlorantraniliprole (CAP), an insecticide pertaining to the anthranilic diamide class, has been of great academic interest to the Tjeerdema group at UC Davis for potential use in California rice fields. In order to study the environmental fate of CAP, degradation products of this insecticide must be synthesized for use as standards in HPLC analysis. Compound A, is one of the degradates of CAP. A synthetic scheme to obtain Compound A is proposed. The initial step of this reaction scheme involves the amination of a 2-halopyridine moiety with 2-1H-bromopyrazole. Attempts included a Buchwald-Hartwig Amination cross coupling reaction and nucleophilic aromatic substitution reactions (SNAr). The SNAr was further examined in efforts to find a pyridine derivative from which substantial enough yields can be obtained. A 2-fluoro-3-nitropyridine provided the highest yield for the SNAr coupled with 2-1H-bromopyrazole. Further work will involve eventually replacing the nitro group on the coupled product with a hydroxy group providing an immediate precursor to Compound A.

UF14 Robin Bumbaugh, Lisa Ott Reusable biodegradable solvents from biodiesel
coproduct glycerol

Abstract: Biodiesel is a renewable, biodegradable alternative to petroleum based fuel that produces fewer emissions. The process of synthesizing biodiesel results in the cogeneration of approximately 10% glycerol. This coproduct glycerol is currently viewed as a disposal problem for biodiesel producers. One potential way to add value to coproduct glycerol is to use it as a component in deep eutectic solvents (DESs). DESs are a class of solvents related to ionic liquids, comprised of a hydrogen bond donor (HBD) and hydrogen bond acceptor (HBA). DESs are polar, have novel solubility and electronic properties, have low volatility, can be reusable, and are often biodegradable. Implementing these reusable DESs in teaching labs will lower university solvent acquisition and disposal costs while adding value to industrial biodiesel synthesis. Previous research showed that DESs can be prepared using synthetic glycerol+choline chloride (ChCl) mixtures; our group has shown that a DES can be prepared with coproduct glycerol from acid-catalyzed (CGAC) biodiesel synthesis. This work extends our study on DESs prepared using synthetic glycerol. Four HBAs were used to prepare DESs with CGAC. DES formation was confirmed by density and viscosity measurements. DESs prepared with synthetic glycerol or CGAC were used as solvents in a ring closing metathesis and a Diels Alder reaction to determine the DESs viability as solvents in common organic chemistry teaching labs. Product formation was confirmed by GC-MS and ¹H NMR and DESs were successfully reused in a second ring closing metathesis reaction.

UF15 Casey Becker, Austin
DuBose, Dahlia Chavez,
Nick Barnett, Juan Diaz, Hemoglobin Drug Synthesis and Assessment:
Matthew McDonald, Dr. Experiment Redesign and Refinement
Carolynn Arpin

Abstract: As the world of medicinal chemistry advances every day, so does the need for exceptional chemistry education. Our goal is to optimize and improve a laboratory experiment designed to introduce undergraduate chemistry students to the field of medicinal chemistry. The experiment entails synthesizing a drug, executing a binding assay involving hemoglobin, and data analysis to determine the binding efficacy of the drug. It was launched in the undergraduate organic laboratory for chemistry majors (CHEM 370M) at CSU Chico in fall 2018. Our research has since focused on the drug synthesis portion of the experiment. Working with two of the experiments four different drug scaffolds, we have begun to develop an expansive library of compounds able to be synthesized in sufficient yields and purities for implementation in the CHEM 370M experiment. We are currently optimizing the reactions for the remaining drug scaffolds, and will soon move on to optimizing the binding assay protocol. Our project motivation, methods, experiment launch feedback, and current work will all be presented.

UF16 Brandon Nusser, Minjoo
Kim, Alejandro Synthesis of Linked Chalcones
Calderon-Urrea, Dr.
Carolynn Arpin

Abstract: Nematocides have been an important area of research due to the devastating affect that nematodes have on agriculture. In pursuit of developing new nematocides, we previously discovered a library of chalcone small molecules that were effective in exterminating *Caenorhabditis elegans* (a free living nematode) and *Meloidogyne incognita* (the so called Root Knot Nematode, a plant parasitic nematode) nematodes. Notably, treating the nematodes with two different library chalcones resulted in a synergistic effect in killing nematodes. Thus, we hypothesized that linking the library chalcones would result in an enhancement of nematocidal properties. We recently completed a small library of linked chalcones using a 2-carbon linker but, unfortunately, these compounds showed a decrease in nematocidal activity as compared to mixtures of individual chalcones. Therefore, our present work involves the linkage of two library chalcones using longer linkers such as those with four, six, and eight-carbons. We hypothesize that the longer linkers will enable the chalcones to more freely move and rotate independent of one another and thus, improving the nematocidal properties. Project motivation, library synthesis, and preliminary biological data will be presented.

UF17 Madison Wong, David Ball Synthesis of the degradates of the herbicide Oxyfluorfen

Abstract: Oxyfluorfen, an herbicide pertaining to the nitrodiphenyl ether class, has been of great academic interest to the Tjeerdema group at UC Davis for potential use in California rice fields. In order to study the environmental fate of oxyfluorfen, degradation products of this herbicide must be synthesized for use as standards in HPLC analysis. The degradation of oxyfluorfen by *Chryseobacterium aquifrigidense* has been observed through multiple different biochemical pathways to produce the following degradates. The synthesis of these degradates will be discussed.

Sydney Angel and Monica
UF18 C. So Decontaminating Water with Metal-Organic
Frameworks: An Integrated Laboratory Experience

Abstract: We investigated the removal of harmful anionic dyes, acid orange 7, methylene blue and malachite green, from aqueous solution using metal-organic frameworks (MOFs). However, there have been limited efforts to integrate this class of materials into the undergraduate laboratory curriculum. Therefore, we designed an integrated laboratory experiment in our upper-division integrated laboratory sequence to teach students about research procedures and tools used in physical, organic, inorganic, and materials chemistry. This laboratory sequence involves preparation of four different MOFs (ZIF-8, ZIF-67, UiO-66, UiO-66-NH₂) by solvothermal reactions and testing their adsorption of anionic dyes. In this work, upper-level undergraduates study four MOFs. To do so, students use scanning electron microscopy, X-ray diffraction, and infrared spectra to determine the creation of the MOFs. The factors we investigated affecting adsorption capacity include a variation of the organic linkers and metal clusters of the MOFs. Students are able to execute simple experimental setups and critically interpret and compare their results. Further, students are asked to determine what facilitates the removal of the dyes from water and what MOF exhibits the highest adsorption capacity and the MOFs regeneration ability. Importantly, this laboratory prepares students for cutting-edge inorganic and materials research topics.

James J. Calvo, Monica C.
UF19 So Removal of Persistent Organic Pollutants from Aqueous
Solution with Metal-Organic Frameworks

Abstract: We investigated the removal of a harmful anionic dye, acid orange 7 (AO7), from aqueous solution using metal-organic frameworks (MOFs). We prepared four different MOFs (ZIF-8, ZIF-67, UiO-66, UiO-66-NH₂) by solvothermal reactions and then tested their adsorption of AO7. Infrared spectra and adsorption capacity data confirmed the removal of AO7 from aqueous solution. The factors we investigated affecting adsorption capacity include variation of the organic linkers and metal clusters of the MOFs. Our results suggest that the hydrogen bonding, $\pi - \pi$ interactions, and zeta potentials facilitate the removal of AO7 from water. Of the four MOFs examined, ZIF-67 exhibited the highest adsorption capacity of AO7 and can be regenerated easily.

William Shive, Christopher
UF20 Ivey, Daniel Edwards Phenolic Compound Profiling of Valley Oak Leaves

Abstract: This research project aims to understand the correlation between the phenolic compounds present in Valley Oak (*Quercus lobata*) leaves and oak gall formation as a result of small wasps infesting the Valley Oak trees. A better understanding of valley oak phenol profiles may provide insight into key chemical defensive components that affect oak gall formation. To analyze phenolic compounds samples were prepared by acetone extraction of oak leaf samples. Extracted samples were analyzed through High-Performance Liquid Chromatography with UV-Vis Diode Array Detection. The data revealed a complex mixture of phenolics present in Valley Oak leaves. In order to reduce the complexity of the samples, an acid hydrolysis procedure was used which allowed for characterization of hydrolysable tannin components.

Brice Vanness, Dr.
UF21 Sandrine Matiasek Analysis of Hydrocarbons in Urban Storm Runoff

Abstract: The need to measure a wide range of pollutants associated with urban areas has only grown as the world becomes more urbanized. In this study, we have developed a method for measuring hydrocarbons in urban storm runoff utilizing gas chromatography. In this method, Diesel Range Organics (DRO) and Polycyclic Aromatic Hydrocarbons (PAH) are extracted from stormwater samples with an organic solvent. Once extracted, gas chromatography is used to identify and quantify individual hydrocarbon compounds. In total, 27 compounds from the standard mixes of DROs and PAHs can potentially be quantified if found in a storm runoff sample. This method will be used to assess the performance of a local biofiltration system in removing hydrocarbons from the surrounding environment.

Gabrielle Wyatt, Dr.
UF22 Sandrine Matiasek Heavy metal phytoremediation at the Butte College
Bioswale: A long-term study of bioaccumulation in
three California native plants.

Abstract: Stormwater runoff generated by impermeable surfaces such as parking lots can contain high levels of toxic heavy metals. These heavy metals have the potential to biomagnify and cause heavy metal-induced neurotoxicity in sensitive organisms. Vegetated bioswales are one solution for the bioremediation of urban stormwater runoff, using plants to bioaccumulate heavy metals at concentrations higher than required for biological processes. This study investigates heavy metal accumulation in three California native plants at the Butte College Bioswale. Plants are processed and analyzed to determine the fate of heavy metals within plant tissue. Tissue analysis will be conducted twice a year on individual plants to understand bioaccumulation over time in an attempt to observe any phenological variance in plant species. Preliminary results from the October 2018 analysis are consistent with previous greenhouse studies measuring greater heavy metal concentrations in root tissues than in shoot tissues. Knowledge obtained from this study is important for improved planning and management of bioswale systems.

Andre Bourret, Alexis
UF23 Lopez, Hannah Aird

Characterizing the paragenetic sequence of alteration at
the Moonlight IOCG deposit, Plumas County, CA

Abstract: The Moonlight deposit is a hematite-rich Iron Oxide Copper Gold (IOCG) deposit located in Indian Valley, CA. The Moonlight deposit and the regional geology are poorly understood and the conditions of IOCG formation are very broadly defined. IOCGs form from mixing of magmatic fluids with brines, causing alteration of host rocks and ore mineralization. This study will characterize the alteration assemblages in the Moonlight deposit and determine the alteration processes by studying cross-cutting vein relationships. Drill core was analyzed and samples were selected for thin sections based on the different observed stages of alteration. The sections were analyzed petrographically. The Moonlight deposit is hosted in quartz monzonite comprising 43% plagioclase, 42% orthoclase, and 15% quartz. The host rock contains large tourmaline crystals (2-3mm) and quartz-tourmaline nests (4mm). Cross-cutting veins with different mineral assemblages (black, siderite, ankerite and sericite) indicate that the deposit has undergone multiple phases of alteration. Black veins comprise 70% quartz, minor plagioclase and orthoclase, and magnetite which gives them their color. Three generations of brown veins, consisting of siderite, sericite, and ankerite, cross-cut each other and all rock types. The first phase(s) of alteration created the black veins and the final phase(s) created the brown veins. Hand sample shows two phases of alteration, black and brown veins, but thin sections show four stages of alteration, black and three different brown veins, that can only be seen in thin section.

Evan Davis, Natalio
Plascencia, Rachel
UF24 Teasdale, Jennifer M.
Wenner

Olivine trace element indicators of thermal history and
mantle source compositions of primitive magmas at
PLC, Lassen Region

Abstract: The Poison Lake Chain (PLC) is a group of calc-alkaline cinder cones and mafic lava flows that are separated into nine distinct compositional groups (Muffer et al., 2011). Three of the compositional groups include primary basalts, which have been interpreted to have unique mantle source domains. In the current study, pressures and temperatures of mantle source melting were calculated using whole rock compositions and a geothermobarometer (Lee et al., 2009). Results identify that the three primary basalt groups are derived from three separate depths, ranging from 25 to 45 km. To further constrain the petrogenetic history, new work uses trace element content of olivine to determine the mantle source lithology, olivine crystallization temperatures, and the degree of partial melting. Initial results suggest that all PLC groups are derived from garnet peridotite mantle lithologies, as indicated by the Al and Mn contents of olivine (De Hoog et al., 2009). Crystallization temperatures of olivine range from 1242°C to 1336°C based on the Al in olivine thermometer of De Hoog et al. (2009). Next, the Cr# is used to calculate the degree of partial melting (De Hoog et al., 2009) for the three primary PLC groups, which range from 16% to 20% melting. With the distinct depths and pressures, the temperature of olivine crystallization, and the calculated degree of partial melting, this work has reconstructed the unique thermal history of each primary basalt group of the PLC.

Matthew Larsen, Mark
UF25 Szymanski, Rachel Teasdale

Heat loss and lava flow cooling rates of Fantastic Lava
Beds Flow 2, Cinder Cone, Lassen Volcanic Center

Abstract: Cinder Cone is located in the northeast area of Lassen Volcanic National Park, approximately 35km SE of Old Station, California. The area consists of a cinder cone constructed of loose scoria, lava flows, and a 1316km diameter ash deposit. Using radiometric dating from a tree buried by the lava and paleomagnetic data, USGS scientists established that Cinder Cone was formed from eruptions in about A.D. 1630-1670 (Clynne et al., 2001). The youngest and longest flow is the Fantastic Lava Beds Flow 2, (Clynne et al., 2001), and is the focus of this research. Heat loss plays a fundamental role in determining flow core cooling rates, thereby influencing cooling-limited flow length (Harris & Rowland, 2009). Work done by Szymanski and Teasdale (2015) finds that average groundmass crystal sizes generally increase with distance from the vent and the number of crystals per area decreases with distance from the vent. The MELTS program predicts the liquidus (crystallization temperature) for minerals based on the rocks composition, in this case plagioclase is 1150°C. The predicted temperature is tested with equilibrium experiments to verify the starting temperature from which cooling proceeded. Ongoing research uses cooling experiments starting at the liquidus temperature to reproduce groundmass plagioclase textures observed in the natural samples to determine Cinder Cone lava cooling rates. This research experiment is a good way to reconstruct active lava flow processes that were unobserved or not monitored.

Margaret Pierce, Hannah
UF26 Aird

Geochemical and Petrographic Analysis of the Lights
Creek Stock in the Plumas County Copper Belt

Abstract: The Lights Creek Stock (LCS) is a 178-148 Ma pluton originally mapped as five distinct compositions, and is associated with Iron Oxide \pm Cu \pm Au (IOCG) deposits. The magmatic dynamics necessary for the formation of IOCG deposits are poorly understood. The pluton was last mapped in 1970, with variations in pluton lithology delineated by contours of the potassium feldspar to plagioclase ratio. The variations in mineralogy were attributed to a felsic magma that assimilated a preexisting mafic igneous body as evidenced by the mafic inclusions. The purpose of this project is to reevaluate the magmatic evolution of the LCS by analyzing bulk geochemistry, lithology, and petrography for each plutonic unit. Whole rock geochemical data was collected using XRF and ICP-MS, and was plotted using Excel and GCDkit. LCS samples were plotted along with Sierra Nevada samples obtained from EarthChem. Compared to the Sierra Nevada Batholith, the LCS is enriched in total FeO and K₂O, and is depleted in CaO and Al₂O₃. Petrography of the LCS samples indicates that the plagioclase have been sericitically altered. The LCS samples that were depleted in CaO were enriched in K₂O which indicates that the pluton likely underwent some degree of potassic alteration. Potassic alteration occurs when primary elements in minerals get replaced by secondary potassium. Widespread potassic alteration is commonly associated with IOCG deposits. Future work includes remapping the Lights Creek Stock and quantifying the degree of potassic alteration.

Scott Stokes, Angelica
UF27 Rodriguez, Rachel Teasdale

Oxygen Isotopic Composition of Sulfur Works, Lassen
Volcanic Center: Correlating Thermal and Meteoric
Fluid Inputs Using d18O

Abstract: The Lassen Volcanic Center (LVC) is located at the southern end of the Cascades Volcanic Arc. It is the largest and most active hydrothermal system in the Cascades Range. Hydrothermal fluids at Sulphur Works (SW), are characterized by high temperature and low pH (85-92 C, <3.6 pH). Previous work investigated the proportions of thermal and meteoric water inputs into the hydrothermal systems and hypothesized that water samples collected during dry years or seasons should have a stronger thermal component (high d18O) compared to wetter years and seasons, which should have a stronger meteoric component (low d18O). This trend was not seen in d18O data from 2017/2018 when the dry fall was lower (-1.42‰) than in the wet spring 2018 (-0.88‰). Thus, there is no correlation between seasonal precipitation variations and d18O of hydrothermal fluids from the same year. Additionally, no correlation was found between the amount of precipitation (snow pack) in drought and non-drought years and the d18O of fluids collected in the same year. The mean residence time of the groundwater is likely longer than one year and can be determined using water and snow hydrogen isotope ratios (Tritium(H-3) : Hydrogen(H-1)). Tritium ages of hydrothermal fluids and precipitation quantities from appropriate years will be correlated to appropriate d18O data to test whether drought has impacted the proportion of meteoric and thermal fluids. A two-end-member mixing model will use the d18O of meteoric, thermal and hydrothermal fluids (mixed) to quantify the proportions of each source.

Eric Dearden, Sandrine
UF28 Matiasek

Evaluating Benefits to Stormwater Management From a
California Bioswale

Abstract: Bioswales are a form of stormwater biofiltration systems used to 1) treat urban runoff through biological uptake and contaminant sorption, and 2) mitigate flood risk by enhancing infiltration. Monitoring bioswales after their construction is not standard practice, thus bioswale efficacy is largely unexplored. Concentrations of nutrients and heavy metals in runoff flowing through a Butte College bioswale were sampled across multiple storm events throughout 2018 and early 2019. Runoff inflows and outflows were monitored at one-minute intervals through pressure transducers installed in flumes and weirs in order to measure the volume of water retained by the bioswale. Flow rate and concentration data were used to obtain pollutant load during storm events. Across five storm events, an average of 72% of heavy metals were removed, while 42% of nutrients were retained by the bioswale. Flow volume was reduced by 38% in early winter storm events and 75% in an early spring storm event. Methods developed for this project contribute to stormwater management programs as a foundation for monitoring existing and developing biofiltration systems. Continuation of this work will identify efficient performance parameters of the bioswale and serve as the basis for future site improvements.

UF29 Sean Berriman, Sandrine Matiassek Monitoring post-fire surface flow in Clear and Dry Creeks

Abstract: The Butte County Camp Fire set an unprecedented level of destruction for an urbanized watershed in California. In order to quantify the total amount of contaminants in creeks flowing from the burn area, a measurement of discharge out of the burn site is needed to interpret contaminant load from collected water quality data. Two creeks downstream of the burn area, Clear and Dry Creeks, were measured for discharge and stage. Lag time was analyzed for two specific storm events to compare stage in these creeks to USGS data from Butte Creek, also flowing through the burn area. More data collection will be needed to accurately characterize the discharge of both Clear and Dry creek. Greater understanding of pollutant transport from wildland-urban interface fires will be useful for remediation efforts of similar future events.

UF30 Jillian Olivar Investigating the effects of the Camp Fire on water composition

Abstract: Understanding how the chemical composition of water may change after catastrophic events such as wildfires is relevant for the health of aquatic systems. The presence of aromatic molecules give water its color, therefore monitoring water color can provide details on the chemical composition of filtered water samples. We characterized the optical properties of water from creeks flowing out of Paradise, CA after exposure to an urban fire. Water samples were collected during various storm events following the November 8, 2018 Camp Fire. Specific UV absorbance (SUVA) was utilized to evaluate the content in the aromatic molecules and compare the composition of the creek waters. Monitoring changes in the optical characteristics of water samples can help us pinpoint trends in aromatic molecules generated by fires.

UF31 Natalio Plascencia, Evan Davis, Rachel Teasdale, Jennifer Wenner Trace Element Analysis of Plagioclase in Primitive Basalts at Poison Lake Chain, Lassen Region

Abstract: The Poison Lake chain (PLC) is a volcanic field of mafic lava flows and calc-alkaline cinder cones located 30 km ENE of Lassen Peak. PLC lavas erupted between 100-110 ka in a 30 km² area that contains nine compositionally distinct groups (Muffler et al., 2011). Six groups include primitive basalts with high MgO content (>6%; Muffler et al., 2001). Within the six groups, three groups (Basalt of Cone Lake road (bc), Basalts of Robbers Spring (br), and Basalt of old railroad grade (bg)) are classified as primary basalts based on their trace element content. Basalts of Pittville Road (bt) are not primary mantle compositions, but their affinity to the garnet stability field establishes that bt samples represent an additional mantle source, distinct from other PLC groups. Plagioclase compositions are used in this research to test if primary samples underwent magmatic processes or ascended from the mantle without interaction with other compositions (open vs. closed system crystallization). Plagioclase in groups br, bc, and bg have increasing %Ba with fractionation (decreasing %An), indicating closed system crystallization, which is consistent with their classification as primary basalts. Plagioclase crystals in bt samples have oscillating incompatible and compatible trace element compositions and anorthite contents from core to rim. This oscillation pattern indicates that bt underwent some type of open system crystallization process, which is in contrast to the closed system trends in br, bc, and bg. These differences can be used to determine the unique histories of PLC groups.

UF32 Nora Pizzella, Sandrine Matiassek Nutrient Removal of Sustainable Additives to Biofiltration Systems

Abstract: Nutrient Removal of Sustainable Additives to Biofiltration Systems Bioswales are biofiltration systems designed to remove pollutants from stormwater runoff through increased infiltration and nutrient uptake. Heavy metal removal has been well documented in bioswales. However, the removal of nutrients commonly found in runoff, such as ammonium, nitrate, and phosphate, is generally less effective in these systems. Sustainable additive materials, including zerovalent iron, water treatment residuals, walnut shell biochar, rice hull biochar, and logging residual biochar, were assessed for their nutrient removal ability in triplicate columns that contained each additive, pebbles, fine sand, coarse sand, soil, mulch, and California native sedges. Synthetic stormwater was applied three times to columns and samples were collected and filtered for nutrient analysis. Nutrient concentrations were measured using colorimetric analyses and a spectrophotometer. Across all columns, 95% of ammonium was removed. For nitrate, columns that contained additives more effectively removed nitrate than controls. Walnut shell biochar was the most consistent in nitrate removal (36-61%). Zerovalent iron and water treatment residuals removed 62-100% of phosphate, while biochars and controls released excess phosphate. Further sampling will investigate long-term trends in the effectiveness of each additive.

Amy Robson, Angelica
UF33 Rodriguez, Rachel Teasdale

Vertical Variation of Hydrothermal Alteration from the
Core to Upper Flank of Ancient Mt. Tehama, Lassen
Volcanic Center

Abstract: The hydrothermal system of the Lassen Volcanic Center (LVC) is primarily exposed at Sulphur Works (SW) within the eroded edifice of Mt. Tehama (MT). Additional hydrothermal features are at Boiling Springs Lakes (BSL) in Warner Valley, 12 km east of SW. The goal of this work is to investigate the zonation of hydrothermal alteration along a vertical transect from the exposed core at SW to Pilot Pinnacle (PP), a remnant of MT's edifice, and at a lateral distance from SW to BSL. Previous studies used alteration mineral assemblages of debris flows and geophysical surveys to reconstruct alteration zones at Mt. Rainier and Mt. Adams, which include advanced argillic alteration (up to 300°C) nearest heat sources (feeder dikes and conduits) and argillic alteration (up to 200°C) (John et al., 2008; Finn et al., 2007). At LVC, the SW (core) samples have advanced argillic alteration and more distally, BSL has argillic alteration, consistent with decreasing temperature trends from the core to flank at Mt. Rainier and Mt. Adams. However, the alteration mineral assemblages of the vertical transect (SW to PP) indicate that alteration zones are more complex than proximity from heat source. Pyrophyllite, an indicator mineral of advanced argillic alteration, is not present at lower elevations at the SW core but is elsewhere at irregular intervals along the vertical transect. Additional work will incorporate fossil vs. modern hydrothermal system designations identified by John et al. (2006) to better characterize the irregular distribution of alteration assemblages at Mt. Tehama.

UF34 Easley Adoremos Predicting a Song's Genre using it's Lyrics

Abstract: Song lyrics vary from genre to genre. The word truck is probably used more in country music than, say, songs from the rap genre. So could we perhaps predict a songs genre by just using the songs lyrics? Using lyrics collected from Genius.com from the top 50 songs of 2018 of five different genres (rap, country, metal, Christian, and pop), I try and find out if predicting genre by just using a songs lyrics is feasible and practical. After cleaning up the dataset of lyrics, I used the frequency of each unique word in a song and the songs total word count to try and predict that songs genre using the Random Forest Model. This model is a machine learning algorithm that constructs several decision trees to use for classification, and in this case, to classify which genre a song belongs to.

UF35 Kyle Hammer L-Functions of Graph Covers

Abstract: We investigate a relatively new field of mathematics, connecting the theory of numbers to the theory of graphs. Using the machinery of graph covers and L-functions, we found a new formula for computing constants associated to graphs. This work was completed with Dr. Thomas Mattman and Dr. Daniel Vallieres during the fall of 2018.

UF36 Kyle Hammer Obtaining the Thermophysical Properties of Solids at Uniform Heating

Abstract: We investigate a certain reverse problem in mathematical modeling in which we are given data about heated solids. Our goal is to use the given data of a contacting solid around our unknown material to determine the thermal properties of the unknown material. This project was completed during the summer of 2018.

Susan Ye, Eduardo Gomez,
Eric Montoya, Allen
UF37 Valdovinos, Karina Modeling the Spread of Radioactive Contaminant in
Zamacona, Sergei Fomin, Fractured Aquifers Surrounded by Porous Rock
Vladimir Chugunov

Abstract: This paper examines the spread of radioactive contaminant by mass transfer through fractures and aquifers in subsurface porous rock. This is a topic of consideration for nuclear waste repository design, where radioactive waste must be isolated from the environment and especially groundwater sources. By solving a system of fractional differential equations that model the radioactive contaminant transport in the fractured aquifer and surrounding porous rocks for the steady-state case, the maximum possible zones of contamination are determined. The model accounts for the physical processes of diffusion, dispersion, and advection due to fluid flow, in addition to intrinsic properties of the system, such as rock porosity, radioactive half-life of the contaminant, and anomalous fracture patterns in the rock. Due to prior experimental and theoretical results, which validates that fluid flow and mass transport in fracture patterns with fractal geometry are better modeled by fractional derivatives, this work utilizes these fractional-order terms to model the mass transport in the aquifer and porous rocks. The solutions can then be used to examine contaminant zones in various real-world conditions to help outline safety procedures and guidelines for disaster prevention.

Jonathan Teazis, David M.
UF38 Keller, Colette Calmelet

Micropeptides: A New Chapter in Proteomics

Abstract: Non-coding RNAs (ncRNA) have been given the name because it was assumed that they do not code for functional proteins. This assumption has not been verified and requires further analysis. Short open reading frames (ORFs), less than 30 codons, within these non-coding regions of the genome could encode for biologically significant peptides. However, sequence similarity tools such as Basic Local Alignment Search Tool (BLAST) and similar programs are not capable of analyzing these short sequences. The purpose of this work was to create a new program using Wolfram's Mathematica that can analyze short ORFs. The program finds peptide sequences less than 30 amino acids long and determines the amino acid similarity between peptides in the same sequence. After analysis of ncRNA within the mouse genome, two potential micropeptides were identified from the Xist and Gm29811 genes. The Xist gene encoded for short ORFs that showed sequence conservation to two proteins involved in intracellular trafficking. Interestingly the Gm29811 gene encoded for micropeptides that showed sequence homology to two different proteins in the zinc finger family of transcription factors. Further analysis of these genes may show that they code for biologically significant molecules. With this new program high throughput analysis of short ORFs is possible. This can be helpful in any future analysis of previously uncharted regions of the genome.

Ricardo Aguilar, Robin
UF39 Donatello

The Effects of Supplemental Instruction on Student Performance

Abstract: Supplemental instruction (SI) is a peer-led academic support model available since 2012 in 17 courses at Chico State. These courses historically have high enrollment and low pass rates. Prior research at the individual course level has shown that students who attend SI pass these classes at a higher rate than students who do not attend SI. However, these analyses tend to be done on a bivariate basis, looking at one class at a time and only comparing two groups (e.g. Males vs Females). These bivariate analyses do not control for other factors such as academic preparedness, first generation student status, and being a student of color. This research provides an institutional level analysis of the effectiveness of SI on the likelihood a student will pass a class after controlling for other factors known to be related to student success across all classes and all years. Several multivariable statistical models including logistic regression, random forest, stochastic gradient boosting were used to model the likelihood a student will pass a class. Models were compared on their accuracy and predictive ability. Propensity score matching was used to identify two groups of students who are equal on all measured characteristics aside from attending SI. Then among this matched case-control sample we assessed the effectiveness of SI on the students likelihood to receive a passing grade. This method of analyzing a matched case-control study provides a stronger causal argument that SI is directly contributing to the success of students in these historically high fail rate classes.

Sydney Carroll, Courtney
UF40 Merrick, Levi Johnson,
Dylan Bailey and Seth
Selorm Klobodu

Weight-Related People-First Language Use and Visual Content Analysis of Images from the Online Coverage of the 2018 Presidential Physical Exam

Abstract: Weight-related stigmatization is pervasive in American society with health and social consequences. The public increasingly gets news online and it can influence how they understand health issues, including obesity. Online media has a wide reach and can perpetuate the social acceptability of weight stigma through language and visual content. To combat weight bias, experts recommend the use of People-First Language (PFL) and avoidance of stigmatizing images by the media. Research has not yet analyzed the use of weight-related PFL or images in online coverage of any presidential physical exam. Our first objective was to determine the prevalence of PFL in online news coverage of the 2018 presidential physical exam. Our second objective was to examine the images that accompanied the online coverage. Google search engine was used to identify all US based online news articles that covered the physical exam between December 7, 2017 and February 17, 2018. Articles meeting inclusion criteria were coded for the presence of weight-related language keywords and use of PFL. We then performed a content analysis on the images that accompanied the online news articles. Four coders systematically reviewed the visual content to capture images that may be stigmatizing. Simple descriptive statistics were used to summarize data. Exactly 1,242 articles were obtained based on keyword searches and 376 met inclusion criteria. After excluding duplicates, 179 articles were included in the final analysis.

UF41 Emilee Hansen, Lauren Housley Effects of Sulforaphane on Cytokine Secretion in Triple Negative Breast Cancer Cells

Abstract: In 2019, 268,600 new diagnoses of and over 41,000 deaths from invasive breast cancer are expected. Effective therapies for these highly aggressive cancers (e.g., triple-negative breast cancer (TNBC)) are lacking and include mainly surgeries and chemotherapy that result in many side effects and disease recurrence. Thus, it is critical to seek alternative therapeutic interventions for TNBC patients. Sulforaphane (SFN), a dietary compound found in cruciferous vegetables, has been shown to reduce proliferation and metastasis and increase apoptosis of breast cancer cells. These chemopreventive effects may in part be due to SFN disrupting signaling between cancer cells and other cells in their environment. Studies have shown SFN to modify cytokine signal expression in breast cancer cells and surrounding cells. This experiment aimed to determine the capability of SFN to influence signals produced and secreted by TNBC cells, specifically. TNBC cells (MDA-MB-231) were incubated for 7 days before being treated with either 15 micromolar SFN or 15 micromolar DMSO control. Media samples were analyzed on a BioPlex 2000 using a 27-multiplex cytokine plate from Bio-Rad. Cytokine levels in the media were compared between treatment and control groups to evaluate the effect of SFN. This work will help to clarify how SFN influences cytokine signaling by TNBC cells, which will pave the way for future studies that investigate signaling between TNBC cells and other cell types in their immediate environment. Together, these studies will inform breast cancer treatment strategies using SFN.

UF42 Cindy Olvera Perez, Austin Pollard, Jose Luis Baranda, Nicholas J. Nelson Magnetic Loops on the Sun

Abstract: Magnetic spots on Sun like stars are a major driver of space weather and can impact habitability of planets. Sunspots are formed in the interior of the Sun starting in the convection zone where the differential rotation creates pressure causing the loops to become buoyant enough to rise to the photosphere. The formation of sunspots progenitors has been modeled using 3D magnetohydrodynamic simulation of stellar convection. These buoyant magnetic loops are small coherent structures in a large turbulent volume, therefore making the loops hard to find. Here we report on a project to develop and empower post-processing tools for there simulated data sets. We have located almost 200 loops between $0.90R_{\odot}$ to $0.98R_{\odot}$ and have begun to track their motion through the convection zone.

UF43 JaneAnne Arnone, Eric Ayars Analysis of a Weakly-Coupled Oscillator Apparatus for Upper-Division Physics Labs

Abstract: We've built and tested an apparatus that allows precision measurements of coupled oscillations. The device clearly demonstrates phenomena from mechanics/dynamics courses such as beats and resonance modes. The Q value of the oscillation is well over 600, allowing long-timescale measurements and milli-Hertz frequency resolution on resonance measurements. The coupling strength can be repeatably adjusted over a wide range of values without changing other equipment parameters. Initial tests show excellent correspondence between theory and experiment, with room for more in-depth study of harmonic splitting also.

UF44 Steven Sheppard, Jason Mickel, Anna Petrova-Mayor, Joseph Pechkis and Hyewon Pechkis Progress Towards Understanding Hollow Optical Waveguides

Abstract: We characterized the transmission properties of a 750 micron uncoated hollow-core fiber with a Q-switched Nd:YAG laser at 1064 nm. We measured the attenuation as a function of bend radius and found it in good agreement with the theoretical model. In particular, the attenuation is 1.53 dB/m for a straight fiber and the incident polarization is preserved. With a bend radius of 6.5 m the attenuation is 3.30 dB/m. We also characterized the spatial profile of the transmitted beam.

C. Crichton, M. Doris, L.
Gorman, J. Levine, J.
Permann, L. Vanderspek,
UF45 Dr. H. Pechkis, Dr. J.
Pechkis, Dr. A.
Petrova-Mayor

Design and Construction of an Ultra-cold Atom
Apparatus

Abstract: We report on progress to construct an ultra-cold atom apparatus at California State University, Chico. Atoms will be laser cooled to ultra-cold ($T < 1$ mK) temperatures in a magneto-optical trap. The cooling and trapping light will be provided by custom-built, external-cavity diode lasers that have been frequency-stabilized to the transition frequencies of 85Rb and 87Rb using a sub-Doppler Dichroic Atomic Vapor Laser Lock (sub-DAVLL). Software-controlled Acousto-Optical Modulators provide precise control of the frequency and intensity of the cooling and trapping beams. OEM shutters driven by a custom designed driver circuit will enable switching of the cooling beams, while imaging light will be controlled by a custom shutter based on a readily available iPod hard drive. Current-carrying coils that have been designed and constructed in an anti-Helmholtz configuration will provide the necessary magnetic field gradient for cooling and trapping experiments. Computer control via the Labscript suite has been completed and allows autonomous shot-based experimental control of the apparatus.

Sean Dillon, Tessa Swenson,
UF46 Trey Grijalva

Modeling Convection in Slowly Rotating Sun-like Stars

Abstract: The behavior of solar-type stars is heavily influenced by their rotation, which slowly decreases over their main-sequence lifetimes. Recent observational results have shown that stars older than our Sun behave differently than younger stars. The behavior of sun-like stars and their changes in rotation rate are determined by the convection in their outer layers. Using the Rayleigh code to create 3D global simulations of stellar convection, we seek to model how rotation rate influences the convection realized in stars at varying ages. These simulations will produce petabyte-scale datasets, which will require specialized numerical tools to analyze and visualize. Here we present the development and initial results of a suite of computational tools to analyze the convection and differential rotation of a sample simulation.

Eric Strauss, Dr. Nicholas
UF47 Nelson

Modeling the Trajectory of a Pitched Baseball

Abstract: The flight of a baseball is governed by gravity, lift, and drag forces. Modeling the trajectory of a baseball using Newtonian mechanics yields three nonlinear differential equations. These equations are generally not analytically solvable and so require the use of numerical methods. Major League Baseball's development of the Statcast tracking system has caused increased interest in the effects of rotational lift on pitches like fastballs and sliders. Using our numerical model we investigate the effect of spin rate and spin axis on pitch trajectory. We also show preliminary results for the possible chaotic motion of a knuckleball.

John Schad, Eddie Cruz,
UF48 Daniel Wheeler, Dr. Paul
Arpin

Building a Femtosecond Spectrometer to Measure
Ultrafast Molecular Dynamics

Abstract: The initial steps in many light initiated reactions including natural and artificial light harvesting occur on the timescale of hundreds of femtoseconds or even faster. Ultrafast optical spectroscopy encompasses a broad range of laser spectroscopy techniques that can be used to measure these dynamics. The overall objective of this project is to build a transient absorption spectrometer to measure ultrafast dynamics in molecules and to characterize molecular vibrational modes of model systems. When completed, this instrument will excite molecules with a short laser pump pulse and then characterize the state of the sample with a time delayed probe pulse. This poster will describe progress on the development of this instrument. In particular we will describe our optical alignment used to control how the pump and probe interact with the sample; we will describe the synchronization of an optical chopper and imaging detector; and we will describe the user interface we have built to automate the collection of data.

Elizabeth Freitas, Anne
UF49 Stephens, Ph.D.

Analyzing the Use of Productive Discourse Strategies
by Future Teachers in the Science Model Academy for
Reflective Teaching (SMART) Lab.

Abstract: This study examined the use of a newly modified observation tool to document student-teacher discourse moves during elementary class field trips to the CSU Chico Science Model Academy for Reflective Teaching (SMART) Lab. Established in 2000, the SMART Lab is a unique classroom facility on the Chico State campus that provides early science teaching experiences for Liberal Studies and Science Bachelor of Arts majors preparing to enter the credential program. Our work builds on Marcum and Heaston's 2014 study that found that college interns demonstrated an improvement in attitude toward science, along with increases in science content knowledge and confidence in teaching science after a semester in the SMART Lab. This current study examines the quality of their teaching through the use of productive discourse strategies that research has identified as supporting student sense-making. Using a tool modified from Doing and Talking Math and Science (Cook et al. 2014), trained observers recorded the discourse moves of 7 interns during two 5th grade field trips during the Spring 2019 semester, totaling 36 fifteen-minute lessons. Each verbal interaction between the college intern and the students was recorded and identified. Upon analysis, we found that most of the interactions were triadic, with the instructor asking a question then responding to student responses, rather than the students engaging in dialog among themselves.

Student Class Projects

| ID | Author List | Title |
|---|--|--|
| S1 | Zachery Reed, Rebekah Nunez, Kevin Wagner | Secondary Succession of Plant life following the Camp Fire |
| <p>Abstract: The secondary succession response of plant life following the wildfire known as the Camp Fire is to be measured and assessed approximately six months after the disturbance. A method of random sampling based on burn severity, the species of plants present, and the characteristics of the surrounding habitat will be used to compare areas affected and unaffected by the Camp Fire. A species diversity index and quadrats are to be used to determine the prevalence of species recovering in and around affected areas. Expected results are grasses, shrubs, and plant life that does not take long to establish itself to be more prevalent than trees and plant life that take longer time and more nutrients to fully develop. Some species of plants are dependant on wildfire for seed germination and will be evaluated independently of plant wildlife that uses more traditional methods of seed germination. The results observed in this study could be used by conservationists and those who monitor natural resources for future predictions of vegetation succession in areas affected by wildfire in Northern California and potentially other areas. These results could also be followed up at a later date in order to establish a consistent pattern and the change in plant life in secondary succession following a wildfire in Northern California.</p> | | |
| S2 | Ayala M, Capurro T, Cayaban R, Claiborne J, Dollar J, Larsen M, Lopez A, Mason E, McGuire D, Stokes S, Velazquez M, White P, Aird H. | The origin of zoning in the Bald Rock Pluton |
| <p>Abstract: The Bald Rock pluton (BRP) is an igneous intrusion in the northern Sierra Nevada, that was studied by Compton in 1955. Through detailed mapping and petrographic analysis of more than 500 samples, he determined that the BRP displays a concentric progression from rim to core of relatively mafic to more felsic granitoids. The purpose of this investigation is to determine whether assimilation contributed to the zoning within the BRP. It is hypothesized that through the assimilation of the metavolcanic country rock the composition of the pluton evolved at the border of the pluton. There is still much debate on the formation of plutons and characterization of the formation of the BRP will help to support either the diapir or multiple sill model. We utilized prior publications and fieldwork in order to find textural, geochemical and compositional variations within the zoning. Twenty-two samples were taken from 6 stops in the field and 12 were used to make lithological and petrographic observations. Geochemical data is also analyzed. Our preliminary results show that hornblende concentrations decrease and quartz concentrations increase in the granitoid moving towards the core. Plagioclase and K-spar concentrations remain consistent throughout the granitoid. Abundance and size of inclusions decrease from the rim of the pluton toward the plutons interior. This work can reveal information about the emplacement of earlier subduction-related plutons before the intrusion of the major Sierra Nevada Batholith.</p> | | |
| S3 | Jerry Tucay | Imputing Missing and Faulty Data |
| <p>Abstract: Missing and faulty data is a common occurrence through all parts of statistics. It is important to handle with care and choose the correct path to fix your issue, but what if you dont know what path is right for you or you cant find a path at all. That is why my library mfddata could be a really useful tool. By creating a data set that mimics your situation you could freely test out different methods to see which path works best for your situation without having to handle the big data that a lot of people are dealing with currently. Not only does it have its place in an applied setting but an academic one as well. My library is an easy way to demonstrate to students the effect that missing and faulty data has on analysis. Answering several different questions such as: Why does missing erroneous data matter? When should I keep missing faulty data/ get rid of missing faulty data? How can I fix it? i.e MICE</p> | | |

S4 Eduardo Gomez Influence of Driver's Race on the Outcome of a Traffic Stop

Abstract: In todays America, whether or not people are being discriminated against based on their race is still a hot topic. The discrimination being referred to is the unjust treatment in education, places of work, politics, public areas, and more because of a persons skin color. There are people claiming racial discrimination is over, that its a problem thats been fixed and others are saying that its still an ongoing problem. There is also big talk on racial discrimination when it comes to the outcome of the interaction between law enforcement and people of color. Entire groups (BLM) have formed from this discussion that people have over how poorly the police treat black men and women. Traffic stops are an example of where people of color could be victims of racial discrimination from police officers. We are looking at information provided by the police officers of Connecticut in 2013-2014 (with about 366,000 stops) to see if there is a relationship between the outcome of the traffic stop and the driver's race.

S5 Ricardo Aguilar, Robin Donatello Does the News Polarize Viewers Opinions?

Abstract: The possible effects of media bias are a concern in our current political climate. This analysis looks at the association between watching the news and how far into the extremes a viewers opinion is.

S6 Tayari Coleman, April Nuestro, Lauren Gorman Lasers: Illuminating the Future

Abstract: We will present our project for the course PHYS/EECE 451, Lasers and their Applications. The objective of the project was to learn how a compact Argon ion and a Zeeman stabilized He:Ne laser operate and study a set of beam parameters. Both lasers were made in the 80s and had no manuals. We found that the Argon laser had a failed power supply. However, at the poster session we will discuss the theory, design, and applications of the laser. The Zeeman stabilized He:Ne laser was operational. We will present measurements of the output power stability, pointing stability, beam divergence and spectrum. In addition to studying different gas lasers, we successfully characterized two optical shutters, noted their specifications, and analyzed their performance. We also examined multiple diode lasers, and made some rather interesting finds. Throughout this project we had to rely on the cumulative knowledge and hands-on skills acquired throughout the semester to be able to successfully and safely navigate such intricate and complex works of physics.

S7 Blake Buckner, Olivia McIntosh Argon lasers and collimeters

Abstract: We will present the results of our studies into the operation of an Argon ion laser and applications of a collimeter for the course PHYS 451, Lasers and Their Applications. Argon ion lasers are utilized for Raman spectroscopy, microscopy, holography, forensics, ophthalmic surgery, entertainment, and as sources for optical pumping for solid-state lasers such as Ti:sapphire. The first project was to evaluate the condition of a tunable Argon ion laser and fully characterize it. We followed the manufacturers manual and performed the troubleshooting procedures. However, the laser worked only for a few minutes at a time. At the poster session we will discuss the operation and design of such lasers. The second project was to learn about the dynamic collimation testers, also called collimeters. They are useful tools to gauge the wave front curvature of laser beams that are passed through a beam expander. The collimeters produce a scanning fringe pattern onto a screen. The shape of the fringes indicates whether the beam collimated. We will discuss a few results obtained with a collimated, converging and diverging beam incident on the collimeter.

S8 Mitchell Molletta, Benjamin Thorvick Examining CO2 lasers and Fabry-Perot Interferometers

Abstract: In Physics 451, Lasers and their Applications, we set off to investigate the condition of a CO2 laser and Fabry-Perot Interferometer (FPI) devices over the period of four labs. Carbon Dioxide lasers are among the most powerful lasers available to-date. CO2 lasers are common in the medical industry for noninvasive surgeries and dermatology. They are also used for engraving and cutting material in industrial settings. The CO2 waveguide laser that we studied was manufactured in 1984. It failed to operate long enough to study its performance due to overheating and no parts/service manuals are available for it. In addition to the CO2 laser, we also studied 3 FPIs and 3 pulse generators. The FPI takes in a laser beams and bounces it off interior mirrors that vibrate at a high frequency. This splits up the beam and outputs various shapes based on alignment. The shape and patterns of the output light give much information about the beam such as the number of transverse modes present. The pulse generator is what moves the mirrors inside the FPI and also filters the signal picked up by it.

S9 Daniel Wells, Jamsheed
Teimoorian, Vivekanand
Kota Nitromite laser and Wavemeter

Abstract: As with any other scientific domain, the role of Lasers (Light Amplification by Stimulated Emission of Radiation) in modern day applications has grown exponentially since its inception in 1960. This has led to the extensive study of lasers both in and out of the classroom. Our goal is to determine if an older Nitromide laser (LN100) and a wavemeter are operational and still valuable for future lab use. The Nitromite laser we studied is a pulsed beam that operates outside of the visible spectrum. Through visual examination and study of the internal configuration of LN100 along with its operation, the output sensitivity to variations in input voltage and repetition rate were observed and it was determined that, with a couple of minor repairs, it was useable. A wavemeter is a device used to measure the wavelength of light. The wavemeter uses a He:Ne laser as a reference. We tested it with a known fiber-coupled diode laser and found that the wavemeter is quite accurate. It is able to measure the wavelength of the laser beam up to thousandths of nanometers, which is well within the desired working range to be utilized in curriculum lab experiments.

S10 Victoria Sieglinger, Kayla
Clyde, Linda Mena Teen Parent Program

Abstract: Abstract: Teen parents and their children are at a significantly higher risk of adverse outcomes related to pregnancy, birth, health and injury in their first year. For our senior nursing community health project, we partnered with the Teen Parent Program at Fairview High School to provide education on these subjects to the teen parents enrolled at the school. We taught a total of 9 classes covering subjects including healthy pregnancy, birth information, breastfeeding, child nutrition, pediatric safety and emergencies, STD and contraceptive information and more.

S11 Callie Wright, Emmeline
Hurley, Mandy McPherrin,
Kirsten Gunderson Free Healthcare for Camp Fire Survivors

Abstract: Following the tragic events of the Camp Fire that unfolded on November 8, 2018, many health care resources on the ridge were destroyed or damaged to the point of being non-operational. Approximately 13,000 people lost their homes, Feather River Hospital was destroyed, and many lost the places they received healthcare. Due to this, many of the healthcare facilities in the surrounding communities have been overwhelmed by the influx of new patients. Residents still living in the areas not destroyed by the fire are facing the challenge of finding accessible healthcare. As fifth semester nursing students we have teamed up with Medspire, a nonprofit organization, to bring this care to them. Medspires goal is to create a free mobile clinic that strives to alleviate the ongoing medical need in the surrounding Camp Fire affected areas. Non-emergent needs such as prescription refills, wound care, connections with providers, and emotional support are provided. The clinic is still in its beginning stages and we have had the privilege of assisting with piloting their first free clinic, creating a volunteer database, and streamlining their effectiveness.

S12 Jeanne Cha, Wendy
Jimenez, Ana Bernal Hungry Wildcat Food Pantry Awareness Project

Abstract: A 2016 report from the California State University showed that about one in four students in the California State University system were going hungry. In 2018, another research survey found that 50% of Chico State students experience low to very low food security. Food insecurity can have a great impact on the education and academic performance of students leading to lower grades and lower chances of graduating. For our public health nursing project, CSU Chico senior nursing students worked with the Hungry Wildcat Food Pantry on campus to raise awareness about the Food Pantry and decrease food insecurity on campus. We publicized the Pantry and its location on social media and on flyers, as well as held two pop-up pantry events on campus. These pop-up pantry events allowed us to speak to students about the pantrys services and were held on Fridays in order to provide students with food that could help provide meals for the weekend. Our goal was to increase awareness of the Food Pantry by 30%, which we evaluated by giving surveys before and after our efforts.

- S13 Masud White, Keenan
Vernon, Satya Shah, Jason
Oates The effects of brief education on individual likelihood to
donate blood.

Abstract: Blood donations are essential to any healthcare organization, and given that the number of donors nationally continues to decline, this poses a risk to our healthcare system as a whole. The reason behind this being that older adults are becoming ineligible to donate due to chronic illness or medication therapy, while younger adults aren't replacing the current donors. To further compound the matter, there are many misconceptions surrounding blood donation that discourage youth from donating. These myths include but are not limited to the belief that most participants faint after donating blood, donating blood is time consuming and the misconception that those with tattoos cannot donate blood. Our project demonstrates the results of brief education about the myths surrounding blood donation and their effects on participant likelihood to donate at upcoming blood drives. In the study we utilize anonymous surveys that assess donor sentiment prior to education and donor sentiment after education. The research has suggested that this intervention has had little to no effect on the individual likelihood they will participate in blood donation.

- S14 Elena Tiedeman, Mika
Rulona, Savanah Reich,
Gunash Solmaz Sexually Transmitted Infections Education

Abstract: This study was conducted to assess and educate the Chico State college population regarding sexually transmitted infections (STIs). A knowledge deficit regarding safe sex practices and STI prevention has been evidenced by an increase in the prevalence of STIs on college campuses. By using an online polling method, we surveyed Chico State students to determine their general knowledge and prevention methods of STIs. This involved distributing the survey through various social media platforms. Sexual health education began with tabling on campus and sending a program-wide electronic message to Chico State Nursing students. The results from this study show that further details about the level of understanding that students have about the mode of transmission, signs and symptoms, complications, treatment, and prevention methods of STIs need to be further addressed. This demonstrates the need for further education on college campuses in order to reduce the risk for STIs.

- S15 Sarah Bengson, Nicole
Bissada, Page Kininmonth Diabetes Education for Adolescents

Abstract: Fifteen years ago, Type 2 Diabetes was nearly unheard of in youth across the United States. The number of youth diagnosed with Type 2 diabetes in the United States has increased by 21% between the years of 2001 and 2009. Due to these alarming statistics, our group decided to provide Diabetes education and prevention to the students in the Chico Unified School District. Our 50-minute Diabetes Education Class educated the students about the definition of diabetes, the differences between Type 1 and Type 2 Diabetes, modifiable and non-modifiable risk factors associated with the development of Diabetes, the signs and symptoms associated with hypoglycemia and hyperglycemia, and lifestyle changes to promote optimal health. Before our presentation, 0.16% of the students answered the pre-test questions correctly. At the end of our presentation, 75% of the students answered the post-test questions correctly. The results of our presentation have shown that our class has been effective.

- S16 Kary McKinnon, Rachel
Modugno, Rachel Turner Keeping Mothers Strong

Abstract: According to the American Psychological Association, 1 in 7 women suffer from Perinatal Mood and Anxiety Disorders (PMAD) (2019). This number can be even higher for mothers who experience trauma. This project connects the services provided by Care Net of Paradise and Mothers Strong of Chico to bring education and tools for success in navigating PMAD. We aim to provide short-term and long-term assistance to mothers who are especially susceptible to PMAD as well as the community organizations that work with them. After the Camp Fire, our group was interested in how this natural disaster affected the Care Net population that was based in Paradise, CA. We are specifically looking at both pregnant and postpartum women. In order to disseminate our information in the short-term, we worked with three mothers from Paradise who were directly impacted by the fire and are at a high risk for PMAD. We met with the mothers, assessed their mental status and resource management, and provided education and further resources as appropriate. For long-term dissemination of PMAD information, we organized an educational briefing to the Care Net staff using Mothers Strong material to unite the organizations and their mission. With this information, the Care Net staff can continue to provide their clients with PMAD information and resources. To cast a wider net of impact regarding PMAD, we also created several resources that will be dispersed amongst the community's providers.

S17 Emily deBoisblanc, Marisa
Faust

Four Winds After School Program

Abstract: The goal of this Public Health project was to provide health education to Transitional Kindergarten - 8th grade students at the Four Winds Charter School which provides an educational after school program to American Indian Children. This population is of a lower socioeconomic status and are oftentimes not fully educated on how to maintain a healthy lifestyle. We chose this target population to educate students on various health related topics to ultimately improve and encourage maintenance of healthy behaviors. Providing health education at a young age could prevent the development of numerous health-related complications later in life. We incorporated lecture material, hands-on demonstrations, indoor and outdoor physical education activities, and entertaining educational games in our weekly lesson plans. We brought in supplies related to the various topics for the activities planned and as well as items for the students to take home. For example, during our dental hygiene lesson plan, we provided toothbrushes and flossers for the children to bring home. We assessed the students comprehension of our weekly presented material by implementing pre and post tests.

S18 Kaitlin Coburn, Haleigh
Hensleigh

Student Health Awareness Project

Abstract: A 2019 California State University, Chico student research survey indicated that 22.7% of Chico State student respondents have never accessed the on-campus Student Health Center; 16.7% of respondents have accessed the Student Health Center only once in their time at Chico State. For our senior public health nursing project, Chico State students partnered with administrators and interns at the Student Health Center to increase student awareness of services and provide education about timely health issues affecting the student population. To assess and evaluate student use of the health center and its services, our team conducted the survey mentioned above. Efforts to promote awareness included tabling on campus with informational materials on Student Health Center services, sexually transmitted diseases, and measles. Our goal was to interact with at least 250 students on campus. We surpassed our goal and had over 300 student interactions that provided the student community with education and pertinent information on the health issues that are relevant to the population.

S19 Gillian Sammis, Noel Meyer

Project Thrive

Abstract: The purpose of our project was to assess the health issues and barriers that students face on campus along with finding a way to address them. As California State University, Chico has implemented many programs to attempt to bridge the health gap many students continue to be unaware of the services available on our campus. Some of the biggest issues students face include lack of financial funding for services which includes the ability to afford purchasing food products. This issue has already had an attempted solution which is the Hungry Wildcat Food Pantry. Unfortunately, through our survey of students we found that many were not aware of the process in which students go through to access food from the pantry along with the fact that there is a garden on campus. We have spent this semester working to engage the campus in the increased use of the pantry along with building a larger garden on campus to increase access to healthy food choices. Our poster analyzes the potential health benefits of an easily accessible garden on a school campus. This project included a survey, educating students about services available on campus, and informing students of the Associated Student candidates that are running that are in support of the proposed garden. Our mission was to increase access to fresh produce and the ability to grow their own food on campus to improve students overall physical and mental health.

S20 Cecilia Munoz, Hanna
Archer, Allan Wold, Tyler
Stadulis

Medspire Health Mobile Clinic

Abstract: Medspire Health is a free mobile clinic that strives to alleviate the ongoing medical need in Butte County and the surrounding Camp fire affected areas. Our goal is to connect the individuals and families who are repopulating the Paradise, Magalia, Concow areas with primary care doctors and address their immediate nonemergency medical needs while being accessible at no cost. Provide free access to non-emergency medical needs. Our vision for long-term services include: vaccines, case management, social services, preventative health and wellbeing education, as well as our own disaster relief medical team. Medspire has developed a short, online survey and have been spreading the word by posting the link on personal facebook pages, and any Camp Fire facebook group we can find. The next step, is developing a door-to-door survey in the town of paradise, so we can hear from those who have moved back to their properties. Many of these individuals might not have access to the Internet, let alone a facebook account. They are most likely our most underserved, unhealthy population, and we need to know their current needs. Based on the results from these surveys we will have a clue of what is needed in the mobile clinic.

S21 Meghan Kelly, Addie
Pavelko, Nicole Paulsen,
Zoya Hasan

Girls on the Run

Abstract: Background: With the unrealistic ideals of pop culture and pressure of societal norms, low self-esteem is an issue faced by today's female youth, specifically with pre-teen girls. For our community project, we worked with the non-profit, international organization, Girls on the Run (GOTR) in attempt to empower 3rd-5th grade girls and ultimately build their self-confidence. Not many programs are available that teach life skills to young children, nor are these ideas strongly incorporated into school curriculum. Interventions: Our interventions included lesson plans from the GOTR handbook, which we used to conduct our weekly practices that focused on explaining the benefits of maintaining emotional and physical health. Results: By the end of the GOTR program, girls felt confident in creating strong connections with others and themselves. The results of a pre-GOTR and post-GOTR survey demonstrated that these girls exhibited an increase in well-rounded qualities including competence, confidence, connection, character, and caring. Conclusions: The mission of our Girls on the Run community project, to empower young girls and teach them lasting qualities to become strong, confident women, was met.
