Undergraduate Research and Creative Work

7 December 2018 – 9:00am to 1:00pm
Sakamaki Hall
Honolulu, Hawai‘i
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Sakamaki Hall Breakout Rooms
Oral Presentations Session One  
9:40a - 10:30a  
Oral Presentations Session Two  
10:40a - 11:35a

A101  Arts & Humanities/Social Sciences  
A102  Engineering & Computer Sciences  
B101  Natural Sciences  
B102  Natural Sciences  
B103  Natural Sciences

Sakamaki Hall Courtyard
Lunch & Awards Ceremony  
11:40a - 1:00p
### Oral Presentations Session One
**9:40 - 10:30a**

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<td>Serena “Nai’a” Michel</td>
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<td>Rae Kuruhara</td>
<td><em>The Moʻolelo Comic Collection</em></td>
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<td>Sakamaki B102</td>
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<td>Foraging Behavior of the Black-Crowned Night Heron (Nycticorax nycticorax hoactli) on Oʻahu, Hawaiʻi</td>
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<td>Hallie Hernandez</td>
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<td>Jessica Idle</td>
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<td>Chloe Asato</td>
<td>A Theoretical Study of the HBr+ + CO2 → HOCO+ + Br Reaction: Potential Energy Surface</td>
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<td>Alyson Shoji</td>
<td>Investigating Zika Virus Infection Kinetics in Primary Human Leydig Cells and Peritubular Myoid Cells</td>
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<td>Leah Creamer</td>
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<td>Cristina McLaughlin</td>
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<td>Glenn Galvizo Jr.</td>
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<td>Kaiaka Kepa-Alama, Brittney Whaley, Nicholas Yama</td>
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<td>Efficient Parameter Estimation of a Microsatellite Mutation Model</td>
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<td>Reproductive Strategies and Population Genetics of <em>Varroa destructor</em></td>
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<td>Heterotrophic Culture of Transgenic <em>Chlamydomonas reinhardtii</em> as a Cell Factory of Recombinant Proteins</td>
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<td>Diagnosing Nutrient Deficiencies in Hawaiian Breadfruit (<em>Artocarpus altilis</em>)</td>
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<td>The Effects of Temperature on the Zooxanthellae Density of <em>Sarcothelia edmondsoni</em> in Lanikai, Hawai‘i</td>
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<td>Kayla Chantel Brignac</td>
<td><strong>Identification and Spatial Distribution of Plastic Marine Debris Polymers in the Hawaiian Islands: Beach, Sea Surface, and Seafloor</strong></td>
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<td><strong>Synthesis of GnRH-Like peptides for Cellana sandwicensis</strong></td>
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<td>Zinnia Jazmin D’Agostino, Rebecca M. Katz, Lane Morrow</td>
<td><strong>50 Year Longitudinal Assessment of Macroalgal Assemblages on a Reef Flat in Waikīkī</strong></td>
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Abstracts of oral and poster presentations are listed in alphabetical order of presenter’s last name. Information below the name includes the student’s major, the category of their presentation, and time/location of presentation. The faculty mentor, if appropriate, is listed below the abstract.

Group abstracts are listed alphabetically by the Last Name of the group member whose name occurs in this list:

Kaiaka Kepa-Alama, Brittney Whaley, Nicholas Yama
Zinnia Jazmin D’Agostino, Rebecca M. Katz, Lane Morrow
John Paul Arios, Brandon Day

Abstracts are direct from presenters; wording and content are the author’s responsibility.
Kahealani Acosta  
Tropical Plant & Soil Sciences  
Natural Sciences  
Participation for UROP  
Oral Presentation: Session 2 (10:40-11:35am) in Sakamaki B102

Diagnosing Nutrient Deficiencies in Hawaiian Breadfruit (*Artocarpus altilis*)

Breadfruit (*Artocarpus altilis*) is an abundant staple crop to Hawai‘i, possessing historical and cultural value in its versatility. As a low maintenance crop, breadfruit has considerable potential to provide economic and ecological benefits in agricultural systems throughout the tropics and subtropics. Encouraging the productivity of breadfruit can increase food security and environmental sustainability; however, little research has been conducted regarding optimal breadfruit growth. In this classic agronomic "minus-1" experiment, physical and visual symptoms of depriving a single essential nutrient will be measured to understand optimal breadfruit growth and development. Ten treatments, each consisting of three replicates, are maintained in 45-gallon pots of inert media at the Magoon Research Station. Treatments include one control with all necessary nutrients, eight treatments lacking in one essential macro or micronutrient (N, P, K, Ca, Mg, B, Fe, S), and one treatment that contains all essential nutrients with the addition of a toxic level of NaCl. Monthly applications of fertilizer solutions are applied to the trees until deficiency symptoms are exhibited. Growth is measured by height (cm), diameter (at every 20 cm height increments), leaf color, chlorophyll, photosynthesis, water exchange, and foliar nutrient concentration. Preliminary results from January to September 2018 display visual symptoms of limited growth in (-)N, (-)P and (-)S treatments. On average, (-)N has shown the lowest productivity in all variables measured. Further results from this experiment will provide essential information to growers seeking to maximize breadfruit productivity.

Mentor: Dr. Noa Kekuewa Lincoln
Investigating Zika Virus Infection Kinetics in Primary Human Leydig Cells and Peritubular Myoid Cells

The most recent 2015-2016 outbreak of Zika virus (ZIKV) was the largest and in the US alone, more than 40,000 cases were reported. This outbreak was also associated with sexual transmission. This suggests that the virus can hide in the testes and establish persistent infection even after it is cleared from other body fluids. Leydig cells (LC) are located in the interstitial space between seminiferous tubules and produce testosterone. Peritubular Myoid cells (PMC) surround the seminiferous tubules and are involved in spermatogenesis. The objective of this study was to compare the replication kinetics of ZIKV in human LC and PMC. LC and PMC were infected with ZIKV at a multiplicity of infection (MOI) of 1. Virus titers were measured by plaque assay and RT-PCR. Total RNA was extracted for cDNA synthesis to determine changes in the expression of genes associated with key host defense response. Our data shows that ZIKV infection in LC is not productive and does not cause cytotoxicity. ZIKV mRNA was detected in LC but the levels were not as robust as other testicular cells (PMC and Sertoli cells, SC). ZIKV infection in LC does not induce type I interferon response and virus-induced increase in the cytokines is modest as compared to SC. However, ZIKV infection reduced expression of one of the key enzymes responsible for testosterone synthesis. This study provides first evidence that unlike PMC and SC, LC do not support active virus replication. More studies need to be done to understand why LC does not support ZIKV infection and what is the role of PMC in ZIKV pathogenesis.

Mentor: Dr. Saguna Verma
Gonadotropin-releasing hormone (GnRH) is essential for the chemical initiation during the pre-reproduction phase in most organisms. There are many studies that focus on the structure composition of the GnRH peptide within Phylum Chordata, however, there is limited knowledge on the specific conservative regions within Phylum Mollusca. Special emphasis will be placed upon the possible analog sequences from a known GnRH peptide, Lg-GnRH. The efficacy of the hypothesized sequences will be tested on local ‘opihi ‘alinalina, the yellowfoot limpet Cellana sandwicensis. Yellowfoot limpet is most demanded by consumer within the fish market industry, however, due to the decline in overall populations, the yellowfoot limpet has become difficult to find. The development of an inexpensive and efficient product would have a positive impact on aqua-farming of ‘opihi. This would alleviate the stress of harvesting wild ‘opihi, leading to the restoration of healthy populations.

Mentor: Dr. Jon Paul Bingham
Screening of Marine Microbial Extracts for Antiviral Properties

The marine environment is a virtually untapped resource for a wide variety of bioactive compounds. Due to the dynamic nature of oceans, organisms are forced to adapt, causing secondary metabolites with complex biological activities to be produced. These secondary metabolites have the potential to be effective against a wide variety of human pathogens, particularly viruses. This study tested 4 crude microbial extracts (B5, F4, F5, G12) from coastal waters for antiviral activity in Vero cell lines against the vesicular stomatitis virus (VSV). They were tested for cytotoxic effects using the MTT assay, and safe concentrations to be used in the antiviral tests were determined for each extract. An attachment inhibition assay, as well as a replication inhibition assay, were used to quantify the antiviral effect of each. Of these crude extracts, F4 and F5 displayed moderate inhibition (50-80%) of the VSV virus and G12 displayed high antiviral effects (>80%) in the attachment inhibition assay. Additionally, F4 and F5 displayed moderate ability to inhibit VSV replication in Vero cells. These results warrant further testing to validate the antiviral effects against VSV as well as sample purification and compound determination to determine what gives the crude extract its antiviral capabilities.

Mentor: Dr. Yuanan Lu
Foraging Behavior of the Black-Crowned Night Heron (*Nycticorax nycticorax hoactli*) on O‘ahu, Hawai‘i

The Black-crowned Night Heron (*Nycticorax nycticorax hoactli*), or ‘Auku‘u, is a subspecies of *Nycticorax nycticorax* that inhabits wetlands throughout the Hawaiian Islands. The ‘Auku‘u is one of the few native, terrestrial predators remaining in the Hawaiian Islands. The continental population of the Black-crowned Night Heron primarily forages at night, but the little information that exists regarding the foraging behavior of the ‘Auku‘u in Hawai‘i is contradictory. The Hawai‘i state Department of Land and Natural Resources states that they are diurnal, primarily foraging during the day, while the US Fish and Wildlife Service states the ‘Auku‘u are nocturnal, primarily foraging at night. In this study, we conducted observational surveys to determine the time of day ‘Auku‘u are most likely to be seen foraging, identified and quantified available and ingested prey, and determined the potential impact on endemic Hawaiian waterbird chicks. ‘Auku‘u were observed foraging during both the day and night. This may be due to the abundance of prey available in Hawai‘i wetlands, and a lack of competitors, compared to continental systems. Results of this study will be used to optimize survey protocols to maximize the likelihood of detection.

Mentor: Dr. Melissa Price

Co-Author: Kristen Harmon
Identification and Spatial Distribution of Plastic Marine Debris Polymers in the Hawaiian Islands: Beach, Sea Surface, and Seafloor

Polymer identification of plastic marine debris is crucial for understanding sources, fate, transport, and impacts of this emerging global contaminant. This study is the first to assess polymeric differences of plastic debris across different marine environments in the Hawaiian Islands, one of the hotspots globally for this environmental problem. A total of 4472 plastic debris pieces were collected on 8 windward and 3 leeward beaches in the Main Hawaiian Islands, 3 sea surface tows, 3 seafloor dives, and Midway Atoll. Significantly more debris per m$^2$ was observed on the windward (>4 pieces/m$^2$) compared to the leeward beaches (<1 pieces/m$^2$). A subset of debris pieces (n=3821) was analyzed using attenuated total reflectance Fourier-Transform infrared spectroscopy (FTIR) for polymer identification. Overall, the predominant polymers were high-density polyethylene (HPDE) (26.5%), polypropylene (PP) (26.3%), and nylon (22.8%) by mass, and low-density polyethylene (LDPE) (27.3%), PP (25.0%), and HDPE (16.8%) by pieces. Polymer composition was significantly different (p<0.05) among sea surface, windward beaches, leeward beaches, and seafloor. Sea surface and windward beaches were dominated by floating, more weathered polymers, while sinking, less weathered polymers dominated samples from leeward beaches and the seafloor. Our results are some of the first to provide evidence of polymeric stratification in the marine environment. The results emphasize that biota in different marine habitats are exposed to the impacts from different amounts and forms of plastic pollution.

Mentor: Dr. Jim Potemra and Dr. Jennifer Lynch
Cross-cultural Differences in Business Management Practices between the United States and Germany: A Qualitative Study

Globalization of the business world is forcing organizations to adapt to growing cultural influences. This globalization is progressing faster than the necessary cultural research, and in turn leads to gaps in important knowledge. As a result, companies have begun to see value in recognizing the effect different cultural influences have on employees to retain a competitive advantage in the global market.

The focus of this study is to draw connections between German and American business management systems. The connections this study explores are those between these different cultures and management systems, specifically, through leadership, human resource management practices, and ethics. These three variables are extremely important in business management and are further analyzed and connected through the different cultural dimensions of, individualism, power distance and uncertainty avoidance. We are testing the hypothesis that these interviews will show strong correlations between cultural dimensions and the variation in management systems. A case study is used to compare the connections between different management systems and cultural dimensions. This study looks at German business natives and American business natives who have had significant business experience in both the United States, and Germany. Furthermore, this case will point out specific points that should be focused on when dealing with cultural differences.

Further research to bridge the gap and create fluidity between differences in cultures is vital to running globally competitive organizations. This study will also serve as a foundation for future research comparing specific cultures with more efficient management practices.

Mentor: Hannah-Hanh D. Nguyen
Long-term quantitative datasets in tropical areas are rare, yet needed for comparisons to present community states to identify temporal patterns and inform management of culturally and ecologically important species. From 1966 to 1969, M. Doty and colleagues (Doty 1969) intensively surveyed the biomass and species composition of macroalgae, or limu, in 12 plots from 0 to 230 m offshore of the Waikiki Natatorium War Memorial, south O‘ahu. In a seasonal continuation of the undergraduate research program Our Project in Hawaii’s Intertidal (OPIHI) Spring 2018 Survey, our goal was to resurvey three of these plots (10, 110, and 210 m from shore) using the same methodology as Doty 1969 to identify changes in the species composition, seasonality, and abundance of macroalgae over the past ~50 years. In 1967, the most abundant nearshore (10 m) species were Ulva spp., the invasive Acanthophora spicifera, Dictyosphaeria cavernosa, and Valonia aegagropila while the offshore sites (110 and 210 m) were dominated by a high abundance of the native brown algae Sargassum spp. (limu kala), Dictyopteris plagiogramma (limu lipoa), and Padina sp.. The species composition in 2018 dramatically shifted to a high abundance of the invasive species Gracilaria salicornia and A. spicifera, and an absence of large brown algae such as Sargassum spp. and D. plagiogramma. The loss of these culturally important native species and increase in invasive species suggests this area has undergone a dramatic shift in community assemblage structure, with unknown ramifications for this area’s food web dynamics, fisheries habitat function, and ecology.

Mentor: Joanna Philippoff

Co-Authors: Florybeth La Valle, Dr. Celia Smith, Dr, Heather Spalding
Everyday activities involve our use of space and manipulation of objects in space. How objects are placed or organized in a workspace can affect efficiency for completing a task. A neatly organized environment is likely to allow productive tasks to be completed easily and with more efficiency. Conversely, disordered environments may make completing a productive task more difficult. Considered as an outcome, then, organization seems obviously beneficial. However, the process of organizing is a time-consuming process and requires effort. In the present experiment, we investigate how individuals balance the costs of organization against the costs of environmental disorder. Task manipulations include time pressure (low and high) and clutter pressure within the workspace (more space versus less space). We examine the effects of these manipulations on the likelihood and style of organizing and on the rate of progress in the task. Data will be analyzed by looking at how participants rearrange or reduce items in their workspace. We expect to find reduced tendencies to organize the workspace in high time pressure cases due to the timely costs of organizing and discarding items in a limited amount of time. In low space pressure manipulations (larger workplace), we expect to see reduced tendencies in decluttering the workspace due to the amount of space available for moving items around. After analyzing data from the present task, we intend to discuss the implications of these findings for real world naturalistic behavior.

Mentor: Dr. Grayden Solman
Efficient Parameter Estimation of a Microsatellite Mutation Model

Variation in DNA sequences allow us to describe the history of humanity. A microsatellite is a form of genetic variation where short sequences are repeated in tandem. Each microsatellite variant differs in how many times the short sequence is repeated. Human history inferences can be made by surveying how the number of repeats change across generations. Given a mutation and evolution model for human microsatellites, the question this research aims to answer is, “What are the best parameters for this model?”.

To find the best parameters given a set of observed microsatellite samples is to maximize a likelihood. For this problem though, the maximum cannot be found numerically in a reasonable amount of time. My methods to circumvent this were as follows: (1) Observations were collected from an existing database. (2) Simulated samples were generated using a coalescent approach, which avoids working on individuals that do not directly contribute to a sample’s evolutionary history. (3) To compare an observed sample and a simulated sample, the angular distance was used. (4) An approximate likelihood calculation was used in lieu of the exact likelihood to account for the low frequency of exact observation – simulation matches. (5) A Markov Chain Monte Carlo (MCMC) method was used to produce samples from the approximate likelihood.

Preliminary results show strong evidence for the existence of optimal parameters for our microsatellite mutation model. With defined parameters, future work entails using the same methodology for parameter determination of various population and admixture models.

Mentor: Dr. Floyd Reed
Contemporary Representations of Social Groups Surrounding the Case of Jack the Ripper

Jack the Ripper is at the forefront of popular culture because issues surrounding his case make it particularly interesting to adapt and rewrite time and time again. Looking at the 20th and 21st century I aim to discuss how contemporary representations of Jack the Ripper in popular culture glorifies the police, exaggerates violence against women, and perpetuates anti-Semitism. As such, the commodification of his case perpetuates stereotypes against the marginalized and exploited social groups, which fictionalizes the case and disrespects the victims by turning their lives into a form of modern-day entertainment. I analyze two novels and two modern-day attractions within London, each of which appropriate different aspects of the case to provide entertainment to the audience. The police are seen as heroic which marginalizes other groups because their glorification is in stark contrast to the exploitation of the other two groups. While the violence in the case was towards women, the fictionalized narrations exaggerate the violence towards women dramatizing it and killing the women more brutally. Lastly, all the works perpetuate the anti-Semitism within the case. The highlighting of these issues within the new narratives has the effect of increasing the levels and intensity of exploitation against the people who lived through the case, turning their lives into a form of entertainment for people today.

Mentor: Dr. Anna Feuerstein
An in silico Model for the Osmotic Control of Prolactin Transcription in Oreochromis mossambicus

Osmoregulation is the active maintenance of salt and water balance and is essential for life in higher vertebrates. A failure in osmoregulation is a contributing factor to pathologies of nearly every organ system and one of the most difficult problems internal medicine practitioners face in treating critically ill patients. The neuroendocrine system largely regulates the rapid and coordinated activation of genes encoding ion transporters needed to maintain osmotic homeostasis. A central impediment to advancing our knowledge on how osmotic homeostasis is regulated and integrated through the neuroendocrine system has been the lack of a suitable model. Prolactin (PRL) cells of the Mozambique tilapia (O. mossambicus) solve this problem because they are arranged into a nearly homogeneous mass making them easy to isolate in culture. O. mossambicus tolerate salinities ranging from freshwater to double strength seawater. Tilapia PRL cells respond directly to a fall in extracellular osmolality by releasing PRL, inducing osmoregulatory organs to promote ion uptake. The molecular mechanisms underlying the regulation of the prl gene, however, are poorly understood. We employed an in silico approach encompassing comparative genomics and bioinformatics analysis of the structure of prl and associated genes to identify putative regulators and coregulatory patterns involved in osmoreception. Based on this analysis we propose a model where competitive binding by predicted transcription factors and unique DNA conformations regulate prl transcription in response to changes in extracellular osmolality. Together, these approaches provide a comprehensive framework to understand the mechanisms involved in osmoreception.

Mentors: Dr. Zoia Stoytcheva, Dr. Andre Seale
Visualization of Lateral Line Nerve Related to Laterality of an Adaptive Foraging Behavior

Many animal species express laterality in sensation and behavioral responses. However, the evolutionary mechanism for the sensory wiring that generates laterality has not been well studied. As the first step, we are developing a neuro-tracing method for the newly emerged model for the laterality evolution—the Mexican teleost Astyanax mexicanus. A. mexicanus is composed of an ancestral-type surface-dwelling morph (surface fish) and a derived cave-dwelling morph (cavefish). Cavefish have an increased adaptive foraging behavior—vibration attraction behavior (VAB) whose level is associated with the number of left, but not right, cranial mechanosensory-superficial neuromasts. Surface fish do have the same mechanosensor but show no asymmetric association with the VAB level. To determine whether there is L-R asymmetricity in the superficial neuromast wiring, we performed a series of neural tracing by using HRP-conjugated wheat germ agglutinin (WGA-HRP), TMR-biocytin, FluroSpheres, Neurobiotin, Dil and 4Di-10ASP. Unfortunately, neither of these tracers labeled the nerves from peripheral to the central, nor even within central (the superficial neuromast to hindbrain, the eye to tectum, or within tectum or cerebellum). We suspect that the neuronal cell membrane of A. mexicanus does not have a particular polysaccharide residue that WGA and biocytin can attach to and therefore be taken up into neurons. We are conducting neuro-tracing by using Dil and 4Di-10ASP in fixed tissue, as well as the electroporation of neurobiotin. We will present our latest update of these neuro-tracing techniques.

Mentor: Dr. Masato Yoshizawa

Co-Authors: Vânia Fernandes, Christian Macaspac, Louise Lu
The Effect of Human Presence and Burrow-site Characteristics on the Nesting Success of Wedge-tailed Shearwaters

Due to previous management actions such as predator control and outplanting of native plants on O‘ahu’s offshore islets, Wedge-tailed Shearwater (*Ardenna pacifica*, WTSH) populations have increased to the point that new WTSH colonies are forming on O‘ahu coastal areas. While there is limited human access to most of the offshore islets of O‘ahu, a beach such as Kailua Beach Park with unrestricted access and where new WTSH colonies are forming, was hypothesized to have a significantly lower nesting success compared to beaches that have little to no human activity. It was also hypothesized that nesting success would be higher for WTSH burrows with greater than 50 percent ground cover within a one-meter radius of the burrow. Nesting success, nest-site characteristics, and human presence data was collected from occupied WTSH nests at Kailua Beach Park and the Kāneʻohe Marine Corps Base Hawaiʻi (KMCBH). The Mayfield Method was utilized to calculate nesting success. Human activity was recorded as the amount of human presence within five meters of the burrow over a five-minute period. WTSH nesting success was negatively correlated with human presence and positively correlated with percent ground cover. Wildlife managers can utilize these results to make decisions regarding protection of nesting seabirds on public beaches, and to implement outplanting efforts to create more successful nesting habitat.

Mentor: Dr. Melissa Price

Co-Author: Brooke Friswold
Analyzing the Success of the Anti-Pesticide Movement in Hawaii

In July 2018, SB 3095 relating to environmental protection was signed into law by Hawaii Governor David Ige. This bill contains the ‘first in the nation’ ban on chlorpyrifos, mandates reporting of all restricted use pesticides (RUPs), establishes a mandatory buffer zone around sensitive community areas, and funds a study on the effects of pesticide drift. This law was met with robust opposition from the agrochemical companies that have had a historic and contemporary hold on the Hawaiian Islands. This thesis will use interviews with former legislators and anti-pesticide activists to examine how SB 3095 was able to succeed despite previous failures and pushback by the international agrochemical industry. Years in the making, SB 3095 followed the basic tenets required of a successful policy yet garnered unprecedented levels of public support and civic engagement in a notoriously politically disengaged state. The standard notions of a policies success being determined by a corporation’s allowances, as described by John Kingdon’s theory of policy making, are challenged by the impacts of grassroots organization.

Mentor: Dr. Colin Moore
Reproductive Strategies and Population Genetics of *Varroa destructor*

The ectoparasitic mite, *Varroa destructor*, is an economic pest that parasitizes the European Honeybee, *Apis mellifera*. The mite’s reproductive strategies make it highly inbred, where the females produce a single son and then several daughters, which mate with their son. Strategies that result in genetic inbreeding are not uncommon for insects, yet these strategies often change depending on environmental pressures, an effect which has not been observed in mite populations. Low resources favor sexual reproduction, while high resources favor asexual reproduction. As mites prefer drone cells over worker cells as a resource, the fluctuation in drone cell appearance throughout the year should have some effect on mite genetics. A reduction of drone cells would see an increase of multiple foundress mites within the same cell, as resources are low.

Mites were collected from two apiaries, one in Waimānalo, and the other in Mānoa. Two hives were selected at each location, and over 50 mites were individually sampled from drone cells in pre-marked brood frames in total. DNA was extracted from these mites, and microsatellite markers specifically selected for tracking genetic changes were then examined using RT-PCR. Preliminary results indicate that approximately 10% of the mite population were found to be genetically different at a significant level under one genetic marker, while 16% of the population were different under the other marker. Although *Varroa destructor* is still highly inbred, it appears that there is some hidden diversity within its populations.

Mentor: Dr. Mark Wright
Heterotrophic Culture of Transgenic *Chlamydomonas reinhardtii* as a Cell Factory of Recombinant Proteins

Advances in biotechnology and genetic engineering have led to increased use of bioengineered organisms to produce valuable recombinant proteins. Limitations with bacteria and yeast have directed attention to the green microalgae *Chlamydomonas reinhardtii* due to the species’ low production costs, biosafety, and protein expression capabilities. Past studies on recombinant protein production using this organism were conducted mostly under phototrophic conditions. However, *C. reinhardtii* can grow heterotrophically using acetate as the carbon source. This method is both easy to scale up and sustainable as acetate is a low-cost carbon source that can be converted from organic waste and methane.

As there is little known about recombinant protein production in *C. reinhardtii* under heterotrophic culture conditions, this study aimed to evaluate such in comparison to photomixotrophic cultures with acetate as the carbon source. To accomplish this, *C. reinhardtii* cells were transformed to express the fluorescent protein mCherry as a model recombinant protein. Using the antibiotic Zeocin to screen for transformants, we developed many Zeocin resistant lines of *C. reinhardtii*. However, many were not PCR positive. We also found that our *C. reinhardtii* strain (137c) did not grow well in complete darkness. As a result, protein production was compared in cultures grown under high and dim light conditions. Culture optical density measurements were used to track growth, and fluorescence measurements and Western blot were used to monitor protein production. Findings from this study may help to advance the use of algal cells as an alternative cell factory for recombinant protein production.

Mentor: Dr. Wei-Wen Su
Kaiaka Kepa-Alama, Mechanical Engineering  
Brittney Whaley, Electrical Engineering  
Nicholas Yama, Electrical Engineering  
Engineering & Computer Sciences  
Participation for UROP  
Oral Presentation: Session 2 (10:40-11:35am) in Sakamaki A102

Droplet Generation

Understanding gene expression in diseased or damaged cells would allow for the development of medicine to treat cancer and other major illnesses. Current biomedical research is heavily reliant on in-vitro cell assay such as polymerase chain reaction (PCR), but these methods are inefficient due to the large number of cells that are required and minimal breadth. A solution is droplet-based microfluidics whereby high-throughput encapsulation of individual cells in single droplets allows for the isolation and characterization of many variables during a single experiment with high resolution. Droplet microfluidics requires suspending one fluid into a second immiscible fluid producing microliter size droplets via specialized microchannel geometries. The purpose of this design is to capture individual cells into single aqueous droplets and later merge with PCR reagents laden droplets which can then be broken and analyzed. We have been able to successfully fabricate such a device and achieved the conditions produced PCR and cell laden droplets at high throughput rates. Various design aspects have been explored and are continually being refined. We have demonstrated that such technology is not only possible, but practical enough to implement for large scale processing of data. Ultimately, such technology can be used to improve our understanding of diseases at a fundamental level, allowing for the development of specialized medicine that currently is not available.

Mentor: Dr. Aaron Ohta  
Co-Author: Carissa Nakao
The Moʻolelo Comic Collection is an anthology of both well and lesser known Native Hawaiian short stories reimagined as vibrant graphic narratives. The collection aims to be a unique educational tool for children of all backgrounds interested in learning more about Hawaii’s indigenous culture, while serving as an opportunity for Native Hawaiian youth to see themselves represented in comic books for the first time. During my semester as a UROP Grant recipient, I was able to get a running start on the first of what I hope will be at least a dozen stories in this creative anthology, a myth entitled “Puniakai’a.”

The idea came from a reflection of my own love for comics, namely Japanese manga, during which time I realized that my childhood obsession with these stories stemmed directly from the lack of Asian heroes in American popular culture. As a part-Hawaiian myself, I hope to be a part of creating the representation I wish I had by writing and drawing the books I would have wanted to read. By immersing myself in all aspects of the creation of comics all the while researching how comics have the potential to appeal to non-traditional learners, I explored how effectively narratives from the oral histories of indigenous cultures are complimented by the engaging and sensory medium of comics. From research, to drafting, writing dialogue, sketching, inking, and coloring, I hope to share the progress I’ve made in what could be an excited future for Native Hawaiian literature.

Mentor: Dr. kuʻualoha hoʻomanawanui
Interactive Data Visualization for Contact Tracing Statistics

Hospital Acquired Infections (HAIs) cost the medical industry an estimated $30 to $33 billion and infect 1 in 25 patients. This project is branching off a previous multi-part UROP project, by Tamra Oyama and Jie Zhou, in which they created a computer simulation to model infection propagation and later designed a wearable Bluetooth device to detect proximity between people. Both techniques produce large amounts of unorganized data. The goal of this project was to develop a tool to extrapolate the raw simulation data and display it as an infection tree, network matrix, and other insightful, interactive graphs.

The original simulation was scaled up to mimic a medical-surgical unit with 50 patients, hospital staff, and visitors—all referred to as agents. A networking algorithm was coded to determine relationships between each agent, based upon the duration and distance of contact. Using the JavaScript library, D3.js, and Meteor, for application building, an interactive dashboard was successfully created; it processed and displayed the network data according to what a user requested. The system was validated by comparing the produced infection tree against multiple simulation runs where a single infected agent was introduced. It correctly identified possible patient zeros and highly susceptible agents. This tool will be necessary in analyzing future implementations of the wearable contact tracing devices.

Mentor: Dr. Darren Carlson, Ph.D.
From the Darkness, Filling the “Páginas en Blanco”:

*Soñando con el amor negro (Dreaming Black Love)*

This creative project seeks to shed light on antihaitianismo (anti-Haitian) and anti-Black sentiments in Quisqueya (Dominican Republic and Haiti) through fiction. It examines the term “dreaming Black love” between Haitians and Dominicans, where love is the locus of social interaction between Black bodies and all bodies of color. It encompasses a love for Blackness with its fragmented history and the continual reassembly of those broken pieces. *Soñando con el amor negro (Dreaming Black Love)* follows a family’s story of loss and tragedy, but most importantly, how love acts as the strongest force to heal ancestral wounds across generations and between peoples.

This story is shaped by the works of authors Junot Díaz, Edwidge Danticat, and Julia Alvarez, especially the notion of “páginas en blanco” (blank pages) presented in Díaz’s *Oscar Wao* novel (2007). Michel’s interaction with Kanaka ʻŌiwi and tāngata Māori, and their intellectual foundations that are filled with mana (power) and sophistication, also influenced this work. She employs a lei wili methodology in gathering disparate elements of research together and weaving them into a narrative, taking a makawalú (multi-perspective) approach from Oceanic and Caribbean viewpoints to form its creation. Seeing ʻike Hawaiʻi (Hawaiian knowledge) and mātauranga Māori (Māori knowledge) as integral to understanding her world, Michel draws from the concepts of moʻokūʻauhau/whakapapa (genealogy), ea (sovereignty/breath), Te Kore (the “Nothingness”), and Te Pō (the Darkness). She also deconstructs the ideas of “memory in the blood,” love, silence, and fear, especially during the Trujillo Era in the Dominican Republic.

Mentor: Dr. Shawna Yang-Ryan
A Theoretical Study of the HBr+ + CO2 → HOCO+ + Br Reaction: Potential Energy Surface

Recent cross beam experiments have revealed interesting reaction dynamics of the HBr+ + CO2 → HOCO+ + Br· reaction under different excitations. The hypothesis is that the predominant reaction mechanics depends on the collision energy between two reactants, angular momentum of HBr+, and the spin-orbit coupling state of the system. The potential energy surface of the HBr+ + CO2 → HOCO+ + Br· reaction is studied in this research. First, a benchmark energy of the critical points of this reaction were identified using coupled-cluster theory extrapolated to the complete basis set limit. A transition state connecting the previously reported intermediates was found, making the potential energy surface of the HBr+ + CO2 → HOCO+ + Br· reaction double-well. Second, various ab initio methods were tested by comparing to the benchmark energies to search for the most suitable ab initio method for the molecular dynamics simulation of this reaction. One MP2 theory and one density functional theory, each utilizing a different double zeta basis set and a different effective core potential, have been shown to be efficient and accurately represent the potential energy surface of this reaction. Compared to the previously proposed MP2 method with a triple-zeta basis set, the two theories that we proposed in this manuscript take less than 10% of the computational resources without sacrificing accuracy.

Mentor: Dr. Rui Sun
The Effects of Temperature on the Zooxanthellae Density of *Sarcothelia edmondsoni* in Lanikai, Hawai‘i

Coral bleaching events have increased in frequency and severity across the world, causing decreases in coral species and diversity of reef ecosystems, along with other environmental impacts. To help protect and conserve coral reefs around the world, it is crucial to study this phenomenon. The purpose of this study was to better understand the adaptations and traits of *S. edmondsoni*, in order to better study the native and endemic Hawaiian species. *Sarcothelia edmondsoni* is a species of Hawaiian octocoral that has not been observed to bleach during warming events, as many other species of corals do. It was hypothesized that this species is more resistant to thermal stressors, which has important biological implications. To observe the effects of changing temperature on small colonies of *S. edmondsoni*, samples were placed in aquariums with small heaters that were used to manually and steadily increase the temperature of the surrounding water. The density of these zooxanthellae in individual polyps was measured and recorded weekly, along with observational photo-documentation, in order to determine whether or not *Sarcothelia edmondsoni* appeared to expel their symbionts. By the end of the experiment, husbandry conditions proved to be insufficient to maintain the specimens, even in control tanks, and the data were inconclusive. More research is still needed to further identify the thermal resistance of this species.

Mentor: Dr. Cynthia Hunter
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The Undergraduate Showcase is a collaboration between the Honors Program, Office of Undergraduate Education and the Undergraduate Research Opportunities Program, Office of the Vice Chancellor for Research that is open to all undergraduate students at the University of Hawai‘i at Mānoa.

The Honors Program provides opportunities for talented and motivated undergraduates to excel in their academic studies. Students complete a challenging enquiry-based curriculum that encourages independent research and creative expression. They enjoy intimate and personalized educational experiences within the setting of a large research university through small classes, dedicated advising, peer mentorship and faculty-guided projects. The Honors Program promotes critical thinking and oral, written and audio-visual communication skills; respect for diversity and commitment to social justice; and civic participation and capacity for leadership. It fosters among its students and faculty a sense of identity and a joy in scholarship, which it communicates to the university and the community.

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