Undergraduate Research and Creative Work

10 December 2021 – 9:45am to 12:35pm
Virtual Showcase
Honolulu, Hawai‘i
## SCHEDULE & MEETING INFORMATION

<table>
<thead>
<tr>
<th>TIME</th>
<th>ACTIVITY</th>
<th>LOCATION</th>
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</thead>
<tbody>
<tr>
<td>9:45-9:55a</td>
<td>Welcome</td>
<td>Main Room</td>
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<tr>
<td>9:55-10:40a</td>
<td>Oral Session 1</td>
<td>‘Ilima Room</td>
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<tr>
<td></td>
<td>• Creative/Design</td>
<td>‘Awa Room</td>
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<td></td>
<td>• Biochemistry</td>
<td>Limu Kala Room</td>
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<td>• Mental Health</td>
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<td>• Community Engagement</td>
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<td>10:40-10:50a</td>
<td>Break</td>
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<td>10:50-11:35a</td>
<td>Oral Session 2</td>
<td>Olonā Room</td>
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<td></td>
<td>• Engineering</td>
<td>Limu Kohu Room</td>
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<td></td>
<td>• Marine Biology</td>
<td>‘Ulu Room</td>
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<tr>
<td></td>
<td>• Plant Sciences</td>
<td>‘Awapuhi Room</td>
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<td>• Soil/Earth Sciences</td>
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</tbody>
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*Please join us for the release reception of volume VI of the *Horizons* undergraduate journal*

<table>
<thead>
<tr>
<th>TIME</th>
<th>ACTIVITY</th>
<th>LOCATION</th>
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<tbody>
<tr>
<td>11:45a-12:30p</td>
<td><em>Horizons</em> Student Author Panel</td>
<td>Main Room</td>
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<td>12:30-12:35p</td>
<td>Closing</td>
<td>Main Room</td>
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<thead>
<tr>
<th>SESSION 1</th>
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<th>ZOOM LINK</th>
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*Password for all rooms: showcase21*
Oral Session I
9:55 - 10:40a

'Ilima Room  Creative/Design

Leslie Dam  Love In Silence

Shailyn Makana  E Kupu Ana Ka Hana No‘eau: An Honors Portfolio in Hawaiian Studies

Mitchell Marabella  The Design and Modification of Larvae Rearing Tanks for 'Opihi Settlement

‘Awa Room  Biochemistry

Dylan Pilger  Assessment of Resistant Starch in Fresh And Fermented Poi

Airi Morita  A Computational Study of the Decomposition of Nitro-amine-based Energetic Material

Jia Cashon  Metabolic Shift by a New Compound, Ketone-ester, may Potentially Reveal the Molecular Link between Ketosis and the Multigenic Asocial Condition in the Mexican cavefish, Astyanax mexicanus
<table>
<thead>
<tr>
<th>Room</th>
<th>Topic</th>
<th>Presenter(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Limu Kala Room</strong></td>
<td><strong>Mental Health</strong></td>
<td>Bryce Dolph: Quality of Life and Coping Strategies among People Experiencing Homelessness in Hawaiʻi</td>
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<td>Migdalia Pensado Alvarenga: Mentally Contagious: An Investigation of Parent and Child Anxiety During the COVID-19 Pandemic</td>
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<td><strong>Kukui Room</strong></td>
<td><strong>Community Engagement</strong></td>
<td>Jannah Lyn Dela Cruz: Legislative Civic Engagement of Oahu Young Adults and Teens</td>
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<td>Sarah-Lyn Kaeo: Practicing Advocacy Through Political and Community Engagement in Hawaiʻi: The Search for Preventative Solutions to Combat Food Insecurity</td>
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<td>Anthony Butac, Michael Corotan, Jessa Dela Cruz, Monet Jones: A Homeless Shelter and Encampment Design Framework</td>
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<td><strong>Olonā Room</strong></td>
<td>Engineering</td>
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<td>Deylen Nekoba, Justin Yip</td>
<td>Effects of Coil Geometry on Collected Ice Growth in Thermoelectric Freeze Desalination</td>
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<tr>
<td>Lillian Shibata</td>
<td>Particle Physics Simulation: Applications of Swarming for Spaceflight</td>
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<tr>
<td>Nagahiro Ohashi</td>
<td>Aerodynamics and Acoustics of a Flapping Wing Drone</td>
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<td><strong>Limu Kohu Room</strong></td>
<td>Marine Biology</td>
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<tr>
<td>Teagan Roome</td>
<td>Wound Recovery and Coralivore Behavior Observations with Bleached and Non-bleached Phenotypes of <em>Montipora capitata</em> and <em>Porites compressa</em></td>
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<td>Steven Oleg Prasoloff</td>
<td>Circadian Rhythm Based <em>in vivo</em> Guppy Bioassay for Novel Drug Discovery</td>
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<td>‘Awapuhi Room</td>
<td>Soil/Earth Sciences</td>
<td>Brylin Nelson: Farming on the Final Frontier: Space Farming with Martian Soil Simulants</td>
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<td>Landon Wong: Host Status of <em>Rotylenchulus reniformis</em> and <em>Meloidogyne javanica</em> on <em>Vitex rotundifolia, Sida fallax, Ipomea pes-caprae brasiliensis</em>, and <em>Pritchardia sp.</em></td>
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<td>Caitlyn Lee, Arel Ragasa: Characterization and Biochemistry Analyses of Local Fungal Isolates</td>
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<td>‘Ulu Room</td>
<td>Plant Sciences</td>
<td>McKenna Bonn-Savage: Investigating Genetic Variation in Ontogenetic Patterns in Leaf Anatomical Traits in a Long-term Field Experiment</td>
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<td>Daezon Arruda: Analysis of the Potential Antibacterial Effects of Plants Implemented in Hawaiian Medicine</td>
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<td>Kea Kam: Targeting Specificity of Centromeric Retrotransposons</td>
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</tbody>
</table>
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. If appropriate, the faculty mentor’s name, as given by the student, is listed below the abstract.

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

**Anthony Butac**, Michael Corotan, Jessa Dela Cruz, Monet Jones
**Caitlyn Lee**, Arel Ragasa
**Deylen Nekoba**, Justin Yip

Abstracts are direct from presenters; wording and content are the authors’ responsibility.
Analysis of the Potential Antibacterial Effects of Plants Implemented in Hawaiian Medicine

In Hawai‘i, as in many indigenous cultures, plants are routinely used medicinally and incorporated into a healthy lifestyle. Today, plant-based dietary supplements are commonly employed by individuals looking to improve their health. Although it is widely accepted that plant-derived supplements have value, many of these compounds have not been thoroughly examined. In order to better understand the bioactivity of plants commonly used in Hawaiian medicine, we quantified the total phenolic content of select species available as commercial supplements. Phenolics are a large class of compounds that have established relevance to medicine because they act as antioxidants. Using the Folin-Ciocalteu method, we quantified the total phenolic content for 10 plant species with potential medicinal value: kava (Piper methysticum), noni (Morinda citrifolia), cinnamon (Cinnamomum cassia), pohe kula (Centella asiatica), garlic (Allium sativum), ginger (Zingiber officinale), passionflower (Passiflora incarnata), heart-leaf sida (Sida cordifolia), wireweed (Sida acuta), and mamaki (Pipturus albidus). In this project, the Kirby-Bauer method was used to further examine the bioactivity of these species by assessing their antimicrobial effects against gram-positive (e.g. Staphylococcus aureus, Enterococcus faecalis) and gram-negative (e.g. Pseudomonas aeruginosa, Shigella dysenteriae) bacteria. Chronic diseases, such as heart disease and cancer, are a leading cause of death. They have critical impacts on both our local and global communities. By assessing the phenolic content and antimicrobial activity in common commercial plant supplements, we hope to better understand the medicinal application and health benefits of these plant species and how they can address the concerns that chronic diseases present.

Mentors: Dr. Daniel Owens, Rebecca Barone
Investigating Genetic Variation in Ontogenetic Patterns in Leaf Anatomical Traits in a Long-term Field Experiment

Ontogeny refers to the genetically regulated shifts in phenotypic traits across developmental phases. While ontogenetic variation is well documented for some plant traits, there is a lack of research investigating the potential of these developmental trajectories to evolve. I investigated genetic variation in ontogenetic trait trajectories by studying leaf stomatal traits in *Betula pendula*, from a long-term field experiment in Finland. Stomata are major regulators of photosynthetic rate, which in turn drives patterns of growth and ecosystem productivity. Epidermal peels were made from leaves collected for 8 birch genotypes at two ontogenetic stages, and replication within genotypes included a total of 610 trees sampled at both stages. The stomatal traits were digitized and analyzed using ImageJ, and density and stomatal size estimates were collected from 3 sub-samples per peel. Genetic variation in ontogenetic trait trajectories is detected as the interaction between genotype and ontogeny in stomatal traits. Preliminary results indicate considerable variation in stomatal traits both within and among genotypes, with complex patterns across ontogeny. This study provides the first test for genetic variation in ontogenetic trait trajectories in long-lived woody plants, providing key insights into the evolvability of these trajectories.

Mentor: Kasey Barton, Chris Muir
A Homeless Shelter and Encampment Design Framework

Hawaii has one of the highest rates of homelessness in the nation, second only to New York. Here, 72% of our homeless population are unsheltered, many living in encampments. Our project included research on houseless encampments on Oahu in order to formulate a design framework that addresses the needs of informal houseless communities and learn from their resourcefulness and resilience. We worked closely with former houseless individuals to document, draw, and construct physical models of a previous encampment in Kaka’ako. This research allowed us to create a design framework that defines shelter, safety, community, and develop a vision for optimal shelters for the houseless population. With our design framework, we created a conceptual plan for Nimitz Kauhale which is a future area designated for permanent housing for the houseless community.

Mentor: Cathi Ho Schar
Metabolic Shift by a New Compound, Ketone-ester, may Potentially Reveal the Molecular Link between Ketosis and the Multigenic Asocial Condition in the Mexican cavefish, Astyanax mexicanus

Although many animals demonstrate collective behaviors, some species have evolutionarily decreased them during adaptation. How did these social populations become asocial through evolution? As for their genetic bases, ~1,000 risk genes have been listed in the studies of human psychiatric disorders associated with asocialness. Surprisingly, 62% of the top 281 human risk genes are dysregulated in an evolutionarily asocial fish species (no disorder), suggesting that the conserved molecular pathway can be involved in asocialness. However, key gene(s) that promoted the asocialness evolution are still unknown. A hint could be from an environmental intervention (ex., diet) because many animals change behavior strategies according to their metabolic states. The teleost model, Astyanax mexicanus, has two forms, cave-adapted (cavefish) and surface-dwelling forms (surface fish). Cavefish shows substantially reduced social-like behavior compared with surface fish. Previous transcriptomic analysis indicated 62% overlap, as mentioned above. To reveal the genes promoting asocialness evolution, we induced a metabolic shift, from glycolytic to ketogenic, by supplying a new compound, ketone ester. Ketone ester induces ketosis by directly supplying the major metabolite (ketone bodies) of the ketogenic diet, whose treatment could increase social-like interactions but attenuate somatic growth in cavefish. The ketone ester treatment in this study indeed induced social-like behavior in the cavefish without decreasing the growth rate, suggesting that the metabolic state certainly influences social tendency. In the future, using ketone ester, we will address which of the 'human risk genes' drive asocialness evolution regardless of the metabolic state, highlighting the master gene(s) for asocialness.

Mentor: Dr. Masato Yoshizawa
Love In Silence

*Love in Silence* is a creative project in the form of a short-narrative film, about a gay U.S Navy Sailor finding his courage to come out to his father after the repeal of Don’t Ask Don’t Tell. This film's motif and impact draws from the intricate relationships between not only LGBTQ+ individuals and their relationship with their parents, but also the barriers and cultural differences between Asian American children and their Immigrant parents.

The creative process is done in three parts. Pre-Production, Production, Post-Production. Pre-production process was holding meetings, going over crew responsibilities and working on a plan of action. This helps the crew prepare and brainstorm both logistically, financially, and artistically about the process in how we will create this film. Casting the actors and finding the correct location is also part of this Pre-Production process. Scouting for locations and holding auditions took weeks. Production is the actual filming portion of the process. With our storyboards, shot-list, and our shooting schedules, we are on-set and filming the scenes that we have been planning for over Pre-production. Post-Production happens when filming is completed and we start to put all shots together, edit them in softwares such as Adobe Premiere Pro, conduct sound editing/mixing, and then color grading. Once the picture is considered locked, then we can export it to be distributed and applied to Film Festivals around the world.

Mentor: Lisette Flanary
Legislative Civic Engagement of Oahu Young Adults and Teens

Civic engagement is significant to the development of states and nations. This includes the civic engagement of youth - as it can help develop their own skills to become agents of change for their communities. According to the 2020 US Census report, 36% of Hawaii residents are age 29 and below; however only 19.7% of its registered voters are from this age group. Participation in the electoral process is one of many forms of civic engagement that youth can become involved in.

This project seeks a clearer understanding of youth civic engagement through an online survey. The survey investigates the level of civic engagement and involvement demographic of young adults and teens. Areas focused on are the knowledge of and extent of involvement in legislative processes. It also explores attitudes, reasoning and accessibility relating to the legislative process. This study is particularly focused on local engagement of those ages 14-29 on Oahu with Oahu’s respective legislative bodies: the Honolulu City Council and Hawaii State Legislature.

Preliminary results indicate levels of civic engagement beyond the 50th percentile. Of the young adults (ages 18-29) who took the survey, nearly 65% report being involved in community or campus organizations. Similarly, 65.6% report having voted in a prior local government election. However, 51% report having no engagement with legislative bodies beyond the voting process and 37.6% indicate an understanding of legislative processes. A similar trend develops based on results from teens (ages 14-17) who took the survey - with 60% reporting no actual engagement with legislative bodies or processes.

As data collected from this survey shall support the development and accessibility of programs, forums and resources related to youth and civic engagement, there is future work to be done. Conclusions and future recommendations can be made with more survey responses overall, most particularly from teens 14-17.

Mentor: Dr. Bonnyjean Manini
Experiencing homelessness negatively impacts individuals’ quality of life. Stressors catalyze maladaptive coping mechanisms, which in turn, negatively impact wellbeing. These maladaptive behaviors are then amplified by a lack of access to resources. This contributes to a struggle to assimilation in society, and contributes to the development of mental health issues. This project analyzed coping mechanisms exhibited by these individuals experiencing homelessness, and reports on accessibility to public resources like healthcare and social service needs.

A quality of life questionnaire was completed by 78 new residents of a transitional shelter for individuals experiencing homelessness. All participants had recently experienced homelessness and completed a comprehensive assessment.

Data shows that positive (support of others) and negative coping strategies (substance use) are prevalent, with positive coping being associated with higher quality of life, and negative coping with lower quality of life. Self-reported mental health was estimated using the CDC Healthy Days Measure. Experiencing unhealthy mental health days was positively correlated with stress (measured by the Perceived Stress Scale). This association, in turn, was positively correlated with substance use. Participants reported a desire to work, but noted a lack of resources available including healthcare, housing, transportation, SSI/ID assistance, and vocational training.

People experiencing homelessness exhibit difficulty with positive coping behaviors when subjected to daily stressors. These individuals lack available resources, which feed the cycle of stress, substance use, and poor mental health. These individuals are commonly written off as a “lost cause” due to erratic behavior, and the data discussed aims to interject this notion and change the narrative.

Mentor: Dr. Jack Barile
Sarah-Lyn Kaeo
Human Development & Family Studies and Sociology
Minor in Communicology
Arts & Humanities - Creative
Honors
Oral Presentation: Session 1 (9:55-10:40a) in Kukui Room

Practicing Advocacy Through Political and Community Engagement in Hawai‘i: The Search for Preventative Solutions to Combat Food Insecurity

As a Human Development & Family Studies student at the University of Hawai‘i at Mānoa (UHM), my Senior Honors Portfolio Project documents my participation in advocacy through political and community engagement focused on food insecurity. A problem that affects families across Hawai‘i and my community, Nānākuli, I’ve witnessed firsthand how it leads to adverse health outcomes. I explored the dimensions of this problem and demonstrated practical knowledge and hands-on problem-solving skills and methods to address the need for immediate action on this issue. To advocate for this issue, three components were established with the tool(s) of computer-mediated communication (CMC). The first component consisted of letters shared with a non-profit organization and a public media entity that displayed my political engagement. The second component consisted of letters shared with a local Neighborhood Board member of Nānākuli that exhibited my community engagement. Each letter discussed what the people of Hawai‘i and the government could do to alleviate this stress for families. The third component is a product of a mock House Bill from a Congressional Internship experience that would hypothetically help families avoid experiencing food insecurity by aiming at education reform. Throughout this journey, I learned and understood the importance of civic engagement while also building connections with my community members using my voice. These opportunities not only helped me gain beneficial skills and knowledge in advocacy, but allowed me to showcase my true passion for caring for the social well-being of families from all walks of life through policy-making and analysis.

Mentors: Dr. Sothy Eng, Dr. Thao Le
Targeting Specificity of Centromeric Retrotransposons

Retrotransposons utilize a well characterized integration system capable of inserting genes into a host genome facilitated by its integrase (IN), a retrotransposon-encoded enzyme that targets specific genomic regions using epigenetic markers. The integrase of centromeric retrotransposons (CR) specifically target the centromere, a part of the chromosome essential in chromosome segregation during cell division. To understand this integration system, the IN of CR2 will be tested for targeting specificity.

To accomplish this objective of further characterizing the regions of the CR IN which contribute to targeting specificity, chimeric INs will be generated shuffling the putative targeting domains of CR2 and Human Immunodeficiency Virus 1 (HIV-1). It is expected that the loss of the targeting domain of the CR IN will abrogate centromeric protein interactions, and thus lose preference for the centromere. The novel chimeric integrases will be generated via Gibson Assembly, a cloning method allowing the joining of DNA fragments. Constructs will be inserted into the pGST.parallel1 plasmid containing a glutathione S-transferase (GST)-tagged fusion protein, improving the solubility of the expressed integrase protein and allowing for purification by glutathione agarose beads. Assembled constructs will then be sub-cloned in Escherichia coli (E. coli) DH5-α, sequence verified and then cloned into E. coli BL21(DE3)pLysS for expression. The purified IN protein will be tested for activity using a well-characterized in vitro assay used in the lab.

Mentor: Dr. Gernot Presting
Characterization and Biochemistry Analyses of Local Fungal Isolates

Fungi play a crucial role in the ecosystem, being decomposers and recycling nutrients. In addition to their ecological importance, many fungal strains can produce valuable bioproducts. To discover the potential of soil fungi that can produce bioproducts, we isolated 22 fungal strains from soil, identified them by sequencing of the fungal internal transcribed spacer rRNA gene, and analyzed. The growth rate of each strain was measured daily to obtain a growth curve for up to 10 days on malt extract agar (MEA). Fungal mycelium of each strain grown in the ME medium was harvested for lipid and fatty acid profiling by thin-layer chromatography (TLC) coupled with gas chromatography-flame ionization detection (GC-FID). Lipid extraction was performed on the samples, followed by TLC for lipid composition, and each lipid was collected for GC-FID. The productive strains were selected for further co-culture with oleaginous microalgae to establish co-production consortia for valuable bioproducts.

Mentor: Dr. Zhiyan Du, Dr. Nhu Nguyen
Co-Author: Sophia Lee
The Design and Modification of Larvae Rearing Tanks for 'Opihi Settlement

In efforts to replenish wild populations of 'opihi (*Cellana exarata, Cellana sandwicensis*) through laboratory-based growth, a major boundary has been the low survival of larvae after reproduction, during the latching phase. With previous methods, latching and survival into the next life stage have been very low, and we propose that by using modified larval rearing tanks that better mimic the natural environment of 'opihi, survival of larvae will increase.

Mature test subjects are obtained from the western coast of Oahu and stored in broodstock tanks in the Bingham Laboratory prior to spawning. After spawning using artificial maturation and fertilization, larvae are placed into the modified tanks. Plates are then incrementally removed for evaluation of latching success and examination of surface conditions. Preliminary results show successful latching of 'opihi and sustained algae growth on substrate plates. These positive results show a possible next step toward the goal of completing an 'opihi’s full life cycle under laboratory conditions.

Mentor: Dr. Jon-Paul Bingham
A Computational Study of the Decomposition of Nitro-amine-based Energetic Material

Nitro-amine-based molecules feature high explosion efficiency that has promising potential in civilian and military applications. Despite this, there has been no comprehensive computational study conducted where the decomposition mechanisms and structures along with overall spectrum of newly formed products are revealed condensed phase.

1,1-diamino-2,2-dinitroethylene, FOX-7, is one of the three known energetic molecules that feature a rare combination of high performance and low sensitivity. It is one of the smallest in the family of energetic molecules which lightens the burden in its computational study and has therefore, been selected as the representative molecule to study the decomposition process of nitro-amine-based energetic molecules. As a result of this study, several key findings are expected which includes an accurate potential energy surface, theoretically feasible intermediates and products, the branching ratio of the products, etc.

The research pushes the boundaries of our current knowledge on the interplay between the molecular structure of energetic materials and their behaviors, and will play a significant role in designing and synthesizing future energetic materials of high performance and low sensitivity.

Mentor: Dr. Rui Sun
Effects of Coil Geometry on Collected Ice Growth in Thermoelectric Freeze Desalination

Freeze desalination (FD) is a relatively new process that involves the freezing and rinsing of seawater to yield freshwater. While other processes exist such as reverse osmosis and boiling, FD requires only 1/7 the energy compared to boiling, and it is a simple process that requires little maintenance.

Previously, this experiment consisted of a thermoelectric cooler (TEC) cooling IPA in a closed loop system running through a straight copper tube in contact with a reservoir of 35PPT saltwater (seawater equivalent), indirectly cooling it. This previous setup was considered inefficient due to small freezing volume and limited cooling surface between tube and saltwater. To improve efficiency, the effects of running two TEC coolers in series and testing different copper pipe geometry were investigated. In addition, preliminary COMSOL and Solidworks computer simulations were performed to compare experimental results.

By utilizing a pipe geometry with a serpentine-like pattern, the surface area of the pipe exposed to saltwater increased, allowing for a higher heat transfer to the reservoir saltwater and more surface area for growing ice. Running two TEC in series significantly increased the cooling rate to produce initial ice growth. Preliminary results with a washing process yielded 11PPT 135mL water from cooling 1000mL of saltwater for 1.2hrs. Different serpentine patterns with similar surface area were also tested. The combination of having two TEC in series and having an optimal coil geometry allowed for the freezing of higher quantities of seawater as well as reducing the amount of time to reach freezing.

Mentor: Dr. Woochul Lee
Farming on the Final Frontier: Space Farming with Martian Soil Simulants

Because temperature and light intensity on Mars are significantly lower than that of Earth, controlled environment agriculture production to grow crops is an option. The objective of this study was to compare Mojave Mars Simulant (MMS-1) and Enhanced Mojave Mars Simulant (MMS-2) to a commercial growing medium, Pro-Mix BX Mycorrhizae (Pro-Mix), for overall growth, plant health, and edible end products. The Martian soil simulants, MMS-1 and MMS-2, are composed of crushed Saddleback Basalt rock. MMS-2 differs due to the addition of nutrients and oxides. In this study, we looked at a variety of crops chosen for nutritional value, cold and shade tolerance, and size. Crops were dwarf curled kale, ‘Red Robin’ tomato, and ‘Cherry Belle’ radish. Mars is further from the Sun than Earth meaning lower light intensity and colder climate. To simulate this, a shadehouse and fans were used to diffuse sunlight and regulate temperature. To explore this idea further the crops in the soil were examined under full-spectrum LED grow lights indoors on a 16-hour day length timer. Plant height and stem diameter taken on a weekly basis had delayed rates of growth in all crops with both MMS-1 and MMS-2 compared to Pro-Mix. Edible end products were not significantly different in the compared soils. From these experiments, it was found that additional nutrients through a pellet fertilizer or nutrient solution is necessary for proper plant development when using the Martian soil simulants.

Mentor: Dr. Kent Kobayashi
Aerodynamics and Acoustics of a Flapping Wing Drone

The acoustics and aerodynamics of flapping wing flight remains an unexplored topic in both biological organisms and engineering applications for bio-inspired drones. This investigation compares flight dynamics of drones with those of insects in a laboratory setting. An accelerometer and high-speed camera were used to track the movement of two commercially available flapping wing drones, MetaFly and Bionic Bird. The acceleration data obtained by the accelerometer was compared via frame-by-frame analysis using Tracker video software. This data was used to estimate thrust, lift, and drag from various empirical formulas developed for bird and insect flight. A more extensive comparison was done with a computational fluid dynamics (CFD) software was developed with joint efforts by Allen lab and Adaptive Research, Inc (Las, Vegas, NV). A visual and quantitative comparison can be obtained for conditions of Vortex shedding and membrane deformation with respect to transverse rotation. These results are further compared to tethered flight data obtained from invasive beetle species using high speed video and synchronized array acoustics. Acoustic data for the drones was collected via microphones and the flapping frequency was extracted with signal processing methods. Future improvements could include testing in larger wind tunnels to simulate dynamic flight paths. Also, more controllable drones might be used if developed to obtain higher fidelity data.

Mentor: Dr. John Allen
Mentally Contagious: An Investigation of Parent and Child Anxiety During the COVID-19 Pandemic

The COVID-19 pandemic has engendered anxiety in millions of people around the world, especially in parents and their children. These feelings of anxiety are even more prevalent in vulnerable groups such as nurses, doctors, young adults, racial and ethnic minorities, and unpaid caregivers for older adults.

The goal of the study is to understand the relations between household income, economic pressure, parent perceptions of COVID-19, parent threat transmission to children, parent anxiety, and child anxiety during the ongoing pandemic. I hypothesized that household income, economic pressure, and perceived threat of the virus will all contribute to a rise in parental anxiety, which will increase child anxiety.

To test these hypotheses, an online survey was administered using Amazon Mechanical Turk (MTurk) to parents living in the state of Hawai‘i with at least one child between the ages of 1-15 (n =108). All participants were invited to report their levels of anxiety, their child’s anxiety, household income, economic pressure, perception of COVID-19, and parent threat transmission. Using structural equation modeling, a measured variable path model was fit to the data, demonstrating excellent fit.

The final structural model revealed that household income predicted economic pressure and parent anxiety, while economic pressure predicted parent anxiety above and beyond income. In turn, parent anxiety strongly predicted child anxiety.

Mentors: Dr. Emily Daubert, Dr. Siobhán Ní Dhonacha
Assessment of Resistant Starch in Fresh and Fermented Poi

Both taro and poi are traditional foods that have been a staple in the Hawaiian diet since Polynesians first arrived on the Hawaiian Islands and therefore possess cultural significance. Poi is prepared by grinding cooked taro (Colocasia esculenta L) into a fine paste and is either served fresh or fermented. Scientific studies indicate that poi may improve allergies, support weight-gain in preterm infants, have probiotic properties, inhibit proliferation of colon cancer cells, and contribute to reduced obesity and cardiovascular disease risks. RS is a type of fiber that is resistant to digestion and absorption, thereby imparting health benefits including improved glycemic control, insulin sensitivity, digestive health, and weight management. It has been demonstrated that flour prepared from fermented raw taro contained increased concentrations of amylose, amylopectin, and RS content, however, no studies have been conducted on the RS content of commercially available fresh and fermented poi. Fifteen independent samples of poi were purchased at local supermarkets and fermented for 0, 24, and 48 hours at 20°C. RS will be extracted using amylglucosidase and α-amylase and measured spectrophotometrically with a D-glucose standard. Findings will be presented at the symposium. Measuring the effects of fermentation on RS content of poi can further our understanding of its nutritional qualities to inform and promote healthier food choices for people living in Hawai‘i. This work is supported in part by the Undergraduate Research Opportunities Program, Office of the Vice Provost for Research and Scholarship (OVPRS) at UH Mānoa and USDA, Agriculture Research Service.

Mentor: Dr. Pratibha Nerurkar
Circadian Rhythm Based in Vivo Guppy Bioassay for Novel Drug Discovery

Ever since the 1960s, zebrafish (Danio rerio) have been the ideal model organism for biomedical and pharmaceutical research. This is largely due to their availability, cost, and receptor similarities to humans. Though zebrafish are widely considered to be the most convenient test subject, there is always motivation to find a better alternative to them as a model organism. This project proposes that guppies (Poecilia reticulata) can be used as an alternative model organism to zebrafish in circadian rhythm and activity-based bioassays. Through the development of a light-controlled, motion tracking apparatus, we were able to create activity charts that highlight the aggregate movement of an individual fish over a 24-hour time period. Dose-dependent activity charts with increasing concentrations of galantamine hydrobromide were also created to reflect how one can monitor drug activity in guppies, and subsequently, how one can use these charts for discovering novel pharmaceuticals.

Mentor: Dr. Jon-Paul Bingham
Wound Recovery and Coralivore Behavior Observations with Bleached and Non-bleached Phenotypes of *Montipora capitata* and *Porites compressa*

Rising sea water temperatures due to global climate change are causing corals to experience high heat stress. The most common and main consequence of this is coral bleaching which causes mortality. Bleaching susceptibility in corals depends on both biotic and abiotic factors including individual thermal tolerance and symbiont type. Coral reefs experience direct and indirect impacts from the loss of coral and their ecosystem services, including providing shelter for reef organisms and food for corallivores. The aim of this project was to look at the tradeoffs of thermal tolerance and ecosystem services in two of Hawai’i’s common reef building corals: *Montipora capitata* (rice coral) and *Porites compressa* (finger coral). We measured wound recovery rate and the juvenile bullethead parrot fishes (*Chlorurus spilurus*) bite rate in two bleaching phenotypes (Bleached (B) and Non-bleached (NB)) determined during the 2014-2015 bleaching event in Kāne‘ohe Bay. We found that *Porites compressa* recovered faster than *Montipora capitata* and overall, that the NB phenotype recovered more quickly than the B phenotype. There was no significance seen in preference from the bullet head parrot fish between coral species or phenotype. These results are important because they illustrate that the corals of future reefs will have quicker recovery rates and will still provide satisfactory food for corallivores.

Mentors: Dr. Crawford Drury, Joshua Hancock M.S., Dr. Jacob Johansen, Dr. Jeroen Brijs
Establishing ways to control a swarm of robots has been a continued topic of interest as technology and machines have advanced toward autonomy. Instead of relying on human commands for direction on how to behave, algorithms and protocols must be in place for robots to make informed decisions on how to act and respond to certain situations. Since there are many satellites in Earth's orbit, proper coordination is needed. This makes maneuvering around in Earth's orbit difficult especially for swarms of small satellites. However, this also makes it possible for a swarm of small satellites to converge to a specific location and collect data.

The research conducted for this project explored and applied how fluids move and behave to a swarm of small satellites. Modeling their behavior after fluids were ideal because they can change their shape to fit whatever container they are put in. This was applied to how the satellites will respond to an obstacle near them. The concept of smoothed particle hydrodynamics (SPH) was used to implement a control algorithm that allows a satellite to behave like a particle of a fluid - they need to stay close enough to one another while staying away from obstacles that enter their orbit path. In this project, SPH was applied to a simulated swarm of five satellites and showed in simulation that this concept was successful, allowing the satellites to maintain formation while adapting whenever necessary.

Mentor: Dr. Zhuoyuan Song
E Kupu Ana Ka Hana Noʻeau: An Honors Portfolio in Hawaiian Studies

As a Hawaiian Studies and Hawaiian Language student at the University of Hawaiʻi at Mānoa (UHM), my Senior Honors project documents the beginning of my journey as a Hawaiian cultural practitioner—an emerging hana noʻeau—in the form of a multimedia portfolio. I combined knowledge and skills from my studies of ʻŌlelo Hawaiʻi and ʻIke Hawaiʻi to tell the story of my research, practice, and perpetuation of three Hawaiian cultural practices: hana lei hulu (feather lei making), hula and oli (Hawaiian dance and chant), and haku mele (song/poetry composition). My project is entitled “E kupu ana ka hana noʻeau.” Hana can be translated as “work, activity, practice, process.” Noʻeau can be translated as “skillful, artistic, expert.” Kupu can be translated as “to grow, sprout.” As an emerging Hawaiian cultural practitioner, the works that I studied and showcased in this portfolio are my hana noʻeau. As I went through the process of researching, creating, and practicing each component, my knowledge, skills, and experience continued to kupu or grow. Similarly, I, myself, can be considered a hana noʻeau, a practitioner of hana noʻeau who is also continuing to kupu. It is through this process that I learned more about myself while also developing into my role as a practitioner of these art forms of my kūpuna and discovering the important roles that these hana noʻeau play in the perpetuation and resurgence of our Hawaiian culture, language, and people.

Mentors: Maya L. Kawaiłanaokeawaiki Saffery, PhD; Leilani Basham, PhD
Host Status of *Rotylenchulus reniformis* and *Meloidogyne javanica* on *Vitex rotundifolia*, *Sida fallax*, *Ipomea pes-caprae brasiliensis*, and *Pritchardia sp.*

Many plant diseases such as fungi, nematodes, viruses, and bacteria affect the health of native plants. Two pathogenic nematodes, *Meloidogyne javanica* and *Rotylenchulus reniformis*, are common plagues of garden and landscape plants. *M. javanica* is a species of root-knot nematode which causes roots to form tumor like galls on the root tips preventing growth and decreasing nutrient absorption efficiency (Fig. 1). This will often result in slowed growth and weakened health of the plants (Hussey, 1973).

*R. reniformis* causes general poor health in host plants. These nematodes infect the plant host roots and reduces secondary root growth. Nematode infection also impairs nutrient absorption. An infected plant will be unable to absorb nutrients and will show typical symptoms of nutrient deficiency (Wang, 2007).

The purpose of this experiment was to determine the host status of common native Hawaiian landscape plants. The hypothesis was that the native plants will be host to both *Meloidogyne javanica* and *Rotylenchulus reniformis*.

*Sida Fillax*, *Vitex rotundifolia* and the *Pritchardia sp.* were found to not be good hosts of Rotylenchulus reniformis. *Sida fillax* appears to have been a moderate host to *M. Javanica*. *Ipomea pes-caprae brasiliensis* was an excellent host from *Meloidogyne incognita* and *Rotylenchulus reniformis*. *M. Javanica* was not tested on *Ipomea pes-caprae brasiliensis*.

Certain outliers indicate that future research should focus on repeat trials to account for external variables and that testing on further native plants would give a broader understanding of the impact of nematodes on the native forest.
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Cathi Ho Schar      Dr. Rui Sun
Dr. Jacob Johansen  Dr. Masato Yoshizawa
11:45-12:30 student panel

PROGRAM SCHEDULE
Welcome & Introduction..................Dr. Vernadette Gonzalez, Honors Director
Panel Discussion..................................................Volume VI Student Authors
Moderator: Dr. Jayme Scally, Editor
Closing.................................................................Dr. Jayme Scally, Editor

ABOUT THE JOURNAL
Horizons is a peer-reviewed academic journal dedicated to high-quality creativity, innovation, and research created, conducted, and synthesized by undergraduate students at the University of Hawai’i at Mānoa (UHM) in all academic fields represented by the UHM campus community.

Each annual issue, released in the fall, is published with simultaneous print and online versions. See the full version on our website at: https://manoa.hawaii.edu/horizons/

CALL FOR SUBMISSIONS
We invite students enrolled at UHM during the Spring 2021 through Spring 2022 semesters to submit work produced within this time frame to be considered for the Fall 2022 issue (Volume VII). We encourage submissions from any undergraduate academic discipline.

For specific deadlines and detailed instructions on how to submit works for consideration, please visit our website listed above.

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The Undergraduate Research Opportunities Program (UROP) under the Office of the Vice Provost for Research and Scholarship (OVPRS) coordinates and promotes opportunities for undergraduate students across all disciplines at the University of Hawai‘i at Mānoa to engage in faculty-mentored research and creative work. UROP serves all undergraduate students in all disciplines by offering financial and programmatic support that includes: project and presentation funding; the Summer Undergraduate Research Experience (SURE) and accompanying SURE Symposium; a database of on- and off-campus research and creative work opportunities; and, in collaboration with the Honors program, the Undergraduate Showcase Event.

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