Undergraduate Research and Creative Work

8 December 2017 – 9:00am to 1:30pm
Sakamaki Hall
Campus Center Ballroom
Honolulu, Hawai‘i
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<td>10:35-10:45a</td>
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Sakamaki Hall
Oral Presentations Session One 9:40a - 10:35a
Oral Presentations Session Two 10:45a - 11:40a

B101 Engineering & Computer Sciences
B102 Arts & Humanities – Creative and Research
B103 Social Sciences
C101 Natural Sciences
C102 Natural Sciences
C103 Natural Sciences

Campus Center Ballroom
Poster Presentations 11:50a - 12:30p
Lunch and Awards Ceremony 12:30 - 1:30p
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<td>Tiffany Eulalio</td>
<td>Evaluating Priority Queues on GPUs</td>
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<td>Glenn Galvizo</td>
<td>Analysis and Optimization of Lost-in-Space Star Identification</td>
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<td>Sakamaki B102</td>
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<td>Tani Mei Loo</td>
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<td>Devon Miller</td>
<td>“If It Were My Way, All This Ought to Be Red”: George Thomas and the Frontier of the British Empire 1781-1802</td>
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<td>Fueling the Flames: The Case Against Arming Nonstate Actors in Intrastate Conflicts.</td>
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<td>Who’s Helping Whom: Medical Voluntourism In Costa Rica and Nicaragua</td>
<td>Angelique Fontaine*</td>
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<td>Addressing the Concussion Epidemic in Public Schools: Hawai‘i State Concussion Policy and Physical Education Teachers (PETs) Concussion Awareness</td>
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<td>Characterizing the Efficacy of LRRK2 Kinase Inhibitors in Live SHSY5Y Dopaminergic-like Cells for Novel Parkinson’s Disease Therapeutics</td>
<td>Donovan D. Delgado</td>
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<td>Differences in Protein Production by Bacillus subtilis in the Presence and Absence of Alternative Ribosomal Proteins</td>
<td>Sasha Canovali</td>
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*next to name in schedule indicates student is also presenting a poster*
Oral Presentations Session One  
9:40 - 10:35a

Sakamaki C102  
Natural Sciences

Honour Shore Ai  
Lin Booth  
Assessing the Sunscreen Sheen: Determining the Presence of Organic UV-Filters at the Hanauma Bay Marine Life Conservation District

Annika Little,  
Alexa Foster  
Carbon Footprint of UH Mānoa

Ariel Christina Lorenzen  
Assessing the Accuracy of an Environmental Monitoring System in the Ala Wai Boat Harbor

Sakamaki C103  
Natural Sciences

Nina Bean*  
The Effect of Different Concentrations of Oxybenzone-Based Sunscreen on the Photochemical Efficiency, Growth Rate, and Mortality of Two Coral Species.

Samantha A Donohoo*  
The Effects of Light Intensity on *Plakobranchus cf. ianthobapsus* Fitness

Sarah Albright  
A Growing Problem: The Missing Link for Ecological Success by the Invasive *Avrainvillea*

* next to name in schedule indicates student is also presenting a poster
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<td>Tamra Oyama, Jie Zhou</td>
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<td>Sakamaki B101</td>
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<td>Kevin Kam, Brianne Tengan</td>
<td>Ionic Gel Graphene Field Effect Transistors</td>
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<td>Sakamaki B101</td>
<td>Engineering &amp; Computer Sciences</td>
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<td>Sakamaki C101</td>
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<td>Lexie Kajihara</td>
<td>Tuning Cellular Photoprotection to Improve Algal Productivity</td>
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<td>Sakamaki C101</td>
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<td>Jeff Kleyner</td>
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<td>Candide Krieger</td>
<td>The Efficacy of Using Strawberry Guava (Pisidium cattleianum) Mulch to Control Weeds in Hawaii</td>
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<td>Sherilyn Munroe</td>
<td>Lichens of Hawai‘i: Using a Molecular Approach to Give Cladonia skottsbergii a Seat at the Evolutionary Table</td>
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Natural Sciences

Nina Bean  
The Effect of Different Concentrations of Oxybenzone-Based Sunscreen on the Photochemical Efficiency, Growth Rate, and Mortality of Two Coral Species

Samantha A Donohoo  
The Effects of Light Intensity on Plakobranchus cf. ianthobapsus Fitness

Alex J. Lee  
Sequencing the Genome of a Novel Piscirickettsia Species
Social Sciences

Adriana Botero, Tiffany Cha
Exploring the Lives of Clubhouse Members on O‘ahu through Photovoice

Angelique Fontaine
Who’s Helping Whom: Medical Voluntourism in Costa Rica and Nicaragua

Nikolas Ernest A. Herrera
Honeybees (*Apis mellifera*) Learn to Choose the Odd Size

Jennifer Keliikuli
Promoting Benefits of Skin-to-Skin Contact Between Mothers and Newborns
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:

Adriana Botero, Tiffany Cha  
Kevin Kam, Brianne Tengan  
Annika Little, Alexa Foster  
Tamra Oyama, Jie Zhou  

Abstracts are direct from presenters; wording and content are the author’s responsibility.
A Growing Problem: The Missing Link for Ecological Success by the Invasive Avrainvillea

The invasive green alga *Avrainvillea* has an unusual anatomy but typical of its siphonous evolution, there are no crosswalls that separate cells within the body of this plant. First detected in Hawai‘i in 1981, *Avrainvillea* has spread along the south shore of O‘ahu, displacing diverse communities of native reef plants, despite being a single cell. Such unusual morphology and rapid spread leads to questions about a potential relationship between plant body and competition for essential nutrients. Are nutrients from surrounding waters drawn down and stored evenly in this alga as an adaptive strategy for ecological success? In this study, I assessed differences in the morphology of *Avrainvillea amadelpha*, specifically the biomass and nitrogen content of the basal holdfast and its upright blades. Intra-plant sampling was conducted by collecting specimens in Maunalua Bay, O‘ahu. Nitrogen content of groundwater beneath dense patches of *Avrainvillea* was compared to that of nearby areas with no algae to assess whether *Avrainvillea* draws on this potential source of nutrients. These results demonstrated a significantly higher concentration of nitrogen in the upright blades compared to the basal holdfasts for the same plant. Further, $\delta^{15}$N levels tended to be higher in the basal holdfasts, suggesting nutrient partitioning is occurring. In about half of the groundwater nutrients samples, areas without algae had substantially higher nutrients than in locations with algae. These studies give insights to the competitive strategies that have allowed *Avrainvillea* to rapidly dominate native plant communities on O‘ahu.

Mentor: Dr. Celia Smith
The Effect of Different Concentrations of Oxybenzone-Based Sunscreen on the Photochemical Efficiency, Growth Rate, and Mortality of Two Coral Species

Reef-building corals are extremely vital biologically and economically, yet they are under multiple global and local stressors. Personal care products, such as oxybenzone-based sunscreen, may be one of them. We exposed colonies of *Montipora capricornis* and *Acropora cervicornis* to varying oxybenzone concentrations (3 mg/L, 0.3 mg/L, 0.04 mg/L, 0.007 mg/L, 0 mg/L) derived from a particular sunscreen formulation for 17 days. To quantify the physiological impacts from exposure, we measured photochemical efficiency of photosystem II within the algal symbionts of the corals, the growth rates of *M. capricornis*, and the mortality rate of both species. After 17 days of exposure, *A. cervicornis* in the 3.0 mg/L and the 0.3 mg/L oxybenzone treatments and all of the *M. capricornis* aside from the controls were either visually bleached or pale. Growth rates of *M. capricornis* were reduced at oxybenzone concentrations of 3 mg/L and 0.3 mg/L. All corals in the 3 mg/L oxybenzone treatment suffered 100% mortality within 9 days. There was a reduced maximum electron transport rate (ETR) and ETR slope within the 3 mg/L oxybenzone treated *M. capricornis* and *A. cervicornis* and a reduced maximum effective quantum yield for *M. capricornis* in the 3 mg/L oxybenzone treatment. In general, *M. capricornis* appeared to be more sensitive to the effects of the oxybenzone-based sunscreen than *A. cervicornis*, although both species were negatively affected by the exposure. Our results show that some oxybenzone-based sunscreen formulations can cause reduced coral health, reduced growth rates, and increased mortality rates of two important corals species.

Mentor: Dr. Erinn Muller
Assessing the Sunscreen Sheen: Determining the Presence of Organic UV-Filter at the Hanauma Bay Marine Life Conservation District

Organic ultra-violet (UV) filters are known endocrine disruptors that interfere with larval and embryonic development, reproduction, and gender determination in marine invertebrates, fishes, and rodents. They find their way into the environment via plastic and personal care product waste. When humans enter the ocean after applying sunscreens with these UV-filters as their active ingredient they eventually wash off, directly entering the environment. Hanauma Bay is a Marine Life Conservation District famous for its abundant coral reefs that boast a myriad of indigenous and endemic biota which sees 3,000 visitors a day, many of whom use sunscreen products containing organic UV-filters. The purpose of this study was to investigate the change in concentrations of the sunscreen UV-filters oxybenzone (BP3), avobenzone (AVO) and octocrylene (OC) in the surface waters of Hanauma Bay from shore to reef. Replicate samples were collected from three sites along a transect every 6 hours from 6:00-18:00 on a Monday and Wednesday in August 2017. Analytes were extracted from environmental samples using reverse phase solid phase extraction and analyzed using triple quadrupole liquid chromatography/mass spectrometry. Recovery for each analyte are as follows: BP3 74.2%, AVO 18.9% and OC 75.4%. As expected, concentrations were highest at shoreline and peaked at mid-day. The highest concentrations for BP3, AVO and OC were, respectively, 444 ng/L, 54 ng/L and 210 ng/L. With the new attention to the risk that sunscreen chemicals may pose to corals and marine ecosystems, this data and further studies of presence in the water column should be considered.

Mentors: Dr. Philip Williams, Mackenzie Manning
Exploring the Lives of Clubhouse Members on O‘ahu through Photovoice

Clubhouses are community centers that serve adults with mental illness by providing social support and opportunities for growth. Opportunities include providing a community, a safe and welcoming place to go, employment opportunities, and wellness supports. However, little is known about what Clubhouse members actually feel or go through at Clubhouse, in their community, or at home. With the significant stigma associated with mental illness, this project aims to provide the means and opportunity to work on a project that is both collaborative and engaging. Therefore, the objective is both to create a meaningful and participatory research process, and to produce findings that are illuminating to the community about strengths and challenges facing people with mental illness on O‘ahu. Participants needed to be an active Clubhouse member, and participation in this study was voluntary. All participants gave written consent. Using Photovoice, a participatory action research method, participants from three Clubhouses on O‘ahu took pictures of strengths and challenges in their community. Participants then presented their photos in focus groups. Each focus group-session was facilitated by a researcher in the study. Members described their photographs. All focus group sessions were recorded, transcribed and analyzed by team members. Our results capture themes that emerged across the Clubhouses, and their respective prompts: Past, Present & Future, Happiness, Meaning and Purpose.

Mentor: Dr. John "Jack" Barile & Joy Agner

Co-Author: Nikolas Herrera
Differences in Protein Production by Bacillus subtilis  
in the Presence and Absence of Alternative Ribosomal Proteins  

(no abstract submitted)

Mentor: Dr. Sladjana Prišić
Donovan D. Delgado  
Molecular Cell Biology, Psychology  
Natural Sciences  
Participation for UROP  
Oral Presentation: Session 1 (9:40-10:35a) in Sakamaki C101

Characterizing the Efficacy of LRRK2 Kinase Inhibitors in Live SHSY5Y Dopaminergic-like Cells for Novel Parkinson’s Disease Therapeutics

Parkinson’s disease (PD) is a chronic neurodegenerative disorder characterized by the death of dopaminergic neurons in the substantia nigra region of the midbrain. The most common genetic cause of autosomal dominant PD are mutations in the leucine-rich repeat kinase 2 (LRRK2) gene with G2019S being the most frequent. Functional analyses of the G2019S mutation have described a two-fold increase in kinase activity. Due to this finding, current drug discovery trials have targeted LRRK2 kinase inhibitors as a potential novel disease modifying therapy for PD. Functional studies in our laboratory have indicated lower levels of LRRK2 protein concentration and novel alterations of active LRRK2 in a living, dynamic, and highly differentiated, dopaminergic-like SH-SY5Y cell line. These experiments are the first to examine the cellular and chemical alterations of LRRK2 caused by the addition of commonly studied kinase inhibitors in a dynamic system. This project further characterized these abnormal LRRK2 dynamics by utilizing advanced fluorescence microscopy techniques using the in house 2-photon confocal microscope (2P) and total internal reflection fluorescence (TIRF) microscope. Images collected were analyzed using photon counting histogram (PCH), number and brightness analysis (N&B), and Raster image correlation spectroscopy (RICS) to determine oligomerization, diffusion, and concentration. Our data suggest that these potentially hazardous alterations in LRRK2 protein function are also present in endogenous LRRK2 concentrations and at therapeutic drug concentrations (IC50). Further analysis of the factors involved in LRRK2 kinase inhibitor function is important to understand PD pathology, normal LRRK2 function in dopaminergic neurons, and optimal conditions for drug delivery.

Mentors: Dr. Nicholas James, Dr. Robert Nichols

Co-Authors: Bethany J. Sanstrum, Brandee M.S.S. Goo, Diana Z.Y. Holden
The Effects of Light Intensity on *Plakobranchus cf. ianthobapsus* Fitness

Sacoglossans, or “sap-sucking” sea slugs, are primarily algivorous with many taxa exhibiting kleptoplasty - the stealing and retaining of photosynthetically active chloroplasts (kleptoplasts). The *Plakobranchus* species complex demonstrates one of the longest kleptoplast retention times and survival under starvation conditions, but the contribution of these kleptoplasts to slug survival and overall fitness has been widely debated. This study assessed the correlation between slug weight (i.e. fitness) and irradiance by placing starved *Plakobranchus cf. ianthobapsus* individuals into dark, low-light (40%), mid-light (70%), and high-light (ambient) irradiance treatments for eight weeks. The study was repeated with new individuals for an additional eight weeks. Weight and photosynthetic yield ($F_v/F_M$), via Pulse Amplitude-Modulated (PAM) fluorometry were measured weekly. ANOVA and Tukey’s Test were then used to assess the validity of this correlation. Low-light treatment *Plakobranchus* lost significantly less weight than those in the ambient light treatment, but not when compared with those in the dark and medium light treatments. The significant decline of photosynthetic yield in ambient light supports this increased weight loss, suggesting that constant refreshment and replenishing of kleptoplasts may be essential for kleptoplast benefits to be realized. This constant uptake of new kleptoplasts is most likely also responsible for mitigating the highly damaging effects of ambient light on sequestered chloroplasts in the natural environment.

Mentor: Dr. Alison Sherwood

Co-Author: Rachael M. Wade
Evaluating Priority Queues on GPUs

Priority queues are a fundamental data structure in computer science with many widely-used applications. Priority queues are commonly used in many classical algorithms, including Dijkstra’s algorithm for finding shortest paths. The shortest paths problem is highly applicable to modern technology, including robot navigation, networking, and GPS navigation systems such as Google Maps. There are many different implementations of priority queues, including binary heaps, pairing heaps, and Fibonacci heaps. However, while priority queue implementations are versatile and efficient, the application of priority queues has mainly been done on traditional sequential computers or CPUs. Today, graphics processing units (GPUs) have become a commonly used tool. The high degree of parallelism in GPUs make them an essential tool in high-performance computing. As opposed to CPUs which are designed to complete only a few complex tasks simultaneously, GPUs can perform thousands of simple tasks in parallel. In this study, we analyzed several different versions of existing priority queues and judge their applicability to parallel processing on GPUs. We analyzed binary heaps, pairing heaps, and parallel priority queues. After the analysis, we selected the pairing heap as the most suitable for implementation in parallel on GPUs. We developed an algorithm to implement a parallel priority queue based on pairing heaps whose application is intended for the shortest paths problem. Specifically, the algorithm was made to perform Dijkstra’s algorithm in parallel. We use an amortized analysis to evaluate the applicability of our parallel priority queue algorithm.

Mentor: Dr. Nodari Sitchinava

Co-Author: Ben Karsin
Who’s Helping Whom: Medical Voluntourism in Costa Rica and Nicaragua

Volunteer tourism combines leisure travel with humanitarian work and is rapidly growing in popularity. From the participant’s point of view, volunteer tourism, and specifically medical volunteer tourism, is relatively unexplored throughout multiple disciplines, including medical anthropology. This research project exposes potential issues that surround medical voluntourism, and volunteerism in general, that may otherwise go unrecognized. My research aims to determine whether these types of medical voluntourism programs are beneficial to both the pre-medical students and the local patients in need of healthcare. By working with the students, trip coordinators, and other volunteers involved in a medical volunteer program, I delve into why students are attracted to traveling outside of the U.S. to volunteer, as well as what their expectations of the program are. By comparing and contrasting the roles of the medical volunteers in Costa Rica and Nicaragua, this project analyzes the respective rules governing the types and levels of clinical interactions foreign student volunteers have with local patients, as well as how students and patients understand and perceive their prospective roles.

In compliance with standard ethnographic research, a combination of participant observation and interviews were utilized throughout a two-week period in Costa Rica and Nicaragua. Multiple interviews were conducted with roughly 20 participants, which included student and adult volunteers, program staff, and physicians. In addition to an anthropological perspective on Costa Rican and Nicaraguan health care, this project has found that there is clear ethical significance in medical voluntourism programs between all parties involved.

Mentor: Dr. Jan Brunson
Analysis and Optimization of Lost-in-Space Star Identification

Ancient mariners could look at the night sky, and plot accurate routes to destinations hundreds of miles away. Now we use maps and the Global Positioning System (GPS) to navigate—but stars are still crucial for the navigation of spacecraft. One can think of the spacecraft computer as the ancient navigator, the camera as the navigator’s eyes, and the star identification algorithm as their process for determining which stars they are looking at. My work involves finding a more optimal method for star identification with the added constraint of not knowing how we orient the camera (which is inherent to spacecraft navigation).

This project was designed to compare four existing procedure: Tappe’s Angle Method, Cole & Crassidis’s Spherical and Planar Triangle Methods, and Motari’s Pyramid Method—as well as one of my own. Artificial “images” were generated using the Hipparcos catalog, a dataset of known stars and their location. Each method’s candidate search process, end to end accuracy, and end to end performance was examined under centroiding noise.

The results show that planar triangles are the most noise-tolerant method for catalog searching, that all methods have the same accuracy, and that the angle method was the most efficient. In this case, the most straightforward approach outperformed the more complex methods.

Mentor: Dr. Lipyeow Lim
Thomas Charles Hall
Political Science
Arts & Humanities
Participation for Honors
Oral Presentation: Session 1 (9:40-10:35a) in Sakamaki B102

Fueling the Flames: The Case Against Arming Nonstate Actors in Intrastate Conflicts

This thesis utilizes a multidisciplinary, mixed methods approach to examining the relationship between state sponsored military aid provided to nonstate actor in intrastate conflicts and the choice by that nonstate actor to utilize violent rather than nonviolent methods of opposition. This thesis uses an original dataset which draws from existing academic datasets, government reports, and journalistic sources in English, Russian and Ukrainian languages to examine the relationship between foreign military aid to nonstate actors and the onset of violent intrastate conflicts compared to the incidence of nonviolent conflicts between 2000 and 2015. Furthermore, data on state fragility prior to the onset of the conflict is utilized to select paired violent and nonviolent case studies for qualitative analysis. The data indicates that in all instances in which foreign military support was provided to a nonstate actor, that nonstate actor chose violent methods of opposition over nonviolent methods. The qualitative analysis suggests that this is the case even if in circumstances in which the nonstate actor had been utilizing nonviolent methods of opposition prior to the receipt of military aid. Finally, this thesis examines the policy implications of providing military support to nonstate actors.

Mentor: Dr. Carolyn Stephenson
Honeybees (*Apis mellifera*) Learn to Choose the Odd Size

Recent research with honeybees has revealed some surprisingly complex learning abilities. Honeybees can learn to discriminate symmetrical and asymmetrical objects, patterns containing face-like and nonface-like features, two-color and single-color patterns, and the paintings of Monet and Picasso. Furthermore, honeybees can distinguish same and different relationships among stimuli. In the present experiment, honeybees were trained in an oddity problem to choose the odd-sized stimulus. Eight forager honeybees were trained individually to repeatedly visit a laboratory window for a drop of sucrose on a feeding target. On each of the training trials, there were three stimuli, two that were the same and one that was odd. The set of two-dimensional stimuli used in training consisted of a large and a small version of differently-colored shapes (blue triangles, yellow circles, green squares, etc.) with the odd stimulus always the small version. On each trial the initial choice of the bee was recorded. Choice of the odd stimulus was correct and rewarded with a drop of sucrose solution. Choice of a non-odd stimulus was punished with a drop of stevia solution, and the bee was allowed to find the sucrose. The bees learned to choose the odd size on 80-90% of the trials which indicates that honeybees can discriminate large and small sizes. Both the discrimination of size and the discrimination of oddity require relational learning capabilities. These results are further evidence that an invertebrate species is capable of complex cognition similar to that of vertebrate animals including humans.

Mentor: Dr. Patricia A. Couvillon
Tuning Cellular Photoprotection to Improve Algal Productivity

Green algae light-harvesting systems include three stress related genes \( lhcsr1, lhcsr3.1 \) and \( lhcsr3.2 \) that catalyze the rapidly reversible component of non-photochemical quenching (NPQ), a response to dissipate excess light energy under high light exposure. In the green microalgae \textit{Chlamydomonas reinhardtii}, \textit{lhcsr3.1} and \textit{lhcsr3.2} are silenced, and this has been found to improve biomass production at low light intensities. Traditional algal suspension cultures result in low biomass concentrations, which complicates economical harvesting in large-scale cultivation. The goals of this study are to gain insight on the photoprotective processes of NPQ for more efficient light capture and conversion in algal mass cultures as well as identify the effects of sessile growth conditions on algal light regulation mechanisms.

\textit{C. reinhardtii} wild-type and \textit{npq4} strains were grown under a range of full spectrum light intensities at constant illumination and one minute on/off cycles. Growth was characterized through measurements of optical density, cell concentration, and total chlorophyll. ANOVA was used to identify significant differences between the wild-type and \textit{npq4} strains. Under suspension conditions, preliminary results found the \textit{npq4} strain to have greater growth rates under moderate cycled, high constant and high cycled light in comparison to the wild-type strain. Under sessile conditions, no significant difference in growth rate was found between the wild-type and \textit{npq4} strains. However, under moderate cycled and high constant light, cell concentration for both strains increased by an order of magnitude over the growth period indicating that sessile growth may be a considerable option for increasing commercial biomass yields.

Mentor: Dr. Winston Su
Ionic Gel Graphene Field Effect Transistors

Building off the results from last semester’s Graphene Field Effect Transistor project, our current project focuses on the implementation of high capacitance ionic gels as a gate dielectric on a flexible field-effect transistor (FET). We will be implementing this gel along with graphene, a 2D carbon material, which has become a widely researched material due to its tunable energy band capabilities and remarkable carrier mobility for low frequency devices. Liquid metal Galinstan, which consists of Gallium-Indium- Tin, will serve as the ohmic contacts serving as source and drain electrodes for our FETs.

The ionic gel was synthesized in an atmosphere controlled glove box using ionic liquid 1-ethyl-3-methylimidazolium bis(tri-fluoromethylsulfonyl)imide [EMIM][TFSI] and triblock copolymer Poly(styrene)-b-poly(ethylene oxide)-b-poly(styrene) [PS-PEO-PS] with Acetonitrile as the solvent. The ionic liquid and triblock copolymer were chosen based on a literature review, in which we found this combination, along with its amounts, yielded the best results in terms of electrical properties.

After the fabrication of our transistors, we will be using a semiconductor parameter analyzer to measure the drain current vs. gate voltage, which will help classify our devices. This data will be useful in showing the performance of our transistors relative to our previously fabricated devices, as well as industry manufactured transistors.

Our findings may have an impact on current transistors as well as on the future of flexible, wearable technology.

Mentor: Dr. David Garmire
Jennifer Keliikuli
Public Health
Social Sciences
Participation for Honors
Oral Presentation: Session 1 (9:40-10:35a) in Sakamaki B103
Poster Presentation: 11:50a-12:30p in Campus Center Ballroom

Promoting Benefits of Skin-to-Skin Contact Between Mothers and Newborns

It is important to develop strong bonds between mother and child early after birth. One way this bond may be initialized is through skin-to-skin contact between mother and newborn during the first hour following birth. Benefits of instant skin-to-skin connection for newborns include enhanced biological transition following delivery, initiation of neuroprotective mechanisms, and allowing for early neurobehavioral self-regulation. For a new mother, benefits include improved recovery following delivery, the strengthening of maternal attachment to the child, and stimulation of breast milk production.

This project focused on increasing awareness of benefits to mom and baby of instant skin-to-skin contact. Data were collected from literature and personal experiences of health care professionals, and were used to develop an educational pamphlet for distribution to expectant mothers. Awareness should be further promoted through distribution of materials and in-person information, particularly through pregnancy support programs, (e.g. Lamaze). Hopefully, through increased awareness, more expectant mothers will request skin-to-skin contact with their newborns following delivery to promote improved birth outcomes and long-term benefits among mothers and children.

Mentor: Denise Nelson-Hurwitz, PhD / Tessa Carter, RN
Ages of Stars in Upper Scorpius Through Kinematic Motion

The material around stars, or their circumstellar disks, have ages that are needed to help us create accurate disk models. Current observations of stars and their circumstellar disks only appear as snapshots throughout their evolution as we cannot observe long periods of time. In order to determine the age of young stars, I will be creating a simulation to back track the motion of stars within stellar groups to their positions of origination. I will then identify groups of stars that belong in associations from the current Gaia Catalog, which includes the first release of astrometry. The high resolution Gaia data will be ideal for accurate analysis of star ages. By picking out the OB type stars from the Upper Sco association, I can simulate their proper motion back to the point in time of nearest position. In this work I carried out Monte-Carlo simulations of back tracking a toy model cluster designed to emulate many of the observational properties of the Upper Scorpius OB association. Perturbing the results within errors in x at 0.5 parsecs and errors in vx = ±2km/s, many trials were taken with a metric approximating the point of least variance of the system. This was assumed to be the point of convergence of a system. With a true age of 10Myrs, results plotted within a histogram date the model age to be 9.95Myrs. With the simulation work calibrated, I simulate Gaia’s actual data to determine the ages of Upper Sco stars.

Mentor: Joshua Barnes
Island ecosystems have little defense against invasion by non-native exotic plant species. Resource managers often use herbicides to control exotic plant pests but these chemicals may have unintended effects on the surrounding environment. This research explored the efficacy of strawberry guava, *Psidium cattleianum*, as an allelopathic mulch barrier to suppress weeds and prevent establishment of invasive plant species. We hypothesized that fresh strawberry guava mulch with allelopathic properties would be more suppressive compared to conventional allelopathic mulch and fresh non-allelopathic mulch. An experiment was established with 1m² plots separated with 1m between each plot. The leaves and wood of *P. cattleianum* and the non-allelopathic Haole koa, *Leucaena leucocephala*, were mechanically chipped. A commercial bark mulch (Green’s Mix) and an unmulched treatment served as controls. The weed population consisted of *Indigofera hirsuta* (hairy indigo), *Euphorbia hypericifolia* (graceful spurge), and *Dactyloctenium aegyptium* (crowfoot grass). The mulches were applied to a thickness of 5 cm. Percent weed coverage in a 0.5m² quadrant were collected weekly. After 1 week, Green’s Mix had 12.5% weed coverage followed by *P. cattleianum* (23%), *L. leucocephala* (48%), and the unmulched plot (100%). Weed coverage increased over time and at 6 weeks was 67, 69, 88, and 100% in the bark, *P. cattleianum*, *L. leucocephala*, and unmulched plots respectively. *P. cattleianum* can suppress weeds and may work as well as Green’s mix over a 6-week period. To improve weed suppression, the mulch may need to be applied at a greater thickness.

Mentor: Dr. Brent Sipes
Sequencing the Genome of a Novel *Piscirickettsia* Species

A Gram-negative bacterium, designated Y2^T^, was cultivated from seawater at Waimanalo Beach Park, O‘ahu, in January, 2016. The level of sequence identity based on a fragment of the 16S rRNA gene in the Basic Local Alignment Search Tool suggested that Y2^T^ is a novel species in the *Piscirickettsia* genus, with the closest relative being *Piscirickettsia salmonis* LF89^T^. *P. salmonis* is the only other species in this genus, and is also an obligate intracellular pathogen for salmon. The whole genome of Y2^T^ will provide insights into the evolution of pathogenicity in the genus, and why one species is pathogenic while another appears to be free-living. This project used Oxford Nanopore Technology, the latest in DNA sequencing technology, to generate large volumes of Y2^T^ sequence data. Sequence data from the Nanopore MinION, along with data from another platform, were assembled in Newbler. The Newbler assembly was polished and rearranged using a reference genome, resulting in five scaffolds of various sizes. The largest scaffold of ~3 million base pairs is likely to be the chromosomal DNA of Y2^T^. Subsequent sequencing provided strong evidence that the large scaffold is indeed the chromosomal DNA of Y2^T^. Completing the whole genome of Y2^T^ requires remaining gaps in the scaffolds to be closed, and determination of whether or not remaining fragments are plasmids.

Mentor: Dr. Stuart Donachie

Co-Author: Xuehua Wan
UH Mānoa intends to be a net zero emission campus by the year 2035. The objective of this project was to calculate the current carbon (C) footprint for the University of Hawai‘i at Mānoa to assess UHM’s carbon emission profile and determine what gaps exist between now and the 2035 sustainability goal. Various carbon footprint reduction scenarios were also analyzed to identify which alternatives are the most cost effective. To calculate the total carbon footprint for UH Mānoa, data from four different sectors was collected, including: transportation, CFC’s, utilities, and land use. The SIMAP, created by the University of Virginia, was used to calculate the total carbon footprint and to estimate the impact of the reduction scenarios. Then, the cost of each reduction was estimated to ensure that decision makers could identify the cost effectiveness of each option.

Mentor: Dr. Linda Cox
This neo-Victorian novel explores racial tensions and gender dynamics in late-nineteenth century England as a consequence of British imperialism. Fears of reverse colonization as a result of the collision between East and West have been fictionalized in British literature, but character portrayals have been decidedly problematic and suppressive of colonized peoples’ voices. I, however, work to disrupt stereotypical representations of the East in order to speak directly to the categories of colonizer versus colonized. The story follows a young woman after her adoption by a wealthy family to adulthood. She becomes a favorite of the lord of the household, which spawns a one-sided rivalry between herself and the lord’s son. Not only must she navigate their injurious dynamic, but she also deals with the cryptic comments made about her heritage. Only when she uncovers her past does she begin to comprehend and question the events that have unfolded. To capture the enormity of her discovery, this work is focalized entirely through the protagonist. The narrative is presented linearly in order to illustrate the rising tension between the protagonist and antagonist, and the causality between deaths. I also employ space breaks to emphasize major plot points, including the protagonist’s unearthing of the lord’s backstory, which shape the conclusion of the novel. In doing so, I aim to present a strong, independent biracial woman as both the main character and focalizer, and consequently, tell the story of people, even fictional, who have been quieted or silenced by uneven exchanges of power.

Mentors: Professor Shawna Yang Ryan, Dr. Anna Feuerstein
Assessing the Accuracy of an Environmental Monitoring System in the Ala Wai Boat Harbor

The ZAPS Technologies LiquiD station is an innovative instrument that uses light to monitor the overall quality of water in real time through a process called Zero Angle Photon Spectroscopy (ZAPS). The primary objective of this study was to evaluate the ZAPS instrument to see if the real-time concentration data that it provides correlate with values obtained by manual discrete sampling and traditional methods of analysis. In addition, the nature of its functionality in a tropical estuarine ecosystem has yet to be assessed because the system was originally designed for wastewater treatment plant applications. In order to assess the performance of the LiquiD in tropical estuarine ecosystem, the instrument was placed in the Ala Wai Harbor and continuously samples estuarine water issuing from the Ala Wai Canal. For this study, we compared chlorophyll-a, nutrients (NO$_3^-$ and NO$_2^-$), and total suspended solids (TSS) concentration. All manually collected water samples were filtered through individual 47mm Whatman GF/C microfiber glass filters. Chlorophyll-a was determined fluorometrically while nutrients were determined colorimetrically. TSS samples on filters were heated at 60°C for 24 hours to obtain dry sample concentrations. For chlorophyll-a and TSS, the LiquiD underestimated values that were produced in the lab while for nutrients, a dissolved constituent, the LiquiD overestimated values that were produced in the lab. Higher lab values for TSS and chlorophyll-a may be attributed to the long length and fouling of the intake line; however, for dissolved constituents, a sensor calibration in fresh water may be the problem.

Mentor: Dr. Eric Heinen DeCarlo
“If It Were My Way, All This Ought to Be Red”: George Thomas and the Frontier of the British Empire 1781-1802

In 1805, a printer in England published a tale of imperialism, conquest and tragic loss from a memoir from Calcutta, India. Sponsored by key figures of the British Indian Administration, the *Military Memoirs of Mr. George Thomas* tells the story of a poor Irish Catholic boy who, in the midst of the war torn Mahratta Empire, India in the 19th Century, carved out his own kingdom on the edge of the Punjabi. Succeeding in the chaotic maelstrom of violence, constantly shifting loyalties and political intrigue, his tale would be considered to be of ‘great interest’ to the British public by contemporaries. This project explores George Thomas’ story, analyzing who this man was, where he fits within his world, and why his story was told through the use of narratives, letters, and governmental debates.

While it is clear the author of the memoir wished to portray Thomas as a quintessential British patriot and soldier, it is equally clear that this portrayal of the man was not the reality. Adopting the pretensions of Nationalistic loyalty out of sheer pragmatism, Thomas was a proud, competent and ambitious man who, over the course of his life propagated three imperiums: Mahratta, British, and his own.

This project helps us to understand the political reality of the Mahratta Empire during 1780-1802 and a 19th Century Catholic Irishman’s understanding of loyalty, honor, self-identity, and his place within his world, allowing us in turn to reflect upon ours.

Mentor: Marcus Daniel
Lichens of Hawai‘i: Using a Molecular Approach to Give *Cladonia skottsbergii* a Seat at the Evolutionary Table

The Hawaiian Archipelago is the most isolated landmass on the planet, yet it maintains rich and diverse ecosystems. Lichen are composite organisms built by the mutualism between fungi (the mycobiont) and algae or cyanobacteria (the phytobiont). In these classic forms of mutualism the fungi provide protection from the environment and the phytobiont supplies a food source by means of photosynthesis. *Cladonia skottsbergii* is believed to be an endemic species to Hawai‘i, meaning that this species is only known to exist in the Hawaiian Islands, yet no molecular work had been done to describe its evolutionary history. We began DNA extraction using 46 specimens from 5 islands stored at The Joseph F. Rock Herbarium. After weeks of troubleshooting extraction and amplification we headed to Oahu’s highest peak, Mt. Ka’ala, and collected 12 individuals of *C. skottsbergii*. The quantity and quality of DNA extracted from the fresh material vastly surpassed previous attempts at extracting DNA from older herbarium specimens. Sanger sequencing was employed to classify the mycobiont of *C. skottsbergii*. By compiling information from previously sequenced members of the *Cladonia* genus we were able to infer evolutionary relationships that exist between *C. skottsbergii* and sister species. Further molecular work needs to be done on all lichen genera to better understand these often overlooked organisms.

Mentor: Dr. Nicole Hynson
Predicting Power Draw based on Indoor Climate Data

Global energy consumption is projected to increase by 48% by 2040 and most of this energy will come from fossil fuels. In residential areas, about 30% of electricity is used for lighting and HVAC systems and in commercial buildings, they account for over 50% of electricity. This rapid rise in electricity demand is lending need to energy efficient buildings. Energy efficient buildings operate with a limited use of natural resources without compromising the operation, services, and products. Often these buildings do not require energy to be supplied by external sources; the energy is produced and used at the site. The College of Education at University of Hawaii at Manoa has introduced two sustainable, energy-efficient buildings. The buildings are equipped with various sensors to collect indoor climate data. The available dataset included humidity, various wall temperatures, lighting intensity, carbon dioxide values, and whole building instantaneous power collected between January 1st and September 14th. The main aim of this research was to utilize statistical techniques to investigate inherent relationships in the available data and develop a model on the power draw of these buildings based on indoor climate data. Analysis included discretizing the continuous data into informative and representative partitions. The desired model was developed through recursively partitioning features of the data set based on entropy and mutual information. Development of this model could aid in ongoing research to develop whole-building energy simulations which are allowing architects and engineers to design and retrofit buildings for maximum energy efficient and occupancy comfort.

Mentors: Dr. Olga Boric-Lubecke, Dr. Narayana Prasad Santhanam, Dr. Shubha Kadambe
Hospital Associated Infection Propagation Monitoring Hardware Implementation

Hospital Associated Infections (HAIs) account for 99,000 deaths and 33 billion dollars in health care costs in the U.S. annually. This project is a continuation of a previous UROP project, which created a computer simulation that models the propagation of HAIs in a hospital ward. When an outbreak occurs, it is crucial to quickly determine the source of the infection and where it will propagate. This project developed a wearable device for detecting contacts that would provide information to track the infection. Intel’s Curie chip was evaluated for this application due to its small size, Bluetooth low energy, and 6-axis accelerometer and gyroscope. The basic functionality of the Curie is to establish contacts accurately, record the duration, and determine the proximity between the two objects or persons via a quantitative Bluetooth signal strength. Previously, the Intel Edison was being used. While the Edison is incredibly powerful, it is no longer supported by Intel, has too many unnecessary features, and consumes too much power.

Zephyr, a scalable real-time operating system (RTOS), was implemented on the Curie. The Zephyr RTOS is incredibly intricate and does not utilize the standard open sourced BlueZ development stack. After gaining access to the Bluetooth capabilities, a program was written to test the capabilities of the chip. A stress and scaling test were conducted. Thirty TinyTILEs with the Curie chip were run simultaneously to determine response time and signal strength degradation. It was determined that the Curie would be suitable for a wearable device to detect contacts.

Mentor: Dr. David Garmire
Matsu Thornton  
Electrical Engineering  
Engineering & Computer Sciences  
Participation for UROP  
Oral Presentation: Session 2 (10:45-11:40a) in Sakamaki B101

Internet-of-Things Hardware-in-the-Loop Simulation Testbed  
for Demand Response Ancillary Services

Demand response (DR) has proven to show capabilities of providing ancillary services (AS) to grid operators. Advances in high speed computing and the availability of widespread and efficient network infrastructure bring tools that were otherwise inaccessible—financially or technologically—within reach. Building upon these advances, economically sound solutions to the established need for simulation testbeds for integration of distributed energy resources (DERs) systems into the power grid become available. This work presents methods of advanced power system modeling, integrated hardware design, and software development tools to develop a DR simulation testbed for grid stabilization in a power grid with a high presence of intermittent renewable generation. The result is a comprehensive package for internet of things hardware-in-the-loop simulation (iHILS) that was tested using DR aggregate control to provide stability to a grid with high integration of DERs.

Mentor: Dr. Reza Ghorbani
Identification of Transcription Factors Driving \textit{altRP} Operon Expression in \textit{M. tuberculosis}

\textit{Mycobacterium tuberculosis} (Mtb) is the causative agent of tuberculosis (TB), the leading cause of death among infectious diseases. Mtb must resist considerable extracellular stresses during pathogenesis, including severe zinc depletion. This stress activates a switch from primary ribosomes (PrimRP) to their homolog form or alternative ribosomes (AltRP), which are better equipped and crucial to its pathogenicity. The substitution that occurs is regulated by gene expression through transcription factors and other regulators. Accordingly, identifying transcription factor that drives the expression of these alternative ribosomes is of high importance in understanding pathogenicity of Mtb and selecting antibiotic targets.

Based on this understanding, the goal of this study is to isolate and identify the transcription factor(s) responsible. To this end, a pull-down method was developed. Bacterial cytoplasmic lysate was added to biotin-conjugated DNA that contains the promoter for alternative ribosome (\textit{altRP}) activation, allowing the binding of potential transcription factor(s). Streptavidin-bound magnetic beads are used to pull down the DNA and proteins bound to it. Non-specific DNA is washed away using buffers and high salt and low pH conditions are used to elute the specific DNA-protein complex. Electrophoretic separation of proteins and mass spectrometry would allow for subsequent identification of the transcription factor(s).

At the time of submission of this report, identification by mass spectrometry was inhibited by low protein recovery. Hence, the current goal is to optimize the assay to obtain adequate protein amounts to allow identification.

Mentor: Dr. Sladjana Prišić
Addressing the Concussion Epidemic in Public Schools: Hawai‘i State Concussion Policy and Physical Education Teachers (PETs) Concussion Awareness

This research paper focuses on State of Hawai‘i concussion law and policy through a survey conducted with 141 physical education teachers (PETs) from public schools across the State of Hawai‘i. The surveys assessed PETs knowledge of the signs and symptoms of a concussion and how to accommodate a concussed student in class; and includes PETs from schools on Oahu, Maui, Kaua‘i, and Hawai‘i Island (Hilo and Kona). In 2015-2016, the Hawai‘i State Department of Education reports there were 10,984 classroom teachers for 50,625 students enrolled in high school (grades 9-12). Concussion policy, especially the "Return-to-Learn” protocol, emphasizes the importance of teachers both identifying brain injuries and supporting student recovery. A brain injury can have long term health effects, and there is substantially increased risk if the injury is overlooked or the recovery is unintentionally mismanaged. Selection of physical educators (PETs) has to do with the likelihood of witnessing sports-related concussions during physical activity while teaching, and accommodating students who are following the “Return-to-Learn” protocols while recovering. This paper draws insights from Hawai‘i State Department of Education and Hawai‘i Concussion Awareness Management Program high school data since 2011; describes what PETs reported about knowledge of concussions through the Dillman (2010) survey research method; and gives an overview of concussion policy in the State of Hawai‘i thus far and recommendations for the future.

Mentor: Jairus Grove
Using GPI as a Holistic Guide for Policy Creation to Increase Welfare in Hawai’i

The Genuine Progress Indicator (GPI) has been proposed as an alternative well-being indicator to Gross Domestic Product (GDP). GPI measures a nation’s prosperity through 26 indicators that account for both the benefits and costs of economic production, through computation of economic, social, and environmental indicators in a holistic manner. To better understand the barriers to GPI being used to evaluate and/or influence policy, this study conducted research in three states that have implemented GPI as an indicator. Interviews were conducted with experts and policymakers in these states to obtain their opinion of the effectiveness, efficiency, and equity of any GPI-influenced policies. Analysis of primary source reports, press releases and documents from government agencies, journals, and academia were used to evaluate the barriers to alternative indicators globally. Based on the information provided by the interviewees and literary review, it was found that GPI as an indicator is still in its infancy. Its computation is cumbersome and there is disagreement on the level of influence it should have. This means that for GPI to be used as an indicator of policy creation in Hawai’i, the data needed for its computation must be readily available and its purpose clearly defined. Once these barriers are overcome GPI could offer a holistic approach to measuring Hawai’i’s prosperity, accounting not only for economic factors but also environmental and social factors.

Mentor: Dr. Kirsten Oleson
ACKNOWLEDGMENTS

MAHALO A NUI LOA to Interim UH-Mānoa Chancellor David Lassner, Vice Chancellor for Research and Interim Vice Chancellor for Academic Affairs Michael Bruno, and Assistant Vice Chancellor for Undergraduate Education Ronald Cambra.

STUDENT VOLUNTEERS
We would like to thank the student volunteers who helped to set up and take down the facilities and to monitor the rooms during sessions.

STAFF
The organizers would like to extend a special thank you to their respective office staff for all their hard work behind the scenes during the conference and throughout the year. Thank you to:

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SPECIAL THANKS
We would like to thank our event partners:
Batch Yama for catering from Yama’s
Campus Center Meeting and Event Services Staff for facilities and planning assistance
Copy Hut Hawaii for program and poster printing services
Sakamaki Hall for use of facilities
SAPFB for partially funding this event
JUDGES AND MODERATORS
We would like to thank all the faculty members, administrators and researchers who volunteered to judge and moderate the sessions and to lend their experience and expertise to this student conference:

FACULTY JUDGES
Dr. Dilmurat M Azimov
Patricia Brandes
Dr. David Christopher
Dr. Angel Del Valle Echevarria
Dr. Katherine Finn Davis
Dr. Ben Folgelgren
Dr. Jason Kenji P Higa
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Scott Sinnett, PhD
Angie Solomon
Dr. Monica Stitt-Bergh
Chad Walton, PhD
Dr. Paulette Yamada

GRADUATE STUDENT MODERATORS AND JUDGES
James Patrick Alonzo
Brooke Friswold
Roshan Paudel
Kyeann Sayer
Lindsay Veazey
ACKNOWLEDGMENTS

FACULTY MENTORS
We would like to acknowledge the time, effort and expertise that faculty mentors put into advising students on their projects. Mahalo to the following people:

Joy Agner
Dr. Anthony Amend
Dr. John "Jack" Barile
Joshua Barnes
Dr. Olga Boric-Lubecke
Dr. Jan Brunson
Tessa Carter, RN
Dr. Patricia A. Couvillon
Dr. Linda Cox
Marcus Daniel
Dr. Eric Heinen DeCarlo
Dr. Stuart Donachie
Dr. Anna Feuerstein
Dr. David Garmire
Dr. Reza Ghorbani
Jairus Grove
Dr. Nicole Hynson
Dr. Nicholas James
Dr. Shubha Kadambe
Dr. Lipyew Lim
Mackenzie Manning
Dr. Erinn Muller
Dr. Denise Nelson-Hurwitz
Dr. Robert Nichols
Dr. Kirsten Oleson
Dr. Sladjana Prišić
Professor Shawna Yang Ryan
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Dr. Alison Sherwood
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