



Kapi'olani Community College STEM Undergraduate Research Experience

<http://stem.kcc.hawaii.edu>

STEM URE Program Overview

The KCC STEM Undergraduate Research Experience (URE) provides students with numerous opportunities to participate in faculty mentored research projects. The STEM URE engages students in research early in their academic careers in order to better prepare them for future projects in STEM related fields. URE participants gain hands-on experience and valuable insight in regards to research and professional development while learning the critical thinking and problem-solving skills necessary to succeed in today's work environment. Students conduct research alongside STEM faculty independently, in groups, or in competition teams. URE students can apply for research stipends each semester.



2010 KCC Underwater Remotely Operated Vehicle Team putting on a demonstration at a middle school science fair.

Students interested in participating in the STEM URE should first find a faculty mentor to discuss possible projects. Once a research project has been established, students may apply for the STEM URE program, as well as a research stipend. Applications can be found on the STEM website.



URE Students from the Sustainable Biofuels Project show middle school science fair students the various steps and reagents required to turn used cooking oil into biodiesel.

Students are also encouraged to apply for other summer research internships to broaden their experiences. For more information about KCC SURE, research, scholarship, or internship opportunities, please contact Nari Okui, the URE Coordinator, at nari@hawaii.edu or (808)734-9425. Additionally, more information can be found at the STEM Center, which is located in room 202 of the Koki'o Building at Kapi'olani Community College. Please refer to the STEM website for general information and program applications: <http://stem.kcc.hawaii.edu>

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KCC STEM URE Structure

- 1. URE Traineeship:**

KCC STEM URE Trainees are generally new to undergraduate research and do not have much experience with data collection and research methodologies. These students work closely with a faculty mentor on a meaningful research topic, doing literature reviews and gathering background information. Trainees focus on experimental design and familiarizing themselves with technology and analysis tools relevant to their research. Trainees may qualify for stipends of up to \$1200.
- 2. URE Fellowship:**

KCC STEM URE Fellows have had previous research experience and/or technical experience. Fellows interact closely with their faculty mentor on hypothesis-driven research projects and/or specially designed faculty-led projects. Qualified fellows may apply for stipends of up to \$2000.
- 3. Private/Professional Internships:**

Students of all levels are encouraged to apply for a number of private and professional internships available throughout the year. Students may also receive outside funding from programs such as the Center for Microbial Oceanography: Research and Education (C-MORE), the NASA Hawai'i Space Grant Consortium (HSGC), and the NSF Experimental Programs to Stimulate Competitive Research (EPSCoR) to participate in research projects at KCC under a faculty mentor. Eligible students may receive stipends of up to \$2000.

Other KCC STEM Undergraduate Research Opportunities

- **NASA Hawai'i Space Grant Consortium Traineeships and Fellowships:**

The HSGC expands educational opportunities for UH undergraduates by awarding fellowships and traineeships in fields that are relevant to NASA's goals, which are those in STEM that are focused on studying the Earth from space, exploring our Solar System and the universe beyond, understanding the potential for life elsewhere, etc. Fellows, Junior Fellows, and Trainees work under the guidance of mentors, who in most cases will be faculty members. Stipend amounts will vary depending on the type of research being conducted. For more information and application instructions, please see the URE Coordinator, or visit the Hawai'i Space Grant Consortium website: <http://www.spacegrant.hawaii.edu/>.
- **EPSCoR DEW Student Summer Internship**

EPSCoR provides funding through the Diversity, Education, and Workforce (DEW) initiatives to develop and diversify Hawai'i's workforce within STEM careers. Native Hawaiian, Pacific Islander, Filipino, and other underrepresented students interested in conducting research under a faculty mentor or with an EPSCoR researcher may be eligible to participate in this program. For more information, please see the URE Coordinator.
- **Directed research for credit:**

Students taking an Independent Study course, usually listed as ALPHA 299 or ALPHA 199 in the course catalog, may conduct research under a faculty member for credit.
- **Volunteer research**

Students who do not qualify for a stipend or are unable to make the time commitment required by their specific research project may be considered for a volunteer research position.



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Life Science



Sustainable Biofuels Project

Faculty mentor: Dr. Kathleen Ogata

Objectives: As part of a partnership between KCC's STEM Program and the Culinary Institute of the Pacific, used cooking oil is utilized to sustainably synthesize biodiesel. The biodiesel produced is then used to power the Culinary Institute's food service carts. Students experiment with different mechanical and chemical processes to better optimize biodiesel manufacturing. Students also explore methods to make the manufacturing process more sustainable and ecologically. Other focuses include developing methods to recycle the glycerin byproduct that remains as a result of the biodiesel synthesis. Uses for glycerin include soap and candle products.

Linking Behavioral Ecology in the *Nerita picea* and the Science of Ancient Hawaiians

Patricia Cockett, Faculty Mentor: Dr. Wendy Kuntz, Kapi'olani Community College, Honolulu, HI.

Excerpt from Abstract: Ancient Hawaiians studied the behavior of animals in their environment and with no written language to formally document their findings, knowledge was passed on through 'olelo no'eau (Hawaiian Proverbs) and 'oli (chanting). "Kokolo no o pipipi, o kalamoe, me 'alealea a ke alo o Kuhaimoana." is an 'olelo no'eau which means pipipi, kalamoe, and alealea crept in the presence of Kuhaimoana. Pipipi, kalamoe, and 'alealea are all shellfish and Kuhaimoana is the name of an important shark god. From the perspective of an evolutionary biologist, this Hawaiian proverb could be describing how pipipi (*Nerita picea*) evolved patterns of movement with the tide. These movement patterns may be genetic and linked to patterns of lunar cycles, or they may be in response to changing water levels. I hypothesized that pipipi move themselves according to water level, with the lunar cycle having no effect on their relocation. Understanding the patterns of movement in pipipi will provide insight into how this movement behavior might have evolved and the important connection between cultural observations and modern biology. *(Presented at 2009 National Conference on Undergraduate Research)*



Impact of Historical Reforestation Efforts on Contemporary Forest Composition

Patra B. Foulk, Faculty Mentor: Dr. Wendy Kuntz, Kapi'olani Community College, Honolulu, HI.

Brief Abstract: Effective watershed forest management should include thought about the impact of choices on the trajectory of native ecosystems. Trees constitute a major component of any forest habitat, and the absence of native species to fill this role can affect the composition of the understory. A century ago, Oahu was heavily deforested, and restoration efforts at the time used a variety of non-native species. This project explores the impact of the historical use of non-native trees in watershed reforestation efforts on the proportion of native to introduced plant species in the understory. To address this question, we are examining forested locations along ridgelines in the southern Ko'olau Range, including locations in the Honolulu Watershed Forest

Reserve. The model will also include data on topography, temperature, precipitation, and past reforestation efforts in those areas. *(Presented at 2009 National Conference on Undergraduate Research)*



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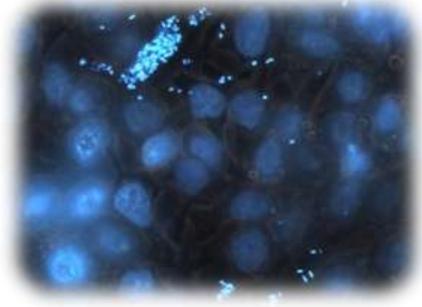
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Virulence of Hawaiian *Campylobacter* Strains

Thomas Jessie Aldan and Hoang-Yen X. Nguyen, Faculty Mentor: Dr. John M. Berestecky, Kapi'olani Community College, Honolulu, HI

Brief Abstract: *Campylobacter jejuni* is the most common cause of bacterial gastroenteritis worldwide. Within the United States, Hawaii has the highest rate of infection in the nation at 81 cases per 100,000. The exact mechanism of how *Campylobacter* causes diarrheal disease is unknown, although the prevailing hypothesis is that the organisms invade the intestinal epithelial cells as part of the disease process and that the intestinal environment somehow activates bacterial virulence. We used HeLa cells in tissue culture as a model system to investigate the interaction between these bacteria and human cells. We studied the attachment and invasion of a number of *Campylobacter* strains that were isolated from local disease cases in which disease severity was documented and we compared these to 'wild' strains isolated from chicken carcasses, the most common source of *Campylobacter* infection. *(Presented at 2009 National Conference on Undergraduate Research)*



Behavior of the Hawaiian Coot (*Fulica Alai*)

Jason P. Alstad, Faculty Mentor: (Dr. Wendy A. Kuntz), Kapi'olani Community College, Honolulu, HI.

Brief Abstract: While Hawaii has the highest endemism in the United States, it also has the most extinct and endangered species. The wetland ecosystems in Hawaii are particularly vulnerable and have experienced a 30% loss in habitat due to urbanization and invasive species. The endemic Hawaiian Coot (*Fulica alai*), has survived these threats and occupies the reduced and altered coastal wetland ecosystem on all seven of the main islands. This study focuses on how individuals allocate time and energy to various behaviors including foraging, incubation, parental care, territorial behavior and mate selection. *(Presented at 2009 National Conference on Undergraduate Research)*

Energy Balance

Naomi Nihipali, Gerry Vazquez, and Reynold Wong, Faculty Mentors: Dr. Ronald Dunn and Amy Patz Yamashiro, Kapi'olani Community College, Honolulu, HI.

Objective: To find a method to calculate energy expenditure for individual subjects in an effort to find and maintain energy balance (the difference in the amount of energy consumed and the amount of energy expended in a 24 hour period). Data collected from this research will be applicable to the general public and everyday life; ideal for those who are interested in weight and diabetes management, fitness improvement and general overall health.





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Physical Science

2010 MATE International ROV Competition

Faculty mentors: Dr. John D. Rand and Hervé Collin

The Mission: The Marine Advanced Technology Education Center (MATE) and the Marine Technology Society (MTS) organize a student remotely operated vehicle (ROV) design and building competition. Teams design and build ROV's to perform tasks based on the marine technical workplace including submittal and presentation of technical papers. The 2010 competition theme focuses on the Loihi seamount, an active undersea volcano, and tasks challenge teams to deploy instruments, take sensor readings, plot data, and collect samples of geologic features as well as organisms that inhabit the volcano's flanks.

Results: KCC's Team Limawai and their UROV, the Ka'imiolakai, finished 7th out of 27 other college teams in the 2010 International MATE ROV Competition.

Website: http://www.marinetech.org/rov_competition/



2010 CanSat Competition

Faculty mentors: Hervé Collin, Dr. John D. Rand, and Dr. Maria Bautista

The Mission: The CanSat Competition is designed to reflect on a small scale a typical aerospace program. The competition includes all aspects of an aerospace program from the preliminary design review to post mission review. During descent, the CANSAT shall collect and telemeter GPS and other related data. Additionally, the CANSAT must accommodate a large raw hen's egg for the entire duration from launch to landing which necessitates the designing of a novel descent control system without the use of a parachute,

para-foil or any similar device. Students are tasked with designing, building, and the subsequent testing of a fully operational device that will emulate a space probe gathering an array of data. There are strict physical limitations to the design volume of the CANSAT, usually confined to fitting inside of a standard 350 ml soda can.

Results: In 2010, KCC's CanSat Competition team took 12th place among 20 other university teams.

Website: <http://www.cansatcompetition.com>



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Solar Tracker Project

Faculty mentor: Hervé Collin

Objectives: Students test the efficiency of double-axis solar panel systems by constructing an automated tracker system able to align a double-axis solar panel towards the sun at all times to increase the gathered solar energy efficiency. Students develop and program an automated tracker to move according to a 5-sensor system. A secondary standalone double-axis tracker will also be constructed. Energy gathered from both systems can be compared to find the accuracy of the automated tracker as well as compare it to the energy gathered by a stationary set up.



Robotic Accessibility Mapping and Data Acquisition (RAMDA)

Faculty mentors: Hervé Collin and Dr. John D. Rand

Objectives: The primary goal of the project is to develop an autonomous robot that generates color gradient maps of the accessibility of a large location. RAMDA will combine GPS, LIDAR, video, and Inertial Measurement Unit (IMU) sensors to provide accurate environment mapping to produce near real-time 4D maps (normal 3D environment plus color gradient scales). This information will be submitted to the college for their use in assessing the schools ADA compliance as well as for the generation of mobility maps.

Interdisciplinary



Pupillometry

Faculty mentors: Dr. John D. Rand and Hervé Collin

Objectives: Using electronic video pupillography (EVP), an objective method for monitoring the size and dynamics of the pupil, students investigate the possibility of using pupil instability to determine daytime sleepiness. Additional research involving pupillometry includes the development of computer algorithms to determine daytime sleepiness.

The Life Sustaining Parameters of an Ancient Hawaiian Fish Pond

John Reilly and Youngsu Kwon, Faculty Mentor: Dr. Kathleen Ogata, Kapi'olani Community College, Honolulu, HI.

Brief Abstract: An ancient fishpond, Waikalua Loko, was built by ancient Hawaiians, who are recognized as being the first to ever farm fish and aquatic vegetation in the known history of the world. Approximately 400 years ago the Hawaiians planned for this pond to be fed from two fresh water streams and open into the ocean bay for a manmade marsh, providing a habitat in which fish from two environments may be farmed and harvested. Modern times and needs of the community had diverted these streams into the bay, decimating this source life that had once provided for the ancient peoples of this same land. The purpose of the research was to collect data and determine the quality of the water's life-sustaining properties and compare our data with data that was collected ten years ago.