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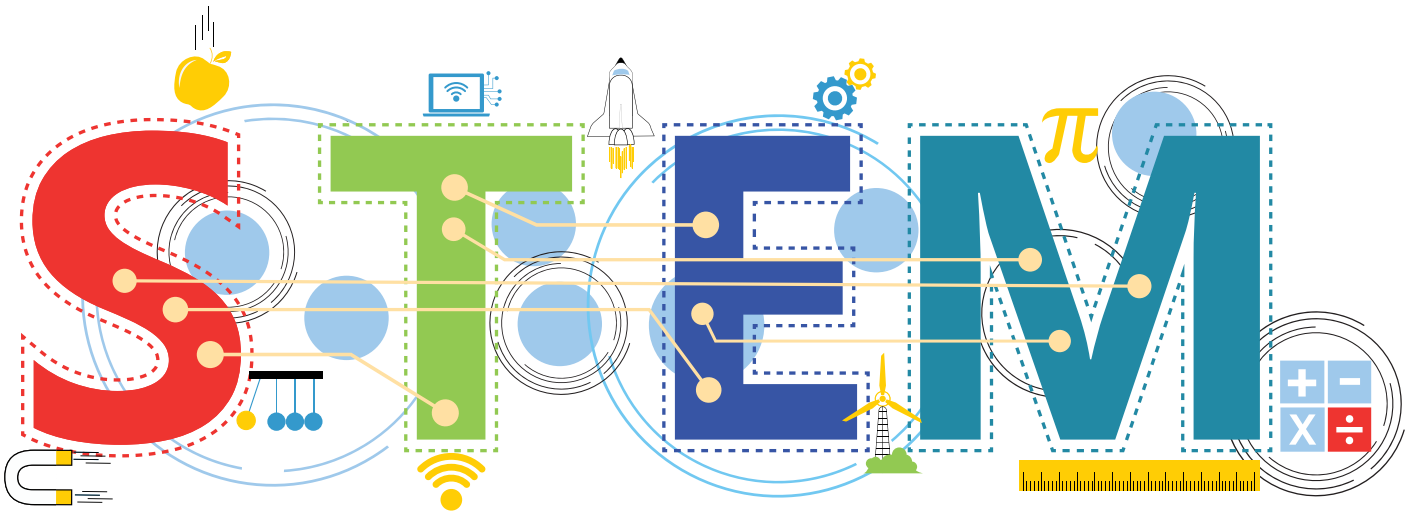
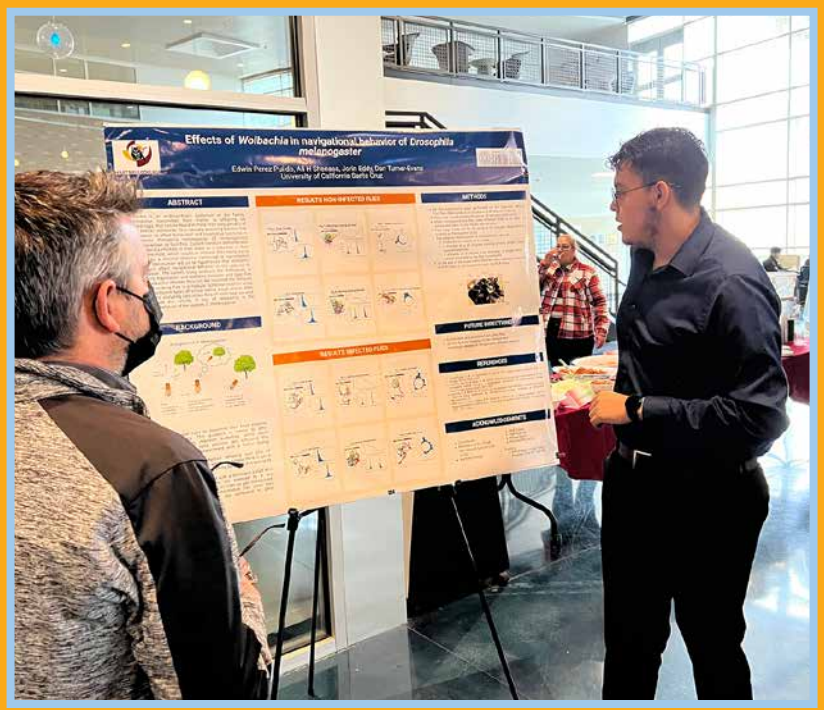


SCIENCE • TECHNOLOGY • ENGINEERING • MATH

INTERNSHIP SYMPOSIUM

SEPTEMBER 14, 2024



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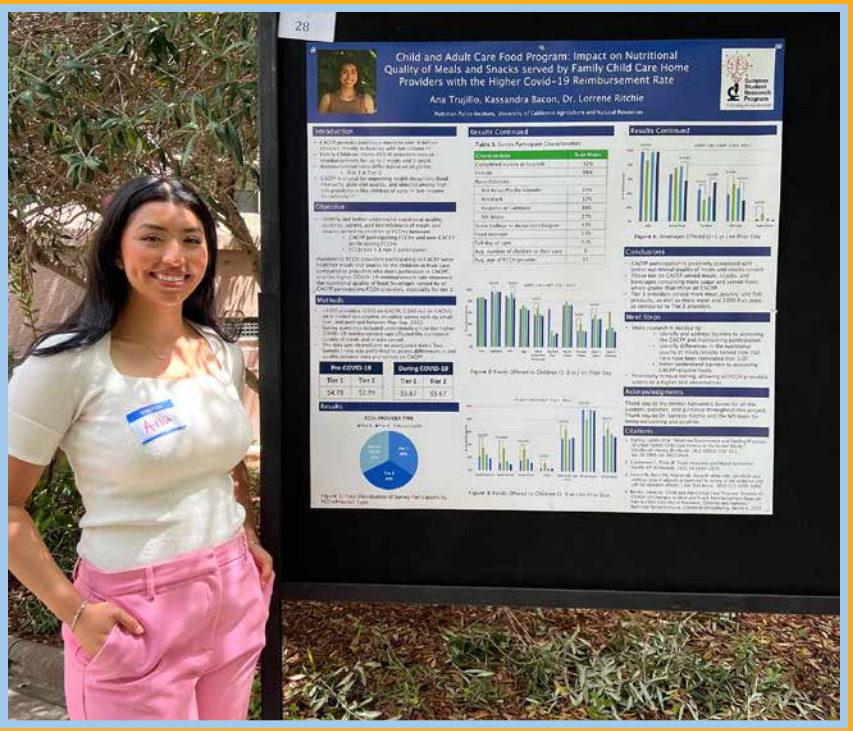

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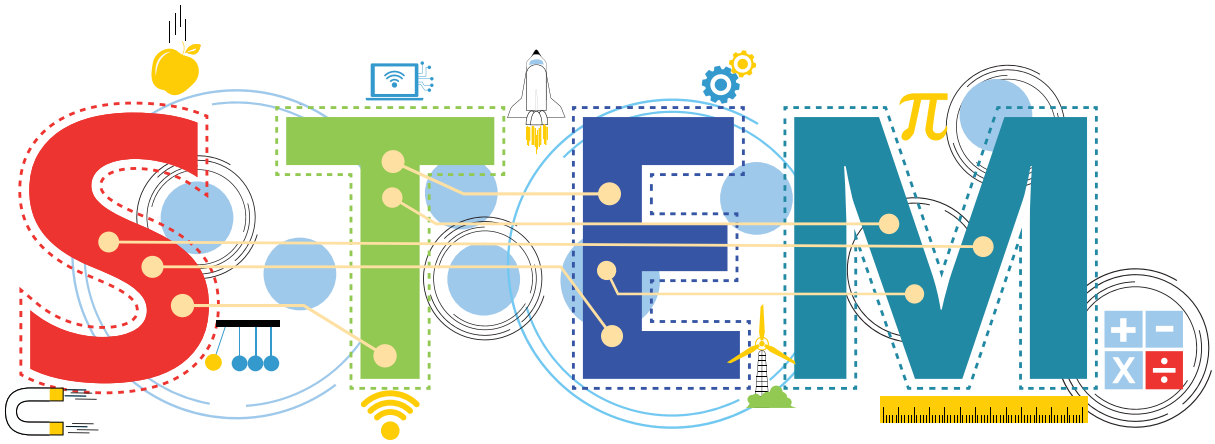

INTERNSHIP SYMPOSIUM

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THE PROGRAM

Hartnell STEM Internship Program

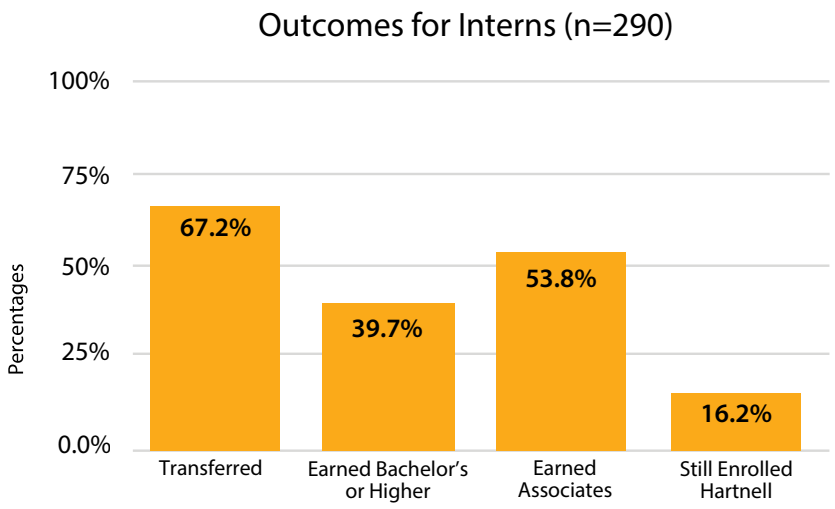
The STEM (Science, Technology, Engineering and Math) Internship Program at Hartnell Colleges supports and engages students in undergraduate academic research and/or professional internship experiences. Internships include relevant and innovative projects with regional research institutions, local partners, and national REU (Research Experiences for Undergraduates) programs. Internships are guided by experienced mentors who provide authentic professionalism and transfer preparation for upper-division and graduate studies. Students are provided the opportunity to share their work with academic and professional communities through presentations and publications.

Hartnell STEM Micro Internship Program

Hartnell College received a National Science Foundation Hispanic Serving Institution grant, with a goal of extending the reach of the Internship program. When students were polled regarding why they were not participating in internships, they stated that they did not feel ready academically or that they could not fulfill the time commitment. To bridge these gaps, we developed the STEM Micro Internship Program, in which students participate in faculty-led, 25-hour applied learning experiences.

Hartnell is strengthening diversity in STEM while taking on the challenge of meeting our nation's skilled workforce needs. The program is creating a new legacy of opportunity for the families of the Salinas Valley by producing future generations of bright young scientists through innovative and comprehensive STEM programs and initiatives. For the past 18 years, our unique STEM Internship Program has achieved unprecedented success, matching hundreds of community college students with university researchers and industry experts in prestigious laboratories throughout the Central Coast.

The STEM Internship Program began in 2006 with the placement of six student interns. Since then, the program has placed more than 1,300 students in undergraduate research and professional internship opportunities. In addition to its growth over the 18-year period, the program has demonstrated higher academic success rates for participating students when compared with their peers. For example, degree attainment for Hartnell interns is dramatically higher than that of non-participants. Of the 290 interns from cohorts 2016 through 2023, **67.2% have transferred, 53.8% earned their Associate of Science, 16.2% still enrolled at Hartnell College**. Of the interns who have transferred, **39.7% have earned their bachelor's degree**. Evidence shows that STEM internships have been a valuable resource not only for skill-building, but also for overall student success and degree completion.



FUNDING SOURCES

- Hartnell College
- Hispanic Serving Institutions STEM Title IV Grants
- Hartnell College Foundation
- National Science Foundation
- UCSC-ACCESS Program (National Institutes of Health)
- UCSC-iGEM Program

Thank you!

Hartnell College

STEM INTERNSHIP PROGRAM TEAM

Dr. Ram Subramanian
Vice President of Student Success and Teaching Excellence

Moises Almendariz
Director of Academic Affairs, Hispanic Serving Institution Initiatives

Richard Morales
Director of Communications and Marketing

Joel Thompson
Director of Academic Affairs, Science and Math Institute

Belen Gonzales
Director Career Hub

Anely Meneses
SMI Program Specialist

Leda Polio
HSI Program Assistant

Micro-Internship Mentors
Dr. Adrea Gonzalez-Karlsson
Dr. Jeffrey Hughey
Mohammad (Tarek) Hussain
Dr. Rosser Panggat
Dr. Ver Marie Myr Panggat
Tito Polo
Dr. Mohammed Yahdi

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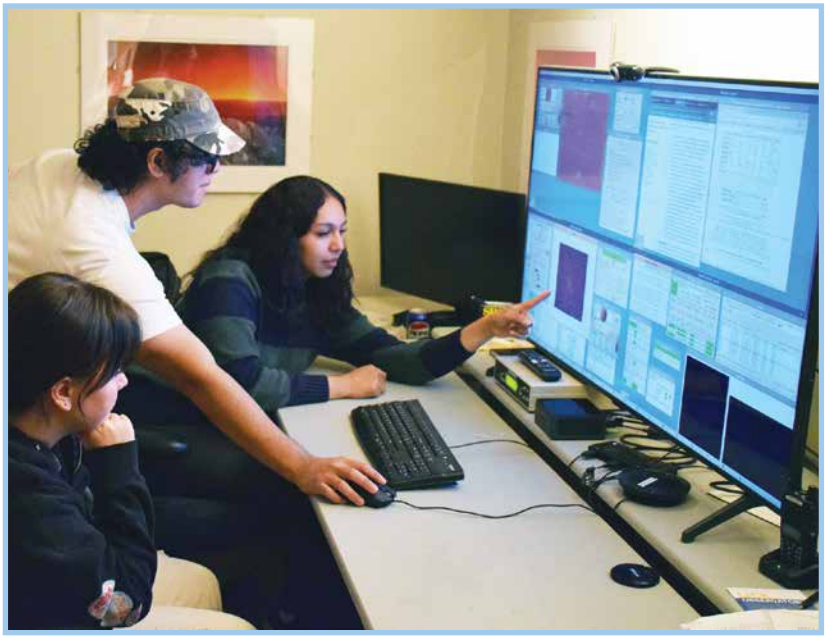

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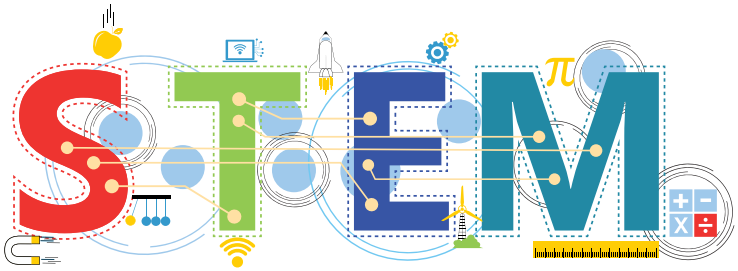


INTERNSHIP SYMPOSIUM

WELCOME

Welcome to the 2024 celebration of the Hartnell STEM Internship Program – an exceptional program now in its 18th year.

Today's symposium completes the STEM summer internship experience, where student interns exhibit their newfound skills and the level of professional learning they have achieved in the scientific process. The mentors of this program are proud to showcase how the interns have captured the significance of scientific questioning, research, techniques, and, finally, discovery.

The Hartnell College STEM Internship program has given our students an invaluable experience and an opportunity to see the world from a different perspective. With curious minds, we are reassured that today's interns are poised to reach new heights and become the STEM leaders of the future.

Over the past decade, Hartnell has been a pioneer in providing STEM internship opportunities for college students. What started as a program of six interns in 2006 has now grown into a powerful network. This network has connected hundreds of students with mentors and researchers from universities, scientific research communities, and industry experts. The result of the work is an immersive experience that equips students with the skills and knowledge they need to thrive in their academic and professional lives.

The success of this program is proof that influence and partnerships in our communities lead to positive student outcomes. Today and every day, we thank our higher education community and the invaluable contributions of volunteering scientific and industry experts for the support and mentorship that is helping change the lives of our students and beyond. Their generosity and passions for producing excellence in the next generation of innovators and leaders have been instrumental in catapulting our students to where they are today, ensuring the future success of the program.

Thank you all for your continued support and enjoy today's presentations.

— Michael Gutierrez
Hartnell Community College District Superintendent/President

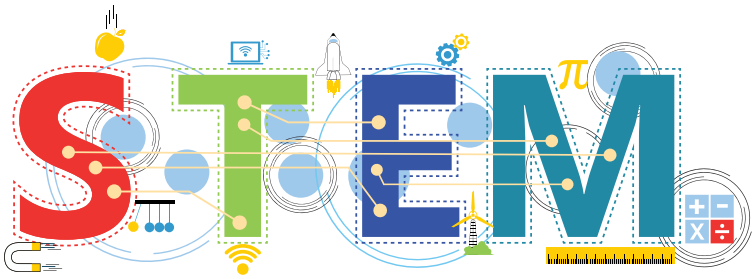
HARTNELLCOLLEGE

Hartnell College Vision

Hartnell College students will be prepared to contribute as leaders to the intellectual, social, cultural, and economic vitality of our communities and the world.

Hartnell College Mission

Focusing on the education and workforce development needs of communities in the Salinas Valley, Hartnell College strengthens communities by providing opportunities for students to reach career and/or academic goals (associate degrees, certificates of achievement, transfer to four-year institutions) in an environment committed to student learning, achievement and success.



INTERNSHIP PARTNERSHIPS & MENTORS

Blue Marble Space Institute of Science
Dr. Henderson Cleaves

California Space Grant Consortium
Dr. John Kosmatka
Amy Arkwright

Community Hospital of Monterey Peninsula
Dr. Juan Magana

Dark Sky Project
Dr. John Heyl
Dr. Charlie Wahle

Elkhorn Slough Foundation Elkhorn Slough National Estuarine Research Reserve
Juan Ramirez
Beth Scrutton

Fremont Peak Observatory
Patrick Donnelly

Hartnell College
Dr. Adrea Gonzales-Karlsson
Dr. Jeffrey Hughey
Mohammad Hussain
Dr. Ver Marie Myr Panggat
Dr. Rosser Panggat
Tito Polo
Dr. Mohammed Yahdi

Joby Aviation
Peter Church
Wade Casper

Lick Observatory
Dr. Anne Metevier

Monterey Bay Analytical Services
David Holland

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Dr. Jan Lebert

University of California, Santa Cruz (SRI)
Felix Perez

University of California, anta Cruz (IGEM)
Dr. David Bernick

University of California, Santa Cruz (LAMAT)
Deana Tanguay

University of California, Santa Cruz (ACCESS)
Dr. Phil Crews
Pamela J. D'arcey
Dr. Tianchen Cui
Dr. Dan Turner-Evans
Dr. Michael Patnode

University of Rochester
Dr. Kuan Wang

United States Department of Agriculture
Dr. Juan Alvarez (OPPE)
Dr. Greg Simmons (APHIS)
Dr. Javier Flores (NRCS)
Dr. Renee Erickson
Dr. Peter Henry
Dr. Ivan Simko
Dr. Dario Racano (UCD/USDA)

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Andy Newton STEM Internship Partner

Award Winner

DR. MOHAMMED (MO) YADHI

Hartnell Math Faculty

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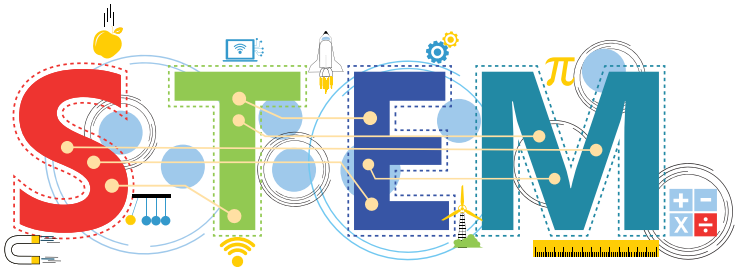

INTERNSHIP SYMPOSIUM

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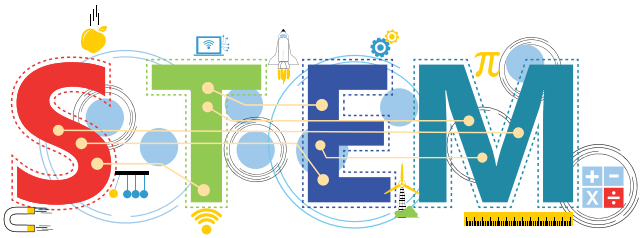

INTERNSHIP SYMPOSIUM

SEPTEMBER 14, 2024

WELCOME

Dr. Ram Subramanium

Vice President of Student Success & Teaching Excellence

PRESENTATION OF ANDY NEWTON STEM INTERNSHIP PARTNER AWARD

Dr. Joel Thompson

Director of Science and Math Institute

STUDENT PANEL DISCUSSION

Edwin Pulido Perez - Rochester MSTP

Zenaida Rodriguez - USDA-APHIS

Jeriel Sevilla - UCSC ACCESS

Kayla Kennamore - UCSC iGEM

WALKTHROUGH OF POSTERS AND SPEAKING WITH THE STUDENT PRESENTERS

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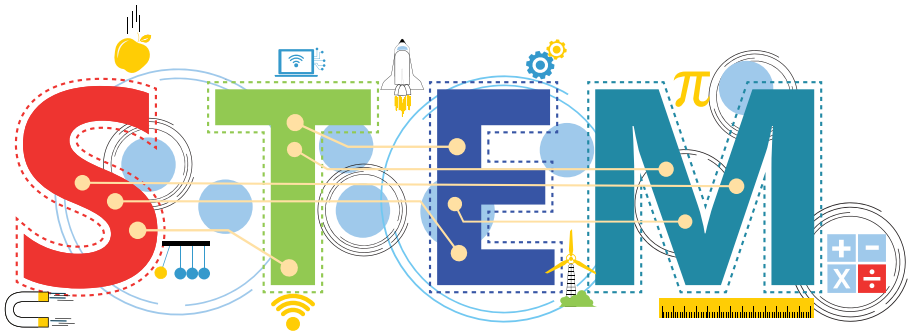
STEM


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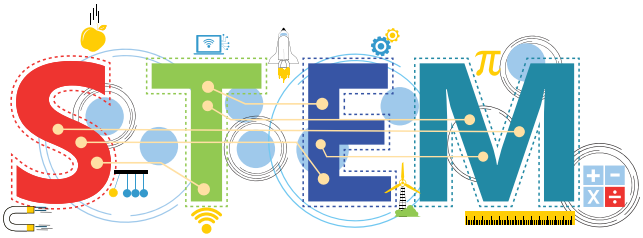

INTERNSHIP PROGRAM 2024

STUDENT INTERNS

Layla Alvarez
Erick Ayala
Alondra Bejarano
Aniyah Chambers
Anna Mikaella Chua
Britney Vera Cortes
Cory Cowden
Jonathan Dominguez
Gabino Guzman
Arely Guijarro
Jonathan Herrera
Marisa Hertzhog
Sandy Huynh
Kayla Kennamore
Athena Lopez
Juan Madrigal
Ana Manzo
Jacob Mejia
Azucena Mendez
Jesus Monroy
Victoria Nava
Napoleon Navarro
Dylan Nieves
Itzel Nolasco Gonzales
Janette Noriega
Samuel Ochoa
David Orta
Joaquin Perez
Lacey Prescott
Edwin Perez Pulido
Alejandro Ramos
Aaron Rivera
Zenaida Rodriguez
Cynthia Ruiz
Kevin Ruiz
Liliana Saavedra
Hector Sedano Sanchez
Jeriel Sevilla
Joshua Sumagang
Xavier Taylor
Ana Trujillo Anaya
Nayeli Valencia
Andres Zamudio Bucio
Alexis Zarate

Evaluation of Methods for Celery Inoculation with Fusarium Oxysporum F.S. Apii Race 4 (FOA)

Intern: Layla Alvarez

Mentor: Dr. Renee Eriksen

Opportunity: USDA-ARS

Fusarium oxysporum f.s. *Apii* race 4 (FOA) is one of the many variations of the soil borne fungus pathogen, *Fusarium oxysporum*, classified as a vascular disease. This project aims to research FOA's effect on celery in specific, one of many plants affected by the disease, in a controlled environment, by conducting trials with a collection of inoculation methods paired with different media types. The selected methods were infected Japanese millet grain, root dip with & without wound, and root drench, which used a concentrated Kerr's broth and FOA solution. The media types used were soil, sand, and a 50/50 mix of the two. Ultimately, we found that using infected grain yielded the least number of successful inoculations, while the root dip and drench methods yielded the most. We also found that wounding the roots made little to no difference in FOA's ability to infect the plants. These results lead us to believe that inoculation through root dip and drench using our Kerr's broth and FOA solution produced the most consistent disease symptoms, including necrosis.

Layla Alvarez

Major: Natural/Enviornmental Science

User Experience of a Magnetic Catch on an Ankle Exoskeleton

Intern: Erick Ayala

Mentors: Antonio Ramirez, Humberto Rosas, Tyler Clites
Opportunity: UCLA SURE

UCLA Samueli School of Engineering

Exoskeletons have the potential to assist individuals with various conditions, such as mobility impairments, muscle weakness, and rehabilitation needs. Our research explores how a magnetic switch added to an ankle exoskeleton may impact what a user feels during everyday gait biomechanics. Our design is a rotational mechanism that attaches to the lab's passive ankle exoskeleton and incorporates a tunable magnetic switch. This magnetic switch then engages at set angles of rotation of the ankle. Our prototype was tested on volunteer human subjects where actions included walking on a treadmill and stairs. We categorized the data and determined how each magnetic configuration impacted a person's gait. After testing various strengths of magnet configurations, it was common for subjects to only report feeling the magnetic catch engage for high-strength configurations and negligible engagement for low-strength configurations. The forces of these high-strength configurations were recorded. The insights gained from our experiments will inform future designs and applications within our lab. Through this research, we aim to advance the field of orthotic development by providing innovative solutions that improve user experience and mobility, ultimately contributing to a better quality of life for individuals relying on these devices.

Erick Ayala

Major: Engineering

Lunar, Utility, Navigation, And Research Bot (L.U.N.A.R)

Intern: Alondra Garcia Bejarano

Team Member: Mikaella Chua
Mentor: Tito Polo
Opportunity: NASA California Space Grant Consortium, Hartnell College

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CALIFORNIA SPACE GRANT CONSORTIUM

The mission to explore the moon's life is endless. The L.U.N.A.R Bot rover aims to help astronauts in data gathering necessary for optimizing the moon's capability of life. To search for and explore the possible life and data found on the moon, the L.U.N.A.R bot will assist in navigation with 6 equipped sensors, ready to provide research that will help us explore habitability of the moon. The sensors included are the soil and moisture sensor, water level sensor, ultrasonic sensor, proximity sensor, gas sensor and the temperature and humidity sensor. The bot will be able to follow alongside a human with 2 infrared sensors and an ultrasonic sensor. A 3-D printed arm, controlled via a joystick will be used to carry out tests of the soil and water levels. By integrating a Bluetooth module and mounting 5 sensors into one Arduino, with all-in-one single code, we will be receiving our data via Bluetooth through a cell phone. The main goal in this project is to be able to carry out a series of data that will be helpful in researching the moon's possible life support.

Alondra Garcia Bejarano

Major: Mechanical Engineering

Temporal and Spatial Description of Population Mixing of Humpback Whales (Megaptera novaeangliae) around Western Antarctic Peninsula

Intern: Aniyah Chambers
Mentors: Logan Pallin, Ari Friedlaender, Paul Thompson and Jordan Lowe
Opportunity: UCSC ACCESS

UC SANTA CRUZ

The Western Antarctic Peninsula (WAP) is one of the most rapidly changing environments on Earth with increasing rates of ocean warming and acidity under the ongoing effects of climate change. The WAP is a specific regional interest for environmental and ecological observation as it is an integral environment for humpback whales in their feeding, socialization, breeding, raising offspring, and migration. Due to unchecked commercial whaling across the 20th century, whale populations were devastatingly depleted to near extinction until the establishment of the International Whaling Commission (IWC). The monitoring of changing or mixing of populations over time and region is crucial in implementing humpback whale conservation management. The sample set of skin blubber biopsies was collected opportunistically from research cruises throughout 2010 to 2023 around the WAP region. DNA was extracted from the biopsies where an 800 bp fragment of the mtDNA control region was amplified and sequenced with the program ARLEQUIN to determine haplotype diversity in the gathered dataset. This project aims to observe the population mixing of the Southern Hemisphere humpback whales along the WAP region via haplotype analysis across the gathered skin-blubber biopsy data set. This project will describe any observed genetic population mixing over a temporal and spatial period. The results of this project are expected to aid in improving the monitoring, management, and conservation implications for humpback whale populations in WAP's rapidly changing climate. Lab analysis and Results are pending.

Aniyah Chambers
Major: Biology

Lunar Utility Navigation and Research (L.U.N.A.R.) BOT

Intern: Anna Mikaella Chua

Team Member: Alondra Garcia Bejarano
Mentor: Tito Polo
Opportunity: NASA California Space Grant Consortium, Hartnell College

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NASA

CALIFORNIA SPACE GRANT CONSORTIUM

Our project goal is to build, develop a navigation robot companion that would assist Artemis astronauts navigate lunar terrain. This project aims to utilize multiple sensors that would help gather data about the moon's environment. The rover will use an Arduino Uno R3 to connect and power the sensor and an ESP32 camera to record visual data of the surface. An infrared sensor will be used to detect the presence of the astronauts, allowing the rover to follow alongside them. The rover will utilize a soil moisture sensor to detect the presence of any moisture within the moon's surface. An ultrasonic sensor along with a proximity sensor will be mounted and positioned on the rover to ensure obstacle avoidance and provide safe navigation for astronauts. DHT11 will be utilized to monitor temperature and humidity levels on the moon and an LCD screen will be used to display temperature and humidity levels. For measuring gasses and identifying gas types present on the moon an MQ4 sensor is utilized with gas reading displayed on LCD screen. The MQ4 sensor can detect Methane, liquid petroleum, alcohol, smoke and carbon dioxide enhancing astronaut safety.

AS the potential for space travel increases so does the need to understand their environment and potential habitability. The prospect of inhabiting the moon has been a significant curiosity and objective of NASA's space exploration. Ultimately L.U.N.A.R aims to assist the Artemis team in evaluating the moon's potential to support vegetation and determining its long-term habitability.

Anna Mikaella Chua

Major: Computer Science

Implementation of Conservation Practices to Preserve Soil, Water, Air, and Wildlife Using Engineering Knowledge

Intern: Britney Vera Cortes

Mentors: Ing. Javier Flores
Opportunity: USDA NRCS

USDA

USDA NRCS
U.S. Department of Agriculture
Natural Resources Conservation Service

The Natural Resources Conservation Service (NRCS) plays a role in supporting landowners by providing help to reduce soil erosion, enhance water supplies, improve water quality, and increase wildlife habitat. The NRCS employs a multidisciplinary team who collaborate with landowners to identify and implement solutions to these challenges. Civil engineers contribute by designing irrigation systems and rangeland projects, ensuring that water is delivered to its intended destinations. Other challenges include managing manure waste. NRCS participates in a variety of projects, following a systematic approach to problem-solving.

The process begins with site visits, where we gather data such as pressure, flow, distance, and elevation. These data are critical for the calculations to develop effective solutions. Interventions include lowering water pressure, installing tanks or new troughs, and modifying drip lines—which require precise calculations and design work. Surveying the land to understand its layout and elevation is a crucial step, enabling us to design projects that address specific needs. Typical solutions include sediment basins to combat erosion and runoff, replacing troughs, drilling new wells, and installing irrigation systems. A project involved designing a sediment basin to prevent erosion caused by heavy rainfall. The sediment basin was engineered to capture and store sediment-laden water, allowing the soil to settle before the water is safely released. It helps in preventing soil loss but also improves water quality by reducing the amount of sediment entering nearby streams and rivers.

The design process involved the analysis of the terrain, rainfall patterns, and soil types to ensure the basin would manage the volume of water and sediment expected during peak storm events. Engineers also considered factors such as basin capacity, outlet structures, and maintenance requirements to ensure the functionality of the system. Before construction begins, detailed engineering reports are prepared to provide guidelines for contractors, ensuring that all aspects of the design are executed precisely according to the engineer's specifications. This includes instructions on the excavation of the basin, the installation of any necessary drainage systems, and the construction of berms or other structural elements designed to withstand the forces of nature. The project exemplifies how thoughtful engineering can play a crucial role in preserving valuable land resources. While this process can take months or even years to complete, each step is essential to safeguarding the long-term health of the land, air, and water resources.

Britney Vera Cortes
Major: Civil Engineering

Uncovering Universal Signatures of Life with Complexity Theory

Intern: Cory Cowden

Mentors: Stuart Bartlett, Anirudh Prabhu, Jim Cleaves
Opportunity: Blue Marble Space Institute of Science

Over the summer, I had the opportunity to work with the Blue Marble Space Institute of Science Young Scientist Program as an intern. My project, Uncovering Universal Signatures of Life with Complexity Theory, was run by mentors Stuart Bartlett, Anirudh Prabhu, and Jim Cleaves. Our project's main goal was to objectively distinguish signs of life from non-life. First, we collected various types of data – biological data such as animal communication, physical signals such as gravitational waves, and technological data such as wifi signals. We processed the data into comparable time series and computed metrics. These metric calculations allowed for a variety of methods, including entropy, statistical complexity, algorithmic complexity, signal processing techniques, self-dissimilarity, and machine learning. Finally, we completed analyses based on the result, an analysis of metric values and correlations with source type, an analysis of how metrics scale with data size, scale, noise, or an analysis of multi-metric clustering by source type. Such clustering aimed to reveal similarities and differences between the various types of data, aiding us in our goal – distinguishing signs of life from non-life.

Cory Cowden

Major: Computer Science

Space Analysis Environment Rover

Intern: Jonathan Dominguez

Team Members: Xavier Taylor, Victoria Nava
Mentor: Tito Polo
Opportunity: NASA California Space Grant Consortium, Hartnell College

HARTNELLCOLLEGE

NASA

CALIFORNIA SPACE GRANT CONSORTIUM

The Space Environment Analysis Rover's (SEAR) main objective is to collect, analyze, and quantify data from different sources. The SEAR rover can detect different types of gasses in the atmosphere, temperature, humidity, use an arm to detect soil moisture, and has a camera to survey the area. The SEAR rover is completely unmanned which allows it to scope out potentially hazardous areas. By use of Bluetooth and Wi-Fi, we can collect the data from the rover thus allowing us to keep the rover isolated in uncharted land for some time. Using all the data collected we can determine whether the land is arable or not for plant life. The goal behind SEAR is to be able to send it to other planets and determine if agriculture is a possibility.

Jonathan Dominguez

Major: Chemical Engineering

Optimizing Cortical Neurosphere Culture for the Temperature-Controlled 3D Bio-Printing of Custom Neural Tissue Models

Intern: Gabino Guzman Losoya

Mentors: Dr. Boris Rubinsky, Maxwell Johnson

Opportunity: UCSF-SSRP

Summer Student Research Program
Focusing on our diversity

UCSF

Accurate in vitro models of neural systems are essential for furthering our understanding of neurological diseases and optimizing potential treatments. The Rubinsky Lab at UC Berkeley explores the creation of in vitro neural tissue models by combining cryopreservation and 3D bioprinting by incorporating neurospheres into their bio-ink. Neurospheres – three-dimensional clusters of neural stem cells – are cultured from mouse cortical stem cells in non-adherent conditions to form spheroids, promoting self-renewal and differentiation into the various neural cell types found within the brain region of interest.

This study aims to optimize the culturing process of stem cell-derived cortical neurospheres for use in temperature-controlled 3D bioprinting to replicate the brain's complex architecture and functionality.

Mouse cortical stem cells are thawed and plated in a 6-well culture plate, where they're fed warmed Epithelial Growth Factors (EGF) and Fibroblast Growth Factors (FGF) in Neural Stem Cell (NSC) Media for cellular expansion. The cells are cultured in an incubator at 37°C and are fed daily until the eighth day when the cells are passaged and split into two new wells, restarting the culture process from the beginning. The neurospheres are evaluated for specific morphometric features through both live and fixed immunofluorescent imaging throughout the culture process, as well as assessing functionality through protein and neurotransmitter concentration screening. Verified functional neurospheres are incorporated into our bio-ink and used in the lab's temperature-controlled 3D bioprinter for fabricating custom neural constructs.

Implementing neurospheres within the bio-ink for 3D printing will significantly enhance in vitro model accuracy, providing a more representative platform for studying neural development, diseases, and exploring potential therapies.

This approach offers promising applications in regenerative medicine, enabling the repair or replacement of damaged neural tissues, and enhances drug discovery by providing accurate platforms for high-throughput screening. This method addresses ethical concerns by reducing reliance on animal models and improving experimental reproducibility.

Gabino Guzman Losoya

Major: Biology

Synthesis of Main-Group Metalloporphyrins for Use as Tunable Lewis-acid Catalysts

Intern: Arely Guijarro

Mentors: Justin L. Peterson, Timothy C. Johnstone

Opportunity: UCSC STEM Diversity SRE

UC SANTA CRUZ

Catalysts are widely used today which allow for a more efficient synthesis of everyday products aiding in the responsible consumption of materials to help strive for sustainability. This work is part of an ongoing investigation into the use of main-group porphyrin complexes as Lewis-acid catalysts. The use of main-group metals that are more earth abundant than precious metals that are commonly used in catalysis can optimize the sustainability of the use of catalysts. Initial experiments aimed at generating a cationic antimony(V) porphyrin complex via halide abstraction from [Sb(TPP)Cl2]+ (where TPP = 5,10,15,20-tetraphenylporphyrin) were unsuccessful. These results prompted the use of tin in place of antimony in the hope that a halide could be more readily abstracted from a neutral complex like Sn(TPP)Cl2. Tetraphenyl porphyrin was synthesized using the Adler method, which was followed by metallation using $SnCl_2 \cdot 2H_2O$. Increasing the steric bulk of the porphyrin scaffold is of interest to try to gain selective reactivity. Functionalization of the 2 and 6 positions of the phenyl rings on TPP will be done via a Suzuki coupling reaction. The steric bulk will be modulated by the addition of methyl, isopropyl, and phenyl groups to these positions. Once these porphyrin complexes are in hand, they will be tested for selective Lewis-acid-catalyzed hydrofunctionalization of terminal over internal unsaturated groups.

Arely Guijarro

Major: Biology and Math

Preserving Dark Skies in the Carmel Valley: Measuring Sky Darkness and Moderating Light Pollution

Intern: Jonathan Herrera-Aguayo

Mentors: Mr. John Heyl, Dr. Charlie Wahl

Opportunity: Carmel Valley Dark Sky

DarkSky

Preserving a dark sky can be crucial for environmental health and astronomical observation. The research gathered during this project focuses on assessing the darkness of the skies in the Carmel Valley to identify areas affected by light pollution and create strategies for mitigation. The primary objective was to measure the current state of the sky's brightness and propose reasonable actionable solutions to reduce light pollution, ensuring the region maintains a natural nocturnal environment.

Under the supervision of my mentors, Mr. John Heyl, and Dr. Charlie Wahle, active members of the Carmel Valley Association (CVA), I've performed extensive research with two key tools: The Sky Quality Meter (SQM) to assess the darkness of the sky, and a light meter to measure light levels in bright spots. For optimal data collecting, SQM readings were taken during the new moon phase of July, August, and September. The data recorded indicated that the Carmel Valley's dark sky was exceptionally darker compared to neighboring cities such as Salinas. I analyzed the data my mentors and I recorded using Excel for accurate calculations and easier record-keeping.

Given the promising SQM values, my research shifted its focus toward light pollution mitigation. My mentors identified locations with significant light pollution, primarily due to unnecessary nighttime lighting or large corporate banks such as Chase and Wells Fargo, which insist on 24/7 obnoxious lighting for safety concerns. The data I recorded in these areas will guide our recommendations to shut off unnecessary lights during nighttime hours and/or replace fixtures with lower-intensity, fully shielded options to preserve dark skies.

This research is part of a bigger plan led by my mentors, pursuing to have Carmel Valley recognized by the Dark Sky Association. By taking a data-oriented approach, my mentors intend to strengthen the Valley's claim for this recognition. The implications of our extensive research go beyond aesthetic and astronomical benefits. Reducing light pollution can also improve local wildlife habitats and improve human health by maintaining natural circadian rhythms. Our research has demonstrated how valuable community involvement can be in policy and our preservation of nature.

Jonathan Herrera-Aguayo

Major: Physics and Math

Improving Zinc Anode Reversibility via Nanostructures

Intern: Marisa M. Hertzog
Mentor: Xinzhe Xu, Yat Li
Opportunity: UCSC ACCESS

UC SANTA CRUZ

Aqueous zinc batteries (AZBs) offer high safety, low environmental impact, and low cost, however dendrite formation and hydrogen evolution reaction (HER) during the zinc stripping and plating process reduce the zinc anode's reversibility, lifespan, and effectiveness which prevent AZBs from widespread application. This project focuses on reducing dendrite formation by depositing copper nanostructures on a commercially available copper foil substrate to ensure the uniform depositing of zinc. The electrodeposition of the copper nanostructures is performed using an electrolyte solution made of $CuSO_4$, H_3BO_3, and NH_4Cl and -20 mAcm-2for 30 minutes to manipulate the morphology of the copper nanostructures. Coin cells made with the deposited copper nanostructures show improved resistance when tested with electrochemical impedance spectroscopy. In Zn//Cu asymmetrical reversibility tests the coin cells with the copper nanostructures lasted longer than bare copper. As the electrodeposition process is refined to create the desired nanostructure morphology the AZB coin cells are expected to show greater improvement in both life cycle and capacity.

Marisa M. Hertzog
Major: Biology

Evaluating the Effects of Silicon Treatments on Lettuce Resilience

Intern: Sandy Huynh

Mentors: Dr. Ivan Simko, Rebecca Zhao, and Roy Stahlhut

Opportunity: USDA-ARS

The Salinas Valley, known as the "Salad Bowl of the World," faces challenges in lettuce production due to climate change-induced extended dry seasons in California. Extreme heat and drought affect lettuce germination and growth. USDA-ARS scientists' experiments aim to enhance lettuce resilience to climate change by applying silicon treatments.

This study evaluates the effects of silicon and calcium concentrations on lettuce's resistance to abiotic stresses, pests, and diseases.

Seeds from 16 cultivars and breeding lines were planted on June 12th, 2024, at the USDA-ARS agricultural research farm in Salinas. Data collection began 29 days after planting when plants reached a size of approximately 7 cm. The experiment was set up in three replications, with approximately 15 plants per cultivar, treatment, and replication. The field was irrigated twice weekly until established. Silicon and calcium applications are applied at weekly intervals.

The cultivar 'Red Zin' was used to assess plant growth and development during the growing season. Three representative plants are collected weekly to measure plant height, width, biomass (fresh weight), leaf count, leaf size, and chlorophyll and anthocyanin content. Silicon and calcium treatments will be compared to the control when plants of 16 cultivars and breeding lines are harvested at full market maturity.

Sandy Huynh

Major: Plant Science

Progress and Contributions to Project LIFT: Nutritional Solutions, Genetic Analysis, and Web Development

Intern: Kayla Kennamore
Mentor: Dr. Bernick
Opportunity: UCSC-IGEM

UC SANTA CRUZ

iGEM

Mothers around the world face significant challenges in feeding their newborns. Some are unable to breastfeed, while others cannot afford nutrient-dense formulas. Additionally, premature babies often require specialized, nutrient-rich formulas to support their development. Regardless of the underlying issue, our project LIFT, aims to address these problems by leveraging *Limnospira fusiformis*, a highly nutritious microalgae known for its rich protein, essential amino acids, vitamins, minerals, and antioxidants. Moreover, as I entered the beginning half of this internship I contacted several professionals, including UCSF's Maternal-Fetal Medicine experts, to discuss the nutritional benefits and applications of our project. I then directed my efforts towards helping to identify PAM, TAG, and RBS sequences which were crucial for understanding whether these elements could effectively support our project's objectives. Using CRISPR-Cas Finder, I found three relevant CRISPR arrays in *Limnospira fusiformis* and documented potential PAMs and associated cyanophages. For TAG sequences, I recorded the last eight nucleotides of palindromic repeats for specific CRISPR arrays. I also identified conserved ribosome binding sites (RBS) and promoter sequences using Improbizer. In the wet lab, I briefly practiced streaking techniques and obtained DNA from single colonies. As the project began to broaden, I investigated methylation sites in *Synechococcus*, a different cyanobacteria, and confirmed Eco47II and AvaII cut sites, as well as identifying Eco47II's sequence. Additionally, since our project requires a website, I started to assist in coding the layout and structuring the placement of information. This involves designing the user interface to ensure intuitive navigation and effective presentation of content, as well as integrating necessary features to support our project's goals. Lastly, I have taken on the role of managing and posting content for the iGEM Instagram account.

Kayla Kennamore
Major: Biology

Motion, Auxiliary, Navigating, Geo-analyzing, Space-rover (M.A.N.G.O.S.)

Intern: Athena Lopez

Team Members: Liliana Saavedra and Alejandro Ramos
Mentor: Tito Polo
Opportunity: NASA California Space Grant Consortium, Hartnell College

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M.A.N.G.O.S., the acronym for our project, stands for Motion, Auxiliary, Navigating, Geo-analyzing, Space-rover. We designed a rover that analyzes and collects data using geo-analyzing sensors. Our goal is to collect a wide array of data types for future studies. We aim to implement five sensors: flammable gas, air quality, atmospheric pressure, magnetometer, and temperature and humidity. The purpose of our rover is to optimize the types of data we can collect on Mars' terrain. The rover is equipped with an atmospheric pressure sensor to help analyze the physical conditions of the rover's environment by measuring diaphragm deformation under different pressures, which is particularly useful on planets with varying atmospheres. The magnetometer-based compass reports changes in x, y, and z values, aiding navigation over terrain and obstacle detection. The air quality, flammable gas, and temperature and humidity sensors detect hazardous components in the air, mitigating risks to astronauts and identifying environmental changes like volcanic activity. We plan to develop an app that enables us to view all the data collected from the flammable gas, the compass, and the atmospheric pressure sensor. With the features of our project, planetary exploration will be optimized. This rover is best suited as a companion for astronauts for data collection. It is equipped with LCD screens for viewing data on the spot from the air quality and temperature and humidity sensor, as well as Bluetooth for remote data access. Additionally, the rover is capable of navigating from a large distance due to its antenna-based operation.

Athena Lopez

Major: Computer Science

Project Comprehensive Data Collecting Drone (C.D.C.D.)

Intern: Juan Madrigal

Team Members: Aaron Arvizu, Dylan Nieves, Alexis Zarate

Mentor: Tito Polo

Opportunity: NASA California Space Grant Consortium, Hartnell College

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The Comprehensive Data Collecting Drone (C.D.C.D.) focuses on collecting data. Its objective is to assist with the upcoming 2024 Artemis lunar mission which focuses on scientific discovery, economic benefits, and the inspiration for a new generation of explorers. This project will use its sensors for research. The project is centered around the use of low-cost programmable microcontrollers and uses an Arduino for the functionality of the sensors. The drone incorporates a water tank and uses sprayer nozzles to release the water which is programmed through Arduino using an NRF transceiver which controls the on-and-off configuration. Sensors include the water lever sensor module, DHT11 (temperature and humidity sensor), BMP180 (digital barometric pressure and altitude sensor module), and MQ-5 (methane natural gas sensor). The water lever sensor is used for determining the level of liquid present in the drone's water tank and its temperature and humidity sensor for detecting surrounding environmental conditions that will help determine the proper use of whatever water or pesticide that is present in the tank. The barometer will support the drone in maintaining appropriate altitude through its detection of air pressure, which will in turn help to avoid malfunctions and the final sensor is used for methane gas detection.

Juan Madrigal

Major: Mechanical Engineering

Lick Observatory Community College Training Workshop

Intern: Ana Manzo

Mentors: Anne Metevier, Archana Aravindan, Ian Weaver, Jarred Gillette
Opportunity: Lick Observatory

Throughout centuries, there have been people who instead of looking down on the ground, for some reason decided to look up. To observe these mysteries, we need devices that help us look out beyond Earth's atmosphere or into space. Telescopes are devices that help us research these distant objects. Lick Observatory is located near San Jose on Mount Hamilton. They have three primary telescopes and many small ones. At the Lick Observatory workshop, we were able to use their telescopes which included the 3-meter telescope, the 36' refractor, and the Nickel telescope.
Our training started off by learning about the background of light and how telescopes used light to give us information about distant objects. We had hands-on experience with eVscopes provided by Unistellar. We learned how to work the telescope, focus it, calibrate it, and find objects in the sky. The workshop gave us the skills to be able to use these telescopes and do our own research. We also planned to observe an occultation happen which is when a closer object blocks a further object from us. It was a 50/50 chance we would be able to see an asteroid blocking an object further away and looking at the data and recording of the observation we were not able to capture it. We learned that from occultations, we can get a light graph from the asteroid blocking the object and calculate the diameter of the asteroid.

A digital activity showed how a pixelated image can give more information than a regular image. We examined an image and asked a question regarding the image and then we turned it into a pixelated version to see if we could answer the question. This was a skill we learned on how something that seems to contain less information, could be different. As groups we were able to use the 36' refractor to see distant objects which was a special experience. We got to see the process of adjusting the telescope, focusing it, and getting the right angle. We saw a globular cluster, a nebula, and binary stars. At the very end, we used the nickel telescope and captured an image of an object that was visible that night. My group captured M71, the angel fish cluster. The process took a while as we had to take photos with different color filters and stack them and create one image. The exposure time for each image was roughly 8 minutes. It was utterly amazing to see a little part of what astronomers do.

Ana Manzo

Major: Astronomy

Investigating the Effects of the V73A Mutation on p18 Tumor Suppressor Activity

Intern: Jacob Mejia

Mentors: Vanessa Mariscal and Seth Rubin

Opportunity: UCSC ACCESS

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The cell cycle is regulated by various checkpoints to ensure proper cell division and prevent uncontrolled proliferation, a hallmark of cancer. p18 is a tumor suppressor protein that functions as a checkpoint in the cell cycle. It inhibits the Cyclin-dependent kinase (CDK 4-6) 4-6/Cyclin D complex, preventing phosphorylation of the retinoblastoma protein (Rb) and blocking the progression from the G1 to the S phase. p18 is a paralog of p16, the second most common mutated protein in cancer. The Rubin lab has identified missense mutations in p16 that may lead to loss of function. The objective of my project is to investigate a similar missense mutation in p18 to determine if it leads to a loss of function in p18. The two possible hypotheses for how the missense mutations can lead to loss of function are: loss of CDK4-6 binding, or loss of structure and/or stability. Using AlphaFold, I made structural predictions of p18V73A (a mutation of p18) compared to wildtype p18 and I am recombinantly expressing and purifying p18V73A to conduct ADP Glo Assays that will assess whether the mutant protein leads to a loss of function compared to wildtype p18. I will identify and characterize the effects of the V73A mutation. The findings of my research aim to provide insights into the mechanisms by which these mutations contribute to the loss of tumor suppressor activity. This understanding could inform therapeutic strategies to restore p18 function or compensate for its loss in cancer treatment.

Jacob Mejia

Major: Chemistry

Silver Wire Based Enzyme Free Electrochemical Sensors For Detection Of Renal Dysfunction And Cystic Fibrosis

Intern: Azucena Mendez-Gomez
Mentors: John Stanley, Nader Pourmand
Opportunity: UCSC ACCESS

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This project focuses on the development of enzyme free electrochemical sensors utilizing silver (Ag) wire electrodes for the analytical detection of creatinine in blood and chloride ions in sweat. The sensitive detection of creatinine involves the electrodeposition of copper on the Ag wire and utilizes the principle of creatine-copper complex formation. Varying electrochemical deposition conditions were studied for their creatinine sensing properties. It was observed that copper electrodeposited from a solution containing 0.1 M $CuSO_4$ and 0.1 M H_2SO_4 for 24 segments using cyclic voltammetry between -1 V to +1 V had an excellent linear detection limit from 0 µM to 450 µM. Interference from common interfering molecules such urea, uric acid, acetaminophen, ascorbic acid, and glucose is currently being tested. This testing helps evaluate the sensor's selectivity, ensuring reliable performance in complex biological matrices such as blood. Chloride sensing is based on the principle of silver's ability to form complexes with chloride ions and will utilize bare silver wire electrodes for sensor development. Electrochemical characterization of the chloride sensor will involve electrochemical techniques such as cyclic voltammetry (CV), linear sweep voltammetry (LSV), and amperometric IT. Scanning electron microscopy (SEM) will be utilized for examining surface morphology for both the sensors, while energy dispersive spectroscopy (EDS) will help elucidate the elemental composition of the electrochemical sensor surface. The successful validation of these two sensors will pave the way for accessible and affordable point-of-care (POC) testing devices capable of detecting renal dysfunction (creatinine) and cystic fibrosis (chloride).

Azucena Mendez-Gomez

Major: Biology

Equipment Maintenance Engineering

Intern: Jesus Monroy

Mentors: Josh Payne & Mauro Villalobos

Opportunity: Joby Aviation

A new form of air travel is on the horizon and Joby Aviation is pioneering this technology. Joby aims to provide safe and clean air travel via electric powered aircraft built out of carbon fiber, titanium and aluminum. My task this summer was to work on making this process more efficient through plasma treatment. During the process of bonding carbon fiber components, the surface has to be treated with plasma to reduce the water contact angle. Doing this will allow the adhesive to cover a larger surface, increasing the bonding strength. This is a very critical step as many quality tests must be passed for airworthiness certification. Currently this plasma treatment is being done manually using portable plasma machines. This is not only time consuming and expensive but inefficient for large scale production which is what Joby Aviation is moving towards. The replacement my team and I were testing was robotic plasma treatment. This testing was done with a Fanuc robot. A high voltage nozzle attached would plasma treat all bonding surfaces, reducing the water contact angle. Testing of this water contact angle was done with a surface testing device. This device is essentially a hand held camera that shoots out a tiny drop of water. The camera then is able to determine the water contact angle based on this droplet. During my time, I was successfully able to plasma treat and certify propeller spars and blades for future treatment. This was a very cool experience because I was in charge of performing the testing.

Jesus Monroy

Major: Mechanical Engineering

Project SEAR

Intern: Victoria Nava

Members: Xavier Taylor, Jonathan Dominguez
Mentor: Tito Polo
Opportunity: NASA California Space Grant Consortium, Hartnell College

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The SEAR-Space Environment Analysis rover's main objective is to collect, analyze, and quantify data from different sources. The SEAR rover can detect different types of gasses in the atmosphere, temperature, humidity, use an arm to detect soil moisture, and has a camera to survey the area. The SEAR rover is completely unmanned which allows it to scope out potentially hazardous areas. By use of Bluetooth and Wi-Fi, we can collect the data from the rover thus allowing us to keep the rover isolated in uncharted land for some time. Using all the data collected we can determine whether if land is arable or not for plant life. The goal behind SEAR is to be able to send it to other planets and determine if agriculture is a possibility.

Victoria Nava

Major: Computer Science

Internship with the USDA FAS International Food Assistance Division (Global Programs)

Intern: Napoleon Navarro

Mentor: Nicholas Kharabadze

Opportunity: USDA Foreign Agricultural Service

The FAS internship program within the International Food Assistance Division under Global Programs helped me develop and become familiar with foreign agricultural exports and creating markets in other countries that need food and economic assistance. The two main programs are the McGovern-Dole Food for Education Program and Food for Progress Program. I supported the Global Programs team by allocating funds and identifying the most and least efficient freight methods to support our goals of providing food and funds to these communities. I helped project this year shipments and commodities quantity for different countries by adhering to the budget for the fiscal year 2024-2025 and collaborating with colleagues to ensure we meet the needs of the communities. Not only does the McGovern-Dole program provide fruits and vegetables, but we also help their local farmers, teach children about nutrition and hygiene, and speak with policymakers to enhance opportunities for these low-income communities. McGovern-Dole also assists in supporting communities with teacher training and installing safe water and sanitation facilities. The McGovern-Dole project's work has affected five and a half million meals served to more than thirty-one million people in forty-eight countries. Communities have seen schools improve literacy rates, reduce hunger, and build capacity of school, local, and national stakeholders to implement locally sourced school feeding programs. I enjoyed going back to review budget summaries and commodity costs to help investigate the receiving countries proposal to provide insight to my colleagues at the FAS. Being able to network and collaborate with people of many different backgrounds and experiences helped me learn more about the work I was doing and gain insight on improving foreign trade.

Napoleon Navarro

Major: Engineering and Agriculture Business

Development of a Comprehensive Data Collecting Drone (C.D.C.D.) for Space Exploration

Intern: Dylan Nieves

Team Members; Juan Madrigal, Aaron Arvizu, Alexis Zarate

Mentor: Tito Polo

Opportunity: NASA California Space Grant Consortium, Hartnell College

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CALIFORNIA SPACE GRANT CONSORTIUM

The Comprehensive Data Collecting Drone (C.D.C.D.) focuses on collecting data. Its objective is to assist with the upcoming 2024 Artemis lunar mission which focuses on scientific discovery, economic benefits, and the inspiration for a new generation of explorers. This project will use its sensors for research. The project is centered around the use of low-cost programmable microcontrollers and uses Arduino for the functionality of the sensors. The drone incorporates a water tank and uses sprayer nozzles to release the water which is programmed through Arduino using an NRF transmitter. Sensors include the water lever sensor module, DHT11 (temperature and humidity sensor), BMP180 (digital barometric pressure sensor module), and MQ-5 (methane natural gas sensor). The water lever sensor is used for determining the level of liquid present in the drone's tank and its temperature and humidity sensor for detecting surrounding environmental conditions. The barometer will support the drone in maintaining appropriate altitude to avoid malfunctions and the final sensor is used for gas leakage detection.

Dylan Nieves

Major: Mechanical Engineering

Compression Testing on Strain-Gauged Carbon Fiber

Intern: Itzel Nolasco Gonzales

Mentors: Elliot Held & Francisco Salcido

Opportunity: Joby Aviation

The first successful aircraft sustained flight was in 1903. Since then, aircraft manufacturing has improved and become revolutionary. At Joby Aviation, they strive to create all-electric vertical takeoff and landing aircrafts for commercial purposes. Although aircrafts seem like they are large in multitudes, much time and testing goes into ensuring that everything works like it should and that materials are adequate to sustain flight. In this internship, I worked alongside material composite and processing engineers and technicians to help prep, test, and evaluate aircraft material adequacy and strength. We managed to test a variety of different materials including bonded carbon fiber coupons, uniaxial compressive material, acrylic, and strain-gauged carbon fiber specimens.

Strain gauges are miniature sensors that vary in electrical resistance as a result of applied force and strain. Strain gauges are engineered to convert mechanical motions in a material into electrical signals that can be measured numerically. In compression testing, the material (carbon fiber in this case), is tested to determine how it behaves under an applied crushing force. With the use of strain gauges in compression testing, a readable graph was able to determine the stress and strain relationship in regards to the compressive force (in Newtons) applied to the material. Compression testing is used to determine the compressive strength, compressive fracture qualities, and adequacy of materials used in the manufacturing of aircraft components, such as aircraft wings or engine parts.

Itzel Nolasco-Gonzales

Major: Engineering

Testing the role of the 3'UTR in regulating sperm-specific NHR-23 expression in *C. elegans*

Intern: Janette Noriega
Mentors: , Nuohan Xu, James Matthew Ragle, Jordan Ward
Opportunity: UCSC ACCESS

UC SANTA CRUZ

A poorly understood process in the hermaphroditic nematode *Caenorhabditis elegans* is how gamete fate is executed after their fates are chosen during meiosis in the germ line. The nuclear hormone transcription factor NHR-23 is necessary for spermatogenesis in *C. elegans* and is expressed in primary spermatocytes but silenced in the oogenic germline. Previous publications concluded that mRNA 3' untranslated regions (UTRs) were sufficient for gene regulation in *C. elegans* except in spermatogenesis, where promoters are required to direct sperm-specific expression. However, preliminary data has shown *nhr-23* mRNA is present in both the spermatogenic and oogenic germline, suggesting post-transcriptional regulation. To test the role of *nhr-23* 3'UTR in regulating NHR-23 expression in the hermaphrodite germline, the activity of reporters containing a generic 3'UTR *(tbb-2)* and reporters containing the *nhr-23* 3'UTR will be compared. First, various molecular cloning methods will be performed to generate plasmids carrying a pan-germline expressed promoter and a nuclear localized GFP reporter containing the desired 3'UTRs. After Sanger Sequencing confirms the desired plasmids have been constructed, a recombinase mediated knockin approach (rapid RMCE) will be used to generate the worm strains that carry the desired transgenes via microinjection. Then, a fluorescent microscope will be used to observe the levels of NHR-23 in the germline. Based on the gene expression pattern, we expect that NHR-23 is post-transcriptionally regulated through its 3'UTR during germ cell differentiation. Better understanding the transcription factors concerning gametogenesis of *C. elegans* could provide insight into ways to combat parasitic nematodes through targeting their reproductive systems.

Janette Noriega
Major: Chemistry

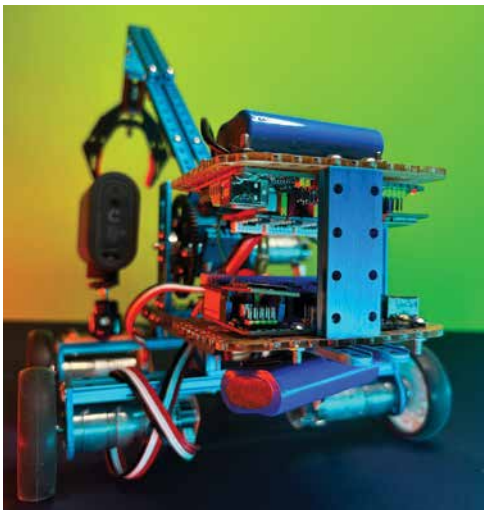
Hands-On Robotics: Guiding the Next Generation of Innovators

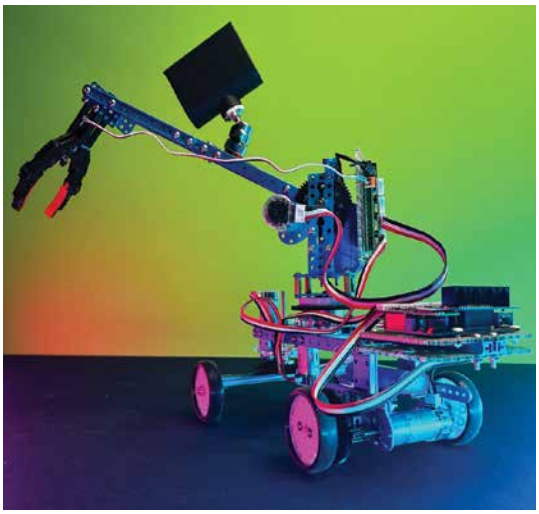
Intern: Samuel Ochoa
Mentor: Sean True
Opportunity: FAB Lab

During my internship with the Fab Lab, I had the opportunity of working with a group of 23 middle school students. During that time the fab lab team and I worked with these students and explored robotic designs, makeblock coding, and 3D printing with the end goal of space exploration and extraterrestrial collection. During our time with these students, we were able to gain insight into how each of these students were best able to focus. Unexpectedly we also found that the students were much more interested in robot building and less attentive about 3D design. We took note of the fact that most of these students enjoyed the hands-on and active building and less of the idea/theory portions of the class. Additionally, along the process of building these robots, we had set game days where students were able to participate in a set of challenges for a prize leading to more collaboration between students and insight on what may or may not be working for their designs. Lastly, on our mission launch day, we had each group go twice the first attempt was to explore the area and adjust any problems that they had found through this attempt, and for the second and final attempt, they had a much better plan and goal resulting in many remarkable attempts.

Samuel Ochoa

Major: Biology





Bridging the Science Equity Gap: The Science Voices Greenworks Program at Hartnell College

Intern: David Orta
Lab Partner: Daniel Orta
Mentor: Dr. Lev Horodyskyj
Opportunity: Science Voices

In the quest to provide equitable access to science education, particularly in underrepresented regions like South Monterey County, the Science Voices Greenworks Program works to close the gap between Hartnell College's main campus and its South County campuses. This program, which I am helping design as part of my internship with Science Voices, focuses on delivering hands-on science education and international collaboration opportunities to our students who traditionally lack access to such experiences.

Greenworks at Hartnell College is an integrated science education initiative that includes a comprehensive teacher training program, project-based learning, and a student exchange program with international collaborators in Brazil. These efforts are geared toward empowering students with practical science skills and global perspectives, which are crucial in the modern STEM landscape. Through this program, South County students will engage in activities such as building and implementing science projects, participating in a capstone showcase, and gaining exposure to international scientific research.

The program's design is informed by a deep understanding of the existing disparities in educational resources and opportunities between different regions served by Hartnell College. By fostering collaboration between Hartnell College, Science Voices, and international partners (like the University of Campinas), the Greenworks Program represents a significant step forward in democratizing access to high-quality science education for underserved communities.

This project is currently in the development phase, with ongoing efforts to refine program elements and secure necessary funding. Preliminary results indicate strong support from local stakeholders and the potential for widespread impact on student engagement and success in STEM fields.

David Orta

Major: Computer Science

The Use of a Biogeochemical Cycle in Microbes Through Arsenic Compounds

Intern: Joaquin Perez
Mentor: Dr. Chad Saltikov
Opportunity: UCSC STEM Diversity SRI

UC SANTA CRUZ

Arsenic pollution of water is thought to affect upwards of 220 million people worldwide. Arsenic is known to cause cancer and cardiovascular disease. Arsenate (As(V)) and arsenite (As(III)) are the most common forms of arsenic in polluted water. Many microbes in water undergo biogeochemical cycling between arsenate and arsenite. Past research has shown that arsenate-reducing and arsenite-oxidizing microbes are able to use arsenic compounds as metabolic substrates for cellular energy production. Moreover, these microbes are likely to co-occur together in nature. **The aim of this project was to investigate coupled cycling of arsenic by co-culturing *Shewanella* sp. strain ANA-3 (arsenate reducer) and *Cereibacter azotoformans* str. *ORIO* (arsenite oxidizer).** We monitored microbial growth on agar plates and in liquid culture across three days. qPCR was used to quantify the abundance of both *Shewanella* and ORIO arsenic metabolic genes in the co-culture. The qPCR data showed that *arrA* (arsenate reductase gene) was greater than *arxB* (arsenite oxidase) in concentration over three days. Changes in arsenate and arsenite concentrations were also analyzed by HPLC ICP-Mass Spectrometer. Arsenate decreased while arsenite increased indicating *Shewanella* arsenate reductase activity dominated the co-culture. With further optimization, these results indicate that these microbes can form a biogeochemical cycle in water sources, contributing to the arsenic levels of both compounds.

Joaquin Perez

Major: Biology

Effect of relative humidity on *Fusarium oxysporum* f.sp. *fragariae* sporulation on strawberries

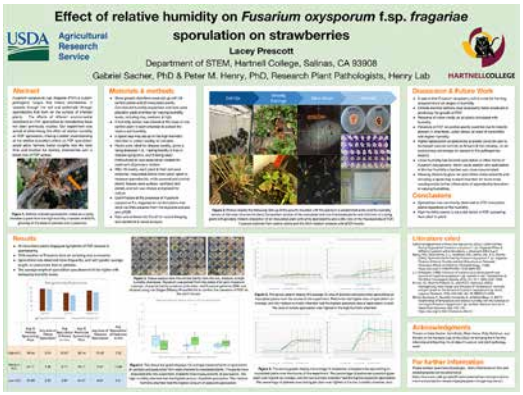
Intern: Lacey Prescott

Mentors: Peter M. Henry, PhD & Gabriel Sacher, PhD

Opportunity: USDA-ARS

United States Department of Agriculture
Agricultural Research Service

Fusarium oxysporum f.sp. *fragariae* (FOF) is a plant pathogenic fungus that spreads through the soil and potentially through recently discovered sporodochia that form on the surface of infected plants. FOF causes strawberry plants to wilt and die, causing major losses for commercial growers. FOF is known to thrive in warm conditions, however, the effects of other environmental conditions on FOF sporulation on strawberries have not been previously studied. Our experiment was aimed at determining the effect of relative humidity on FOF sporulation. Three growth chambers were set to different humidity levels (low, medium, and high) using commercial humidifiers and dehumidifiers. Then, 20 FOF-inoculated and 20 non-inoculated plants were grown for 10 weeks, and were rated weekly for disease and sporulation. After 10 weeks, plants and their soil were collected for destructive sampling and measurements of sporulation and infection were taken. Sporodochia were first observed once the plants displayed a disease rating of 4 (wilting), four weeks post-inoculation.



Sporodochia were observed most frequently on peduncles, though were also found on petioles, crowns, and stolons. At the end of the experiment, 77.5% of peduncles were observed to be sporulating in the low humidity chamber, 71.5% in the medium humidity chamber, and 57.5% in the high humidity chamber; 54.9% of petioles were observed to be sporulating in the low humidity chamber, 63.0% in the medium humidity chamber, and 42.8% in the high humidity chamber. Overall, there was a similar amount of sporulation on the inoculated plants in each chamber over the ten week period, showing that FOF could be a risk for strawberry farming in all ranges of humidity. Having a better understanding of the relative humidity's effect on FOF sporulation could allow farmers better insights into the best time and location for farming strawberries with a lesser risk of FOF spread, based on local climate patterns.

Lacey Prescott

Major: Biology

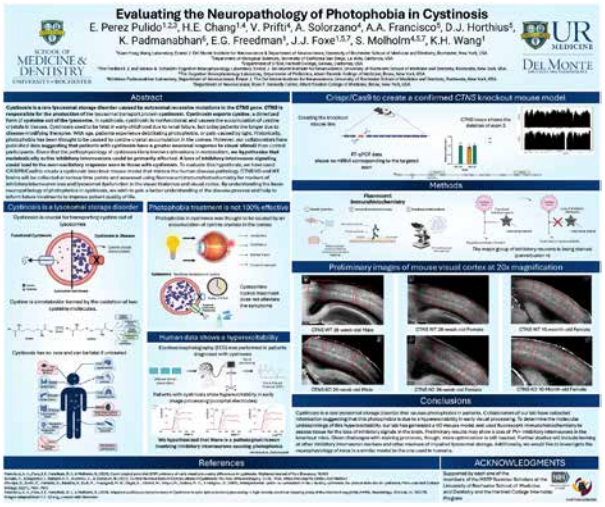
Evaluating the neuropathology of photophobia in cystinosis

Intern: Edwin Perez Pulido

Mentors: Hayley E. Chang, Kuan Hong Wang

Opportunity: Ernest J. Del Monte Institute for Neuroscience, University of Rochester Medical Center, MSTP

Cystinosis is a rare lysosomal storage disorder caused by autosomal recessive mutations in the *CTNS* gene. CTNS is responsible for the production of the lysosomal transport protein cystinosin. Cystinosin exports cystine, a dimerized form of cysteine out of the lysosome.



In cystinosis, cystinosin is nonfunctional and causes the accumulation of cystine crystals in tissues. Cystinosis used to be fatal in early childhood due to renal failure, but today patients live longer due to disease-modifying therapies. With age, patients experience debilitating photophobia, or pain caused by light. Historically, photophobia has been thought to be caused by cystine crystal accumulation in the cornea. However, our collaborators have published data suggesting that patients with cystinosis have a greater neuronal response to visual stimuli than control participants. Given that the pathophysiology of cystinosis likely involves alterations in metabolism, we hypothesize that metabolically active inhibitory interneurons could be primarily affected in this disease. A loss of inhibitory interneuron signaling could lead to the over-excitatory response seen in those with cystinosis. To evaluate this hypothesis, we have used CRISPR/Cas9 to create a cystinosin knockout mouse model that mimics the human disease pathology. CTNS KO and WT brains will be collected at various time points and assessed using fluorescent immunohistochemistry for markers of inhibitory interneuron loss and lysosomal dysfunction in the visual thamalus and visual cortex. By understanding the basic neuropathology of photophobia in cystinosis, we wish to gain a better understanding of the disease process and help to inform future treatments to improve patient quality of life.

Edwin Perez Pulido

Major: Biology

Motion Auxiliary Geo analyzing Organizing Space (M.A.G.O.S) Rover

Intern: Alejandro Ramos

Team Members: Liliana Saavedra, Athena Lopez
Mentor: Tito Polo
Opportunity: NASA California Space Grant Consortium, Hartnell College

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Space rovers have been used in previous space exploration to aid scientists in their research. The purpose of our project was to design a rover that collects and analyzes data via geo-analyzing sensors. By implementing the following five sensors: temperature, humidity, flammable gas, air quality, and atmospheric pressure, our rover will serve to optimize the types of data that can be collected on either the Earth's Moon or Mars' terrain for research purposes. A solar cell was also applied so that the rover can be potentially powered by the sun, in addition it can also be used as a solar tracker to keep track of voltage, current, and power within a time interval. An app will also be implemented that allows us to view and record our data. The rover is intended to aid current and future scientists and astronauts to gain a better understanding of our neighboring planets.

Alejandro Ramos

Major: Physics and Math

Project Comprehensive Data Collecting Drone (C.D.C.D.)

Intern: Aaron Arvizu Rivera

Team Members: Alexis Zarate, Dylan Nieves, Juan Madrigal
Mentor: Tito Polo
Opportunity: NASA California Space Grant Consortium, Hartnell College

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CALIFORNIA SPACE GRANT CONSORTIUM

The Comprehensive Data Collecting Drone (C.D.C.D.) focuses on collecting data. Its objective is to assist with the upcoming 2024 Artemis lunar mission which focuses on scientific discovery, economic benefits, and the inspiration for a new generation of explorers. This project will use its sensors for research. The project is centered around the use of low-cost programmable microcontrollers and uses an Arduino for the functionality of the sensors. The drone incorporates a water tank and uses sprayer nozzles to release the water which is programmed through Arduino using an NRF transmitter. Sensors include the water lever sensor module, DHT11 (temperature and humidity sensor), BMP180 (digital barometric pressure sensor module), and MQ-5 (methane natural gas sensor). The water lever sensor will be used to determine the level of liquid present in the drone's tank, and its temperature and humidity sensor for detecting surrounding environmental conditions. The barometer will support the drone in maintaining appropriate altitude to avoid malfunctions and the final sensor is used for methane gas leakage detection.

Aaron Arvizu Rivera

Major: Electrical Engineering

Analyzing Uni-Trap Liner Placement to Considerably Eliminate LBAM Pests

Intern: Zenaida Rodriguez

Mentor: Gregory Simmons
Opportunity: USDA–APHIS

This summer, I was an intern of Dr. Simmons, an entomologist from the USDA's APHIS department. Throughout my internship, I carried out projects geared to the larger effort to eliminate invasive pests like SWD (Spotted Wing Drosophila) and LBAM (Light Brown Apple Moth).

During my internship, my projects taught me about local and East Coast pests like the BTM (Box Tree Moth). BTM is an invasive pest in the United States and has been spreading rapidly in various East Coast states. Many farmers have combated this problem by trapping the pest with Uni-traps that contain Vaportape II kill strips, an organophosphate insecticide. However, to accommodate changed regulations surrounding this insecticide, there's an urgent need for an alternative to the Vaportape II kill strips.

I was assigned to create and test out various lined trap prototypes and their ability to capture LBAM and record the data catch. Throughout my project, my experiment consisted of nearly a dozen uni-traps. These prototypes all used an LBAM pheromone lure, Epiphyas postvittana. As my data was monitored by Dr. Simmons and the rest of the APHIS department, I updated the treatments to accommodate the project as they were needed in New York. The dynamic of this project allowed me to innovate and brainstorm logical and relevant methods.

The goal of this project was to decide which trap will be the most efficient based on production time, convenience, and performance, and contribute to finding an equally successful alternative to the kill strip method to address the worry coming from some states concerning organic phosphate health hazards. My results reinforced the efficiency of Delta traps in many agricultural spaces and suggested that increasing the lures used in uni-traps can be unhelpful for certain moth species.

Zenaida Rodriguez

Major: Agriculture Business

Implementing Engineering Practices to Protect Natural Resources

Intern: Cynthia Ruiz
Mentor: Javier Flores
Opportunity: USDA-NRCS

USDA

USDA NRCS
U.S. Department of Agriculture
Natural Resources Conservation Service

By considering all this information, calculations are performed to properly select material, soil, plants, and size for the design. In some situations, engineers begin with an existing structure/system that is inefficient. In these cases, calculations help determine the resource concern and possible solutions to address the issue/s. For example, examining the water pressures can help determine the proper pipe size for an irrigation design that is not uniformly distributing water. Other times, engineers must work on a system from scratch. In these cases, engineers have more freedom to arrange the setup of the system and the materials used. Upon finishing the design, engineers communicate with the client to tailor the design and ensure the client's needs are met, while also achieving the goal of conserving resources. Once the design is complete, technical notes and drawings are made to facilitate a contractor's job of executing the project according to the engineer's plan. After the construction phase, the project is properly maintained to conserve soil, water, and wildlife habitat. By considering all this information, calculations are performed to properly select material, soil, plants, and size for the design. In some situations, engineers begin with an existing structure/system that is inefficient. In these cases, calculations help determine the resource concern and possible solutions to address the issue/s. For example, examining the water pressures can help determine the proper pipe size for an irrigation design that is not uniformly distributing water. Other times, engineers must work on a system from scratch. In these cases, engineers have more freedom to arrange the setup of the system and the materials used. Upon finishing the design, engineers communicate with the client to tailor the design and ensure the client's needs are met, while also achieving the goal of conserving resources. Once the design is complete, technical notes and drawings are made to facilitate a contractor's job of executing the project according to the engineer's plan. After the construction phase, the project is properly maintained to conserve soil, water, and wildlife habitat.

Cynthia Ruiz

Major: Civil Engineering

Airframe Assembly Intern

Intern: Kevin Ruiz Hernandez

Mentors: Travis Welch, Tedd Michel, Tristan Kyle-Hammer, Jordan Lowe, Alek Parolari

Opportunity: Joby Aviation

An Electric Vertical Take-Off and Landing aircraft is the future of aerospace and transportation. Joby's goal is to help put EVTOL's in the sky by 2025 to help reduce our emissions by offering a ridesharing experience similar to Uber.

This summer I had the great opportunity of working alongside a great team of engineers to help this become a possibility. With the help and mentorship of these amazing engineers, I was able to design tools that help with the manufacturing and assembly of the aircraft itself, by improving and helping ease the technicians' already very difficult task of assembling an aircraft that is going to carry passengers in it. I managed this by working alongside the technicians and engineers by designing and 3D-printing various prototypes of a tool and going back to the technicians and engineers for feedback until we came up with the final design that the techs were comfortable using.

One of my biggest accomplishments during this internship was working alongside one of my Mentors, Travis Welch to help design a fixture that would make bonding the Wing Tip fairing a lot easier than what it was for the technicians. During this process I had to learn what would work and what would not with graphic design, as well as coming up with a solution to make sure physical moving parts will all move in synchronization to ensure that the surfaces being bonded are all bonded evenly. Once the fixture was complete and put to use, the wing tip fairing assemblies had drastically improved not only in quality aesthetically but also structurally.

Kevin Ruiz

Major: Engineering

Motion Auxiliary Navigating Geo-Analyzing Organization Space (M.A.N.G.O.S.) Rover

Intern: Liliana R. Saavedra

Team Members: Athena Lopez, Alejandro Ramos
Mentor: Tito Polo
Opportunity: NASA California Space Grant Consortium, Hartnell College

HARTNELLCOLLEGE

NASA

CALIFORNIA SPACE GRANT CONSORTIUM

We designed a rover that analyzes and collects data by using geo-analyzing sensors. Our goal is to be able to collect a wide array of data types that can be used for future studies. To collect environmental data we implement the following 5 sensors: temperature, humidity, flammable gas, air quality, and magnetometer. The purpose our rover will serve is to be able to optimize the types of data that we can collect on mars' terrain. The rover is also equipped with a camera to provide the operators with surveillance capabilities. We plan to implement an app that allows us to view all the data collected.

Liliana R. Saavedra

Major: Computer Science

Joby Material & Processes

Intern: Hector Enrique Sedano Sanchez
Mentor: AJ Fullerton
Opportunity: Joby Aviation

The FAA (Federal Aviation Administration) has strict rules in place for the sake of safety in the aerospace industry and even more so for a new aircraft like the Joby eVTOL. As a new aircraft is being built you must test all material batches that are used on the production of said aircraft, and that is what Material & Processes at Joby Aviation does and what I was charged with doing. A panel will usually be laid up in a CCA, cured in an autoclave, then sent to NDI for quality inspection. After all this is done, it is sent to the M&P lab to be machined into testable specimens. For these specific test plans they would be notched and pulled on in a SHIMADZU until failure, these were the simplest of the tests I conducted. Another material I tested was the unidirectional layup, as the name implies the carbon fibers are all going in one direction. For this we would strain gauge them and we would leave as is and test that under tension. For the tension test we would see numbers as high as 40000 newtons until we saw complete and quite frankly violent failure, this was done on the 100 KN setup as to not max out the 50KN machine. Important to note for this material is that there is a 0 degree and 90-degree direction; the 0-degree direction would be stronger as that is the direction the fibers were pointing. So, we would see multiple dips in the graph after the initial drop because of this. For the UNI strain to be tested under compression, we would have to solder on wires to get our strain measurements and place the specimen in a fixture and conduct the test. The computer would use Young's Module to get the data that we required after the test was complete. Material & Process is an important process in the manufacturing of any aircraft, and this was made evident with my time at Joby.

Hector Enrique Sedano Sanchez

Major: Aerospace Engineering

Synthesis of Iron Chalcogenide (S, Se) Nanoparticles Functionalized by 4-ethylphenylacetylene (EPA)

Intern: Jeriel Sevilla
Mentor: Xingjian Song, Shaowei Chen (PI)
Opportunity: UCSC ACCESS

UC SANTA CRUZ

Metal chalcogenide nanoparticles have various applications due to their low and tunable band gap, optical combination for conversion efficiency, and properties (chemical, electrical, mechanical, optical, thermal). Amines and thiols, such as 4-ethylphenylthiol (EPT), are traditionally used to synthesize nanoparticles but do not facilitate electron transfer and delocalization due to σ-bonding. However, alkynes, such as 4-ethylphenylacetylene (EPA), enable electron transfer and delocalization due to π-bonds. Moreover, metal carbonyls can directly react with alkynes as opposed to metals because of the coordination complex in the metal carbonyls that allows exchange reactions and is soluble in organic solvents, which prevents heterogeneous reactions. Herein, a wet-chemistry technique was used to synthesize EPA-functionalized metal chalcogenide nanoparticles from metal carbonyls. Iron pentacarbonyl ($Fe(CO)_5$) centers, ligands, and chalcogenide (S, Se) solutions are added to tetrahydrofuran (THF) and heated and stirred in a nitrogenous atmosphere. The product was washed with water and ethanol, and the precipitate was collected. The synthesized EPA-functionalized iron chalcogenide nanoparticles have stable structures, are soluble in organic solvents, and exhibit semiconductivity and unique optical properties. In addition, they are expected to have better electron transfer than nanoparticles functionalized by EPT due to the presence of Fe–C≡ interfacial bonds.

Jeriel Sevilla

Major: Chemisty, Biology, Math, Physics

Concurrent Observing and Data Acquisition System (CODAS)

Intern: Joshua Sumagang

Mentor: Dr. Jean Perkins

Opportunity: MIRA Hamming Astronomy Center

In order to address one of the most pressing issues in astronomy research which is the problem of proper data storage/organization and efficient data retrieval, I have been learning how to devise an efficient data model and implement it into a database which can properly store essential data of observations and also data of the specific instrument configurations used in observations. The design of the CODAS database keeps instrument configuration data in mind along with metadata of observations in order to streamline the instrument configuration process when it comes to making observations of transient events. I have been working with the database management application Microsoft Access in order to craft an intuitive data model that works well to promote data independence and enable easy, efficient, user-friendly observation data retrieval. I have also been working in software development using Python and various libraries such as tkinter, sqlite3, and pandas to develop intuitive user interfaces to test the functionality of my devised data models.

Joshua Sumagang

Major: Computer Science

ASTRAL Workshop

Intern: Joshua Sumagang

Mentors: Anne Metevier, Ian Weaver, Archana Aravindan, Candice Brown Pacheco, Jarred Gillette
Opportunity: Lick Observatory

During this four day workshop, I was able to gain valuable teamwork experience in a scientific setting through group projects and discussions on inclusivity. Our activities included mock proposals for image engineering projects which practiced creative thinking and communication skills and team projects setting up experiments that replicate an occultation observation event which involved practicing project management and teamwork efficiency. Also, I was introduced to the STEM professions of an astronomy observatory: telescope maintenance, telescope operation, and IT maintenance. Telescope maintenance involves critical-thinking and problem solving skills in being able to diagnose mechanical or software related problems very quickly and critical decision making when prioritizing problems that are quicker to solve. The telescope operation at Lick involves working with various computer applications that control many different aspects including direction of the telescope and image processing- it also entails emergency response skills in reacting to weather conditions where the telescope operation must be halted and properly closed. Lastly, there are computer technology specialists who must be able to diagnose and troubleshoot problems that arise in the observatories computer infrastructure.

Joshua Sumagang

Major: Computer Science

SEAR (Space, Environment, Analysis, Rover)

Intern: Xavier Taylor

Team Members: Victoria Nava and Jonathan Dominguez
Mentor: Tito Polo
Opportunity: NASA California Space Grant Consortium, Hartnell College

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The SEAR (Space, Environment, Analysis, Rover) rover's main objective is to collect, analyze, and quantify data from different sources. The SEAR rover can detect different types of gasses in the atmosphere, temperature, humidity, use an arm to detect soil moisture, and has a camera to survey the area. The SEAR rover is completely unmanned, allowing it to scope out potentially hazardous areas. Using Bluetooth and Wi-Fi, we can collect the data from the rover thus allowing us to keep the rover isolated in uncharted land for some time. Using all the data collected we can determine whether the land is arable or not for plant life. The goal behind SEAR is to be able to send it to other planets and determine if agriculture is a possibility.

Xavier Taylor

Major: Aerospace Engineering

Child and Adult Care Food Program (CACFP): Impact on Nutritional Quality of Meals and Snacks Served by Family Child Care Home (FCCH) Providers with the Higher Covid-19 Reimbursement Rate

Intern: Ana V. Trujillo Anaya

Mentor: Kassandra Bacon

Contributing Author: Lorrene D. Ritchie

Opportunity: UCSF SSRP

Summer Student Research Program
Focusing on our diversity

UCSF

CACFP is vital for feeding over 4 million U.S. children in childcare from low-income families1. It provides licensed FCCHs meeting certain criteria by reimbursing providers for 2 meals and 1 snack served per child daily. Maximizing CACFP reach is crucial for improving health disparities like food insecurity, poor diet quality, and obesity among vulnerable groups like children of color in low-income households. Offering nutrition training may help achieve this.

FCCH providers participating in CACFP serve healthier meals and snacks to the children in their care compared to providers who don't participate in CACFP, and the higher Covid-19 reimbursement rate improved nutritional quality of food/beverages served by all CACFP participating FCCH providers, especially for tier 2.

FCCH providers completed an online survey sent to them via email, text and postcard. Survey questions included understanding how the higher COVID-19 reimbursement rate has affected the nutritional quality of meals and snacks served. Data will be cleaned and analyzed to understand any impact of the higher reimbursement rate on diet quality between tiers and those on and not on CACFP.

I expect to see that implementation of the higher and equal Covid-19 reimbursement rate allows for all CACFP providers to serve higher quality foods, especially tier 2 providers. I expect that CACFP providers in general serve more nutritious foods than providers not on CACFP.

This work is significant because by studying the implementation of the higher reimbursement rates due to COVID, we can assess differences in nutritional quality of meals and snacks served between tiers and between FCCHs on and off CACFP. Higher reimbursement rates have been shown to enable providers to purchase nutritious, higher quality foods and beverages for the children in their care.

Ana V. Trujillo Anaya

Major: Public Health

City of Monterey - Engineering Division Internship

Intern: Nayeli Valencia

Mentor: Marissa Garcia, EIT
Oppportunity: Monterey City Hall, Monterey
City of Monterey - Engineering Division Internship

THE CITY OF MONTEREY

I had the opportunity to intern with the City of Monterey's Public Works Engineering Division, which is an internship I started in the summer and will continue into the semester. I was able to work on various projects and tasks, which included fieldwork, Neighborhood and Community Improvement Program (NCIP) Projects, interpreting traffic signal plans, reconfiguring traffic signal timings, and assisting in the transition to reflecting traffic signal backplates.

NCIP Projects focus on improving neighborhoods and satisfying the needs of the public. I was able to assist on a project that focuses on reconstructing and improving curb ramps to make them ADA compliant, where I used AutoCAD to create the preliminary design for the curb ramps at an intersection.

I spent most of my internship focusing on the traffic aspect of civil engineering, which included fieldwork of examining traffic signals and determining what type of signal head it was. This fieldwork was then used to determine how many reflective traffic signal backplates would be needed. Additionally, I spent time learning about phase diagrams to create intersection diagrams that consisted of the phases and landmarks at each signalized intersection in the city.

Understanding phases also helped me during my fieldwork, where we would go to signalized intersections that had time controlled traffic signals. Which is how I learned how to adjust information inside the traffic controllers to correct the timing of the signals. I learned a substantial amount throughout this internship, which further reassured me in my decision to pursue a civil engineering degree.

Nayeli Valencia

Major: Civil Engineering

Peer Mentor for California Space Grant Consortium

Intern: Andres Zamudio Bucio

Mentor: Tito Polo

Opportunity: NASA California Space Grant Consortium, Hartnell College

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This summer, I worked alongside Tito Polo as a peer mentor for the California Space Grant Consortium. Using knowledge from my engineering coursework, I helped familiarize interns with engineering methods to help them achieve their objectives. As part of my role, I organized and maintained the inventory of key electronic components and internship material, ensuring that all resources were readily available for upcoming projects. Additionally, I managed the physics stockroom, to simplify accessing necessary equipment. I also helped interns assemble mechanical components, offering hands-on guidance and technical insights.

Through peer mentoring, I provided interns with valuable feedback, diverse perspectives, and consistent support, fostering an environment of collaboration and growth. My role as a mentor enabled me to contribute to their learning experience, as well as my own, encouraging them to overcome challenges and effectively apply the engineering principles being taught.

Andres Zamudio Bucio

Major: Electrical Engineering

Comprehensive Data Collecting Drone (C.D.C.D.)

Intern: Alexis Zarate

Team Members: Aaron Arvizu, Dylan Nieves, Juan Madrigal
Mentor: Tito Polo
Opportunity: NASA California Space Grant Consortium, Hartnell College

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NASA

CALIFORNIA SPACE GRANT CONSORTIUM

The Comprehensive Data Collecting Drone (C.D.C.D.) focuses on collecting data. Its objective is to assist with the upcoming 2024 Artemis lunar mission which focuses on scientific discovery, economic benefits, and the inspiration for a new generation of explorers. This project will use its sensors for research. The project is centered around the use of low-cost programmable microcontrollers and uses an Arduino for the functionality of the sensors. The drone incorporates a water tank and uses sprayer nozzles to release the water which is programmed through Arduino using an NRF transmitter. Sensors include the water lever sensor module, DHT11 (temperature and humidity sensor), BMP180 (digital barometric pressure sensor module), and MQ-5 (methane natural gas sensor). The water lever sensor is used for determining the level of liquid present in the drone's tank and its temperature and humidity sensor for detecting surrounding environmental conditions. The barometer will support the drone in maintaining appropriate altitude to avoid malfunctions and the final sensor is used for gas leakage detection.

Alexis Zarate

Major: Math

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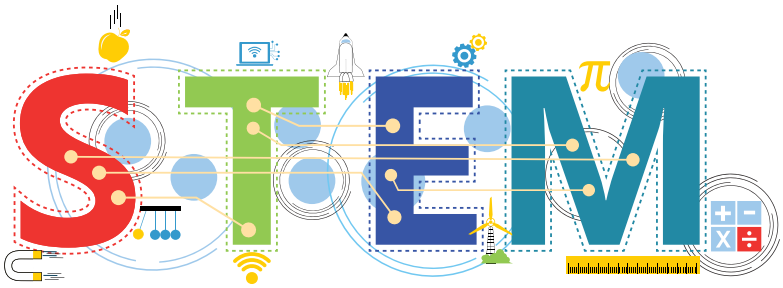


INTERNSHIP PROGRAM 2024

MICRO-INTERNSHIP MENTORS

Adrea Gonzalez-Karlsson

Dr. Jeffery R. Hughey

Dr. Rosser Panggat

Mohammad (Tarek) Hussain

Tito Polo

Dr. Ver Marie Myr Panggat

*Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation. This material is based upon work supported by the National Science Foundation under Grant No. 1832446.

Assessing and recording Lichen diversity on the Hartnell College campus

Mentor: Adrea Gonzalez-Karlsson

STUDENTS:
Annamikaela Chua
Melissa Distancia
Sandy Huynh

Lichens are composite organisms composed of a fungal component and a photosynthetic component, typically algae or cyanobacterium, which exist in a mutualistic relationship. We have several species of lichen that you can find here on campus via our poster or via the iNaturalist project. If you find more species, you can also add them to the project! iNaturalist is a social network where users around the world can share biodiversity information to help each other learn more about nature. iNaturalist users can identify plants and animals with visually similar suggestions and verification by dedicated contributors. The students shared their Lichen data with the iNaturalist platform.

***Pertusaria californica* (California Pore Lichen):** white, warty texture with a flat top. Crustose lichen and granulate and forms in patches on California's coastal rocks. Pores may turn orange

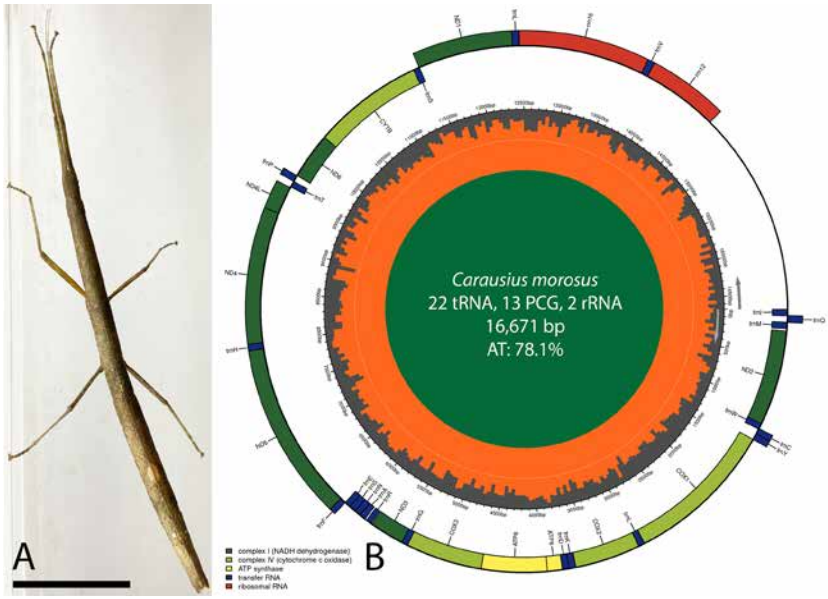
***Candelariella rosulans* (Sagebrush Goldspech Lichen):** Thallus appears dark yellow with lobed squamules. Have thick, raised margins, disks that are slightly darker than the thallus. Found in rocks or occasionally on wood and bark, especially in mountains.

Complete mitochondrial genome of the introduced Indian walking stick *Carausius morosus* (Lonchodidae, Insecta) from California

Mentor: Dr. Jeffrey R. Hughey

ONLINE STUDENTS:

Mariana Aguirre Linares, Taym Al-Zuhairi, Yareli Alfaro Maldonado, Layla Alvarez, Elizabeth Anguiano, Hailey B. Nava, Christian B. Trujillo, Mateo Brambila, Javier C. Diaz, Flavio C. Mora, Gladys Cabrera Luis, Aniyah Chambers, Pearl Chenevert, Aiden Clarke, Caitlin Collins, Audri Contreras, Benny Cuevas, Emily D. Alcaraz, Jenny Do, Soledad Duran, Lacey E. Prescott, Angelica G. Fernandez, Roberto Garcia Velazquez, Mariah I. Marquez-Gonzalez, Maria J. Velasquez-Moreno, Mia J. Windham Cortes, Konnor L. Barrett, Claudia L. Dominguez-Trejo, Steven L. Meza, Phoebe Lewis, Jessica Lopez, Victor M. Padilla, Andres Mandujano, Lizbet Merino Juarez, Henry N. Huynh, Eduardo Pantoja-Garcia, Michael Perez, Felipe Rodriguez, Juan Pablo Rodriguez Cortes, Jesus Rosas, Areli Ruiz Nunez, Jeriel S. Sevilla, Samantha Santos, Stephanie Solis, Froylan Tinoco Rivera, Alice Trujillo, Natalie Trujillo, Maximiliano Villa, Reema Y. Mubarz



Carausius morosus, the Indian walking stick, is a large polyphagous species originally described from specimens from Shembagonor and Trichinopoly, Madura Province, southern India. It was introduced to Australia, Azores, Madagascar, Madeira, South Africa, United Kingdom, and United States, likely due to the escaping of captive C. morosus and the accidental discarding of eggs. *Carausius morosus* was first reported from San Diego county, California in 1991 and has since spread to ten counties where it is a pest on ornamental plants. Here, we analyzed the complete mitochondrial genome of *C. morosus* from Salinas, California. The mitochondrial genome of is circular, AT rich (78.1%), and 16,671 bp in length. It consists of 13 protein-coding, 22 transfer RNA, and 2 ribosomal RNA genes and is identical in gene content to *Carausius* sp. from China. These data contribute to the bioinformatics of *C. morosus* and future studies on the phylogenomics of Phasmatodea.

†All authors contributed equally to the analysis and writing of this paper. Author order was determined alphabetically. – Research mentor, Jeffery R. Hughey.

Complete mitochondrial genome of the introduced Indian walking stick *Carausius morosus* (Lonchodidae, Insecta) from California

Mentor: Dr. Jeffrey R. Hughey

IN PERSON STUDENTS:

Mariah Marquez-Gonzalez
Christian Trujillo
Mariana Aguirre Linares
Taym Al-Zuhairi
Emily Alcaraz
Yareli Alfaro Maldonado
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Carausius morosus, the Indian walking stick, is a large polyphagous species originally described from specimens from Shembagonor and Trichinopoly, Madura Province, southern India. It was introduced to Australia, Azores, Madagascar, Madeira, South Africa, United Kingdom, and United States, likely due to the escaping of captive C. morosus and the accidental discarding of eggs. *Carausius morosus* was first reported from San Diego county, California in 1991 and has since spread to ten counties where it is a pest on ornamental plants. Here, we analyzed the complete mitochondrial genome of *C. morosus* from Salinas, California. The mitochondrial genome of is circular, AT rich (78.1%), and 16,671 bp in length. It consists of 13 protein-coding, 22 transfer RNA, and 2 ribosomal RNA genes and is identical in gene content to *Carausius* sp. from China. These data contribute to the bioinformatics of *C. morosus* and future studies on the phylogenomics of Phasmatodea.

†All authors contributed equally to the analysis and writing of this paper. Author order was determined alphabetically. – Research mentor, Jeffery R. Hughey.

Complete chloroplast genome of the marine red alga *Rhodochorton tenue* (Rhodochortonaceae, Rhodophyta) from San Juan Island, Washington

Mentor: Dr. Jeffrey R. Hughey

STUDENTS:

Layla T. Ahmed
Hiba Alesmail
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Rachel Christian
Jonathan Coronado
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Alena Fierro
Angel Garcia Mora
Kayla Gonzalez
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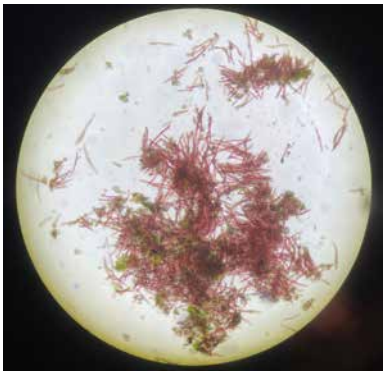
Jose Velasquez
on behalf of Hartnell College Genomics Group†



Rhodochorton tenue was originally described as a short plant 3-5 mm high with more or less branched filaments and a creeping basal layer. The type locality of *R. tenue* was cited as San Juan Island, Friday Harbor Marine Laboratories Preserve where it was said to densely cover rocks and stones at the high-water mark. Later workers accepted *R. tenue*; however, based on similarities in morphology and life histories in culture, *R. tenue* was placed into synonymy under the generitype of *Rhodochorton, R. purpureum*. The only two DNA marker sequences of *R. tenue* deposited in GenBank are from slowly evolving (SSU and LSU) genes and the authors did not comment on the status of the name. To determine the systematic relationship between *R. tenue* and *R. purpureum*, the complete chloroplast genome of *R. tenue* from San Juan Island, Washington was assembled and analyzed. The chloroplast genome of *R. tenue* is 192,037 bp in length and the analysis shows that *R. tenue* is genetically diverged from *R. purpureum* from the north Atlantic Ocean. These data support the recognition of *R. tenue* as a distinct species.

†All authors contributed equally to the analysis and writing of this paper. Author order was determined alphabetically. – Research mentor, Jeffery R. Hughey.

Electrocardiogram Changes during Exercise with the use of Thumb ECG

Mentor: Dr. Rosser Panggat

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The ECG or electrocardiogram has been recording the electrical events of the heart since its invention in 1895 by Willem Einthoven. It is one of the simplest and quickest tests to evaluate the heart. Exercise provides a form of stress on the heart and causes ECG changes in the ECG tracing. Heart conditions that can be missed by a resting ECG can be caught by ECG during exercise.

This study will utilize the thumb electrocardiogram to record the electrical events of the heart at rest and after exercise. This type of ECG provides short-term recordings that are proven to be effective at the same time as an inexpensive option for patients (NIH, 2017). The thumb ECG has advantages compared to the conventional ECG done in the healthcare facility and also advantages over the wearable Holter monitor. This portable device can monitor the heart rate and rhythm conveniently at home without all the wires and sticky patches that other ECG devices use. The device is very patient-friendly and provides valuable information that can be recorded and shared about the heart's activity especially for patients with arrhythmia and stroke survivors.

This proposal aims to enable 25 Hartnell College Biology students to get in-depth and hands-on learning by training them

in the following skills: skill in using the different kinds of thumb electrocardiogram, skill in reading electrocardiogram tracing, skill in providing live presentations in front of an audience. The training will involve reading the medical information, performing thumb ECG, reading ECG tracings, managing and analyzing data and creating a presentation of their findings in class.

Artificial Intelligence Demystified - Math in Machine

Mentor: Mohammad (Tarek) Hussain

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Kyla Usi
Barbara Valdez
Armando Vega
Eduardo Villagrana
Elsy Villanueva
Jonathan Zavala

This micro-internship introduced the basic concepts of Artificial Intelligence (AI)/ Machine Learning (ML). Students learned about the fundamentals of AI/ML such as, learning to design and implement neural networks using very simple linear mathematical function ReLU (Rectified Linear Unit), along with exponential and logarithmic functions, and matrices; concepts that a student who has taken intermediate algebra should be able to grasp.

Students learned how to take publicly available datasets and analyze them using AI/ML models. Particularly, they learned how to use ML models to solve the two most important problems that ML addresses: regression and classification.

The students applied these newly learned tools, neural nets, to solve real world problems using advanced concepts in ML:

1) Neural Style Transfer (NST) to transform an image into the style of another image.
2) Generative Adversarial Networks (GAN) to create images.
3) **ChatGPT-4** architecture transformer and how it works.

The participants took a journey through advanced computer science topics such as, computer vision and its applications. They learned about LLM (Large Language Models) using transformers and popular applications of computer vision in object detection and self-driving cars.

The Most Common Vision Screening Findings and Vision-Related Symptoms among Hartnell Students

Mentor: Dr. Ver Marie Myr Panggat

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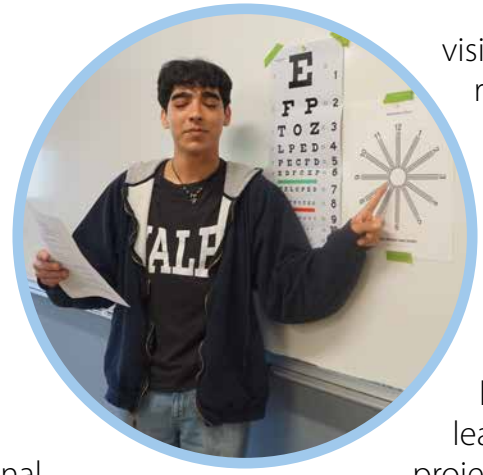
Christabel Mendez
Shaylynn Monteon
Reema Mubarz
Wendy Murguia
Barbara Ramirez Martinez
Jewel Sanchez
Arianna Villagomez
Lauren Wiley
Ya Yang



Eighty percent of all learning comes through visual pathways (Optometrist.org, 2021).

Due to the effects of impaired vision in learning, the California Department of Education created a guide for vision screening in California Public Schools with the main objective of identifying potential vision deficits and encouraging professional comprehensive eye and vision evaluations (www.cde.ca.gov, 2019). Vision screening is recommended to start in the newborn period and continued in every well-child visit (American Academy of Pediatrics and American Academy of Ophthalmology). According to studies, a college student's ability to access and understand course materials could be directly affected by one's vision (Abraham Eye Associates, 2024) and ultimately affects student success. It is therefore important to note that vision screening examinations remain an essential part of a college student's regular doctor's check-up.

Students at Hartnell College are introduced to the anatomy and physiology of the eye in their classes, however, there is no in-depth learning of the subject. This project will enable 25 Hartnell College students to get in-depth hands-on learning by training them with the following skills: skill in taking detailed ophthalmologic medical history, vision screening examination skills and skills on creating eye health digital educational pamphlets. The training will involve reading the medical information, medical interviews, performing vision screening examinations, managing and analyzing data and creating a short and simple eye health digital educational pamphlet.

Arduino, 3D Printing, Electrical Soldering, and Oscilloscope Micro-Internship

Mentor: Tito Polo

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Joshua Sumagang
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Arduino design has been at the front of user-friendly software and hardware development, especially to solve real-world problems. Students will work on Arduino projects such as, programming a blinking LED, creating a temperature and humidity sensor circuit, working on a water level detection device, controlling DC motors using Arduino via Bluetooth, wire up and use an alphanumeric LCD display, analog Joystick module and several other sensors. Students will also learn the concepts of and how to implement different electronic components, Digital and Analog circuits, and Arduino boards. Also, students will learn soldering electronic components, and the use of electrical measuring equipment: voltmeter, ammeter, function generator and oscilloscope.

Hartnell UCSC-ACCESS Interns 2024 plus staff and faculty at the USCS ACCESS Symposium in Santa Cruz

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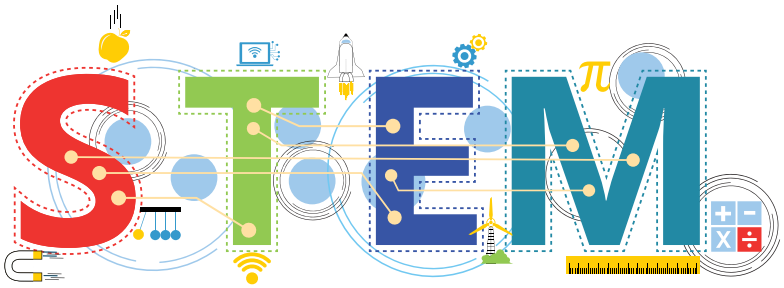

PARTNERS

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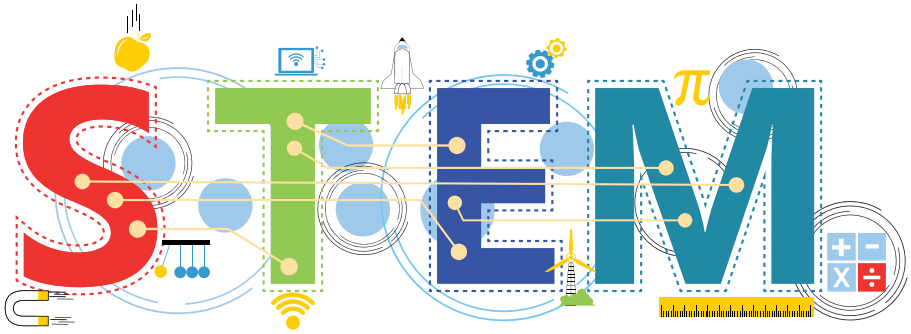

For more information about the
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www.hartnellstem.org

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