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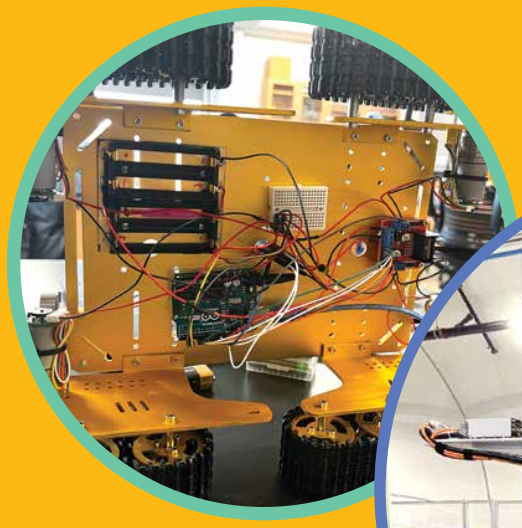
INTERNSHIP SYMPOSIUM



SEPTEMBER 30, 2023

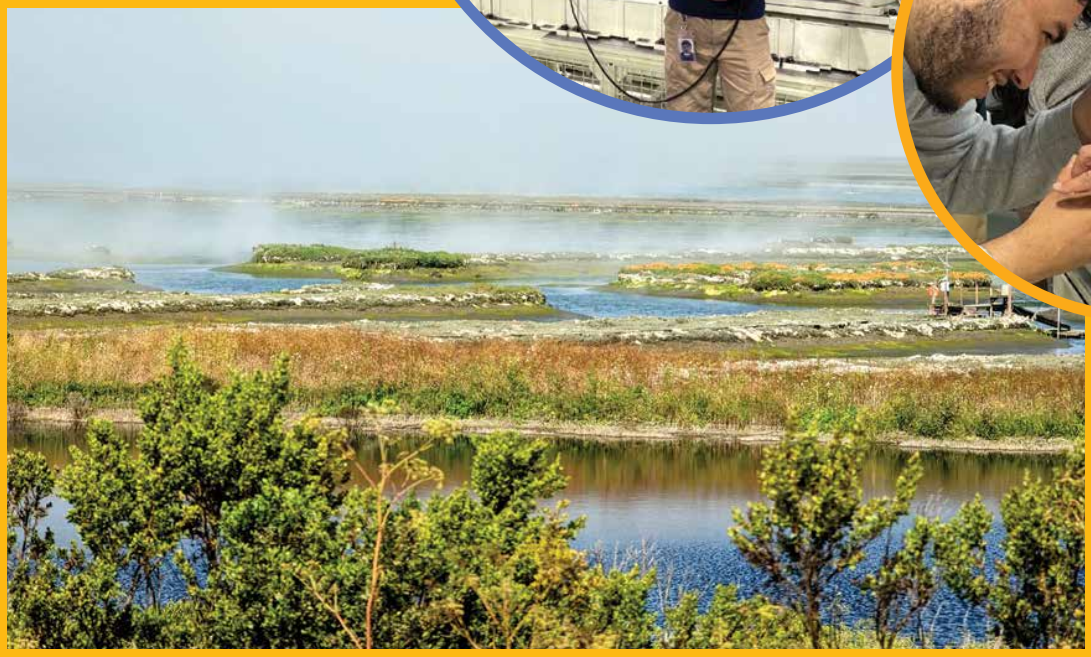
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THE PROGRAM

Hartnell STEM Internship Program

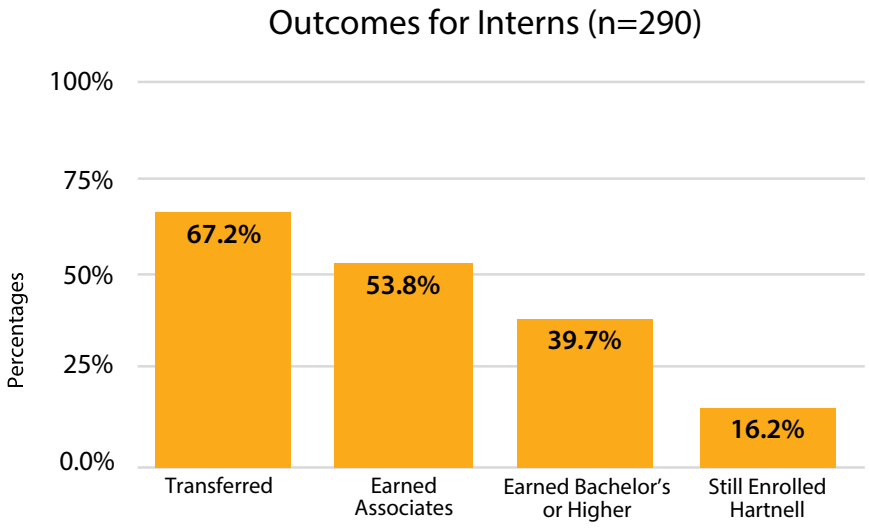
The STEM (Science, Technology, Engineering and Math) Internship Program at Hartnell Colleges supports and engages students in undergraduate academic research and/or professional internship experiences. Internships include relevant and innovative projects with regional research institutions, local partners, 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 17 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 1,250 students in undergraduate research and professional internship opportunities. In addition to its growth over the 17-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
- ACCESS Program (National Institutes of Health)
- California State University, Monterey Bay

Thank you!

Hartnell College

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*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.



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STEM

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WELCOME

Dear Friends of Hartnell College,

Welcome to the 2023 celebration of the Hartnell STEM Internship Program – an exceptional program now in its 17th year.

The symposium is a culmination of the STEM summer internship experience, where 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 essence of questioning, research, techniques, and, ultimately, discovery. This year is the second year of in-person learning post pandemic, and as in previous years, the students have exemplified outstanding responsibility, persistence, and determination to explore and learn.

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

For over a decade, Hartnell has been at the forefront of STEM internship opportunities for college students. What began as a program with just six interns in 2006 has now grown into a full-fledged network that has matched hundreds of students with mentors and researchers from universities, scientific research communities, and industry experts. The result is an immersive experience that prepares students for the rigors of academic life and provides them with practical knowledge to excel in their future careers.

The success of this program would not be possible without the support of the higher education community and the generosity of volunteering scientific and industry experts. It is a testament to the power of collaboration and the passion for cultivating excellence in the next generation of innovators and leaders.

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

— Michael Gutierrez
President/Superintendent

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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.

STEM

INTERNSHIP PARTNERSHIP & MENTORS

Monterey County Blue Zone Project
Dalila Alvardo

California Space Grant Consortium
Dr. John Kosmatka

California State University, Monterey Bay
Dr. Sathya Narayanan
Dr. Corin Slown

Dark Sky Project
John Heyl

Elkhorn Slough Foundation
Elkhorn Slough National Estuarine Research Reserve
Juan Ramirez
Dash Dunkel

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

Joby Aviation
Paul Thompson
Jordan Lowe

Naval Postgraduate School
Dr. Alan Van Nevel
Sadie Hastings
Anna Davari
Dr. Arijit Das
Dr. Tony Ansell
Dr. Christopher Brophy
Dr. Matthew Zefferman
Dr. Giovanni Minelli
Dr. Ronald Giachetti

Seed4STEM
Shannon Bliss

SmartWash Solutions
Dr. Eric Wilhelmsen

University of California, San Francisco
Dr. Jan Christoph
Dr. Jan Lebert

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

University of California, Santa Cruz (ACCESS)
Dr. Phil Crews
Alissa Dawn
Dr. Tianchen Cui
Dr. Dan Turner-Evans
Dr. Michael Patnode

United States Department of Agriculture
Dr. Juan Alvarez (OPPE)
Dr. James Patterson (NRCS)
Dr. Greg Simmons (APHIS)
Dr. Javier Flores (NRCS)

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SPECIAL THANK YOU TO OUR

Andy Newton STEM Internship Partner

Award Winner

DR. DAVID BERNICK

Associate Professor of Biomolecular Engineering,

Baskin School of Engineering at UCSC



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THANK YOU TO

the human Chevron energy company™

for supporting this year's
STEM Internships
and the
STEM Internship Symposium!

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STEM INTERNSHIP SYMPOSIUM

SEPTEMBER 30, 2023

WELCOME

Sharon Albert
Dean of STEM

OPENING REMARKS

Michael Gutierrez
President

PRESENTATION OF ANDY NEWTON STEM INTERNSHIP PARTNER AWARD

Dr. Joel Thompson
Interim Director of Science and Math Institute

STUDENT PANEL DISCUSSION

Gabino Guzman – UCSF Summer Student Research Program

Ana Trujillo Anaya – Blue Zones

Edwin Perez Pulido – UCSC-ACCESS

Yesenia Santiago – USDA

Walkthrough of posters and speaking with the student presenters.

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STEM INTERNSHIP PROGRAM 2023

STUDENT INTERNS

Manuel Aboite
Fernanado Alvarado
Ana Trujillo Anaya
Joel Viorato Arambula
Erick Ayala
Ananda Bouchard
Anna Mikaella Chua
Britney Vera Cortes
Cory Cowden
Erica Jane Estamo
Isael Estrada
Adrian Garcia
Elizabeth Garcia
Luis A. Garcia
Leslie Gomez Jimenez
Loreli Gonzalez
Arely Guijarro
Gabino Guzman
Brandon Ulices Lopez
Carlos Lopez
Lizbeth Lozano-Ruiz
David Mancera
Matthew Montgomery
David Orta
Ricardo Ortiz
Edwin Perez Pulido
Alejandro Reyes
Julie San Pablo
Yesenia Santiago
Hector Enrique Sedano Sanchez
Kenneth Silim
Kristoffer Valdehueza
Lorena Vargas
Christel Vileta
Andres Zamudio-Bucio

USDA-Natural Resources Conservation Services Internship



Intern: Manuel Aboite

Mentor: Javier Flores, USDA-NRCS
Location: USDA Salinas, CA

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

During this summer I had the opportunity to intern with Javier Flores, the field engineer for Monterey County's Natural Resource Conservation Services (NRCS) office. His work all around our county positively impacts our farmers and the environment. The NRCS's mission statement is to, "deliver conservation solutions so agricultural producers can protect natural resources and feed a growing world." The NRCS is most known for its Environmental Quality Incentives Programs (EQIP) that help local farmers reduce soil erosion, enhance water supplies, and improve their water quality. However, this year with the heavy rainfall we received in the winter, the NRCS was flooded with Emergency Conservation Program (ECP) applications. These ECP practices include debris removal, grading, shaping & leveling, fence restoration & restoring conservation structures & other installations. As a native Spanish speaker, I had the opportunity to translate during many of our ECP site visits with our Area Engineer and Agronomist. During these site visits, we would address the needs of the farmer and create a list of practices that the farmers would implement on their land. As a civil engineering student, I would then focus on how the infrastructure could be improved to benefit the landowner and the environment. I was able to see many practices throughout my internship but one that I was able to take lead on was an irrigation system. I designed a system for a land owner that will provide a uniform amount of water for their crops by considering pressure, water flow, friction loss, and the field's elevation change.



Manuel Aboite

Major: Civil Engineering

AIS Ship Tracking/Databases and SQL



Intern: Fernando Alvarado

Mentor: Professor Arjit Das

Location: Naval Postgraduate School

During the summer internship, my primary goal was to get up to date on the AIS (Automatic Identification System) project and understand the utilization of Oracle databases for handling raw data, subsequently exploring strategies for managing large volumes of data effectively. This included utilizing Python for scripting tasks, along with javascript through command prompt, working with the AIS ship data provided by MarineCadestre.gov as the main data source, and employing Oracle/SQL for data manipulation. My specific focus involved utilizing Oracle and SQL to work with provided data entries, along with running java scripts alongside Oracle.

My Contributions included storing AIS data in Oracle databases, performing data manipulation using SQL queries, implementing primary and foreign keys for data integrity, and conducting comprehensive data cleaning to eliminate garbage values, nulls, and duplicate entries and corrupted entries. Additionally, I segmented extensive datasets into more manageable units, optimizing accessibility. The results showcased the ability to leverage databases, Oracle, and SQL to manage and transform the AIS data, enhancing its presentation and usability. One notable observation from the project was the underutilization of the Navy's Oracle license despite its potential for scaling data and information. The internship emphasized the benefits of secure, efficient database systems, making a case for modern database solutions like Oracle in naval operations to optimize data management for improved decision-making and strategic planning. These databases would then be moved onto computer clusters/server racks located on campus at NPS. During my 2 week internship extension at NPS, I would also be tasked with reviewing and replicating a colleague's project on AI machine learning on a virtual machine, based on her report. This AI would be then trained using data entries from the AIS ship database.

Fernando Alvarado

Major: Computer Science

Educating and Improving Overall Health and Wellness In South County Using Different Measures



Intern: Ana V. Trujillo Anaya

Mentor: Dalila Alvarado

Location: Blue Zones Project South County

BLUE ZONES PROJECT

Salinas is considered the salad bowl of the world. Salinas' population is also 80% Hispanic/Latino. Yet, 1 out of 2 US Latinos born since the year 2000 will most likely develop diabetes in their lifetime, and close to 50% of adults in Monterey County have prediabetes or type 2 diabetes. Blue Zones Project recognizes this irony and is actively trying to help improve the overall health and well-being of our community members. This is done through campaigning their RealAgeTest, doing food demos, and starting up community projects such as gleaning. It was an honor for me to work alongside Blue Zones Project as their intern this past summer and help them reach each goal and celebrate as they were accomplished. I helped develop the Gleaning project and its database, promoted their RealAgeTest by tabling at different places and helping individuals complete the test, and bringing my nutritional knowledge and passion to the food demos. Gleaning is a gathering of leftover produce. Whilst developing this project, I collected information of those interested in participating by knocking door to door, emailing and calling in order to fill in the gaps of the project's database. I recorded the type of home grown fruit, vegetable, or other produce each person was willing to donate to the project. RealAgeTest is a survey that helps you discover what your real age is based on your diet, activity, health history, and sleep. At the end of the test, personalized feedback is given in hopes of tracking and improving habits and health, and overall to lower or maintain your RealAge. Lastly, the purpose of food demos is to show community members Blue Zones approved dishes that are easy to make while very delicious and nutritious. I was able to do a food demo on my own, completely in Spanish, while also conversing and connecting with a group of women who shared the same cultural background as me. Working alongside Blue Zones Project showed me the various and creative ways they passionately and vigorously work to make healthy choices, the easier choices through permanent changes to a city's environment, policy, and social networks.

Ana V. Trujillo Anaya

Major: Public Health / Nutrition

Restoring the endemic life of the Elkhorn Slough



Intern: Joel Viorato Arámbula

Mentor: Juan Ramírez

Location: Elkhorn Slough

During my second year interning for the Elkhorn Slough National Estuarine Research Reserve, I reinforced all the values and skills I learned the first year, filling in the gaps for improvement that were left. Coming back to it with a pre-built perspective helped me realize the importance of each segment within the Elkhorn Slough Reserve and how all their different contributions make the goal of restoring and maintaining the land possible. As an intern, I had the opportunity to assist in five of these segments for at least one day a week. On Mondays, I worked with the maintenance department. It would imply the use of all sorts of equipment, from hand tools to powered tools and vehicles, with the purpose of cleaning trails for the visitors, removing or placing fence lines, and completing any other unexpected task that would appear.

On Tuesdays, I cooperated with the Elkhorn Slough Foundation, or ESF for short. There were two parts I assisted the ESF with. In the morning, I would help in maintenance projects at the different properties outside the Elkhorn Slough Reserve. While in the afternoon, I would work at the office digitizing acquisition files to turn them into PDFs as a safe backup. On Wednesdays, a group of volunteers comes each week to help with various projects the reserve has in the form of a social activity that engages my participation with the community. On Thursdays, I would support the nursery by transplanting native plants for ideal growth, making the soil needed to fill all the plant pots, and collecting some native plants from the wild for reproduction. Finally, on Fridays, I would complete smaller assignments for the visitor center, the first stop for all visitors to learn about the Elkhorn Slough and appreciate its beauty throughout all the trails the reserve offers. Having this opportunity to cooperate with all these segments of the Elkhorn Slough Reserve has allowed me to gain a wide variety of knowledge about restoring the land and the endemic life and making it sustainable so nature and humanity benefit each other. This experience directly connects to my career in environmental science so that one day, I cancontribute to finding the balance that can make life sustainable for future generations.

Joel Viorato Arámbula

Major: Biology

Automated Carbon Fiber Plasma Treatment



Intern: Erick Ayala

Mentors: Paul Thompson and Jordan Lowe
Location: Joby Aviation, Marina, CA

Plasma is an efficient solution for preparing carbon fiber for adhesion. However, the methods used by manufacturing facilities today may not be the most effective. Plasma can be harmful to technicians and imprecise if applied by hand.

This summer I had the opportunity to work with an amazing group of engineers to help design maintenance procedures, tooling retrofits, performance improvements, and deploy new processes/equipment during a summer internship. We managed to engineer an efficient, safe, and precise method of treating carbon fiber parts with an industrial 6-jointed robot arm. Some of the procedures include attaching a Plasma Nozzle to the end of this robot's arm and constructing a program that uses a 3D model of specific carbon fiber parts and their location with respect to the plasma nozzle. We also used a mobile surface analyzer to measure the water contact angle on the carbon fiber surfaces to make sure we were achieving the desired surface preparation.

After multiple tests of surface-free energy, program errors, and distance measurements we managed to decrease the time it takes to treat these carbon fiber surfaces by over 80%, as well as get a consistent finish on the parts themselves, but most importantly we managed to eliminate the risk of plasma harm to workers bodies.

Erick Ayala

Major: Engineering

Seismograph Rover



Intern: Ananda Bouchard

Team Member: Brandon Lopez
Faculty Advisor: Tito Polo
Location: Hartnell College, Salinas, CA

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Just like the Earth, astronauts and scientists discovered that the moon has periods where the ground shifts, called the quake. This project aims to detect the ground movement of the moon that is cost effective through a portable seismograph device. There are two components to this project, that is a rover and a box. Inspired by the Mars Perseverance Rover, this rover has six wheels that allow it to run smoothly on a rocky road. In addition, the rover has a camera to capture live images that can be seen on a computer or phone using the device's IP address. An ultrasonic radar can also be found on the front of the rover to detect the objects surrounding the rover using ultrasonic waves. The rover is also equipped with a simple arm that is responsible for moving the seismograph box. A joystick will be used to maneuver the rover.

The box is the second component, and it contains a GY-521 module, responsible for detecting the ground movement and sending the data to a phone via Wi-Fi, and a GPS module for detecting the box's location.

Ananda Bouchard

Major: Biology

Green House Gas Emission

Anna Mikaella Chua

Mentor: Dr. Hyatt Moore, Dr. Ronald Giachetti

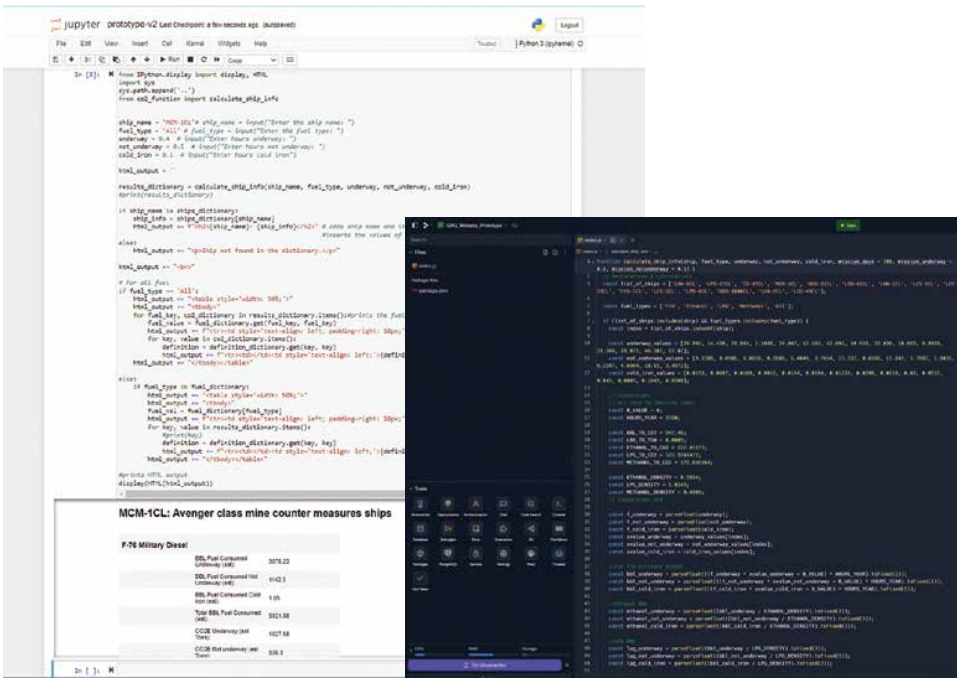
Location: Naval Postgraduate School

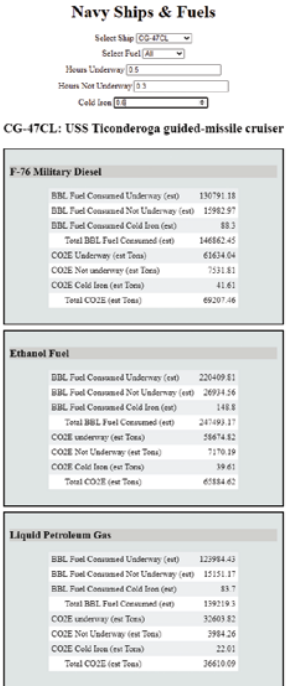


My project at the Naval Postgraduate School (NPS) was to design a webpage that would be accessible to the US Navy to inform them about the carbon dioxide emissions of Naval ships depending on the ship type, fuel type, and hours of operation. The webpage is intended for the Navy to have an accessible tool that would help keep track of the Navy's goal of decarbonization and balancing it with other requirements necessary for Naval ships to complete their mission. I was assigned to create a stand-alone web page that would contain a table displaying the results of the calculations depending on the ship type, fuel type, and operation hours. Using JavaScript and HTML I was able to make a webpage that would take in the ship name, fuel type, and hours of operation and print the results in a table.

Anna Mikaella Chua

Major: Computer Science





Implementation of conservation practices to preserve soil, water, air, and wildlife using engineering knowledge



Intern: Britney Vera Cortes

Mentor: P.E Lorrie Bundy, USDA NRCS

Location: USDA Yreka, CA

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

Soil and water conservation are major concerns farmers and ranchers have along the North of California. NRCS is an agency that provides funding opportunities to private landowners to help reduce soil erosion, enhance water supplies, improve water quality, and increase wildlife habitat. This agency works with multidisciplinary staff that assists the landowners with possible solutions to their problems. Biologists, soil scientists, planners, and engineers do site visits to gather information, take pictures, and learn more about the things that affect farmers and ranchers. Civil engineers in particular help with irrigation systems and rangeland projects to ensure that water is getting properly to its destination and is not causing any problems in their way, but also focus on other related engineering problems like manure waste. During this training, engineers and interns worked on different projects, but the process of giving a solution was the same. As mentioned, site visits are part of the staff's routine. For irrigation systems and rangeland, an engineer looks for information like pressure, flow, distance, elevation, etcetera; numbers that facilitate all the calculations needed to find a solution. Second, engineers research possible solutions; when it comes to water, lowering the pressure, adding a tank or a new trough, or changing the drip line are the most common answers. All this could not be done without calculations. Once this part is done, engineers do surveys to get to know the layout and elevation of the surface, and with the proper calculations, they can begin the design of the project. In NRCS some of the most usual implementations are sediment basins to combat erosion and runoff, replacement of troughs, creation of new wells to ensure water for farmlands and cattle, installation of irrigation systems, and more. One of the most interesting projects worked on NRCS was designing a separation method for poultry liquid and solid manure. Possible solutions for liquid manure evaporation and a design for solid manure storage were found. Third, before beginning construction, engineers' reports and dockets are made; for the contractor to make everything according to the engineer. Finally, this process could take a few months or maybe years to be completed, but every single step is necessary to guarantee the preservation of land, air, and water.

Britney Vera Cortes

Major: Civil Engineering

Medical and Mobile Assistant (M.A.M.A.)



Intern: Cory Cowden

Team Member: Leslie Gomez Jimenez and Kristoffer Valdehueza
Faculty Advisor: Tito Polo
Location: Hartnell College, Salinas, CA

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The Medical and Mobile Assistant (M.A.M.A.) project focuses on creating a rover designed to serve as a vital medical companion for astronauts during lunar patrols. M.A.M.A. uses a range of sensors to fulfill its mission. An ultrasonic sensor is positioned on the rover to enable obstacle avoidance, ensuring safe navigation across the lunar surface. An ESP32 camera on the rover facilitates continuous streaming of real-time visual data to a smartphone via Bluetooth, enhancing situational awareness. For accurate positioning, a GPS sensor is mounted on the astronaut, allowing constant relay of GPS data to the connected smartphone. Additionally, a humidity and temperature sensor are worn by the astronaut, providing essential health monitoring by tracking their body temperature, while a heartbeat sensor worn by the astronaut provides further health status information. Through these integrated sensors, the M.A.M.A. project aims to significantly enhance astronauts' safety and well-being during lunar operations.

Cory Cowden

Major: Computer Science

M. aeruginosa cluster disruption as algal bloom toxin treatment

Toxin inhibition of *M. aeruginosa* cluster via CRISPR-associated transposons



Intern: Erica Jane Estamo
Mentor: Dr. David Bernick
Location: iGEM, University California Santa Cruz

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iGEM

Harmful algal blooms (HABs) are becoming increasingly prevalent globally due to a combination of warming temperatures, agricultural runoff, untreated sewage residues, and other factors. HABs threaten crucial water systems with toxic compounds, limiting access to freshwater and harming local ecosystems. One form of this is Microcystis aeruginosa (M. aeruginosa) located in Pinto Lake in Watsonville, CA. Previously, Pinto Lake had undergone an alum treatment to suppress M. aeruginosa blooms and although it was successful, it was an expensive and temporary solution. This cyanobacterium secretes microcystin, a carcinogenic hepatotoxin responsible for a variety of adverse health effects. Microcystin is a nonribosomal peptide synthesized by the mcy cluster, a group of 10 synthetase genes transcribed as two polycistronic operons governed by a bidirectional promoter separating mcyA and mcyD. We hypothesize that the disruption of the mcy cluster in M. aeruginosa via CRISPR-associated transposons (CAST) will inhibit the production of microcystin, curbing toxicity while maintaining cell viability. Disruption of the mcy cluster will be transmitted horizontally via a conjugative plasmid and vertically by genomic integration to ensure persistent inhibition in HABs. Successful conjugation will be validated by antibiotic selection, and successful transposition will be validated by genomic sequencing. The interference of microcystin production will be tested by liquid chromatography-mass spectrometry. Our goal is to provide an effective, accessible, and ecologically responsible alternative to existing algal bloom treatments.

Erica Jane Estamo
Major: Biology

Defense Analysis and MOVES Playtesting



Intern: Isael Estrada

Mentor: Matt Zefferman

Location: Naval Postgraduate School

Playing video games is a fun activity that many people across the world partake in. Video games are a combination of different types of art and mechanics that may or may not be apparent at first glance. Before the internship the process and effort of creating a video was a mystery to me. Throughout the internship, this process would start to slowly unravel. We became part of the Education Community Collaboration Online(ECCO) team which included various individuals with different types of skills. Our purpose was to assist the ECCO team in any project they needed help with. We began the internship by testing out the video games they had created over many years. Our main objective was to provide a report for any bug that we came across. When trying to break the games, I found myself learning them on a deeper level. Similar to how a speedrunner will learn to break the games in order to improve their completion time, I learned to break games in the hopes that it will provide important information to the game developers. The next objective we had was to create a board game that was based on a video game that they were working on. This took up the rest of our internship. Things that I took for granted like turns, and coin-based systems all of a sudden became incredibly hard to balance. I learned the ins and outs of the game we were making. Once we managed to make something that was playable, there was a feeling of satisfaction I had never felt before. To cap off the internship we took the game to LA to show the rest of the team what we had created. We used it as a means to explain to them how some of the core concepts can be applied to the video game. There is always something that can be improved when making a video game. With our contribution to the team, I hope that their games can continue to improve even after our time there.

Isael Estrada

Major: Computer Science

Quad Bot



Intern: Elizabeth Garcia

Team Members: Ricardo Ortiz and David Mancera
Faculty Advisor: Tito Polo
Location: Hartnell College, Salinas, CA

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The focus of our project is to build, develop and implement the navigation of a robot that would be useful for people back on Earth in the event of a trip to the moon. The purpose of the robot will be to collect data such as video, gases levels, temperature, and humidity. For video data, an ESP32 camera (connected to Wi-Fi) is used to collect data and send it to Earth. For temperature and humidity, we will be using a DHT11 and the accelerometer sensors, data will be sent to the OLED display for readings. Also, to measure the gases level, we will use several MQ sensors, sensors will measure the level of CO2, H2, CH4, NH3, alcohol, acetone, hexane, toluene, smoke and flammable gas concentration, data will be sent to the LCD display for readings. There are twelve servos that are used as legs that allow our robot to travel(walk). Overall, this project (our robot) showcases the successful combination of hardware and software to collect and display temperature/humidity, level of various gases on the atmosphere and as well as video and picture data for people back on Earth.

Elizabeth Garcia

Major: Computer Science

Buddy Quad Bot



Intern: Luis A. Garcia

Team Members: Lizbeth Lozano-Ruiz and Carlos Lopez
Faculty Advisor: Tito Polo
Location: Hartnell College, Salinas, CA

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Luis A. Garcia

Major: Mechanical Engineering

Medical and Mobile Assistant (M.A.M.A.)



Intern: Leslie Gomez Jimenez

Team Members: Cory Cowden and Kristoffer Valdehueza
Faculty Advisor: Tito Polo
Location: Hartnell College, Salinas, CA

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The Medical and Mobile Assistant (M.A.M.A.) project focuses on creating a rover designed to serve as a vital medical companion for astronauts during lunar patrols. M.A.M.A. uses a range of sensors to fulfill its mission. An ultrasonic sensor is positioned on the rover to enable obstacle avoidance, ensuring safe navigation across the lunar surface. An ESP32 camera on the rover facilitates continuous streaming of real-time visual data to a smartphone via Bluetooth, enhancing situational awareness. For accurate positioning, a GPS sensor is mounted on the astronaut, allowing constant relay of GPS data to the connected smartphone. Additionally, a humidity and temperature sensor are worn by the astronaut, providing essential health monitoring by tracking their body temperature, while a heartbeat sensor worn by the astronaut provides further health status information. Through these integrated sensors, the M.A.M.A. project aims to significantly enhance astronauts' safety and well-being during lunar operations.

Leslie Gomez Jimenez

Major: Computer Science

Investigating Competitive and Cooperative Interactions Between Mucin-Degrading Gut Bacteria



Intern: Loreli Gonzalez
Mentors: Nikita Deshpande and Michael Patnode
Location: ACCESS, University California Santa Cruz

UC SANTA CRUZ

The mucus lining of the intestine blocks harmful organisms in the gut from entering the body. Some gut bacteria, such as *Akkermansia muciniphila*, survive by consuming mucin which can lead to a thinner and less effective mucin barrier. Since it is thought that gut bacterial species can compete or cooperate with each other as they consume nutrients, we are looking at how mucin-degrading bacteria, like *Akkermansia*, interact with other species in the gut. We previously found that *Akkermansia* is positively correlated with *Parasutterella* and negatively correlated with *Anaeroplasma*, in the mouse gut. We tested whether *Akkermansia* directly benefits *Parasutterella* via secreted metabolites, and found no effect of *Akkermansia* condition media on *Parasutterella* growth. In order to test whether *Akkermansia* inhibits *Anaeroplasmas* growth, we screened gut bacterial cultures to isolate *Anaeroplasma* strains. Although we did not recover *Anaeroplasma* in our first set of isolations, we are continuing to isolate strains to test whether they benefit from *Akkermansia* condition media. The knowledge gained from these studies could be used to promote bacterial interactions in the gut in ways that improve the health of the host.

Loreli Gonzalez
Major: Biology

Unraveling the Structures of Indo-Pacific Sponge-Derived Halogenated Bioactive Alkaloid Isomers



Intern: Arely M. Guijarro

Mentors: Samuel J. Mussetter, Marissa Kang, Phillip Crews

Location: ACCESS, University of California Santa Cruz

UC SANTA CRUZ

A consortium of UC Santa Cruz (UCSC) scientists have been exploring the discovery of Type III Secretion Systems (T3SS) inhibitors through the screening of unique compound libraries. Their constituent molecules consist of diverse marine natural products and natural product inspired synthetics with testing carried out in the UCSC-Chemical Screening Center. This project presents a progress report using the T3SS assay tool driven complex protein mechanisms, or injectisomes, derived from selective pathogenic Gram-negative bacteria. T3SS causes pathogenesis in several host organisms. Significant preliminary results came from our screening campaign of 2500 tropical marine sponge extracts. This current project focused on the chromatographic fractions from two Verongid (aka Verongida) order sponges (taxonomic analyses in progress), with registry nos. 95669 and 95514, also identified as potentially containing selective injectisome inhibitors. Further described in the poster is an innovative MSbased dereplication analysis strategy. Both sponges provided fractions containing constitutional isomers, identified by ultra-high resolution MS as possessing the same atom diverse molecular formula of C23H26Br3N3O4 (exact mass = 646.9630). These compounds, provisionally named as Purpuramine-647-C appear to possess distinct molecular structures vs. that of the known Aplysamine-2. The outcomes of our follow-up studies involved gathering data from LC-MS/MS, 2D NMR, and T3SS screening will be described.

Arely M. Guijarro

Major: Biology and Math

Optimization of a panoramic three-dimensional optical mapping and ultrasound imaging system for ex vivo imaging of isolated contracting hearts



Intern: Gabino Guzman

Mentors: Dr. Jan Christoph, Dr. Jan Lebert
Location: University of California San Francisco

UCSF

Summer Student Research Program
Focusing on our diversity

Heart disease is the leading cause of death worldwide, making up 16% of all deaths. One kind of heart disease results from the malfunctioning of the heart's electrical system which causes irregular contractions – known as cardiac arrhythmias. Arrhythmias have severe consequences such as sudden cardiac arrest, which 300,000 people die from each year in the United States. Arrhythmias can be studied using optical mapping, but there's a growing need to improve the existing imaging techniques to map the heart. The primary aim of this investigation is to create a calibration device that allows for the cross-registration and alignment of optical and ultrasound data in the same coordinate system which will ultimately improve the ex vivo imaging of hearts.

Our calibration device will be designed using a computer-aided modeling program "OnShape" and will be 3D printed, comprising a flat surface with four or nine cones. The first experiment will begin by filling a chamber with 5 L Tyrode solution and using 40 µL Di-4-ANEPPS dye to stain the heart's surface. An electrode will be placed on the heart to initiate the action potential waves propagating across the heart surface. The ultrasound and cameras will collect the raw movement of the contracting heart. Our second experiment will be identical, except it will be calibrated using our calibration target. Computer-based programming will assign pixels for both the ultrasound and cameras to track the tip of the cones. We will use Python, OpenCV, NumPy, Napari, and MatPlotLib to compare the imaging of the heart's surface to identify if calibrating both the ultrasound and photo-cameras will improve the three-dimensional reconstruction of the heart's movement during contraction.

The heart's electrical and mechanical properties can be expressed through models which have resulted in new insights leading to novel therapeutic approaches to cardiac arrhythmias. By improving the methodology utilized to model the heart's behavior in cardiac arrhythmias, our understanding of cardiac arrhythmias can grow and guide physicians in their search for effective treatment, maintenance, and non-evasive diagnosis of cardiac arrhythmias. It's hypothesized that by combining the raw data from the ultrasound and cameras, it will be possible to image epicardial action potential wave patterns with corresponding transmural wall motion.

Gabino Guzman

Major: Physics, Math, Chemistry and Biology

Seismograph Rover



Intern: Brandon Ulices Lopez

Team Member: Ananda Bouchard
Faculty Advisor: Tito Polo
Location: Hartnell College, Salinas, CA

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Just like the Earth, astronauts and scientists discovered that the moon has periods where the ground shifts, called the quake. This project aims to detect the ground movement of the moon that is cost effective through a portable seismograph device. There are two components to this project, that is a rover and a box. Inspired by the Mars Perseverance Rover, this rover has six wheels that allow it to run smoothly on a rocky road. In addition, the rover has a camera to capture live images that can be seen on a computer or phone using the device's IP address. An ultrasonic radar can also be found on the front of the rover to detect the objects surrounding the rover using ultrasonic waves. The rover is also equipped with a simple arm that is responsible for moving the seismograph box. A joystick will be used to maneuver the rover.

The box is the second component, and it contains a GY-521 module, responsible for detecting the ground movement and sending the data to a phone via Wi-Fi, and a GPS module for detecting the box's location.

Brandon Ulices Lopez

Major: Engineering

Buddy Quad Bot



Intern: Carlos Lopez

Team Members: Luis Garcia and Lizbeth Lozano-Ruiz
Faculty Advisor: Tito Polo
Location: Hartnell College, Salinas, CA

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Carlos Lopez

Major: Computer Science

Buddy Quad Bot



Intern: Lizbeth Lozano-Ruiz

Mentor: Tito Polo

Team Members: Luis A. Garcia & Carlos Lopez

Location: Hartnell College, Salinas, CA

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Lizbeth Lozano-Ruiz

Major: Biology

Quad Bot



Intern: David Mancera

Team Members: Elizabeth Garcia and Ricardo Ortiz
Faculty Advisor: Tito Polo
Location: Hartnell College, Salinas, CA

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David Mancera

Major: Mechanical Engineering

Raspberry Pi Data Logger for Rocket



Intern: Matthew Montgomery

Mentor: Dr. Christopher Brophy
Location: Naval Postgraduate School

The aim of my project was to use a sensor and Raspberry Pi to record the flight data of a rocket. The sensor measured the rocket's attitude, altitude, velocity, and GPS location, while the Pi ran the code and recorded the data. To build the system, we first connected the sensor to the Raspberry Pi and got the code to run. Then we had to find a way to transmit the data recorded on the Pi to the ground team. We did this by logging onto the Pi remotely over my phone's hotspot. We also had to protect the data onboard the rocket in the event of a crash, so we put the Micro-SD card in an aluminum container. Then we designed and 3D printed mounts for the components, and assembled them in a box. That box was placed in the nose cone of the rocket, and secured using couplers. Finally, we ran thermal tests to ensure the electronics wouldn't overheat in the desert during the launch. The data we record from this launch will be used to improve further iterations of the rocket, as well as tested against existing sensors for accuracy. In the future, this new sensor may replace the current sensor used in the flight program.

Matthew Montgomery

Major: Computer Engineering

Landscape Analyzing Rover



Intern: Itzel Nolasco-Gonzales

Team Member: Alejandro Reyes
Faculty Advisor: Tito Polo
Location: Hartnell College, Salinas, CA

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Lunar vegetation and inhabitation have been important goals in space exploration. For years, NASA research involving moving human life and agricultural farming to the moon has been underway. Successfully sustaining human life on the Moon is a vital step in moving human life to other parts of our solar system. As scientists continue to research the potential ways to send humans to live on the moon, information regarding the moon's landscape and qualities will be needed to make this transition possible. The goal that our project strives to accomplish is to program a rover to analyze the lunar landscape to provide information for future lunar missions regarding possible lunar inhabitation or lunar vegetation. The rover will follow an astronaut around using a camera that will be constantly streaming. Through this camera, we will be able to determine where the rover should move in regard to the astronaut and will control the rover's movements with a phone app. Additionally, the rover will be carrying various sensors that will give us information about the Moon's landscape in real time. The rover will be able to analyze the landscape's temperature, altitude, and pressure using a barometric pressure sensor. The rover will also collect the regolith's (moon soil) Nitrogen, Phosphorus, and Potassium components, and will measure the soil's temperature. The information gathered will be displayed on the rover using various LCD screens and will also be monitored via phone.

Itzel Nolasco-Gonzales

Major: Aerospace Engineering

A Simulation of Interagency Cooperation and Adversary Tactics in Modern Geopolitical Context



Intern: David Orta

Mentor: Dr. Mathew Zefferman

Location: Naval Postgraduate School

In the contemporary landscape of shifting geopolitical tensions and the looming specter of terrorism, there is a pressing need to grasp the intricate interplay between security agencies and adversarial entities. "Checkpoint" is not just a board game; it's a strategic simulation of these global security dynamics, born from my firsthand insights and extensive research.

As a principal game board designer, I've woven current geopolitical events, historical data, and nuances from existing military strategy games into the fabric of "Checkpoint" with the help and guidance of my mentor Dr. Zefferman and lab partner Isael Estrada. The game sets two Red players, embodying smuggling/terrorist factions, against four Blue players, who represent the pillars of state security.

Each player is equipped with a distinct coin allocation: 12 coins for Red Players and 10 for Blue Players. The game's economic dynamics are finely balanced, with operations costing 1 coin and successful endeavors reaping rewards of 2 coins. The pursuit of Victory Points, earned through successful operations or thwarts, drives the game's objectives.

Incorporating probability mechanics, such as the Red Players' 33.33% chance of capturing another Red Player's operation, "Checkpoint" demands both strategy and adaptability. Presented on a global map, the game is more than entertainment-- it's an educational adventure into the heart of global security, underscoring its complexities and challenges.

David Orta

Major: Computer Science

Quad Bot



Intern: Ricardo Ortiz

Team Members: Elizabeth Garcia and David Mancero
Faculty Advisor: Tito Polo
Location: Hartnell College, Salinas, CA

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Ricardo Ortiz

Major: Electrical Engineeirng

Effects of *Wolbachia* in navigational behavior of *Drosophila Melanogaster*



Intern: Edwin Perez Pulido
Mentor: Dan Turner-Evans
Location: ACCESS, University of California Santa Cruz

UC SANTA CRUZ

Wolbachia is an endosymbiotic bacterium of the family *Ehrlichiaceae*, it is transmitted from mother to offspring via infected eggs and can be found in more than sixty percent of insect species worldwide. This naturally occurring bacteria has been proven to affect behavioral and locomotive functions in *Drosophila melanogaster* (*D. melanogaster*), commonly known as fruit flies. Current literature demonstrates that *Wolbachia* infection in flies leads to a reduction in their arousal threshold, which results in infected flies being easily disturbed by a minimal stimulus compared to non-infected flies. This observation led us to hypothesize that *Wolbachia* infection will affect navigational behavior in the species *D. melanogaster*. The current study analyzes the differences in the walking trajectories and statistics between wild-type flies (-) and *Wolbachia-infected* flies (+). We recorded the behavior of tethered walking flies in a modular spherical treadmill setup with three different types of virtual reality visual stimuli. After gathering and analyzing data from ten flies of each type, we wish to demonstrate the effects, if any, of *Wolbachia* in the navigational behavior of the species *D. melanogaster*.

Edwin Perez Pulido
Major: Biology

Landscape Analyzing Rover



Intern: Alejandro Reyes

Team Member: Itzel Nolasco-Gonzales
Faculty Advisor: Tito Polo
Location: Hartnell College, Salinas, CA

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Lunar vegetation and inhabitation have been important goals in space exploration. For years, NASA research involving moving human life and agricultural farming to the moon has been underway. Successfully sustaining human life on the Moon is a vital step in moving human life to other parts of our solar system. As scientists continue to research the potential ways to send humans to live on the moon, information regarding the moon's landscape and qualities will be needed to make this transition possible. The goal that our project strives to accomplish is to program a rover to analyze the lunar landscape to provide information for future lunar missions regarding possible lunar inhabitation or lunar vegetation. The rover will follow an astronaut around using a camera that will be constantly streaming. Through this camera, we will be able to determine where the rover should move in regard to the astronaut and will control the rover's movements with a phone app. Additionally, the rover will be carrying various sensors that will give us information about the Moon's landscape in real time. The rover will be able to analyze the landscape's temperature, altitude, and pressure using a barometric pressure sensor. The rover will also collect the regolith's (moon soil) Nitrogen, Phosphorus, and Potassium components, and will measure the soil's temperature. The information gathered will be displayed on the rover using various LCD screens and will also be monitored via phone.

Alejandro Reyes

Major: Engineering

The Importance of Dark Skies and the Effects of Light Pollution



Intern: Julie San Pablo

Mentor: Mr. John Heyl, M.Ed.
Location: Dark Sky, Carmel CA

DarkSky

Light pollution also known as artificial lighting is a problem worldwide, especially in big cities. The Dark Sky International (formerlyIDA) is combatting light pollution and they are also spreading awareness on how to combat it, for example: installing outdoor lighting only when it is necessary, making sure all outdoor lighting is shielded and facing down and using red or yellow tint light. IDA suggests effective ways to decrease light pollution. Also, these strategies are economically friendly, lower light usage, and they are environmentally friendly. This means the nocturnal life will not be disrupted, the ecosystems and wildlife will follow the natural circadian rhythm. The IDA provides international recognition to parks or communities that are protected and support dark-sky conservation and meet specific program requirements. Applicants need to fill out an application indicating they have met or intend to meet the requirements.

This internship was hosted by the Carmel Valley Association (CVA), a citizen group interested in preserving the rural nature of Carmel Valley. During this project, Garland Ranch Regional Park's staff and Board initiated the process of applying to become recognized as an International Dark Sky place. The Park itself has already met most if not all requirements to be rewarded with the recognition, however the process is very long; over this internship progress was made toward recognition. We made comments to the governing Board, and we completed an inventory of outdoor lighting to see what changes needed to be made and to ensure future lighting would be of the safest wavelength. During the internship I worked with an expert in lighting to complete the inventory and lighting plan to replace some light bulbs.

In addition to the recognition work, the CVA hosted a Star Gazing Party. The internship required coordinating with the Monterey Institute for Research in Astronomy (MIRA) to borrow telescopes, planning refreshments, developing promotional materials, fielding community questions, and setting up to view several celestial objects suggested by an astronomer from Fort Lewis College in Colorado.

Julie San Pablo

Major: Psychology

Does Providing Larval Diet Decrease Egg Cannibalism by LBAM?



Intern: Yesenia Santiago

Mentors: Gregory Simmons and Ruth Henderson, USDA, APHIS, PPQ, S&T

Location: USDA Salinas, CA

The Light Brown Apple Moth (LBAM), *Epiphyas postvittana* (Walker) (Lepidoptera: Tortricidae: Archipini), is an invasive pest that is native to the Southeastern part of Australia. It was first discovered in the United States in Berkeley, CA in 2006. This invasive and harmful pest has a wide host range and is known to be found in numerous species of ornamental plants within nurseries. LBAM can also be a pest of apples, grapes, citrus, berry crops, stone fruit vegetables and flower crops. The detection of LBAM in California in 2007 had a huge impact on many agricultural companies. Establishment of a quarantine for LBAM detection caused economic losses due to restrictions on shipments of plants out of quarantine areas or additional costs to inspect and treat agricultural commodities and plants in infested areas. LBAM is a tortricid leafroller that binds leaves together with its webbing and its surface feeds causing cosmetic damage. This feeding can hurt the marketability of the fruit and can cause rot. The evergreen ornamental plant *Photinia* × *fraseri* is an example of a nursery plant that can carry LBAM. Leaves of *Photinia* plants were used for LBAM egg mass collection and placed into Petri Dishes with or without artificial larval diet in order to determine whether providing diet can reduce egg cannibalism by newly-hatched larvae.

Yesenia Santiago

Major: Agricultural Business

Mule Rover to Assist Artemis Astronauts



Intern: Hector Enrique Sedano Sanchez

Team Member: Christel Vileta
Mentor: Tito Polo
Location: Hartnell College, Salinas, CA

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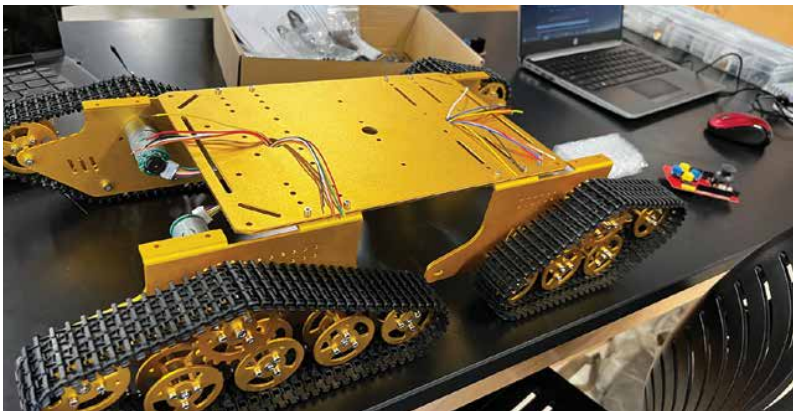
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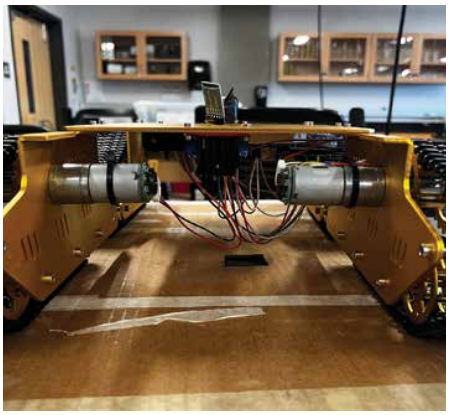
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Space is a dangerous place; thus, we developed a rover that was designed in mind to aid astronauts, but also be able to conduct missions on its own. The main idea behind our rover was to develop a pack mule for the Artemis mission that would take some of the burden off the astronauts, with the inclusion of a multitude of sensors to help the rover traverse terrain, collect data, and give that data to astronauts in real time. These sensors would provide temperature, humidity, photon levels, UV radiation, GPS coordinates via longitude and latitude for locating the rover and/or search and rescue. An ESP32 with built-in Wi-Fi and Bluetooth would be used to send the data of all the sensors, through a web server, to a remote station wherever it may be. An Arduino would be used to control the motors and minor modules like Bluetooth and the sonic sensor. As for the rovers' solo missions, a ESP32 camera would be mounted for remote operation, a claw for collection of regolith samples (with its individual controller), and solar panels to extend mission life. The rover is intended to be an aid to Artemis astronauts, but also a standalone tool capable of undertaking its own objectives adding more utility and value to the rover.

Hector Enrique Sedano Sanchez

Major: Aerospace Engineering





Cold Spraying Aluminum Nanocomposites



Intern: Kenneth Silim

Mentor: Troy Ansell

Location: Naval Postgraduate School

Cold Spraying is a thermal spraying process that allows for thick coatings with solid-state materials. This is done as small particles are inserted to a high temperature and accelerated gas that's shot down through a converging and diverging nozzle. Due to the gas' high speed, the particles reach critical velocity which allows for the particles to adhere to the substrate being sprayed. Due to the particles being accelerated at high speeds, no melting is needed, hence the name cold spraying.

Polyether ether ketone or PEEK is a material used especially in the aerospace industry that can help with different parts, such as pumps. This is due to PEEK's excellent qualities such as its ability to be used in ultra-high vacuum environments, its high mechanical strength, chemical resistance, etc. However, the wear resistance and hardness of PEEK is weak. To resolve this problem, cold spraying and coating PEEK is an option. This project investigates the most optimal parameters to coat PEEK with different aluminum nanocomposites, to achieve a thick coating. Six different layers of aluminum composites were sprayed. The base layer was composed of 3 different materials, 2% BNNT, 2% B4C, and 96% Al-7075. BNNTs and B4Cs are ceramics that help with hardness and coating strength. The following 5 layers are mixtures of nB4Cs, uB4Cs, BNNTs, and Al-7075. In doing this, I hoped to see a coating of around 150 umm.

Optimizing cold spraying parameters can involve many varying factors. This can range from the particle size of the feedstock powder being used to the temperature of the gas. The four different parameters that were tinkered with were the gas temperature, gas pressure, nozzle speed, standoff distance of the substrate, and feed rate of the powder. Test sprays were conducted to optimize these parameters. These test sprays were done only with Al-7075 and not aluminum composites. During these test runs, substrate deformation occurred which is not sought after. The stand-off distance and gas temperature had to be changed due to this. In the end, thick coatings were achieved during test runs. The same parameters were used when spraying with the aluminum composites. After cold spraying, samples were placed in resin and polished to look at the cross sections and the coating. The main instruments that were used to analyze the samples were an optical microscope and a SEM. The optical microscope showed that coatings were successfully sprayed but were around 20 um thick. Testing the sample's coatings was done through nanoindentation and wear testing. Nanoindentation tests the hardness and reduced elastic modulus of a sample, while wear testing tests the effects of friction on the coatings. The

nanoindentation showed that the coatings did increase both the hardness and reduced the elastic modulus. However, due to the coating's thin layer the wear test was inconclusive.

Kenneth Silim

Major: Mathematics

Medical and Mobile Assistant (M.A.M.A.)



Intern: Kristoffer Valdehueza

Team Members: Cory Cowden and Leslie Gomez Jimenez
Faculty Advisor: Tito Polo
Location: Hartnell College, Salinas, CA

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Kristoffer Valdehueza

Major: Aerospace Engineer

M. aeruginosa cluster disruption as algal bloom toxin treatment

Toxin inhibition of *M. aeruginosa* cluster via CRISPR-associated transposons



Intern: Lorena Vargas
Team Member: Erica Jane Estamo
Mentor: Dr. David Bernick
Location: iGEM, University California Santa Cruz

UC SANTA CRUZ

iGEM

Harmful algal blooms (HABs) are becoming increasingly prevalent globally due to a combination of warming temperatures, agricultural runoff, untreated sewage residues, and other factors. HABs threaten crucial water systems with toxic compounds, limiting access to freshwater and harming local ecosystems. One form of this is Microcystis aeruginosa (M. aeruginosa) located in Pinto Lake in Watsonville, CA. Previously, Pinto Lake had undergone an alum treatment to suppress M. aeruginosa blooms and although it was successful, it was an expensive and temporary solution. This cyanobacterium secretes microcystin, a carcinogenic hepatotoxin responsible for a variety of adverse health effects. Microcystin is a nonribosomal peptide synthesized by the mcy cluster, a group of 10 synthetase genes transcribed as two polycistronic operons governed by a bidirectional promoter separating mcyA and mcyD. We hypothesize that the disruption of the mcy cluster in M. aeruginosa via CRISPR-associated transposons (CAST) will inhibit the production of microcystin, curbing toxicity while maintaining cell viability. Disruption of the mcy cluster will be transmitted horizontally via a conjugative plasmid and vertically by genomic integration to ensure persistent inhibition in HABs. Successful conjugation will be validated by antibiotic selection, and successful transposition will be validated by genomic sequencing. The interference of microcystin production will be tested by liquid chromatography-mass spectrometry. Our goal is to provide an effective, accessible, and ecologically responsible alternative to existing algal bloom treatments.

Lorena Vargas
Major: Biology

Mule Rover to Assist Artemis Astronauts



Intern: Christel Vileta

Team Member: Hector Enrique Sedano Sanchez
Mentor: Tito Polo

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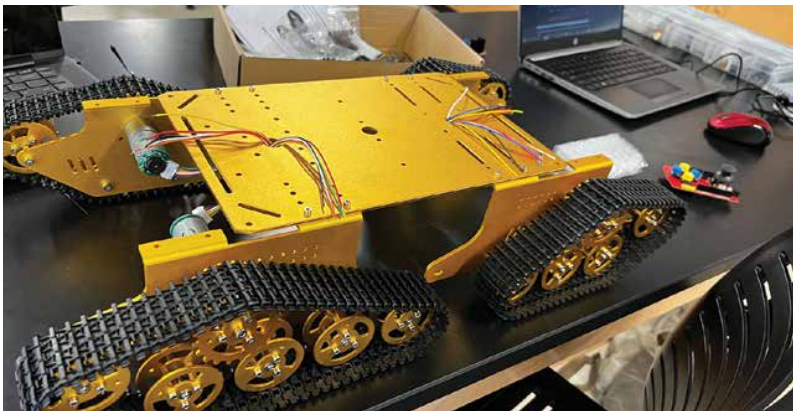
NASA

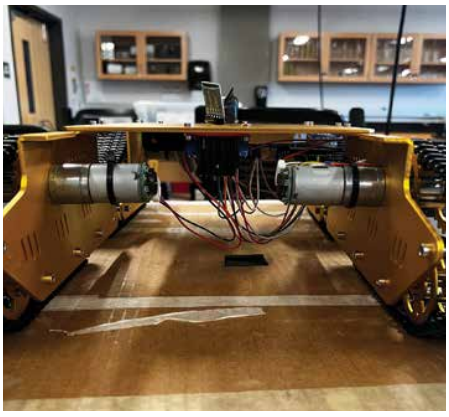
CALIFORNIA SPACE GRANT CONSORTIUM

Space is a dangerous place; thus, we developed a rover that was designed in mind to aid astronauts, but also be able to conduct missions on its own. The main idea behind our rover was to develop a pack mule for the Artemis mission that would take some of the burden off the astronauts, with the inclusion of a multitude of sensors to help the rover traverse terrain, collect data, and give that data to astronauts in real time. These sensors would provide temperature, humidity, photon levels, UV radiation, GPS coordinates via longitude and latitude for locating the rover and/or search and rescue. An ESP32 with built-in Wi-Fi and Bluetooth would be used to send the data of all the sensors, through a web server, to a remote station wherever it may be. An Arduino would be used to control the motors and minor modules like Bluetooth and the sonic sensor. As for the rovers' solo missions, a ESP32 camera would be mounted for remote operation, a claw for collection of regolith samples (with its individual controller), and solar panels to extend mission life. The rover is intended to be an aid to Artemis astronauts, but also a standalone tool capable of undertaking its own objectives adding more utility and value to the rover.

Christel Vileta

Major: Engineering





Greenhouse gas (GHG) emissions of surface ships



Intern: Andres Zamudio-Bucio

Mentor: Dr. Giachetti and Dr. Moore

Location: Naval Postgraduate School

The Navy recognizes climate change as the foremost destabilizing factor in our era, intensifying national security apprehensions and presenting significant readiness challenges. The Navy and the rest of the maritime industry are responsible for 3% of global carbon emissions – a staggering ten billion tons annually. The Navy's climate action strategy is to reach net-zero emissions by the year 2050, in line with the Nation's goal. This project aims to create computer programs to enable emissions analysis and visualization for Navy vessels. Utilizing Python, JavaScript, HTML, and CSS, we laid the webpage's foundation. The interface collects crucial user inputs: ship name, fuel type, mission duration, and operational mode distribution. Employing the useful rate of change formula, our adaptable code, leverages dictionaries/objects to extract and presents insightful data points. Through data-driven insights, our initiative sheds light on Navy vessel fuel consumption and CO2 emissions.

Andres Zamudio-Bocio

Major: Engineering

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STEM

INTERNSHIP PROGRAM 2023

MICRO-INTERNSHIP MENTORS

Adrea Gonzalez-Karlsson

Dr. Jeffery R. Hughey

Tarek Hussain

Victoria Hutchins

Dr. Ver Marie Myr Panggat

Tito Polo

*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.

Lichen abundance and distribution with respect to slope and rock type in Pinnacles National Park

Mentor: Adrea Gonzalez-Karlsson

STUDENTS:

Christine Li
Stephanie Cervantes
Lupita Nunez
Carson Leonard
Daniel Lopez
Eva Gonzalez
Jannet Norienga
Jeriel Sevilla



We studied lichen diversity and distribution at the Pinnacles National Park. The slope and cardinal direction affect lichen abundance. We laid down 44 transect lines of 25 feet each. In each line, we had two observers record each lichen and its size, aspect and slope, we came across near our transect lines. In total, we found 13 species of lichen. There was a higher diversity of lichen on trees than on rocks. North facing surfaces have a higher abundance of lichen diversity.



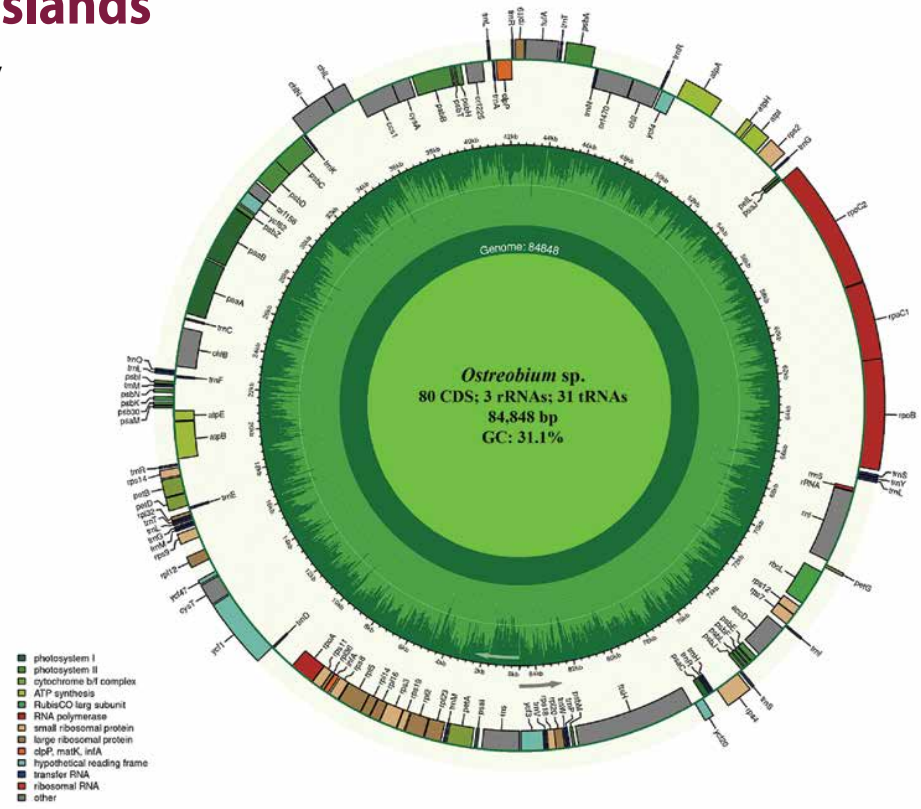


Complete chloroplast genome of an endophytic *Ostreobium* sp. (Ostreobiaceae) from the U.S. Virgin Islands

Mentor: Dr. Jeffrey R. Hughey

STUDENTS:

Mustafa Alesmail, Yulissa Becerra, Kimberly J. Betancourt, Shelly M. Bracy, Anevay T. Castro, Cynthia Cea, Justin Chavez, Janet Del Angel, Edgar Diaz, Yael Diaz-Guzman, Jonathan Dominguez, Jocelynnicole G. Estrada, Lashabelle G. Frei, Andrea Gallardo, Miriam R. Garcia, Eva Gonzalez, Anthony Gonzalez Rocha, Diego Guzman-Bermudez, Cassidy R. Hebert, Marlene Hernandez, Jeffery R. Hughey, Zachary Lee, Alexandra Leyva Romero, Eric Martinez, Nathaniel Martinez, Kazimiera H. Medina, Miguel Morales, Alexis M. Moreno, Isabella Nava, Alyssa N. Nono, Samuel A. Ochoa, Amy Perez, Natasha Perez, Edwin Perez Pulido, Sophie Poduska, Kimberly N. Ramirez, Denise Reyes, Kelsey Richardson, Juanaisa Rodriguez, Alondra M. Rodriguez, Clarisa Serrano-Lopez, Andrea G. Velasquez, Gezelle Villanueva



Ostreobium Bornet & Flahault is a siphonous marine green algal symbiont with three currently recognized species. *Ostreobium* plays an important role in decalcification and providing photosynthates to the corals, especially during bleaching events. *Ostreobium* also occurs as an endophyte in various crustose coralline algae. Twelve complete *Ostreobium* chloroplast genomes isolated from corals have been sequenced. Here, we present the complete chloroplast genome sequence of an endophytic *Ostreobium* sp. isolated from a 19th Century coralline red algal specimen from St. Croix, U.S. Virgin Islands. The chloroplast genome is 84,848 bp in length, contains 114 genes and has a high level of gene synteny to other Ostreobiaceae.

The complete chloroplast genome of the western poison oak *Toxicodendron diversilobum* (Anacardiaceae) from California

Mentor: Dr. Jeffrey R. Hughey



STUDENTS:

Laura I. Huitron Vazquez
Perla E. Aviles
Samantha A. Bailon
Abner G. Cabanillas
Andrea Fernandez
Juan I. Galarza
Brianna Guerrero
Araceli B. Hernandez
Daniel Hernandez
Jeffery R. Hughey
Khegan Jarrett
Tong Li
Francisco J. Maravillo
Magdalena Moreno
Azalea Perez
Nathan A. Rosales
Hunter F. Ruegg
Joel Valdez
Kyla Mae Bravo
Vidal L. Chávez
Daisy I. Diaz
Daniela Enriquez
Edgar L. Martinez
Jesus Mendoza Padilla
Jose Meza
Scott V. Nelson
Crystal Quintero-Ahumada
Adriene Mariah Ramirez

Toxicodendron diversilobum (Torr. & A. Gray) Greene, the western poison oak, was originally described from material collected by the botanist and explorer David Douglas from Fort Vancouver, Washington, USA. The species is naturally distributed from British Columbia, Canada to Baja California, Mexico, where it grows as a vine or shrub inhabiting canyons, slopes, chaparral, and oak woodland communities. All tissues of *T. diversilobum* contain the toxin urushiol, which causes severe dermatitis in about 80% of humans. Five complete *Toxicodendron* chloroplast genomes have been sequenced; however, the western poison oak has not been analyzed. Here, we present the complete chloroplast genome sequence of T. *diversilobum*, the western poison oak, from Pacific Grove, California. The genome is 159,543 bp in length, encodes 133 genes and has a high-level of gene synteny to other species of *Toxicodendron*.

Artificial Intelligence Demystified - Math in Machine

Mentor: Tarek Hussain

STUDENTS:

Michael Graves
Esteban Martinez
Jonathon Barrera
Dylan Garcia
Jorge Barrera
Adam Harvey
Eva Albert
Rigoberto Avalos
Marco Espinoza-Morado
Joshua Sumagang
Lana Ibrahem
Chandrasekhar Kappagantula
Tom Cabrera
Emily Contreras
Carlos Quiroz
Sabino Galindo
Antonio Torres
Calvin Chan
Victor Manuel Ortiz
Gavin Geronimo
Richard Cimientos
Taylan Dincer
Perla Gonzlez
Robert Cruz-Diaz
Alex Li
Tristan Sheppy
Marlen Castro

This micro-internship introduced the basic concepts of Artificial Intelligence (AI)/Machine Learning (ML) and helped students learn how to apply AI/ML algorithms to solve real world problems such as, object identification and classification. Students learned about ChatGPT-4 architecture called transformers, Neural Style Transfer (NST), and Generative Adversarial Networks (GANs). These topics cover some of the fundamental concept in AI/ML. In addition, students learned about computer vision, which is the driving force behind technologies such as self-driving/autonomous vehicles. Students also learned how to use ML/AI models to solve regression and classification problems.



Arduino, Electrical Soldering and Oscilloscope

Mentor: Tito Polo



STUDENTS:

Alejandro Ramos
Ana Rivera
Brandon Lopez
Brandon Sheffer
Francisco Lopez Mora
Francisco Regalado Diaz
Gliann Ramos
Henry Huynh
Itzel Nolasco-Gonzales
Jeriel Sevilla
Jonathan Chavez
Jose De Jesus Espinoza
Kenneth Silim
Lesly Villanueva
Luis Garcia Ponce
Mariano Amparo
Ray Cantu
Robert Tachibana
Salmai Cabrera
Abraham Martinez-Morales
Alejandro Reyes
Alexandra Garcia
Anna Mikaella Chua
Carlos Lopez
Daisy Diaz
Elmer Ramirez
Eric Pio
Ezequiel Barajas
Hector E Sedano Sanchez
Hector Rochin
Jonathan Ramirez-Fausto
Juan Galarza
Kristoffer Valdehueza
Luis A Garcia
Marbella Chavez
Oscar Zavala-Solis
Ricardo Ortiz
Rigoberto Avalos
Roy Sanchez
Xavier Green

Arduino design has been at the front of user-friendly software and hardware development, especially to solve real-world problems. Students worked 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 learned the concepts of and how to implement different electronic components, Digital and Analog circuits, and Arduino boards. Students also learned how to solder electronic components, and the use of electrical measuring equipment, such as the voltmeter, ammeter, function generator and oscilloscope. During the micro-internship, students designed and assembled the Arduino Automatic Watering Plant System.

Improve Student Skills and Confidence in Manual Blood Pressure Measurement using a Teaching Stethoscope

Mentor: Dr. Ver Marie Myr Panggat

STUDENTS:

Isabella Aguilar
Michelle Aguilera
Lucero Abriz-Juarez
Andy Arellano
Nayely Calata Garcia
Guadalupe Castro
Isaiah Covarrubias
Oliva Diaz
Elysse Donato
Ana Fe Cecilia Fajilan
Ryan Francisco
Delilah Garcia
Paola Hernandez
Melanie Iglesia
Tyler Iglesia
Nikkie Joy Jagonio
Michael Lannier
Ivan Lopez
Jessica Perez-Gonzales
Selena Renteria
Aneessa Sandoval
Aiza Suan
Bryanna Tinajero
Diana Torres- Salinas
Nancy Trejo
Jonathan Valdez
Amy Villacana

Accurate blood pressure measurement is important to correctly diagnose and manage hypertension. Manual blood pressure measurement by auscultation is a critical skill for the medical professionals. The accuracy in reading depends on the mastery of the skill and is achieved through initial and on-going training.

Students at Hartnell College are introduced to the anatomy and physiology of the heart and hypertension in their classes, however, there is no in-depth learning of the subject. This project enabled Hartnell College students to get in-depth hands-on learning by training them with the following skills: blood pressure measurement skills and skills on creating a blood pressure measurement guide for students. The training involved reading medical information, performing blood pressure measurements, managing, and analyzing data and creating a short and simple blood pressure measurement guide for students.



Ms. Bryanna Tinajero is taking the blood pressure of Ms. Olivia Diaz. They are using a Teaching stethoscope (with two sets of headsets attached to a common chest piece) so both can hear the Korotkoff sounds.

Enhance Student Learning and Confidence in Ear Anatomy and Physiology with Otoscopic Examination

Mentor: Dr. Ver Marie Myr Panggat

STUDENTS:

Alfaro Perez, Karla
Arroyo Aguilera, Dayana
Balderas, Leonel
Barclay, Charles
Cerna-Mendez, Valerie
Cervantes, Miguel
Davila, Monique
Diaz, Coleen
Escalera, Nathan
Flores-Navarro, Stephanie
Gonzales, Avery
Gonzales, Cintia
Izquierdo, Veronica
Jimenez, Fatima
Mancilla, Jannet
Martinez Neri, Diego
Murguia, Jacqueline
Perez, Nayzeth
Rodriguez-Lopez, Ramiro
Ruiz, Andres
Solis, Marcos
Soria Campa, Yesenia
Toves, Kai
Trafton, Josiah
Wittmann, Jesse
Zazueta, Selena



Ms. Veronica Izquierdo is performing a manual otoscopic examination on Mr. Nathan Escalera.

Students have different learning styles. The main types of learning styles are visual, auditory, and kinesthetic (CDC). Visual learners learn more by seeing, auditory learners learn more by listening while kinesthetic learners learn more by doing hands-on activities. About 47% of learners are multimodal learners, meaning they learn best with a combination of two or even three different methods (FrontiersIn, 2020).

The ear is a very important sensory organ of the body. In-depth understanding of its anatomy and physiology is essential especially for future medical professionals not only because otologic diseases are common but also because it is related to significant health care costs. The common methods of teaching anatomy and physiology of the ear is with the use of pictures, 3D models and videos. Our goal in this study is to see if another method of teaching in the form of otoscopic examination will enhance student learning and confidence in ear anatomy and physiology.

Students at Hartnell College are introduced to the anatomy and physiology of the ear in their classes, however, there is no in-depth learning of the subject. This project will enable Hartnell College students to get in-depth hands-on learning by training them with the following skills: otoscopic examination skills and skills on creating an otoscopic examination guide for students. The training will involve reading the medical information, performing otoscopic examinations, managing and analyzing data and creating a short and simple otoscopic examination guide for students.

Most Common Otoscopic Examination Findings in the Pediatric group with the use of Digital Otoscope

Mentor: Dr. Ver Marie Myr Panggat

STUDENT PARTICIPANTS:

Cabanillas, Brian
Chicas, Doralicia
Diaz, Ricardo
Diaz-Sanchez, Jessica
Escalera, Adam
Hamilton, Peace
Hernandez-Castillo, Mya
Hernandez-Ramirez, Leslie
Huston, Nichole
Larios-Galvez, Noemi
Mendez-Sosa, Zoe
Mendoza, Christian
Mendoza, Natalie
Miguel Cruz, Jessenia
Mojica, Micaela
Prieto, Christina
Reyes, Precious Gem
Ruiz, Charlie
Sanchez, Emily
Sheldon, Kalia
Sierra Gasga, Jessica
Tavares, Brenda
Thompson, Evelyn
Torres, Nicholas
Velasquez-Avina, Giovanna
Victoria, Andrea
Worley, Abigail
Zuniga, Cynthia

According to the National Institutes of Health (2022), parents bring their child to a doctor most commonly because of ear infection. It is also important to note that ear pathologies can be found even in pediatric patients not presenting with ear complaints. This further emphasized the importance of otoscopy as part of the routine examination of pediatric patients. Early diagnosis of ear condition is the key to early referral to an otorhinolaryngologist, early management and the prevention of possible related complications.

This study will utilize digital otoscopes, which are now being used to evaluate the ear canal, tympanic membrane, and the middle ear. Compared with traditional otoscopes, digital otoscopes have a clear advantage. They are user-friendly, they provide crisper images and have the ability to store and share data. Collaboration between medical professionals because of the shareability of data has never been easier. This has enhanced both the efficacy of diagnosis and management of ear conditions.

Students at Hartnell College learn the anatomy and physiology of the auditory system in their anatomy and physiology classes, however, there is no in-depth learning of the subject. This project will enable 30 Hartnell College students to get in-depth and hands-on learning by training them with the following skills: patient interviewing skills, otoscopic examination skills and health educator skills. The training will involve reading the medical information, conducting medical interviews, performing otoscopic examinations, managing and analyzing data and creating a health education digital pamphlet.



Investigations of Tidepool Organisms in Monterey Bay

Mentor: Victoria Hutchins

STUDENTS:

Vidal Chavez
Andrea Fernandez
Pest Gonzalez Aguirre
Marc Guido
Laura Huitron
Henry Huynh
Lorena Ledezma
Jesus Mendoza Padilla
Jannet Noriega
Lupita Nunez
Karolina Rodriguez
Alexandria Soto





Examining patterns in the rocky intertidal by conducting quadrat, swath, and point contact transects in Point Pinos tide pools. Students learned about species that live in the intertidal and conducted surveys to collect data for their individual projects. They investigated organism populations, zonal variation, and the abundance of cover algae to prevent desiccation of intertidal organisms. These relationships show the adaptation of organisms to live in these stressful environments.

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*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.

STEM

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