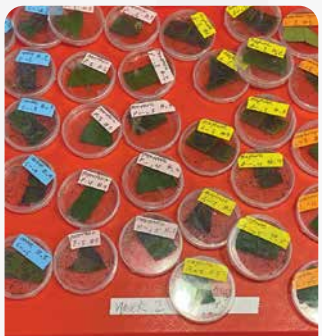
HARTNELL COLLEGE

16th Annual Hartnell College

STEM INTERNSHIP SYMPOSIUM

OCTOBER 15, 2022

STEM






HARTNELL COLLEGE

16th Annual

STEM INTERNSHIP SYMPOSIUM

STEM

SCIENCE • TECHNOLOGY • ENGINEERING • MATH

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.

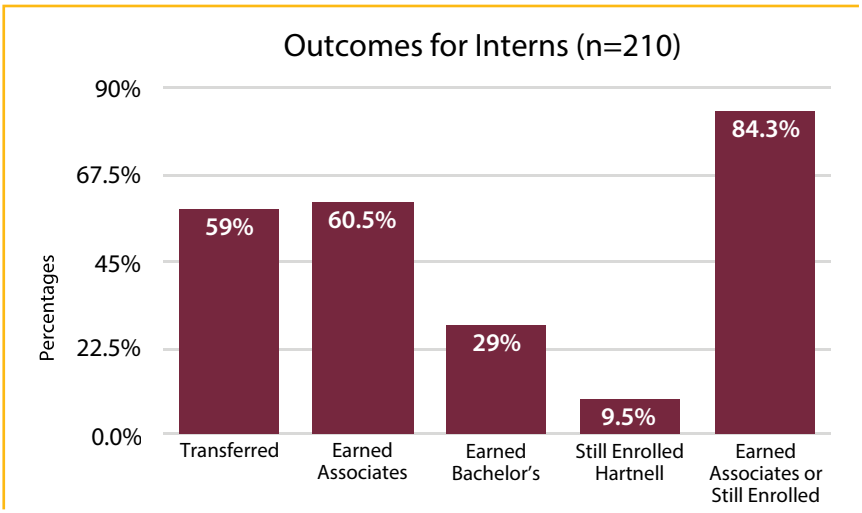
Hartnell is strengthening diversity in STEM while taking on the challenge of meeting our nation's skilled workforce needs. The program is creating a new legacy of opportunity for the families of the Salinas Valley by producing future generations of bright young scientists through innovative and comprehensive STEM programs and initiatives. For the past 16 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 1,200 students in undergraduate research and professional internship opportunities. In addition to its growth over the 16-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 271 interns from cohorts 2017 through 2021, **84% have transferred, earned their Associate of Science, or still enrolled at Hartnell College**. Of the interns who have transferred, **69.5% have earned their bachelor's degree or are still in progress**. 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

STEM INTERNSHIP PROGRAM TEAM

Sharon Albert
Dean of Academic Affairs, Science, Technology, Engineering and Math (STEM)

Moises Almendariz
Director of Academic Affairs, Hispanic Serving Institution Initiatives

Terri Pyer
Interim Director of Communications, Marketing & Public Relations

Joel Thompson
Interim Director of Academic Affairs, Science and Math Institute

Belen Gonzales
Director Career Hub

Anely Meneses
SMI Program Assistant

Leda Polio
HSI Program Assistant

Micro-Internship Mentors

Dr. Melissa Hornstein
Dr. Jeffrey Hughey
Victoria Hutchins
Miguel-Angel Manrique
Brian Palmer
Rosser Panggat
Ver Marie Myr Panggat
Tito Polo
Dr. Mohammed Yahdi

Hartnell Community College District Governing Board

Erica Padilla-Chavez – Board President
Candi DePauw – Board Vice President
Margaret D'Arrigo – Trustee
Irma C. Lopez – Trustee
Ray Montemayor – Trustee
Aurelio Salazar, Jr. – Trustee
Alejandra Gonzalez – Trustee
Laura Rivera – Student Trustee
Michael Gutierrez – Board Secretary and Hartnell College Superintendent/President

HARTNELLCOLLEGE

CONTENTS

16th Annual Hartnell College
STEM INTERNSHIP SYMPOSIUM

Welcome	6
Internship Partners & Mentors	7
The Andy Newton STEM Internship	8
Partner Award Winner: Tito Polo	
Program Schedule	9
Student Interns and Abstracts	10
Hartnell College Micro-Internships	42
Arduino, Electrical Soldering and Oscilloscope	43
Aquatic Engineering Design and Prototyping	44
Chloroplast Genome of the Napa False Indigo	46
Chloroplast Genome of the Coast Live Oak	47
Chloroplast Genomes of Quercus x Morehus	48
Analyzing Bacteria in Household Bathrooms	49
Audio Synthesizers: Fourier Analysis and Synthesis	50
Anatomage Virtual Dissection Table	51
Unhealthy Lifestyle Behaviors	52
Yield Forecasting	54
Thanks to Our STEM Partners	55





WELCOME

Dear Friends of Hartnell College,

Welcome to the 2022 celebration of the Hartnell STEM Internship Program, now in its 16th year.

The symposium not only marks the culmination of the STEM summer internship experiences, but also provides a special opportunity for our students to formally demonstrate to you and to their peers, their research inquiries, techniques, and results, just as professional scientists do at annual meetings and conferences around the globe.

This year's return to a face-to-face gathering after two years of virtual ones is itself a cause for celebration, and an opportunity to show our appreciation for the persistence and determination of our students and their scientific mentors who persevered in the teaching and learning processes during the trying times of the pandemic.

Since its beginning in 2006, with just six interns, this unique program has matched hundreds of student interns with university researchers, college mentors, and industry experts in laboratories, offices, and field work sites around the Salinas Valley, the Central Coast, and far beyond. The resulting experiences have equipped our student interns with empowering tools for university and graduate school preparation, as well as for real-world success.

Hartnell is truly a leader among U.S. community colleges in providing STEM internship experiences, an accomplishment that could not be achieved without the valued partnerships and leadership of the higher education, scientific research, and industry expert communities, who have volunteered their time and expertise to make it a reality. And it could not happen without your encouragement for our students in their quest to become their best selves.

Thank you for your continued support, and please enjoy the work of our students!

— Michael J. Gutierrez
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.

STEM INTERNSHIP PARTNERSHIP & MENTORS

Blue Marble Space Institute of Science/Science Voices
Lev Horodyskyj

California Space Grant Consortium
Dr. John Kosmatka

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

Elkhorn Slough Foundation
Elkhorn Slough National Estuarine Research Reserve
Dash Dunkel
Ariel Hunter

Hartnell College
Paul Chen
James Fitch
Dr. Melissa Hornstein
Dr. Jeffrey Hughey
Victoria Hutchins
Daniel Jimmeye
Miguel-Angel Manrique
Jose Rico Martinez
Steve Otero
Brian Palmer
Ver Marie Myr Panggat
Rosser Panggat
Dr. Pimol Moth
Tito Polo
Dr. Mohammed Yahdi

Naval Postgraduate School
Alison Kerr

OHLA-USA
James Palmer

Salinas Community Science Workshop
Curt Gabrielson

Salinas Valley Memorial Hospital
Brandon Reed

Seed4STEM
Shannon Bliss

SmartWash Solutions
Dr. Eric Wilhelmsen

University of California, Los Angeles (SURP)

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

University of California, Santa Cruz (ACCESS)
Dr. Gabriella Amberchan

United States Department of Agriculture
Dr. Juan Alvarez (OPPE)
Dr. Greg Simmons (APHIS)
Dr. Javier Flores (NRCS)
Dr. Kelsey Wood (ARS)
Dr. Renee Eriksen (ARS)
Dr. Nicholas LeBlanc (ARS)

SPECIAL THANK YOU TO OUR

Andy Newton STEM Internship Partner Award Winner

TITO POLO

Hartnell Science Lab Technician



HARTNELL COLLEGE

16th Annual

STEM INTERNSHIP SYMPOSIUM
OCTOBER 15, 2022

WELCOME

Michael Gutierrez, Superintendent/President

OVERVIEW OF THE PROGRAM

Sharon Albert, Dean of STEM

PRESENTATION OF ANDY NEWTON STEM INTERNSHIP PARTNER AWARD

Joel Thompson, Interim Director of Science & Math Institute

STUDENT PANEL DISCUSSION

Joel Viorato Arambula

Britney Vera Cortes

Veronica Garcia

Gabino Guzman

VIEWING POSTERS AND TALKING WITH THE STUDENT PRESENTERS

CLOSING

STEM

HARTNELL COLLEGE

STEM

INTERNSHIP PROGRAM 2022

STUDENT INTERNS

Manuel Aboite
Joseph Alcalá
Erick Ayala
Adrian De Anda
Britney Vera Cortes
Jose De Jesus Espinoza
Veronica Garcia
Gabino Guzman
Declan Hayworth
Yansha Huang
Jose Jaime
Felix Leon
Archie Lieva
Maha Muhrram
Daniel Orta
David Orta
Victor Manuel Ortiz
Jimena Parra
Ulisses Peralta-Diaz
Jennifer Pérez Diaz
Jonathan Ramirez
Arturo Renteria
Luz Violeta Robles
Byron Rodriguez
Maureen Sanchez
Foram Shah
Ivon Tapia
Marc Anthony Trujillo
David Valdez
Nancy Villalobos
Joel Viorato Arámbula
Andres Zamudi



Astronaut Health Monitoring System for Long Term Deep Space Missions



Intern: Manuel Aboite

Team Members:
Maureen Sanchez and Andres Zamudio
Faculty Advisors: Tito Polo
Location: Hartnell College, Salinas

Modern advances in technology have led to the potential of long-term deep space missions extending beyond what has been done before. With longer space travel for humans, this will require astronauts to be able to monitor their well-being on a constant basis, especially in the event of a medical emergency. With multiple sensors on an astronaut's body that are then connected to an Arduino Mega, we take the measurements of an individual's body temperature. In addition, the Arduino also takes the measurements of the astronaut's surrounding humidity and temperature. In the second remote Arduino, an Arduino Uno is connected to a sensor that collects the individual's heart rate. After all the data that is collected, it is then wirelessly sent to the base Arduino Uno. The data provided by the two remote Arduinos will then be presented live onto several LCD displays that are connected to the base Arduino.

Having this data is crucial in allowing the astronauts to examine for any drastic changes in their vitals and ensuring that their health is not in decline. This is crucial as well since having data samples of how different individuals react to being in space for an extended period of time would help if we ever branched into space colonization.

Manuel Aboite

Major: Engineering

SOIL ROVER

Intern: Joseph Alcalá

Team Members: Jennifer Pérez and Veronica Garcia
Faculty Advisors: Tito Polo
Location: Hartnell College, Salinas



For any deep space mission such as lunar exploration and or mars mission, it is essential we can conduct onsite analysis of soil and evaluate its composition and help determine if it can be useful for agricultural farming as well as construction materials that can all be use for shelter and food for astronauts. For example, phosphorus is an ingredient found in fertilizer and found in some construction materials like clay. Thus, we have created The Soil Rover, a ground vehicle that is remotely operated via the dabble app and has the capability to conduct on site soil analysis of Nitrogen, Phosphorus, Potassium, and Temperature. The rover uses the 3-in-one 3S485 soil NPK Sensor alongside Gikfun DS18B20 Waterproof Digital Thermal Probe Sensor for Arduino. The soil rover's arm is uniquely designed and holds the sensors together. The soil rover's arm is remotely operated to lower the sensors into the soil and perform soil analysis when needed. The results can be read locally on the soil rover as well as remotely via an iPhone app. The results on the soil rover are displayed via Arduino OLED screen for NPK readings and via the LCD 1602 screen for temperature readings. The results can also be access wirelessly with the use of Arduino Bluetooth and an iPhone app which is useful for data trending and analysis of soil samples.

Joseph Alcalá

Major: Mathematics

Curiosity Rover 2.0

Intern: Erick Ayala

Team Member: Yanshan Huang
Faculty Advisors: Tito Polo
Location: Hartnell College, Salinas



Our project aims to facilitate astronauts' tasks and make them safer simultaneously. Curiosity Rover 2.0 will eliminate unnecessary tasks while providing astronauts with valuable information about their atmosphere. We have designed a rover that can transmit live details about its surroundings. Curiosity Rover 2.0 will also be equipped with numerous sensors that will allow astronauts to prioritize research that is not yet attainable by a rover. Curiosity Rover 2.0 was designed with exploring the moon and deep space in mind. We believe it has the ability to provide astronauts with an idea of the temperatures and climates they should be expecting when they arrive on the moon. Although not limited to temperatures, Curiosity Rover 2.0 will also be able to detect moonquakes and alert us via wireless communication programmed to transmit data to our mobile devices. No longer should our astronauts run the risk of dangerous climates or potentially fatal catastrophes while inhabiting the moon or other planets. With a microprocessor connected to our rover through wireless communication, an astronaut can discover irregular activity on the moon while they are inside of an aircraft. In the same device, an astronaut can use it to control the rover on the moon; they can also regularly check live temperature, humidity, and air pollution levels. Single-handedly, Curiosity Rover 2.0 will set a guide on the colonization of the moon.

Erick Ayala

Major: Engineering

OHLA USA Highway 101 CRCP and Bridge Rehabilitation in King City, CA: Project Engineer Internship



Intern: Adrian De Anda

Mentors: James Palmer and Jake Woxland, OHLA USA

The U.S. 101 is a major north-south highway stretching from Los Angeles, CA to Tumwater, WA. Moreover, the U.S. 101 is the principal highway traveled by residents in the Salinas Valley. OHLA USA was awarded an $85m dollar Caltrans contract which consists of the reconstruction of 6.5 miles of Highway 101 in King City, CA. Furthermore, the reconstruction includes the removal and replacement of Continuously Reinforced Concrete Pavement (CRCP) and widening of two existing bridges. In this Internship as a Project Engineer Intern working in Heavy Civil and Transportation Construction, I worked closely with the Project Manager and Construction Superintendents/Foremen to implement policies and procedures required for project success. The daily responsibilities included a well-balanced amount of office and field work. Field work included taking quantity of work performed and working closely with the project manager, superintendents, foreman and crews on project deliverables. The collaboration of OHLA and Caltrans led to working coherently with Caltrans engineers to ensure work is progressing in compliance with project specifications. Another task included supporting craft workers by making sure necessary material and tools are available for work to be completed. On the other hand, office work included processing/managing material deliveries – ensuring that materials received are properly inspected for quantity and quality and are in compliance with contract documents. A high level of involvement in the operations of the cost control system and analysis of construction costs was required as well as managing daily procurement internally and externally. Additionally, submitting weekly SWPPP reports and maintaining a complete and current record of submittals, approvals, and resubmittals, including a file of letters of transmittal and dates of each transaction was done in a timely manner.

Adrian De Anda

Major: Advanced Diesel Technology

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



Intern: Britney Vera Cortes

Mentors: E.I.T. Juan Alejandre and Javier Flores, USDA NRCS

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

Soil and water conservation are some of the major concerns farmers and ranchers have along Monterey, Santa Clara, and San Benito County. 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 problem in their way, but also focus on other related engineering problems like manure waste. During this training, engineers and intern 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 facilitates 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 the design of 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: Engineering

IT Internship at Hartnell College

Intern: Jose De Jesus Espinoza

Mentors: Daniel Jimmeye, Paul Chen, Steve Otero



HARTNELLCOLLEGE

To begin with, the IT internship or at least the one at Hartnell College is different from a research-based internship. Most things that you learn are the normal day to day duties of an IT worker which could range from helping faculty with technical issues, installing, and uninstalling hardware and software, imaging or installing predesignated applications onto computers or anything related to technological devices. One of the things I learned during this internship as previously mentioned are imaging computers. What this entails is using a partition and disk cloning program which has needed software and settings that are used day to day on faculty systems around the various campuses. One other thing we had the opportunity to learn about was the servers that host the Hartnell College website, virtual machines, personal accounts, and various other frequently used things on a computer. During my internship, I swapped out a server which is basically a large rectangular metal box filled with hard drives to store information. We also delved a bit into the Operating System needed to run that. One other daily task involved scanning serial numbers of old and incoming devices like computers, monitors, thin clients, etc. and storing them into an excel sheet for later organization. Overall, there were a plethora of small tasks that we did and learned during this apprenticeship that paints a clear picture of how this specific job field works.

Jose De Jesus Espinoza

Major: Computer Science

Studying Two Lettuce Pathogens in the Salinas Valley



Intern: Alejandro Fuentes

Mentor: Dr. Renee Eriksen USDA-ARS

United States Department of Agriculture
Agricultural Research Service

The Salinas Valley of California produces eighty percent of the lettuce grown in the United States. Two devastating pathogens of lettuce in the Salinas Valley are Impatiens necrotic spot virus (INSV) and Fusarium wilt of lettuce. INSV is transmitted by thrips (*Frankliniella occidentalis*) and symptoms include brown necrotic spots and yellowing (chlorosis) rendering the lettuce unmarketable. Fusarium wilt on lettuce is caused by the fungus *Fusarium oxysporum* f. Sp. lactucae that causes the plants to turn yellow and will start to show tip burn on the edge of the leaves. The fungus prefers high temperatures on the soil and only race 1 has been reported in the United States.

In order to determine the difference in INSV disease severity between thrips only infection and infection by hand we inoculated half of the lettuce plants with the INSV virus, and the rest of the plants were naturally infected in the green house with thrips that carry the disease. Each week the plants were rated from one to five with one meaning the plant is slightly yellow and has little symptoms and five meaning the plant is completely dead. The anticipated results for this experiment were that some lines are resistant or tolerant to INSV and most of them are susceptible which means they died.

For the Fusarium project roots of the young lettuce plants were dipped into the Fusarium fungus liquid inoculum to infect the plants with Fusarium. Our objective of this experiment was to confirm that the collected Fusarium isolates are pathogenic using a Koch's postulate approach.

It takes fourteen days for the lettuce to germinate and the symptoms that appear are stunting, yellowing, browning, and it starts to turn pink by the roots. After two weeks most of the plants died but some of them survived. At the end both projects turned out as expected but this means we need to find ways to determine which types of lettuce are resistant and help the growers keep their lettuce healthy. It's important to keep doing the right research to help the growers to produce their lettuce each year. Results confirmed that PR-6 and SF-3 Fusarium isolates are pathogenic and suggest a new race is present.

Alejandro Fuentes

Major: Agriculture Technology

Genetically Modified *E. Coli* and *S. Cerevisiae* as Type 2 Diabetes Treatment



Intern: Gabino Guzman

Mentor: Dr. David Bernick
Location: UC Santa Cruz

UC SANTA CRUZ

iGEM

Diabetes globally affects about an estimated 1 in 10 people and is the seventh leading cause of death. Yet, fifty through eighty-five percent of all chronic complications with diabetes are preventable with treatment and medication. Consequently, increasing access to effective diabetes treatment will greatly reduce inequities within disadvantaged communities. To aid this prevalent issue of accessibility within the diabetic community, the UC Santa Cruz International Genetically Engineered Machine (UCSC iGEM) team strives to create a solution. This summer, we have worked tirelessly towards producing a protein called "Exendin-4 (Ex-4)" in *E.Coli* and *S. cerevisiae* to make Type 2 Diabetes treatment more accessible for under resourced and socioeconomically disadvantaged communities.

Ex-4 is a glucagon-like peptide 1 receptor agonist (GLP1-RA) drug that triggers a response that leads to increased insulin production and sensitivity. Though Ex-4 stands at the forefront of diabetes medication, it's unavailable to most diabetics as it can cost up to $700 a month without insurance. Our ultimate goal is to produce a bioencapsulated *S. cerevisiae* GLP1-RA Ex-4 that's cost-effective filling in the gaps that our current health systems fail to address.

Gabino Guzman

Major: Biology

SOIL ROVER

Intern: Veronica Garcia

Team Members: Joseph Alcalá and Jennifer Pérez
Faculty Advisors: Tito Polo
Location: Hartnell College, Salinas



For any deep space mission such as lunar exploration and or mars mission, it is essential we can conduct onsite analysis of soil and evaluate its composition and help determine if it can be useful for agricultural farming as well as construction materials that can all be use for shelter and food for astronauts. For example, phosphorus is an ingredient found in fertilizer and found in some construction materials like clay. Thus, we have created The Soil Rover, a ground vehicle that is remotely operated via the dabble app and has the capability to conduct on site soil analysis of Nitrogen, phosphorus, potassium, and temperature. The rover uses the 3-in-one 3S485 soil NPK Sensor alongside Gikfun DS18B20 Waterproof Digital Thermal Probe Sensor for Arduino. The soil rover's arm is uniquely designed and holds the sensors together. The soil rover's arm is remotely operated to lower the sensors into the soil and perform soil analysis when needed. The results can be read locally on the soil rover as well as remotely via an iPhone app. The results on the soil rover are displayed via Arduino OLED screen for NPK readings and via the LCD 1602 screen for temperature readings. The results can also be access wirelessly with the use of Arduino Bluetooth and an iPhone app which is useful for data trending and analysis of soil samples.

Veronica Garcia

Major: Biology

ESP32 VR-Controlled Recon Rover



Intern: Declan Hayworth

Team Member: David Orta
Faculty Advisors: Tito Polo
Location: Hartnell College, Salinas

Lunar habitats have yet to be established along with a fiscal or material incentive. Our rover will be a ground vehicle that will search the lunar landscape for ideal spots for the first lunar habitats and prospecting for precious metals that could be mined once those habitats are established and create future capital and interest in more permanent lunar and space habitats. A VR dual camera system will be mounted on the rover that will move according to the user's head movement to search for areas with shelter such as lava tube caves or large craters for the potential lunar habitats along with craters where rich veins of precious metals could be located. It would navigate the lunar terrain using omnidirectional motion with Mechanum wheels and four-wheel drive controlled by a transmitter mainly utilizing two analog joysticks for direction and two potentiometers for speed.

Declan Hayworth

Major: Engineering

Curiosity Rover 2.0

Intern: Yanshan Huang

Team Member: Erick Ayala
Faculty Advisors: Tito Polo
Location: Hartnell College, Salinas



Our project aims to facilitate astronauts' tasks and make them safer simultaneously. Curiosity Rover 2.0 will eliminate unnecessary tasks while providing astronauts with valuable information about their atmosphere. We have designed a rover that can transmit live details about its surroundings. Curiosity Rover 2.0 will also be equipped with numerous sensors that will allow astronauts to prioritize research that is not yet attainable by a rover. Curiosity Rover 2.0 was designed with exploring the moon and deep space in mind. We believe it has the ability to provide astronauts with an idea of the temperatures and climates they should be expecting when they arrive on the moon. Although not limited to temperatures, Curiosity Rover 2.0 will also be able to detect moonquakes and alert us via wireless communication programmed to transmit data to our mobile devices. No longer should our astronauts run the risk of dangerous climates or potentially fatal catastrophes while inhabiting the moon or other planets. With a microprocessor connected to our rover through wireless communication, an astronaut can discover irregular activity on the moon while they are inside of an aircraft. In the same device, an astronaut can use it to control the rover on the moon; they can also regularly check live temperature, humidity, and air pollution levels. Single-handedly, Curiosity Rover 2.0 will set a guide on the colonization of the moon.

Yanshan Huang

Major: Computer Science

California Strawberry Diseases

Intern: Jose Jaime

Mentor: Dr. Peter Henry, USDA-ARS
Location: USDA Salinas



United States Department of Agriculture
Agricultural Research Service

Strawberries are one of the greatest commodities in Monterey County. They bring in plenty of income to both ranchers and workers as well as provide several jobs for residents here in the county. But with the good, comes the bad. Strawberries are susceptible to many diseases, but we tried to focus on the four main diseases. Those diseases being Fusarium Wilt, Macrophomina Crown Rot, Phytophthora, and Verticillium Wilt. We extracted the DNA from the diseased strawberry crowns and tried to identify the disease using the extract DNA. This helped to verify that the plants were infected with the disease we thought it is infected by.

Jose Jaime

Major: Agriculture Technology

NOYCE STEM Teaching Internship



Intern: Maha Muhrram

Mentor: Shannon Bliss

HARTNELLCOLLEGE

Seeds 4 STEM

The millions of different organisms are one of the most fascinating aspects of life on earth. Because all living organisms have cells, teaching Cell Theory at a young age can be an effective and engaging introduction in biology. During this part time internship, I worked on building an introductory activity for 3rd to 8th graders interested in the animal cell. Using the infrastructure of a city I built an analogy allowing a comparison between city structures and cell structures- "organelles". The introductory activity consisted of using the infrastructures in a city to then compare it to the function of a cell organelle. In this activity the students have to place all the cards upside down and turn one first, then a second one and see if the city infrastructure function is in comparison with the cell organelle. Because youth vary in reading capabilities I built two memory games, one with definitions and one with pictures. The memory game with the definitions is intended for the students that have a small insight on what a cell is but are starting to learn the organelles. The memory game with the pictures is intended for students that have any type of learning or language barriers. Using this content with pilot groups, we found this activity to engage participants with no background in biology. They were able to have a better understanding and introduction to cell organelles and their importance and function inside the animal cell. We have found this activity to be effective on its own, but it can also be incorporated into a larger activity. Thank you to CSUMB's NSF Noyce Grant for funding this internship.

Maha Muhrram

Major: Respiratory Care

This material is based upon work supported by the National Science Foundation under Grant No. (2050336) 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.

Toltecan: A simulated world based on geodynamics

Intern: Daniel Orta

Mentor: Dr. Lev Horodyskyj



Lunar habitats have yet to be established along with a fiscal or material incentive. Our rover will be a ground vehicle that will search the lunar landscape for ideal spots for the first lunar habitats and prospecting for precious metals that could be mined once those habitats are established and create future capital and interest in more permanent lunar and space habitats. A VR dual camera system will be mounted on the rover that will move according to the user's head movement to search for areas with shelter such as lava tube caves or large craters for the potential lunar habitats along with craters where rich veins of precious metals could be located. It would navigate the lunar terrain using omnidirectional motion with Mechanum wheels and four-wheel drive controlled by a transmitter mainly utilizing two analog joysticks for direction and two potentiometers for speed.

Daniel Orta

Major: Computer Science

Toltecan: A simulated world based on geodynamics

Intern: David Orta

Mentor: Dr. Lev Horodyskyj



Science Voices is a digital equity organization that uses a role-playing game called Greenworks to teach science, improve leadership, tackle global issues like climate change and form international friendships.

The current iteration uses a curriculum with Google Docs and Discord for international collaboration. Our goal is to transform the present medium into a gamified simulation with features like geodynamics, mantle convection, plate tectonics, culture, economics, and politics.

The summer internship was to establish the first layer of the simulation game -- a geodynamics model for the fictional continent Toltecan

David Orta

Major: Computer Science

ESP32 VR-Controlled Recon Rover



Intern: David Orta

Team Member: Declan Hayworth
Faculty Advisors: Tito Polo
Location: Hartnell College, Salinas

Lunar habitats have yet to be established along with a fiscal or material incentive. Our rover will be a ground vehicle that will search the lunar landscape for ideal spots for the first lunar habitats and prospecting for precious metals that could be mined once those habitats are established and create future capital and interest in more permanent lunar and space habitats. A VR dual camera system will be mounted on the rover that will move according to the user's head movement to search for areas with shelter such as lava tube caves or large craters for the potential lunar habitats along with craters where rich veins of precious metals could be located. It would navigate the lunar terrain using omnidirectional motion with Mechanum wheels and four-wheel drive controlled by a transmitter mainly utilizing two analog joysticks for direction and two potentiometers for speed.

David Orta

Major: Computer Science

Ideal Vegetation Locator

Intern: Victor Manuel Ortiz

Team Members:
Jimena Parra and Jonathan Ramirez
Faculty Advisors: Tito Polo
Location: Hartnell College, Salinas



As humanity continues to explore other planets, it is crucial to examine the planets' conditions to determine their capabilities. Whether it be for vegetation or human exploration, measurements on the planet are required.

This project aims to address that with a rover that uses multiple sensors and a camera to collect and transmit such information. Moisture, barometric pressure, temperature, humidity, and water level sensors are used to collect the corresponding data while the camera displays live footage of the process and terrain. The moisture and water level sensors are attached to their own arm mechanisms and are controlled separately to collect data as necessary. These arm mechanisms are controlled using joysticks and use two Arduino Uno boards. The data collected is also displayed on the two LCD displays attached to the rover. The rover is controlled with a remote control using a receiver and transmitter. It utilizes another two Arduino Uno boards for the rover and other sensors. An Arduino Uno board is used for the camera's footage and rover control, and an Arduino Uno Wi-Fi Rev2 board manages the data for the sensors. A Bluetooth module is used to transmit the information from the sensors to the client-server using its IP address. All information captured is transmitted to our computer for further analysis and organization.

Victor Manuel Ortiz

Major: Computer Science

Ideal Vegetation Locator

Intern: Jimena Parra

Team Members: Jonathan Ramirez and Victor Manuel Ortiz
Faculty Advisors: Tito Polo
Location: Hartnell College, Salinas



As humanity continues to explore other planets, it is crucial to examine the planets' conditions to determine their capabilities. Whether it be for vegetation or human exploration, measurements on the planet are required.

This project aims to address that with a rover that uses multiple sensors and a camera to collect and transmit such information. Moisture, barometric pressure, temperature, humidity, and water level sensors are used to collect the corresponding data while the camera displays live footage of the process and terrain. The moisture and water level sensors are attached to their own arm mechanisms and are controlled separately to collect data as necessary. These arm mechanisms are controlled using joysticks and use two Arduino Uno boards. The data collected is also displayed on the two LCD displays attached to the rover. The rover is controlled with a remote control using a receiver and transmitter. It utilizes another two Arduino Uno boards for the rover and other sensors. An Arduino Uno board is used for the camera's footage and rover control, and an Arduino Uno Wi-Fi Rev2 board manages the data for the sensors. A Bluetooth module is used to transmit the information from the sensors to the client-server using its IP address. All information captured is transmitted to our computer for further analysis and organization.

Jimena Parra

Major: Social Science

Effect of pesticide residues on LBAM larvae



Intern: Ulisses Peralta-Diaz

Mentor: Dr. Gregory Simmons, USDA-APHIS

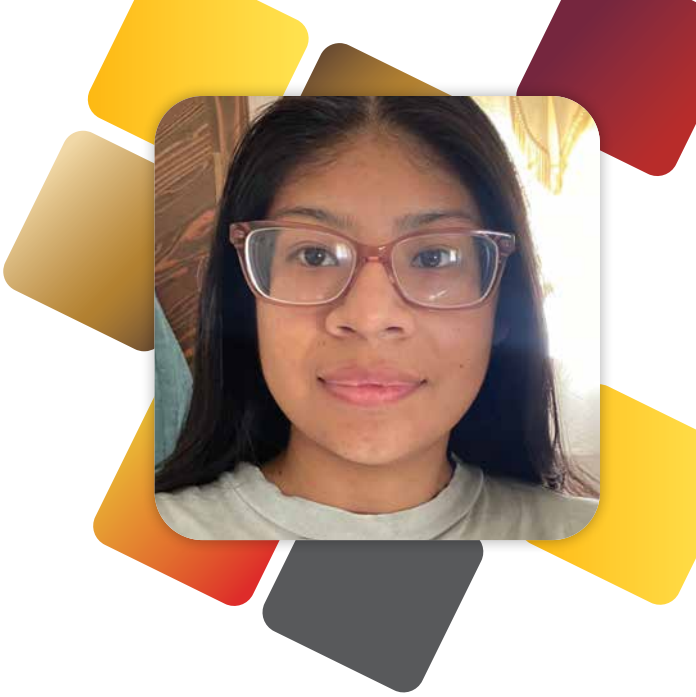
USDA
Animal and Plant Health Inspection Service

The light brown apple moth (LBAM), *Epiphyas postvittana* (Walker) [Lepidoptera: Tortricidae], is an invasive pest native to Australia that feeds on a broad range of host plants including economic crops such as apples, pears, stone fruit, citrus, and grapes. They are external feeders primarily by feeding on leaves. Later stage larvae use their silk to web together foliage to make feeding nests. Direct damage to fruit is by external feeding and can occur when they web leaves to a fruit surface. They were first detected in Berkeley, California in 2007 and since that time have spread to the coast and near coastal counties areas from the Central Coast to Southern California. For this experiment, the efficacy and duration of control by pesticide applications to ornamental nursery plants on larvae that come in contact with the plant after treatment. This experiment was conducted to test the degree of control caused by applications of three different pesticides on LBAM larvae after a period of weathering in the field. Three pesticides, Acephate, Permethrin, and Lambda-cyhalothrin, were compared with an untreated control. A sampling of treated leaves was taken at intervals of 2 days, 1 week, 2 weeks, and 3 weeks after application. The treated plant samples were placed along with larvae in a petri dish to assess how effective residues remain over time. The end goal of this experiment is to quantify how pesticide residues affect the larval survival rate.

Ulisses Peralta-Diaz

Major: Plant Science

SOIL ROVER



Intern: Jennifer Pérez Diaz

Team Members: Joseph Alcalá and Veronica Garcia
Faculty Advisors: Tito Polo
Location: Hartnell College, Salinas

For any deep space mission such as lunar exploration and or mars mission, it is essential we can conduct onsite analysis of soil and evaluate its composition and help determine if it can be useful for agricultural farming as well as construction materials that can all be use for shelter and food for astronauts. For example, phosphorus is an ingredient found in fertilizer and found in some construction materials like clay. Thus, we have created The Soil Rover, a ground vehicle that is remotely operated via the dabble app and has the capability to conduct on site soil analysis of Nitrogen, Phosphorus, Potassium, and Temperature. The rover uses the 3-in-one 3S485 soil NPK Sensor alongside Gikfun DS18B20 Waterproof Digital Thermal Probe Sensor for Arduino. The soil rover's arm is uniquely designed and holds the sensors together. The soil rover's arm is remotely operated to lower the sensors into the soil and perform soil analysis when needed. The results can be read locally on the soil rover as well as remotely via an iPhone app. The results on the soil rover are displayed via Arduino OLED screen for NPK readings and via the LCD 1602 screen for temperature readings. The results can also be access wirelessly with the use of Arduino Bluetooth and an iPhone app which is useful for data trending and analysis of soil samples.

Jennifer Pérez Diaz

Major: Computer Science

Ideal Vegetation Locator

Intern: Jonathan Ramirez

Team Members: Jimena Parra and Victor Manuel Ortiz
Mentor: Tito Polo
Location: Hartnell College, Salinas



As humanity continues to explore other planets, it is important to examine the planets' conditions to determine its capabilities. Whether it be for agriculture or human exploration, measurements on the planet are required. This project aims to address that with a ground vehicle that uses multiple sensors and a camera to collect and transmit such information. Moisture, barometric pressure, temperature, humidity, and water level sensors are used to collect the corresponding data while the camera displays live footage of the process and terrain. The moisture and water level sensors are attached to their own arm mechanisms and are controlled separately to collect data as necessary. These arm mechanisms are controlled using joysticks and use two Arduino Uno boards. The data collected is also displayed on the two LCD displays attached to the rover. The rover is controlled with a remote control using a receiver and transmitter as well as another Arduino board. It utilizes another two Arduino Uno boards for the rover and other sensors. An Arduino Uno board is used for the camera's footage and rover control, and an Arduino Uno Wi-Fi Rev2 board manages the data for the sensors and transmits the information to the client server using its IP address. All information captured is transmitted to our computer for further analysis and organization.

Jonathan Ramirez

Major: Mathematics

Creating a Knowledge Base for Hartnell Faculty



Intern: Arturo Renteria

Mentor: Shawn Pullum, Hartnell I.T. Department

HARTNELLCOLLEGE

To have a concise and accurate location to receive help with something specific without having to involve another person makes work efficient. This is due to being able to locate one's own information without needing another person's help which is what a knowledge base is used for. Having resources in one place to help navigate with whatever one is using the knowledge base for. As for Hartnell, they are using it to create an effective location where employees can look for tips and extra help that can be done by themselves. A brief example are the apps many faculty use through Hartnell, many have trouble when first launching the apps and so a knowledge base has articles readily available for that specific category of help so that they are not looking everywhere for help. Learning more into other Knowledge bases of some nearby colleges and universities has revealed how helpful they have been with assisting many students, staff, and even anybody who is on their website. Right now, it is tailored toward the staff, but eventually a knowledge base should be expanded upon to fit the needs of mostly everyone at Hartnell. The knowledge base so far is in an ongoing development as more time passes more information should be added to make it more efficient and with more input from the staff of what they believe should be included into the knowledge base. The most important part in collecting the information of a knowledge base is to understand what the consensus of what is needed to be looked into first. The next step is to take the information from other knowledge bases and real people so that the knowledge is constantly evolving with the times of the people so that new help can be made for them.

Arturo Renteria

Major: Computer Science

Develop Inventory in IT Help Desk System



Intern: Luz Violeta Robles

Mentors: Daniel Jimmeye, Paul Chen, Steve Otero, Hartnell College

HARTNELLCOLLEGE

Reflecting on the time I spent interning at the Hartnell College IT Department I realized how busy and essential the IT department is to the educational system. On a daily basis, the IT department receives multiple calls from all five Hartnell campuses, requesting help with various technical issues. Whether installing a new computer, fixing a broken computer monitor, installing a new printer, moving equipment, or even updating the system, the Hartnell College IT department responds to all those calls. As an intern, I would assist the IT department by preparing the computers with the correct software they need, as well as updating the system to make sure it is running as efficiently as possible. I would also assist the department in installing new computers and monitors in the different departments and buildings within the Hartnell campuses. In addition to installations, I helped keep track of the equipment that was currently in use as well as the equipment that will be implemented, using Excel. Excel Spreadsheet has allowed us to keep track of data, in an organized and simple way. Skills such as organization, communication, and teamwork have contributed to an effective and productive internship experience at the Hartnell College IT Department.

Luz Violeta Robles

Major: Computer Science

Biocatalytic deuterium incorporation into amino acid substrates by PLP-dependent enzyme GntC

Intern: Alondra Rodriguez

Mentors: Jennifer Cordoza and Dr. Shaun McKinnie (PI)

UCSC ACCESS

UC SANTA CRUZ

The substitution of hydrogen atoms with their slightly heavier isotope deuterium (D) is a conservative chemical change that can have a dramatic impact on a compound's bioactivity. Select addition of D atoms can improve the pharmacokinetics of existing drugs by reducing their oxidative metabolism, leading to an increase in their *in vivo* circulation and physiological effects. This strategy has been previously employed to enhance the lifespan of pharmaceutical agents like deutetrabenazine (Huntington's disease treatment), RT001 (neurodegenerative diseases), and notably, the modified amino acid *d3*-L-DOPA (Parkinson's disease). While chemical strategies exist to incorporate D atoms into drug-like molecules, biocatalytic approaches using pyridoxal-5'-phosphate (PLP)-dependent enzymes have become increasingly popular due to their environmentally-friendly conditions and use of deuterium oxide (D2O) as a D source.

Recently, our lab collaboratively elucidated the biosynthetic pathway of guanitoxin, a potent cyanobacterial neurotoxin. The second biosynthetic step uses the PLP-dependent enzyme GntC to catalyze an intramolecular cyclization on a modified arginine substrate. *In vitro* D2O protein assays and liquid chromatography-mass spectrometry analyses have identified that GntC incorporates up to three D atoms in both its product and substrate. Subsequent investigation into GntC has identified that it efficiently deuterates polar and positively charged amino acids, deviating from the substrate scope of previously established PLP-dependent biocatalysts. We are continuing to investigate the applicability of GntC to produce scalable quantities of deuterated amino acid-like molecules. We intend to use this biocatalytic tool to produce deuterated substrates for use as late-stage intermediates in biomedical research.

Alondra Rodriguez

Major: Chemistry

Network Equipment Tracking/Labeling



Intern: Byron Rodriguez

Mentor: Jose (Rico) Martinez

HARTNELLCOLLEGE

Networking is an important component when it comes to building a system, especially for large enterprises, such as for schools and businesses. When networking for a college campus it requires knowing how to troubleshoot effectively, being able to record information, and being able to communicate in a group. When managing a large enterprise such as a college campus, you must be documenting any type of useful information in order to make changes, fixes, or upgrades more efficiently. When attending this internship, I performed duties from labeling wires in the server rooms to installing telephones in office areas. By labeling cables connected to switches in the server room, it makes it easier to troubleshoot them later. Another thing that I did in the server rooms was to organize the cabling better so it would be easier to track down a certain cable when needed. Troubleshooting was also a big theme of learning, a method used to effectively get down to a networking problem is the OSI Model. The OSI Model consists of 7 layers of functions to describe a networking system. These layers are Physical layer, Data Link layer, Network layer, Transport layer, Session layer, Presentation layer and finally the Application layer. When working in the server rooms, I learned that data could be transferred by light through optical fiber cable or current through copper wires that travel using two voltages, 0V and 5V and it becomes binary code: 1's and 0's. Also, that sending and receiving data is done using packet switching, packet switching means that the data gets transferred into small pieces containing the source address, destination address, total number of packets, and a sequence number that is used for the receiver to rearrange them to form the original message. Data-transferring can be done via cabling, wiring, or wireless connections. Another project that I worked on was helping install Wireless Access Points throughout the new building. When doing this, I had to create a list of their MAC Addresses to keep track of the locations of every single one of them in case of any issue. This procedure is necessary for access control.

Byron Rodriguez

Major: Biology

Astronaut Health Monitoring System for Long Term Deep Space Missions



Intern: Maureen Sanchez

Team Members: Andres Zamudio, Manuel Aboite
Faculty Advisors: Tito Polo
Location: Hartnell College, Salinas

Modern advances in technology have led to the potential of long term deep space missions extending beyond what has been done before. With longer space travel for humans, this will require astronauts to be able to monitor their well-being on a constant basis, especially in the event of a medical emergency. With multiple sensors on an astronaut's body that are then connected to an Arduino Mega, we take the measurements of an individual's body temperature. In addition, the Arduino also takes the measurements of the astronaut's surrounding humidity and temperature. In the second remote Arduino, an Arduino Uno is connected to a sensor that collects the individual's heart rate. After all the data that is collected, it is then wirelessly sent to the base Arduino Uno. The data provided by the two remote Arduinos will then be presented live onto several LCD displays that are connected to the base Arduino.

Having this data is crucial in allowing the astronauts to examine for any drastic changes in their vitals and ensuring that their health is not in decline. This is crucial as well since having data samples of how different individuals react to being in space for an extended period of time would help if we ever branch into space colonization.

Maureen Sanchez

Major: Computer Science

Analyzing and Enhancing Search Engine Optimization (SEO)



Intern: Foram Shah

Mentor: James Fitch

HARTNELLCOLLEGE

Technology is at the core of every advancement in the modern world. From applications, software, systems, and machines, it truly drives our society, facilitates growth and the ability to keep individuals connected, especially through innovations such as websites. This project aimed to target the use of Search Engine Optimization (SEO) to boost user traffic by correcting and fixing data files on the back end. Using the Web Content Management Software OMNI CMS allowed for back-end developers to directly code or edit data for users to see the information and visit the pages they need with ease. We were able to target the HTML web pages of the website that needed the most assistance and began correcting descriptions, adding keywords, and checking tags to ensure accuracy. We had to check through each webpage as many pages were missing descriptions, had descriptions that were too lengthy or were not long enough to constitute proper detail. These parameters made it exceedingly crucial to use precise detail in choosing the correct information. Through the course of the project, we noticed increase in functionality for the website's Search Engine Optimization due to correcting over 1,400 pages which ultimately led to an overall score of 93% in website functionality. This indicated a direct correlation between the way the web pages were coded and described, and the way users were able to navigate to them. This is incredibly crucial as it allows the user to find their information at a faster rate, but still not needing them to investigate the backend of it all. Technology is ever changing and growing, therefore implementing changes such as these aids in creating a more user-friendly environment.

Foram Shah

Major: Computer Science

Analysis of treatment against Verticillium in lettuce roots using bacterial isolates



Intern: Marc Anthony Trujillo

Mentor: Dr. Nicholas LeBlanc, USDA ARS

United States Department of Agriculture
Agricultural Research Service

Verticillium is a fungus that causes disease in plants, more specifically lettuce for this experiment. The proper name of the disease Verticillium causes is Verticillium wilt, which is a considerable problem for lettuce growers. Verticillium is becoming more prominent in the Salinas Valley, leading to scientists attempting to find ways to put a halt to this plant disease. In our experiment, we decided to use beneficial bacteria to combat the disease in lettuce as bacteria is a much safer alternative to chemicals and pesticides. To start the study, we incubated 7 different bacteria on potato dextrose agar in order to use them as a treatment against the disease. After incubating the bacteria on Petri dishes, we created the 7 isolates, which included: SJL17-4, SJL17-1, SCL15-6, MCL20-5, SCL15-4, K61, and MCL20-2 for the treatment against the Verticillium wilt. The testing site was a field next to the facility, with young lettuce arranged in 4 rows. With each of the isolates, we inoculated 10 lettuce plants with 1 ml each before switching to the next isolate along with a negative control. This was done for every row to have multiple results for each isolate. We waited 2 months after incubating to allow the lettuce to grow and as well as to let the isolates treat the lettuce. After two months, Dr. LeBlanc and I unrooted all 331 lettuce plants and rated the severity of the Verticillium wilt on a scale of 0-5, with 0 being none at all and 5 being completely infected by the Verticillium. When all the data was gathered, it was placed onto an Excel sheet in order to calculate the average rating and standard deviation for each treatment. The results of this experiment seemed to be inconclusive as the inoculated roots had similar numbers to the negative control when looking at the individual average of each isolate. Due to this, there seems to be no evidence to show that any of these isolates were able to treat the Verticillium present in the lettuce roots.

Marc Anthony Trujillo

Major: Biology

Maintenance, research, restoration, and social projects at the ESNERR



Intern: Joel Viorato Arámbula

Mentor: Ariel Hunter, outreach coordinator at the Elkhorn Slough National Estuarine Research Reserve

During these nine weeks working at the reserve, I have learned a lot of things, developed different sets of skills, practiced social skills and leadership, and enhanced my physical condition. Throughout the week, I would assist numerous people in charge of their projects at the reserve or in different locations. On Mondays and Tuesdays, I would do maintenance and cleaning. It would include cleaning trails, cutting down trees, trimming trees and bushes, mowing, weed whacking, and pulling out weeds. These projects require hand and powered tools, all-terrain vehicles, engine tools, and physical strength. Volunteers would come every Wednesday to do different activities. I would work with the volunteers teaching them what to do and sometimes leading groups. These activities encouraged my social and leadership skills. On Thursdays, I would work at the nursery doing various restoration projects and sometimes researching the different native plants of California. I would pull out and get rid of invasive species of plants and replace them with the local native plants. I would do a lot of transplantation, make soil, water plants, seed cleaning, and building equipment at the nursery. These tasks would require focus and abundant patience. Fridays would be more variable. Sometimes we would guide groups of visitors, and other times they would send me on long walks around the reserve to take pictures that I would later use to make Facebook posts. These little tasks were fun and made me appreciate the beauty and importance of the slough. Overall, a very enriching experience that would make every day feel very different. It made me change the way I see the world by realizing how much this world needs us. I believed nothing was impossible until I learned that restoration is not possible alone. After being involved at this reserve, I now appreciate the importance of engaging the community in this cause.

Joel Viorato Arámbula

Major: Biology

Astronaut Health Monitoring System for Long Term Deep Space Missions



Intern: Andres Zamudio

Team Members: Maureen Sanchez and Manuel Aboite
Faculty Advisors: Tito Polo
Location: Hartnell College, Salinas

Modern advances in technology have led to the potential of long-term deep space missions extending beyond what has been done before. With longer space travel for humans, this will require astronauts to be able to monitor their well-being on a constant basis, especially in the event of a medical emergency. With multiple sensors on an astronaut's body that are then connected to an Arduino Mega, we take the measurements of an individual's body temperature. In addition, the Arduino also takes the measurements of the astronaut's surrounding humidity and temperature. In the second remote Arduino, an Arduino Uno is connected to a sensor that collects the individual's heart rate. After all the data that is collected, it is then wirelessly sent to the base Arduino Uno. The data provided by the two remote Arduinos will then be presented live onto several LCD displays that are connected to the base Arduino.

Having this data is crucial in allowing the astronauts to examine for any drastic changes in their vitals and ensuring that their health is not in decline. This is crucial as well since having data samples of how different individuals react to being in space for an extended period of time would help if we ever branched into space colonization.

Andres Zamudio

Major: Biology

NOYCE STEM Teaching Internship

Students:
Felix Leon
Archie Lleva
Ivon Tapia
David Valdez
Nancy Villalobos

Mentor: Shannon Bliss



Picture of their zoom gatherings.

HARTNELL COLLEGE

Seeds 4 STEM

Students interested in future STEM teaching worked alone and in groups (virtually) to create engaging STEM activities executable to the 5th-8th grade age group. Using best practice pedagogy frameworks, they incorporated different learning styles to get children engaged and interested in STEM. CSU Monterey Bay students farther along in the teaching pathway served as mentors. The internship culminated in presentation of the activities to children at the Salinas Community Science with great success.



This picture is of the 2 of the interns working with youth at the Salinas Community Science Workshop.

HARTNELL COLLEGE

STEM

INTERNSHIP PROGRAM 2022

MICRO-INTERNSHIPS

Mentor: Tito Polo

Mentor: Dr. Melissa Hornstein

Mentor: Dr. Jeffery R. Hughey

Mentor: Victoria Hutchins

Mentor: Miguel-Angel Manrique

Mentor: Rosser Panggat

Mentor: Ver Marie Myr Panggat

Mentor: Brian Palmer

*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.

MICRO-INTERNSHIP

Arduino, Electrical Soldering and Oscilloscope

HARTNELLCOLLEGE

Mentor: Tito Polo

STUDENTS:

Yoali Cid Solis
Araceli Hernandez
Isaiah Villanueva
Yanshan Huang
Marc Anthony Trujillo
Kiriratanak Vong
Andres Zamudio Bucio
Winter Jimenez
Josue Martinez Santos
Jennifer Perez
Jonathan Ramirez
Alondra Rodriguez
David Cardozo
Elmer Hernandez Torres
Jimena Parra
Jose Polo

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, wire up and use an alphanumeric LCD display, analog Joystick module and several other sensors. Students learned the concepts of 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, and oscilloscope.



MICRO-INTERNSHIP

Hartnell STEM Micro-internship: Aquatic Engineering Design and Prototyping for Arroyo Seco Duck Race 2022

HARTNELLCOLLEGE

Mentor: Dr. Melissa Hornstein, Engineering Faculty

Seven teams composed of 20 Hartnell students prepared for and competed in the Arroyo Seco Citizens Association Duck Race Festival on Saturday, April 30, 2022, an experience that also served as a 25-hour microinternship led by engineering instructor Dr. Melissa Hornstein. The annual event is held on the Arroyo Seco River in south Monterey County. (Pictured: The participants with Dr. Hornstein (back row, red shirt.)

The students followed the engineering design cycle to design, construct, prototype, test, and compete enhanced large floating ducks to go the fastest up and down a stretch of river at the "Unlimited" Engineering Duck Race, the feature of the festival, through remote control of the ducks. Many ducks were powered with small electrical controlled motors, several remotely controlled by Arduino microcontrollers.

Although none of this year's entries defeated competitors from their engineering counterparts at Monterey Peninsula and Cabrillo colleges, Dr. Hornstein reminded the students that "winning isn't the only point," adding, "We learned a lot about engineering project management. Perhaps this was the first real project you did from start to finish. That in itself is an accomplishment."

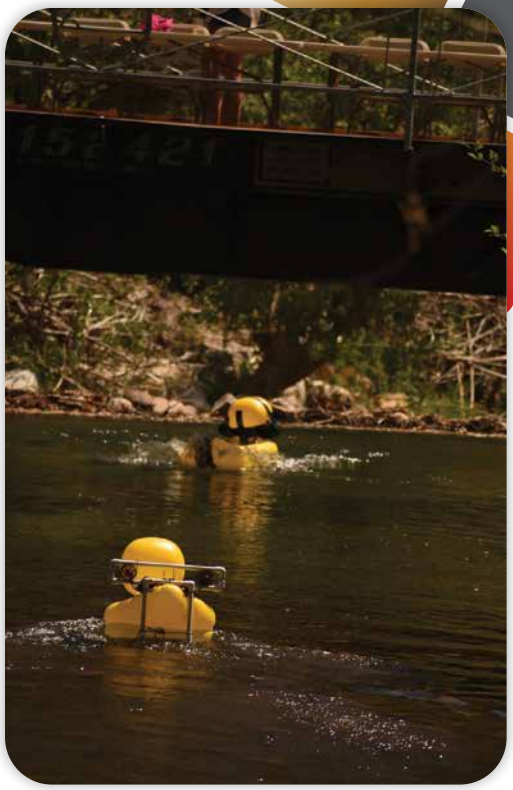
Students echoed that sentiment in reflections on the experience that they submitted to Dr. Hornstein. Wrote electrical engineering major Leslee Still, "My advice to others would be to start the design process right away. Think it through and research all the components to ensure compatibility and ease of use. Don't overthink or try to over engineer. Sometimes simpler is better. Enjoy the process and celebrate the wins no matter how small. Get to the pool for testing early so you have time to make modifications if necessary. In the end if you have learned something then you have won."

For more information on the Arroyo Seco Annual Duck Race Fest, see:
www.asca-ca.org/annual-duck-race-fest









STUDENTS:

Jason Angulo
Erick Ayala
Salmai Cabrera
Gabriel Coria
Edgar Diaz
Mai Lynn Hunt
Kimberly Jarvio
Robin Keire
Archie Noel Lleva
Jose Lomeli-Vega
Samuel Lopez
Dustin Moore
Jennifer Perez Diaz
Elmer Ramirez
Hector Rochin
Alondra Rodriguez
Marano
Maureen Sanchez
Leslee Still
Britney Vera Cortes
Kiriratanak Vong



MICRO-INTERNSHIP

The complete chloroplast genome of the threatened Napa False Indigo *Amorpha californica* var. *napensis* Jeps. 1925 (Fabaceae) from northern California, USA

HARTNELLCOLLEGE

Mentor: Dr. Jeffery R. Hughey

STUDENTS:

Ivan D. Agudelo
Griselda Aldaco, Angel
Brito-Pizano
Kimberly G. Chavez
Karina G. Cortina
Jorge Flores
Alejandro Fuentes
Adam N. Garcia
Alejandro Garcia
Daniel Gonzalez-Martinez
Jennifer Hernandez Ramos
Fernando R. Katada
Felix A. Leon
Maleny P. Lopez
Sandra Z. Lopez
Aileen G. Mendoza
Maritta Molina
Asmahan Muhrram
Daisy Ortiz-Matias
Tonantzin E. Ortiz
Alicia Pacheco
Nandini Patel, Paz M. Ramirez
Jennifer L. Scaramuzzino
Alexandria Soto
Jessica M. Vidauri
Jose Villicana
James A. Yhip

Amorpha californica var. *napensis* Jeps. 1925, the Napa false indigo, is a threatened shrub endemic to northern California. Here the complete chloroplast genome of topotype material of var. napensis was assembled and characterized to contribute to the bioinformatics, systematics, and conservation of this variety. The chloroplast genome (GenBank accession OK274088) is 158,294 base pairs (bp) in length, encodes 130 genes including 85 protein-coding, 37 tRNA, 8 rRNA, and shows a high-level of gene synteny to other Papilionoideae. Phylogenetic analysis of the genome fully resolved var. *napensis* in a clade with *A. fruticosa* L. and *A. roemeriana* Scheele, sister to the Dalbergieae. The newly sequenced chloroplast genome shows that the genetic differences between var. *napensis* and *Amorpha californica* Nutt. var. *californica* are greater than the variation observed between var. *napensis* and many other *Amorpha* spp. sequences deposited in GenBank. These data suggest that var. *napensis* should be elevated to full species rank.



Napa False Indigo

MICRO-INTERNSHIP

The complete chloroplast genome of topotype material of the coast live oak *Quercus agrifolia* Née var. *agrifolia* (Fagaceae) from California

HARTNELLCOLLEGE

Mentor: Dr. Jeffery R. Hughey

STUDENTS:

Adam N. Garcia
Jennifer Hernandez Ramos
Aileen G. Mendoza
Asmahan Muhrram
Jessica M. Vidauri



coast live oak Quercus agrifolia

Quercus agrifolia Née, the California live oak or coast live oak, is an evergreen originally described by Luis Née from Monterey, California, USA. The species was said to have sessile axillary fruits and glabrous leaves that were broad, ovate, subcordate and toothed. *Quercus agrifolia* is distributed from northern California to Baja California, Mexico where it occurs in valleys and slopes in mixed-evergreen forest and woodlands at elevations less than 1,440 meters. More than thirty oak chloroplast genomes have been sequenced (7, 8, 9), however the *Q. agrifolia* genome has not been deciphered. In this study, we assembled and characterized the complete chloroplast genome of var. *agrifolia* to contribute to the bioinformatics and systematics of this variety and subsection *Agrifoliae*. The genome is 161,283 bp in length, encodes 132 genes and has a high-level of gene synteny to other Fagaceae.

MICRO-INTERNSHIP

HARTNELLCOLLEGE

Comparative analysis of the chloroplast genomes of *Quercus x morehus* and the presumptive parents *Q. wislizeni* and *Q. kelloggii* (Fagaceae) from California

Mentor: Dr. Jeffery R. Hughey

STUDENTS:

Alejandro Garcia
Althea C. Katada
Alyssa Serrano
Angel Carrillo
Angelica Castellanos
Azucena Mendez-Gomez
Carlos J. Flores
Christopher Limon
Cynthia Lopez
Daniela Rosas-Uribe
Dylan J. Hidalgo
Ephraim C. Melgarejo
Erica L. Estamo
Faith Mora
Gabino Guzman
Jason F. Morones
Jennifer Sanchez-Mendoza
Jimena M. Parra
Joaquin Perez
Joe H. Perez
Joel Viorato Arambula
Juan S. Chavez
Juan R. Figueroa
Juan Rodriguez
Kevin Cardenas
Leslie Trejo
Lizbeth D. Lozano-Ruiz
Loreli Gonzalez
Lorena L. Vargas
Marc Anthony Trujillo
Mariana Rangel
Martin R. Delgado
Mayra A. Ibarra-Moreno
Nancy Chitica Villalobos
Priscila Corona
Quinn Snowden
Roberto Vargas
Robin B. Staretorp
Stephanie Martin
Victor M. Zavala

Quercus morehus Kellogg, Abram's oak, was originally proposed from a single specimen from near Clear Lake, California, USA. It was described as a small tree (9.14 meters) with black bark, oblong-lanceolate leaves, and oblong nuts. Greene was the first to study *Q. morehus* and concluded it was a hybrid between the interior live oak *Q. wislizeni* A. DC. and the black oak *Q. kelloggii* Newb. Subsequent authors agreed with this hypothesis, including Jepson who itemized six observations supporting the hybrid conclusion (3-7).

Many oak chloroplast genomes have been sequenced to date, however the genomes of *Quercus x morehus, Q. wislizeni,* and *Q. kelloggii* have not been analyzed. To contribute to the bioinformatics of *Quercus x morehus* and these closely related *Quercus* species, we assembled and characterized the complete chloroplast genomes of the presumptive hybrid and parents. The genomes are 161,119–161,130 bp and encode 132 genes. *Quercus x morehus* and *Q. wislizeni* are identical in sequence, but differ from *Q. kelloggii* by three indels and eight single nucleotide polymorphisms. Analysis of the chloroplast genomes support the hybrid designation for *Quercus x morehus* as well as contributes to the systematics and chloroplast evolution of Fagaceae.



Quercus x morehus

MICRO-INTERNSHIP

Analyzing Bacteria in Household Bathrooms

Mentor: Victoria Hutchins

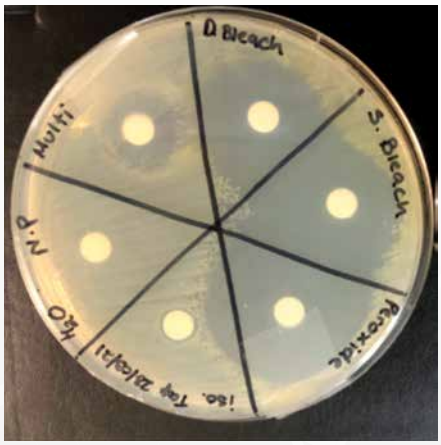
HARTNELLCOLLEGE

STUDENTS:

Ali Mendez
Brandon Gutierrez
David Valdez
Edgar Diaz
Fernando Yañez
Gustavo Pio Castro
Ian Russell
Ivonne Aguirre
Jankiben Patel
Jhoesmi Gomez
Joaquin Perez
Kristin Barber-Scott
Litzi Zepeda
Lorena Vargas
Michael Castro
Nayeli Avina
Samantha Gonzalez-Leon
Viridiana Ramos Ayala

This Micro Internship allowed for students to bring the science to them and create their own experiment at home. They learned about bacterial growth and basic microbiology, researched properties of different disinfectants to explore how they work. Using environmental sampling techniques, they grew bacteria from their bathrooms onto agar plates and tested different disinfectants by setting up plates to measure zones of inhibition. They analyzed which disinfectants were the most effective against bacteria by measuring these inhibition zones. Inhibition zones were measured to determine success showing that 10% Bleach and Lysol All Purpose Cleaner to be the most widely effective.





MICRO-INTERNSHIP

The mathematics of audio synthesizers: Fourier analysis and synthesis

HARTNELLCOLLEGE

Mentor: Miguel-Angel Manrique

STUDENTS:

Gustavo Pio Castro
Yoali Cid
Kimberly Jarvio
Robin Keire
Julian Ortiz Monroy
Frances Wong



The math involved in hearing sound is as complex as one wants it to be. A basic example of the relationship between math and music is that the musical tone "concert A" is defined as 440 Hz, so the tone one octave higher would be 880 Hz, a doubling of the first frequency. Another basic example of math's influence is music is that the musical chords and intervals that sound "good" to most ears are those that are made up of frequencies that have simple ratios such as 1:2 or 2:3. In contrast, tones at frequencies in the ratio 3:7 would sound "bad" to most people.

Especially interesting relationships are revealed when we examine the mathematical shape of an audio waveform (its mathematical graph). It turns out that the uniqueness of a sound is determined by the overall shape of its waveform. In musical terms this is to say that its musical timbre is determined by characteristics of a mathematical graph.

In this micro-internship, students applied music theory, calculus, and computer programming to a problem in electrical engineering. Students extracted timbre information from audio recordings of instruments and then used that information to make an audio synthesizer with the same musical timbre. In more mathematical terms, students used the Fast Fourier Transform algorithm to extract Fourier coefficients from an audio waveform and then synthesized other audio tones of the same timbre profile as the original recording. With students exposed to important basic ideas in electrical engineering and audio engineering, they are able to embark on further studies in either of these fields.

MICRO-INTERNSHIP

The Effectiveness of Anatomage Virtual Dissecting Table on learning Anatomy of the Cardiovascular System among Hartnell College Biology Students

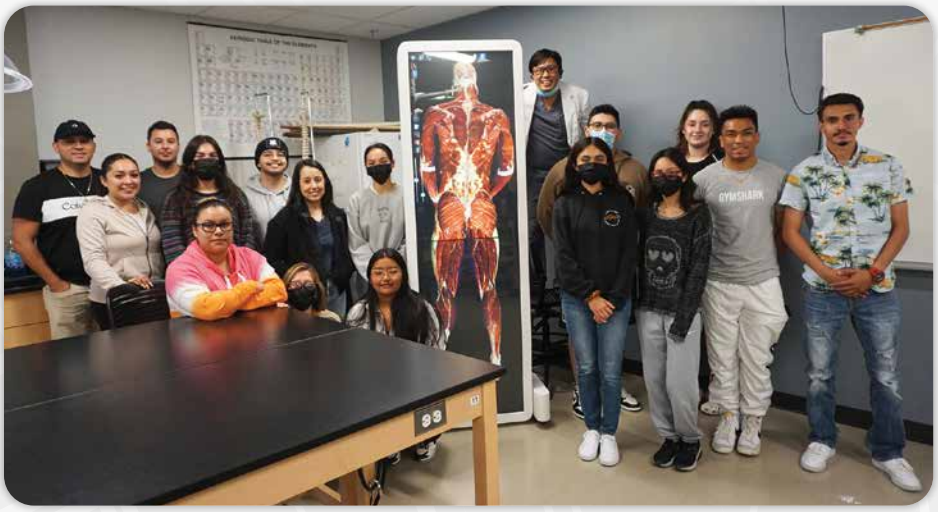
HARTNELLCOLLEGE

Mentor: Rosser Panggat

STUDENTS:

Cristian Antonio
Maria Barajas
Jaime Bernardo
Joaquin Ortiz
Jennifer Zavala Ramirez
Yoselinne Rangel
Sergio Vargas
Libna Bautista
Adriana Gonzalez
Gustavo Jimenez
Diana Navarro
Sarah Panes
Maria Ramirez Rivera
Kimberly Antolin
Jasmine Corona
Judith Gonzales
Jason Montoya
April Serrano
Brisa Ramos

Technology has been part of the U.S. education system for over fifty years. The main goals of technology in education include the following - to improve how lessons are delivered while enhancing the student learning experience, to increase student engagement and encourage student collaboration, to prepare the students for the digital future and overall to promote better quality education. Teaching human anatomy has continuously been evolving. One of these advanced technologies is the Anatomage, which is a virtual dissection table. It is a touch screen computer the size of an operating table that uses real cadaveric images. Historically, students learned human anatomy with real cadavers and models. The project involved thoroughly studying the virtual dissecting table with live hands-on training, taking assessments and evaluation surveys to determine student learning experience and engagement. Students created an Anatomage Table tutorial video and presented it to a live audience for Biology students.



MICRO-INTERNSHIP

The Most Common Unhealthy Lifestyle Behaviors Among Adults Diagnosed with Essential Hypertension

HARTNELLCOLLEGE

Mentor: Ver Marie Myr Panggat

STUDENTS FALL 2021:

Amador, Yvette
Bautista, Alma
Covarrubia, Alexandra
Ferrente, Julianna
Gonzalez, Judith
Gonzalez-Mojarro, Rosa
Hernandez, Adriana Trujillo
Hernandez, Thalia
Izquierdo, Gina
Kais, Darlene
Luna, Maria
Magana, Juan
Maniulit, Kenn William
Martinez, Brenda
Mata, Christine Joy
Medina-Cerritos, Johanna
Pantoja, Maria
Pelagio, Victoria
Perez, Jetzemani Jimenez
Rodriguez, Nayeli
Rombaoa, Jhasmine Samoy
Romero, Norma
Ruela, Salia Quintero
Sanchez, Katelynn
Scholink, Laysa
Tabuni, Olaa
Trujillo, Samantha
Villalobosrocha, Jose
Watson, Megin

STUDENTS SPRING 2022:

Ayala, Carmen
Barron, Jacqueline
Botello, Mariah
Caro, Wendy
Cazares, Anthony
Enriquez, Dianne Kae
Estrada, Bertha
Gomez, Aryana
Gomez, Victor
Jaime, Bernardo
Perez, Amy
Perez, Jazmine
Ray, Jeannette
Rocha, Jasmine
Rodriguez, Maribel
Romero, Salina
Sabillo, Jenthina
Torres, Nelida
Ugale, Jill
Vaca, Cynthia
Vazquez, Fernando Andre
Zamora, Verenice Martinez

Hypertension is a chronic medical condition caused by elevated blood pressure in the arteries. Nearly half of adults in the United States have hypertension (CDC, July 2021). There are a variety of anti-hypertensive medications available nowadays to control hypertension. However, among individuals diagnosed with hypertension and taking medications, there are still reports of inadequate blood pressure control. Among hypertensives with uncontrolled BP, there is an increased risk for heart disease and stroke which are two of the leading causes of deaths in the USA. Unhealthy lifestyle behaviors have been suggested by studies to contribute to inadequate BP control. These factors include lack of physical activity, being overweight or obese, alcohol consumption, smoking and a diet high in sodium. This project will promote in-depth learning of cardiovascular system and hypertension physiology for students. Hartnell College students to get in-depth and hands-on learning by training them with the following skills: patient interviewing skills, blood pressure taking skills and health educator skills. The training will involve reading the medical information, interview hypertensive individuals, taking blood pressure measurements, managing, and analyzing data and creating a health education digital pamphlet.



MICRO-INTERNSHIP

Yield Forecasting

Mentor: Brian Palmer

HARTNELLCOLLEGE

STUDENTS:

Sofia Alvarez
Monica Anaya-Montejano
Jessica Benitez
Javier Castorena
Illyssa Cazarez
Kacy Chandler
Adrian De Anda
Rizzia Legaspi
Archie Noel Lleva
Adelaide Lopez
Melissa Maldonado
Xitlali Medina Moreno
Erendira Medrano Arreygue
Karen Medrano Arreygue
Matthew Meyers
Angelica Montanez
Jonathan Morales
Anjani Raj
Eduardo Ramirez
Jazmin Ramirez
Xenia Sanchez
Jesus Tejeda-Camacho
Angel Virgen
Francisco Villafana
Rogelio Chavez
Guadalupe Rojas-Vega
Patty Barrientos
Andrea Ruiz
Andrea Santos
Enrique Rodriguez
Omar Sandoval
Juan Ortiz
Joel Hernandez
Jasmine Lopez
Elsa Santos
Anthony Paramo Nunez
Gustavo Ramirez
Estrella Ramirez
Margarita Macias

As an ongoing project with Food Origins, Inc., several teams of students during AY2021-2022 were tasked with stress-testing a protocol for counting boxes of strawberries harvested, based on a new system implemented in the field by Food Origins. The box-counting protocol was developed in 2020, and students are now stress-testing the algorithm to examine the problems that arise in its application. Students began by learning the basics of R Programming and applied the basics of R programming to a rich, yet complicated data set from Food Origins. Students then learned the mathematics behind a machine-learning-styled algorithm (details withheld) and applied this technique to the Food Origins data set. Students applied this algorithm, classified portions of the word day by type (pre-work, active harvesting, breaks/lunches, post-work), and applied the box-counting technique during the working periods for harvesters. The issues that arose during the application of the algorithm were highlighted, and future projects will work toward solutions to these problems.



WE THANK OUR PARTNERS



HARTNELLCOLLEGE



































*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.

STEM

For more information about the
Hartnell College STEM Summer Internship Program
contact:
Joel Thompson • (831) 770-6106 • jothompson@hartnell.edu
or visit:
www.hartnellstem.org

HARTNELLCOLLEGE

411 Central Avenue | Salinas, CA 93901 | hartnell.edu