



STEM

13th Annual Hartnell College Summer STEM Internship Symposium







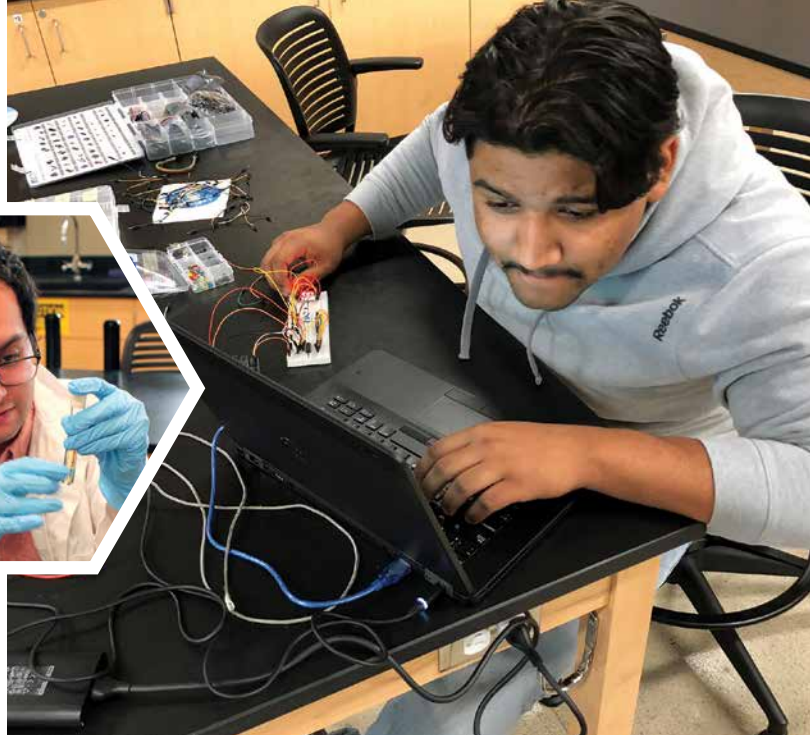
Summer Internship Program

August 17, 2019

For more information contact: Joy Cowden • (831) 770-6106
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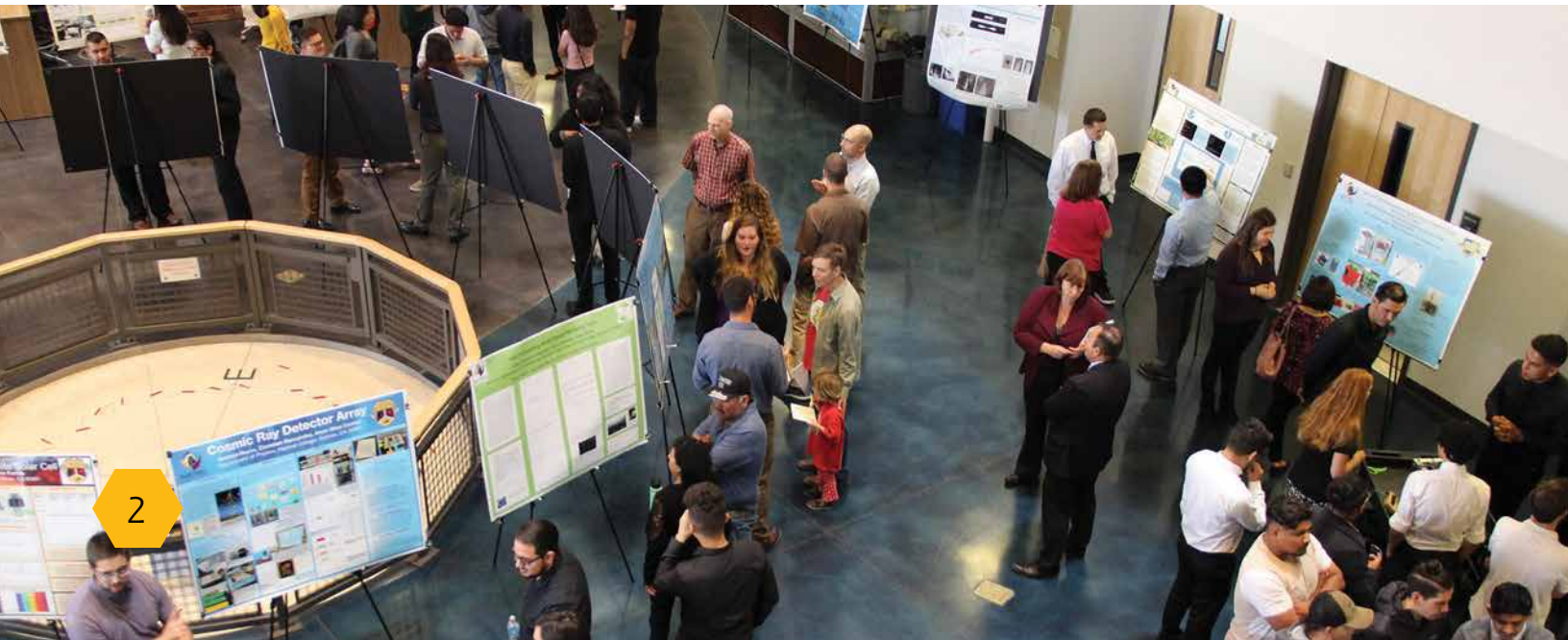


Hartnell College 13th Annual Summer Internship Symposium

STEM

SCIENCE · TECHNOLOGY · ENGINEERING · MATH

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The Program



Hartnell STEM Internship Program

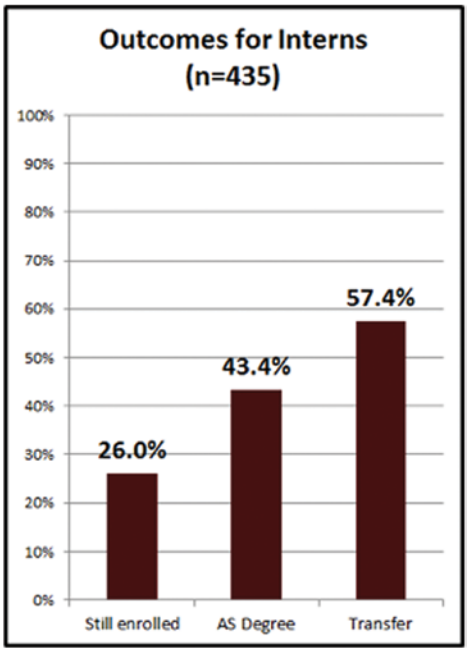
The STEM (Science, Technology, Engineering and Math) Internship Program at Hartnell Colleges supports and engages students in undergraduate academic research and/or professional internship experiences. Internships include relevant and innovative projects with regional research institutions, local partners, and national REU (research 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 13 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 1,000 students in undergraduate research and professional internship opportunities. In addition to its growth over the 13-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 435 interns from cohorts 2007 through 2017, **91% have transferred, earned their Associate of Science or are still enrolled at Hartnell College**. Of the interns who have transferred, **45% have earned their bachelor's degree and 44% are still in progress, and 13% are pursuing graduate work**. 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!

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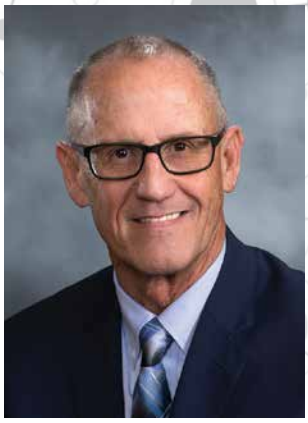




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Hartnell College 13th Annual **STEM** Summer Internship Symposium





Welcome

Dear Friends of Hartnell College,

Welcome to the 13th Annual Hartnell STEM Summer Research Internship Symposium. The symposium is the culmination of our STEM Summer Internship program, which is a special opportunity for students to formally demonstrate their summer research results and celebrate their participation in this unique teaching and learning experience. As an important member of our community, Hartnell College welcomes you to this celebration of student achievement and dedication.

Hartnell is committed to strengthening STEM programs as well as meeting the challenges of providing a well-trained workforce for the Salinas Valley and beyond. This symposium is only one example of how our college is preparing students to meet those challenges.

Since 2006, this unique program has matched student interns with university researchers and industry experts in prestigious laboratories throughout the Central Coast and beyond. These experiences have provided our interns with tremendously empowering tools, not only for university preparation, but also for real-world success.

This year's symposium offers poster sessions, an informational panel of internship alumnus, and a formal program recognizing some of our most valued supporters. We thank you for helping us celebrate the incredible achievements of our students, and we encourage you to engage in the program by asking our students about their summer research projects.

Thank you for your continued support of our students. Together we can realize Hartnell's vision of growing the next generation of leaders through opportunity, engagement, and achievement.

Enjoy the work of our students!

—**Willard Clark Lewallen, Ph.D.**
Superintendent/President, Hartnell College

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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 Partners & Mentors

Bureau of Land Management
Bill Standley

California State University, Monterey Bay
Dr. Steven Kim

CAPE Solution
Walt Duflock

Fremont Peak Observatory
Ron Dammann

Greenfield Community Workshop
Curt Gabrielson
Jose Sánchéz

Hartnell College
Dr. Sewan Fan
Dr. Jeffrey Hughey
Mohammed Hussain
Victoria Hutchins
Laurence London
Dr. Pimol Moth
Brian Palmer
Tito Polo
Alicia Steinhardt
Dr. Mohammed Yahdi

Naval Postgraduate School
Dr. Brij Agrawal
Dr. Justin Brown
Dr. Jeremy Kozdon
Dr. Brandon Naylor
Dr. Andy Nieto
Dr. Wendell Nuss

Smartwash Solutions
Dr. Eric Wilhelmsen

University of California Cooperative Extension
Dr. Richard Smith

University of California, Santa Cruz
Dr. Glenn Millhauser
Christopher Vollmers

United States Department of Agriculture – Agricultural Research Service
Dr. Shyam L. Kandal
Dr. Steve J. Klosterman
Dr. Jim McCreight
Dr. Ivan Simko

United States Department of Agriculture – Natural Resource Conservation Service
Javier Flores



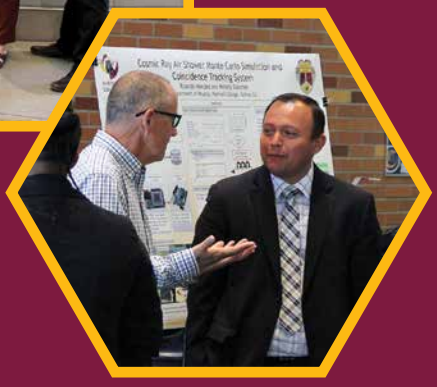
Special thank you to our
Andy Newton STEM Internship Partner Award Winner

Juan M. Alvarez

Central-Northern California & Washington Regional Director
Hispanic Serving Institutions National Program, Office of Partnerships & Public Engagement
United States Department of Agriculture









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STEM

INTERNSHIP PROGRAM 2019

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Greenfield Community Science Workshop



Gustavo Aguilar

Mentor: Curt Gabrielson and José Sánchez

Greenfield Community Workshop

The Greenfield Community Science Workshop is a place where kids can build science projects, work with various power tools and learn the physics behind each experiment for free. The mission of this shop is to work with disadvantaged communities and school districts as well as their schools and teachers. Ultimately the Workshop's goal is to enrich and transform classroom learn into an exciting exploration of the children's environment in all areas of science.

Gustavo Aguilar

Major: Chemistry

Evaluation of a biopesticide for managing downy mildew for spinach in organic production system



Ethnee Aleman

Mentor: Dr. Shyam L. Kandal and
Dr. Steve J. Klosterman

USDA–Agricultural Research Service

In agriculture the containment of pathogens is crucial. It reduces the growth of disease and increases shelf-life. Like many crops, organic spinach faces the hardships of fighting a pathogen. A biopathogen Peronospora effusa, also known as P. effusa for short, is a downy mildew disease that affects organic spinach. With an increase in demand for organic production, the use of pesticides are being replaced by biopesticides. For the experiment we had four beds of spinach and parts of the bed were selected at random for treatment. For downy mildew disease, we used fungicides in our experiment since P. effusa is derived from a group of fungus called oomycetes. The four controlled groups are: Alliete, Procidic, MBI-110, and control. For all three fungicides we calculated the amount needed for 2.9L of water to mix with and would spray once a week. As an intern for the summer, I partnered with USDA ARS to research the effectiveness that the biopesticides had on our spinach. We hope to see that if these biopesticides work, then we can then tell farmers in Monterey County to use them on their crops. This would decrease the use of pesticides, which is favorable since no one knows the real effects pesticides have on the human body over time. With this being said, it also means organic spinach will have a longer shelf-life. Spinach would last fresh longer, and one would save money by not having to waste food and buy more spinach.



Ethnee Aleman

Major: Biochemistry

Cybersecurity Operations Center (CSOC) Internship

Andrea Amezcua

Mentor: Dr. Justin Brown

Naval Postgraduate School



In my project I will study commonly used tools that attackers use to infiltrate a network, and the ways that data analytics is useful for security. One learning objective will be to learn how to think like an attacker and ways they find exploits to stay a step ahead. I will also learn how to differentiate an attack from a normal everyday task and how to trace it back to an attacker. Another learning objective is to detect and prevent an attack before the attacker has time to cause damage. I will learn the fundamentals of cybersecurity and ways to safely and legally mimic an attacker to learn how to defend against attacks.

Learning how attackers think and operate will help me understand how to test and look for exploits to prevent attackers from using such exploits against a network. Part of being a defender and protecting against attacks is being able to think like the attacker and do your best to stay one step ahead of them. Looking for exploits in a safe environment is crucial to be able to know what you are defending against and not being blind to what attacks to defend against.

Being able to tell when a network is being attacked is important to not confuse and everyday normal tasks as an attack. Learning to spot an attack and being able to report it to avoid damage is crucial to any network. This can be actions such as spotting anomalies in the network to be able to tell from a normal user and an attack.

Learning to spot an attack I will learn how to use this information to be able to trace back the attacker. Not only will it help to trace back the source of the attack but to learn about the attack issued and steps I can take to prevent future attacks that are similar. It will enable me to be able to find a quick temporary solution and to then invest time to finding a permanent way to avoid such attacks.

A large part of cybersecurity is to be able to practice attacks and mimic an attacker and using data analytics, Virtual Machines, and Kali to provide a safe testing environment without compromising your own network. This will allow us to attempt to break into our own system to find vulnerabilities and exploits to learn how to think like an attacker. At the same time I will be using data analytics to learn what it looks like from a defender stand point and practice learning what are important things to look for when looking for an attack.

Andrea Amezcua

Major: Computer Science and Information Systems

Math Modeling for Strawberry Production



Rosario Araujo

Mentor: Brian Palmer

Hartnell College/Food Origins

Crop yield forecasting is an important tool needed for the agricultural business to thrive. Yield forecasting will not only benefit farmers' efficiency, but it will create benefits from the farmer through the supply chain to the consumer. It is necessary to model the multiple variables of the farming process in order to produce an accurate yield forecast. Current farming yield forecasting has too much uncertainty, but by adding management variables into the forecast, we greatly reduce the error in yield forecasts. The modeling team used statistical programming to create graphs modeling multiple variables of the crew management. Results include models showing the seasonal curves for each crop variety, distance traveled per unit harvested, time spent per unit harvested, among others, that gives the farmer a management-based forecast to better predict the yields throughout the season. The results of these models will help the farmer better prepare and manage the fields for maximum yields, and will help distributors in managing sales contracts and protecting price integrity. The models will further assist in future research when the individual harvester information is imported in to the research data set.

Rosario Araujo

Major: Computer Science and Information Systems

Cybersecurity Operations Center (CSOC) Internship



Giselle Beltran

Mentor: Dr. Justin Brown

Naval Postgraduate School

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Giselle Beltran

Major: Computer Science and Information Systems

Containerized Micro Grid

Ruben Bravo

Mentor: Dr. Brandon Naylor

Naval Postgraduate School



Power is needed everywhere. Ideally, one would be able to charge their phone or use their computer wherever they are. However, we are limited to the power grids that are already set up, or generators that are inconvenient to carry around, especially if one

The system used to transport fossil fuels is dangerous, costly, and time consuming. Strategic planning has to occur in order to get power where it needs to be, and in certain situations, it does not get there in time. Alternative energy, such as solar, is not practical to use on its own since it is not readily portable or cheap to set up. However, when certain situations occur, such as a truck full of fuel being blow up by enemies, a quick way to get energy to power essential electronics would be ideal.

To address this issue, Brandon Naylor, of the Energy Academic Group at the Naval Post Graduate School, came up with the idea for a containerized Micro-Grid. Essentially it is a power system that would mainly use solar panels to charge a battery bank that would fit inside an ISO shipping container so that the military could easily load it on a boat and take it where it needs to go. To design this system, he had us use knowledge of electrical systems to find parts that would work with each other. However, most of our time was directed towards constructing a data collection system for the battery bank using an arduino and a Raspberry pi. Using these, in combination with programming in C++ and Python, we started the process of creating a system that would monitor the battery bank's charge, charge rate, and energy consumption.

Ruben Bravo

Major: Engineering

Self Sufficient Dual Axis Solar Tracker

Alexis Chavez

Mentor: Dr. Pimol Moth

Hartnell College/California Space Grant Consortium



Solar panels, and solar arrays are very expensive to install and run on various facilities, if the panels are not outputting as much as they potentially could per situation - light conditions- then money is being lost, and potential power is not being generated. An optimization of how each panel captures light could fix the problem and allow the panels to run optimally, without the need to manually track the sun. The optimization refers to the automation of movement of the solar panel towards the most sunlight.

We chose to approach the problem using low cost, low power solutions: we made use of the Arduino microcontroller and simple servos along with a 3D printed structure that allows the servos to move the solar panels based on the light that is present, making use of photoresistors to determine in which direction light is most present, thus moving the panel in that direction. The movement is done by rotating two servos which are each respectively attached to a horizontal gear and a vertical gear, this allows the solar panel to position itself until it is most appropriately facing the brightest direction. The self sufficient aspect comes from the solar panel actually powering the Arduino, allowing it to work continuously. Between the solar panel and Arduino there is a lithium ion polymer (LiPo) battery which simultaneously charges and offloads into the Arduino to power it. The battery allows power to whatever the solar panel is connected to at any time of day, not just while there's sun.

This project represents a concept in pushing solar power even further. This project will allow solar panels to be more optimally used, thus reducing costs and making it more beneficial for people to integrate less solar panels for more power output.

Alexis Chavez

Major: Computer Science and Information Systems

HPC & Climate Modeling in Julia

Guadalupe Cisneros

Mentor: Dr. Jeremy Kozdon

Naval Postgraduate School



This project involved the development of a new climate model using the Julia computer language. It is a joint project with CalTech, MIT, JPL and the Naval Postgraduate math department. Projects included visualization work-flows, GPU computing, mesh generation, testing frameworks for large-scale simulation projects, reading in of topography files, development of new MPI back-end for Julia.

Julia was designed from the beginning for high performance; programs compile to efficient native code for multiple platforms via LLVM. Julia is dynamically-typed, feels like a scripting language, and has good support for interactive use. Julia uses multiple dispatch as a paradigm, making it easy to express many object-oriented and functional programming patterns. The standard library provides asynchronous I/O, process control, logging, profiling, a package manager, and more. Julia is free for everyone to use, and all source code is publicly viewable on GitHub. (https://julialang.org)

Guadalupe Cisneros

Major: Computer Science and Information Systems

University of California Cooperative Extension Research Assistant



Angelita Cisneros-Aguilar

Mentor: Dr. Richard Smith

University of California Cooperative Extension

UC CE
UNIVERSITY OF CALIFORNIA
Agriculture and Natural Resources
Cooperative Extension

Taking the role of being a research assistant isn't easy! Working at the University of California Cooperative Extension (UCCE), Salinas, CA, no day passes by that a discovery is not made. As a research assistant, my roles included; soil and plant sampling and processing, as well as calculating the area of interest for a canopy image to later collect data and transfer that data onto CIMIS. California Irrigation Management Information System (CIMIS) is a system that records hourly weather for roughly 200 stations all over the state of California. Farmers, growers, and other parties utilize this data daily since it provides them with useful information such as temperature and rainfall summaries of the day to day monthly readings.

Farmers rely on data, but how can growers benefit from the data provided by the UCCE? We conduct different trials using different pounds of fertilizer in the fields to see the amount observed in plants and soil. As the trials continue, I collect accurate recordings while processing the samples and then the information is shared. As an eco-friendly valley, we must limit the amount of fertilizer applied, which is cutting the cost of farming and most importantly mitigating water source contamination. Sustainable agriculture, meeting today's needs without compromising tomorrow's!

Angelita Cisneros-Aguilar

Major: Agriculture Production

Self Sufficient Dual Axis Solar Tracker



Michael Delgado

Mentor: Dr. Pimol Moth

Hartnell College/California Space Grant Consortium

Solar panels, and solar arrays are very expensive to install and run on various facilities, if the panels are not outputting as much as they potentially could per situation - light conditions- then money is being lost, and potential power is not being generated. An optimization of how each panel captures light could fix the problem and allow the panels to run optimally, without the need to manually track the sun. The optimization refers to the automation of movement of the solar panel towards the most sunlight.

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This project represents a concept in pushing solar power even further. This project will allow solar panels to be more optimally used, thus reducing costs and making it more beneficial for people to integrate less solar panels for more power output.

Michael Delgado

Major: Computer Science and Information Systems

Motion Following Camera Base

Tyler Doolittle

Mentor: Dr. Pimol Moth

Hartnell College/California Space Grant Consortium



Motion sensors are primarily used for home security systems. With the development of new technology, the use of motion sensors has expanded to everyday life; they are used in the military, agriculture, and even in automatic doors in department stores. Motion sensors use the fundamentals of radar to ultrasonic waves, which is a high frequency that humans cannot hear. These waves are able to travel through air, water, and metal. The aim of this project is to build a motion-following camera base that automatically updates the direction that the camera is pointing in, following where the motion is detected. A wireless camera that streams video and audio is being used for this project, which can be controlled by a phone application. We utilized five motion sensors to cover a visual range of up to 180 degrees. These sensors are connected to a standard servo motor that moves to wherever the motion is detected. This project has a diversity of uses, including use for military and astronomical purposes.

Tyler Doolittle

Major: Computer Science and Information Systems

Developing Effective Fumigants for *Verticillium dahliae*



Meghan Dyck

Mentor: Dr. Steve Klosterman

USDA-Agricultural Research Service

Verticillium dahliae is a soil and seedborne fungus that causes Verticillium wilt disease in various crops, including lettuce, spinach, and strawberries. There are currently no effective fumigants for killing this fungus in seed; the previous fumigant used in soil, methyl bromide, is no longer available due to its ozone-depleting properties. Combinations of NO and NO2 gases are being tested for use as a fumigant; both have proven useful in reducing amounts of other fungi as well as post-harvest pests. This experiment tested 5% NO2 exposure at 35o C for 3 days (T6), 10% NO2 exposure at 35o C for 5 days (T7), and a room temperature control. Each treatment was divided into five replicates. Seeds used for the experiments were either ground in a grinder and plated to examine *V. dahliae*, or whole seeds were used in treatments and plated. Seed germination after treatment was also examined. For ground seed, there was a 74.2% reduction in *V. dahliae* colonies in T6 compared to the control, while there was an 88.6% reduction in T7. For whole seed, infestation was reduced by 26.8% and 45.2% for T6 and T7, respectively, versus the control. An average of 97% of T6, 96% of T7, and 95% of the control germinated. This would indicate that the treatments were effective (with T7 being more effective than T6) in reducing *V. dahliae* infestation without affecting germination. Further investigation into the use of NO2 could result in a fumigant that is environmentally safe and is capable of eliminating *V. dahliae* for use in the agricultural industry.

Meghan Dyck

Major: Chemistry

Natural Resource Conservation Service



Oliver Enriquez

Mentor: Javier Flores

USDA-Natural Resource Conservation Service

During the 1930's A great tragedy known as the Dust Bowl swept through the midwest making its way past the capital and as far east to New York. This catastrophe was caused by severe drought practices that was applied to dry land farming on virgin soil, that before that time, was not used for farming. These practices created something known as the aeolian process (wind erosion) in which the sand transforms into dust. Insufficient knowledge of the ecology of the plains and proper farming methods created storms known as " Black Blizzards" that blew over 100,000,000 acres of soil which eventually turned into dust. Years after the storm settled, on September 12, 1933, the U.S government established the soil conservation service which later became known as the N.R.C.S. Through various engineering and conservation practices such as sediment basins & underground outlets for land erosion control, bio-reactors & wetland restoration sites for treatment of agriculture nutrient rich run-off water, and stock water systems & graze land methods for animal life and proper land use, the N.R.C.S has been able to maintain and conserve various resources beyond soil. It has been able to prevent sediment erosion turning into dust, improve the efficiency use of water, enhance air quality, persevere native ecosystems and plants, and increase animal ecological sites and habitats. Using various surveying methods and equipment, a 3D surface is created on AutoCad Civil 3D to create a design which will address the resource concerns of that client . The use of the Trimble R-10 surveying unit is used to survey, which takes points at a desired location and then uploaded onto Civil 3D using a CSV file through Excel, on a coordinate system. Using the points, a contour - elevation surface is then created on an aerial image of property, which is used for hydrology and hydraulic calculations. Once all necessary information is gathered, the final design is presented to the client for approval and finally constructed.

Oliver Enriquez

Major: Engineering

Optimizing PCR-free protocol for long RNA by testing varying reverse transcriptase



Martin Flores

Mentor: Christopher Vollmers

University of California, Santa Cruz

While traditional PCR methods may be effective for amplification of DNA, RNA must first be copied by reverse transcriptase into DNA to be amplified, adding a layer of variability that is not present in DNA amplification. Additionally, PCR amplification comes with drawbacks as smaller cDNA molecules will be amplified more efficiently than larger cDNA molecules, decreasing the relative amount of large cDNA molecules. Methods for analyzing complete end-to-end of the mRNA molecules are then just limited to small mRNA (<2000 nt long) due to the fragile nature of RNA and the low processivity of many reverse transcriptase. There are, however, highly efficient reverse transcriptase that may be able to produce copies of long RNA strands: MaximaH, and SMARTScribe, each with their own sets of reaction conditions and proofreading abilities. By testing these reverse transcriptases with the ability to capture longer transcripts, PCR-free could be improved to provide a more accurate snapshot of what is happening inside a cell.

Martin Flores

Major: Math/Physics

Modeling of Cancer Risk Using Dose-Response Models



Jenel Fraij

Mentor: Dr. Steven Kim

California State University, Monterey Bay

California State University MONTEREY BAY
Undergraduate Research Opportunities Center

In cancer studies, the common assumption is that the probability of developing cancer increases when we increase the dose of carcinogen, and this is referred to as the monotonic assumption. Alternatively, some researchers argue that the probability of developing cancer might decrease at low doses and increase at high doses, and this is referred to as the hormetic assumption. In our research we develop dose-response models to test for the hormetic assumption. We explore three different models, model 1 is a well-known logistic regression model with a quadratic term, and it can model both monotonic and hormetic assumptions with three parameters. Unlike model 1, model 2 allows discontinuity between the control dose and the other non-zero experimental doses, and it has three parameters as well. Model 3 also allows discontinuity, but it adds flexibility by having a fourth parameter. Our goal is to compare the characteristics of each model under various scenarios by simulations using the statistical software R. When model 1 was true, it performed the best in most cases, but also model 2 performed very well. When model 2 was true, models 2 and 3 were competitive, but Model 1 was not acceptable. When model 3 was true, indeed it performed the best on average. We recommend model 2 to be the best model as it produces slightly higher powers than model 3. Indeed, further studies should be done using other models in order to come up with stronger conclusions about the hormetic assumption.

Jenel Fraij

Major: Mathematics

Fresh Produce Wash Solution Pilot Plant Research Intern



Eli Garcia

Mentor: Dr. Eric Wilhelmsen

Smartwash

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Eli Garcia

Major: Computer Science and Information Systems

Ag Tech Robotic Vision

Andres Garcia Esparza

Mentor: Dr. Sewan Fan

Hartnell College



HARTNELLCOLLEGE

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Andres Garcia Esparza

Major: Computer Science and Information Systems

Crop Yield Forecasting Database Development



Gabriela Gasca

Mentor: Brian Palmer

Hartnell College/Food Origins

Crop yield forecasting is an important tool needed for the agriculture business to thrive. Yield forecasting will not only benefit farmers' efficiency, but it will create benefits from the farmer through the supply chain to the consumer. It is necessary to model the multiple variables of the farming process in order to produce an accurate yield forecast. Current farming yield forecast has too much uncertainty. By adding additional management variables into the forecast, we greatly reduce the error in yield forecasts.

Raw data for strawberry harvests was entered into data sets, and farmers were consulted to interpret raw data for use in the model. Statistical programing was used to sort and combine data sets. Data was sorted and refined for interpretation, and refined data was graphed for further analysis. A second team of interns build a forecasting model based on this data.

The internship resulted in a greatly improved data set for forecasting, which will contribute to the production of algorithms in order to create forecasting tools in the future.

Gabriela Gasca

Major: Agriculture Production

Crop Yield Forecasting Database Development



Jair Gonzalez

Mentor: Brian Palmer

Hartnell College/Food Origins

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Jair Gonzalez

Major: Engineering

Additive Manufacturing of Novel Alloys using Cold Spray

Jose Andres Gonzalez

Mentor: Dr. Andy Nieto

Naval Postgraduate School



Boron Nitride (BN) is a ceramic material which is brittle and stiff in its pure bulk form. Boron nitride nanoplatelets (BNNP) consists of stacks of approximately 10-40 layers of BN. BNNP exhibit kinking and bending of sheets, similar to those observed in other 2D nanomaterials, such as Graphene Nanoplatelets (GNP). These unique structures found in the 2D form can endow a composite with high toughness and efficient strain energy dissipating mechanisms. BN possesses other impressive qualities such as high thermal conductivity and chemical inertness. When incorporated into composites as reinforcement, BN leads to improved mechanical properties such as tensile strength, elasticity, and hardness. This project investigates the possibility of consolidating bulk BNNP composites by incorporating a secondary metallic phase (aluminum) as a binder to aid in the structural stability and integrity of the bulk BNNP material. Bulk BNNP composites could find applications in nuclear shielding and thermal management applications.

Jose Andres Gonzalez

Major: Computer Science and Information Systems

Black Oystercatcher Monitoring Project

Karina Guzman

Mentor: Bill Standley

Bureau of Land Management



The beauty of the California Coastal National Monument (CCNM) attracts tourists from all over the world, as millions of individuals photograph and sight-see from beaches, bluffs, and watercraft. As we inhabit cities, creating our own human environment and lifestyle, it is no question as to why wild life should not have their own home on this planet. With that being said, it is our job to create a home for wildlife, which explains why the CCNM exists. In order to provide protection for wildlife, the monument consists of several coastal areas that are lawfully conserved away from the public. Provided on this monument is a unique coastal habitat found on more than 20,000 rocks, islands, as well as exposed reefs/pinnacles found by the California coastline. Amongst this coastal line inhabits a very under-studied beautiful, territorial shorebird: the black sea oystercatcher (BLOY), which was the focus of my internship. BLOYs only prefer the rocky intertidal found where individuals love to walk out on and snap an awesome photo for their social medias. Over the course of my internship, I went out to the Monterey Peninsula, Pebble Beach, and Point Lobos in order to monitor the reproductive success of known BLOY pairs. About half of BLOY's population is found here in California, and is close to being considered on the list of endangered species under the North American Bird Conservation Initiative (NABCI). Throughout this monitoring experience, it is unfortunate to conclude that reproductive success mainly fails due to constant human impact during BLOY breeding/nesting season, which is usually from February until August. In order to raise awareness about this issue, volunteers and monitors were able to fence up areas where pairs were found nesting. In addition, I was able to join a group of passionate individuals, as well as my supervisor, Bill Standley, who enjoy speaking to the public about shoreline birds and the risk of human impact.

Karina Guzman

Major: Biology

The Effects of High Energy Ball Milling (HEBM) on Metal Powders for Cold Spray Application



Timothy Hanneman

Mentor: Dr. Andy Nieto

Naval Postgraduate School

Cold spray is an exciting additive manufacturing technique, related to 3D printing, used to construct or repair objects by layering material at temperatures under its melting point. The Navy is particularly interested in cold spray research for cost reduction, effective part repair, rapid creation of parts, and developing novel materials. The research involved High Energy Ball Milling (HEBM) of copper (Cu) and stainless steel (Ss) powders to investigate the effective range of their material properties for future investigation. The main powder characteristics under investigation included how Morphology (shape), Particle Size, and Hardness change with varying amounts of ball to powder ratio or time being milled. These factors impact the ability for material powders to flow and bond to a surface. We imaged and quantified the particles aspect ratio and size using a scanning electron microscope. In addition we used a DuraScan 50 to test particle hardness. Conclusions: Ball to Powder ratio has a larger effect on change than cycle time. Aspect ratio showed little change. There were similar, but different scale, trends in increasing hardness for both Cu and Ss.

Timothy Hanneman

Major: Computer Science and Information Systems

USDA Agricultural Research Service Biological Science Aide



Martha Haro

Mentor: Dr. Ivan Simko

USDA-Agricultural Research Service

Over the course of this summer I had the privilege to begin working at the United States Department of Agriculture where I learned many new skills. Among those skills were transplanting, harvesting, pigmentation testing, chlorophyll testing, core measurements, salad processing, shelf life and inoculation. My major focus was centered around salad processing and shelf life.

The main reason for shelf life research is to study different varieties of lettuce to see which ones decay the slowest. The research findings provide important data on which variety is best for stores and can also influence how the lettuce is packaged to extend shelf life.

The research consisted of processing varieties of lettuce through four different stations. Every step was monitored by different interns, everything from location, cutting, weight, rinsing, packaging, and nitrogen exposure were carefully executed.

Martha Haro

Major: Agriculture Production

Ag Tech Robotic Vision

Hernan Hernandez

Mentor: Dr. Sewan Fan

Hartnell College



HARTNELLCOLLEGE

Robotics have been evolving greatly in recent years; making progressive movements in all industries, including agriculture. The aim of this project is to implement computer vision, the process of analyzing and understanding digital images, to acquire the information needed to pinpoint an object. The information will be sent to the robotic arm, which will then move to the specified location. This arm will make it easy to harvest produce (strawberries) because it will allow for autonomous harvesting. Since the project is in the beginning stages, the main goal is for the arm to move in the correct orientation and at the specified speed. Using a 3D camera, such as the Picoflexx, and an object tracking camera, like the Pixy2, coordinates will be obtained. With a C program, the Picoflexx will help to acquire the exact location of the object, as well as using the program with the Pixy 2 to help with color recognition. This will help the robotic arm locate the specific produce that needs to be harvested, thus, allowing for mechanical.

Hernan Hernandez

Major: Engineering

Cybersecurity Operations Center (CSOC) Internship



Francisco Herrera-Guerrero

Mentor: Dr. Justin Brown

Naval Postgraduate School

In my project I will study commonly used tools that attackers use to infiltrate a network, and the ways that data analytics is useful for security. One learning objective will be to learn how to think like an attacker and ways they find exploits to stay a step ahead. I will also learn how to differentiate an attack from a normal everyday task and how to trace it back to an attacker. Another learning objective is to detect and prevent an attack before the attacker has time to cause damage. I will learn the fundamentals of cybersecurity and ways to safely and legally mimic an attacker to learn how to defend against attacks.

Learning how attackers think and operate will help me understand how to test and look for exploits to prevent attackers from using such exploits against a network. Part of being a defender and protecting against attacks is being able to think like the attacker and do your best to stay one step ahead of them. Looking for exploits in a safe environment is crucial to be able to know what you are defending against and not being blind to what attacks to defend against.

Being able to tell when a network is being attacked is important to not confuse and everyday normal tasks as an attack. Learning to spot an attack and being able to report it to avoid damage is crucial to any network. This can be actions such as spotting anomalies in the network to be able to tell from a normal user and an attack.

Learning to spot an attack I will learn how to use this information to be able to trace back the attacker. Not only will it help to trace back the source of the attack but to learn about the attack issued and steps I can take to prevent future attacks that are similar. It will enable me to be able to find a quick temporary solution and to then invest time to finding a permanent way to avoid such attacks.

A large part of cybersecurity is to be able to practice attacks and mimic an attacker and using data analytics, Virtual Machines, and Kali to provide a safe testing environment without compromising your own network. This will allow us to attempt to break into our own system to find vulnerabilities and exploits to learn how to think like an attacker. At the same time I will be using data analytics to learn what it looks like from a defender stand point and practice learning what are important things to look for when looking for an attack.

Francisco Herrera-Guerrero

Major: Computer Science and Information Systems

Tuning a Weather Model

Paulo Jauregui

Mentor: Dr. Wendell Nuss

Naval Postgraduate School



From controlled burns where high winds can quickly spread fire out of control, to launching satellites or having favorable conditions on the battlefield. Successfully forecasting weather phenomena such as cloud formation and wind patterns and speed can mean the difference between a successful or failed mission. Although physics based forecast models are fairly accurate and widely used, leveraging statistics to reduce the error in the physics model should grant closer forecasts. However, there exists a point at which the level of benefits gained is less than the amount of computation invested, our objective is to optimize for that point.

The methods we used to accomplish this aim include: a series of small, deliberately crafted experiments, with the results statistically analyzed to, hopefully, show significant improvement. Tentative results show using a subsample of the available data points rendered a statistically similar result. They also show data collection of only a few days was is enough to more closely predict the forecast. This is significant as results suggest the Navy will be able to leverage the statistical model in data denied regions, such as battlefields, to improve the accuracy of weather forecasting.

Paulo Jauregui

Major: Computer Science and Information Systems

Ag Data Science: Feeding More People



Adolfo Jimenez

Mentor: Brian Palmer

Hartnell College/Food Origins

Today, we have advanced technology that allows us to implement new farming methods for better results and understanding on crop yield numbers. With the help of the R Programming Language, we are able to collect data from the fields that allows the farmers to know what fields have been picked the most and which ones need more time before the crops are ripe for the picking. With the help from Food Origins, we obtain the data from the strawberry fields necessary to analyze the distance from a scanned box to the respective of their field locations and we are also able to calculate the velocity of an individual harvester.

Our team focused on the time and distance it takes to complete a box. These measurements affect the entire supply chain, and we therefore must carefully and accurately measure, analyze, and interpret these metrics, and how they affect yield for individual farmers. The effect on supply chain management potentially has world-wide consequences, and our work establishes this management on a solid foundation of field-level data.

Adolfo Jimenez

Cosmic Ray Array and SiPM Detector Project



Octovio Jimenez

Mentor: Dr. Sewan Fan

Hartnell College

HARTNELLCOLLEGE

Cosmic rays are atom fragments that rain down on the Earth from outside of the solar system. Showers of high energy particles occur when energetic cosmic rays strike the top of the Earth's atmosphere. To measure and analyze these cosmic rays, power boxes, containing power supplies and Photomultiplier sensors, connected to scintillator sheets by enclosed optical fibers that detect and capture cosmic ray events were used. Fixtures, to replace two cosmic ray light sensors, inside wooden power boxes were designed. By having multiple power boxes, the experiment was set up to collect four-fold coincidence data for one detector placed separately at distances from the other two detector boxes. In addition, three cosmic ray detectors placed inside large wooden boxes to make an array of three coincidence detectors were commissioned. Using a program in the Linux OS, this data was analyzed with the use of various statistical methods.

Octavio Jimenez

Major: Engineering

Fresh Produce Wash Solution Pilot Plant Research Intern



Mylisa King

Mentor: Dr. Eric Wilhelmsen

Smartwash

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Mylisa King

Major: Biology

Multi-Wire Proportional Chamber (MWPC) to Accurately Locate Muon Count using GPS Time Tracking



Daniel Lamas

Mentor: Dr. Sewan Fan

Hartnell College

HARTNELLCOLLEGE

A multi-wire proportional chamber (MWPC) is used gain details and information of a particle. This project is designed to accurately locate muon count using GPS time tracking. This will be done using gas detectors in a multi-wire proportional chamber. A muon is a subatomic particle similar to an electron that comes from cosmic rays. The wire chamber frame was designed using computer-aided drafting (CAD) software. A gas mixture of carbon dioxide and argon is filtered into the chamber. Copper was used to cover the top and bottom of the wire chamber. Using computer-aided manufacturing (CAM) software, a circuit board was designed to place inside of the wireframe chamber. This allows a signal to be used to detect the location of muons. A frame was built using plexiglass by cutting the plexiglass using a mill. The multi-wire proportional chamber is powered by a 3000 volt, high voltage power supply. This will cause the wires to create an electric field which will attract electrons and muons to the wires. Future work will include collecting data of pulse shaping wave forms by using Field Programmable Gate Array (fpga) and verilog code for muon coincidences. Final results will be written at the completion of the project.

Daniel Lamas

Major: Engineering

AG Tech Robotic Vision

Christine Lantaca

Mentor: Dr. Sewan Fan

Hartnell College



HARTNELLCOLLEGE

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Christine Lantaca

Fresh Produce Wash Solution Pilot Plant Research Intern



Diego Lucio

Mentor: Dr. Eric Wilhelmsen

Smartwash

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Diego Lucio

Major: Chemistry

Greenfield Community Science Workshop



Alex Lujan

Mentor: Curt Gabrielson and José Sánchez

Greenfield Community Workshop

The Greenfield Community Science Workshop is a place where kids can build science projects, work with various power tools and learn the physics behind each experiment. The Greenfield Community Science Workshop is a place where kids can build science projects, work with various power tools and learn the physics behind each experiment for free. The mission of this shop is to work with disadvantaged communities and school districts as well as their schools and teachers.

Ultimately the Workshop's goal is to enrich and transform classroom learn into an exciting exploration of the children's environment in all areas of science.

Alex Lujan

Major: Mathematics

Our Night Sky: A Closer Look into the Universe



Evelyn Macias Reyes

Mentor: Ron Dammann

Fremont Peak Observatory

Through astronomy people can observe for themselves the wonders of the universe and experience firsthand the beauty of the cosmos. As an ambassador for the Fremont Peak Observatory, assisting the astronomers at the observatory during open public nights, held a few nights a month, was the main objective of the internship. Through the process of hands on training and independent work, I gained hands-on experience setting up, aligning and focusing telescopes ranging in size from 4 - 16 inches in diameter. In addition to working with telescopes I also became accustomed to working with Dobsonian and Equatorial style mounts and using an array of optical equipment. More challenging, in depth and hands-on training was received by working directly with astronomers in order to operate the impressively large 30" Newtonian telescope nicknamed, the "Challenger". I was able to use the experience and skillsets obtained from in classroom studies, to a real-world, hands-on approach manually operating different combinations of astronomy equipment to engage with attending visitors. Using my knowledge and skills I was able to effectively communicate and present the night sky in a fun, educational and interactive way creating an enjoyable and memorable experience for visitors. The summer sky delighted with stunning celestial objects, and through observational astronomy we were able to view an assortment of constellations, binary systems, planetary and deep sky objects. The most popular of the objects viewed included: Jupiter and its moons, Saturn and its rings, globular and open star clusters, the Ring and Swan nebulae, the Whirlpool galaxy, and the moon in conjunction with other various Messier objects.

Evelyn Macias Reyes

Major: Biology

The New-Resistance Breaking Biotype Found in *Nasanovia ribisnigri*



Evelyn Macias Reyes

Mentor: Dr. Jim McCreight

USDA-Agricultural Research Service

The lettuce aphid, *Nasanovia ribisnigri*, is an insect pest that feeds on lettuce in the Salinas Valley of California. Beginning in 1982, resistance to *N. ribisnigri* (Nr:0) was bred into numerous varieties of lettuce, and since then, lettuce containing Nr-based resistance has been the primary mechanism to control this insect pest, both in the Salinas Valley, but also in Europe and Australia. However, in 2007 Nr-based resistance was reported to be ineffective against certain populations of *N. ribisnigri* in Europe, followed by similar reports in Australia in 2017, and in the Salinas Valley in 2018. This resistance-breaking *N.ribisnigri* biotype, referred to as "Nr:1" is morphologically indistinguishable from the susceptible biotype, Nr:0 and to date, no genetic information has been made available to differentiate between the two. Thus the only method to distinguish Nr:1 from Nr:0 is to set up aphid performance bioassays. The objective of this study was to isolate the Nr:1 biotype that was reported to be present in the Salinas Valley and characterize its performance compared to the Nr:0 biotype. In this study, Nr aphids of different life stages collected from lettuce in the Salinas Valley were tested on 3 lettuce varieties with two of them containing Nr-resistance gene and one without. Bioassays contained a leaf disc of each variety with multiple replicates to determine the susceptibility of these lettuce types. Those cultivars of lettuce without the resistance gene deemed to be suitable hosts for *N.ribisnigri* with high reproduction and survival rates. Those with the Nr-resistance gene, although containing a higher mortality rate, still exhibited survival rates, confirming our statement that the Nr-resistance gene has become ineffective against aphids. Overall, this data provides information regarding lettuce aphid population in the Salinas Valley, and can help properly control these pest populations and sustain agricultural prosperity.

Evelyn Macias Reyes

Major: Biology

Fresh Produce Wash Solution Pilot Plant Research Intern



Ricardo Mendez

Mentor: Dr. Eric Wilhelmsen

Smartwash

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Ricardo Mendez

Major: Physics

Cosmic Ray Array and SiPM Detector Project



Kevin Murillo Guizar

Mentor: Dr. Sewan Fan

Hartnell College

HARTNELLCOLLEGE

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Kevin Murillo Guizar

Analysis of Distance, Time, and Velocity: Harvesting Strawberry Fields



Aram Nino

Mentor: Brian Palmer

Hartnell College

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Today, we have advanced technology that allows us to implement new farming methods for better results and understanding on crop yield numbers. With the help of the R Programming Language, we are able to collect data from the fields that allows the farmers to know what fields have been picked the most and which ones need more time before the crops are ripe for the picking. With the help from Food Origins, we obtain the data from the strawberry fields necessary to analyze the distance from a scanned box to the respective of their field locations and we are also able to calculate the velocity of an individual harvester. Our team focused on the time and distance it takes to complete a box. These measurements affect the entire supply chain, and we therefore must carefully and accurately measure, analyze, and interpret these metrics, and how they affect yield for individual farmers. The effect on supply chain management potentially has world-wide consequences, and our work establishes this management on a solid foundation of field-level data.

Aram Nino

Major: Mathematics

Multi-Wire Proportional Chamber (MWPC) to Accurately Locate Muon Count using GPS Time Tracking



Lorenzo Ontiveros

Mentor: Dr. Sewan Fan

Hartnell College

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A multi-wire proportional chamber (MWPC) is used gain details and information of a particle. This project is designed to accurately locate muon count using GPS time tracking. This will be done using gas detectors in a multi-wire proportional chamber. A muon is a subatomic particle similar to an electron that comes from cosmic rays. The wire chamber frame was designed using computer-aided drafting (CAD) software. A gas mixture of carbon dioxide and argon is filtered into the chamber. Copper was used to cover the top and bottom of the wire chamber. Using computer-aided manufacturing (CAM) software, a circuit board was designed to place inside of the wireframe chamber. This allows a signal to be used to detect the location of muons. A frame was built using plexiglass by cutting the plexiglass using a mill. The multi-wire proportional chamber is powered by a 3000 volt, high voltage power supply. This will cause the wires to create an electric field which will attract electrons and muons to the wires. Future work will include collecting data of pulse shaping wave forms by using Field Programmable Gate Array (fpga) and verilog code for muon coincidences. Final results will be written at the completion of the project.

Lorenzo Ontiveros

Major: Engineering

Containerized Micro Grid

Ronel Ordona

Mentor: Dr. Brandon Naylor

Naval Postgraduate School



Power is needed everywhere. Ideally, one would be able to charge their phone or use their computer wherever they are. However, we are limited to the power grids that are already set up, or generators that are inconvenient to carry around, especially if one

The system used to transport fossil fuels is dangerous, costly, and time consuming. Strategic planning has to occur in order to get power where it needs to be, and in certain situations, it does not get there in time. Alternative energy, such as solar, is not practical to use on its own since it is not readily portable or cheap to set up. However, when certain situations occur, such as a truck full of fuel being blow up by enemies, a quick way to get energy to power essential electronics would be ideal.

To address this issue, Brandon Naylor, of the Energy Academic Group at the Naval Post Graduate School, came up with the idea for a containerized Micro-Grid. Essentially it is a power system that would mainly use solar panels to charge a battery bank that would fit inside an ISO shipping container so that the military could easily load it on a boat and take it where it needs to go. To design this system, he had us use knowledge of electrical systems to find parts that would work with each other. However, most of our time was directed towards constructing a data collection system for the battery bank using an arduino and a Raspberry pi. Using these, in combination with programming in C++ and Python, we started the process of creating a system that would monitor the battery bank's charge, charge rate, and energy consumption.

Ronel Ordona

Major: Engineering

Hartnell College Innovation Farm

Gabriel Ortiz

Mentor: Laurence London

Hartnell College

HARTNELLCOLLEGE

AGRICULTURAL BUSINESS AND TECHNOLOGY INSTITUTE

HARTNELLCOLLEGE

The purpose of this project was to help with the rejuvenation of the Hartnell College Innovation Farm at the Hartnell Ranch located at 1752 E. Alisal St. Salinas, CA. Prior to this summer, the farm was left unused and undeveloped, which lead to an abundance of weeds. Weeds are considered any plant in an undesirable location that are detrimental to the desirable crop's yield and quality because of their hardy and vigorous nature. An integration of agriculture, science, and technology are essential applications the farm strives to execute in order to comply with the constantly increasing world population. Over the course of my time as an intern at the Hartnell College Innovation farm, I investigated different pest management practices and crop production methods. The Innovation Farm will assist current/future students with an interest in agriculture explore the dynamics of the agriculture industry such as growing, harvesting, and distributing produce.

I learned how to efficiently operate a tractor and its implements as well as how to weed. I was taught how weeding is a continuous effort that should be implemented regularly during daily strolls amongst one's field to spot and remove undesirable plants during pest monitoring and crop harvesting in order to maintain a healthy field in order to avoid a serious infestation. Continuous weed removal is crucial to a crop's success because they can be easily spread in many different ways such as the wind, water, animals, and people. At our farm, I was able to implement my prior knowledge and be able to scout and identify weeds such as an annual sowthistle, dandelion, common catsear, California burclover, and prostrate knotweed.

In addition, I was able to explore the land-based education programs the Agriculture and Land-Based Training Association (ALBA) had to offer to young aspiring farmers and hard-working low-income farm workers. I worked alongside families of farmers to help harvest, weed, and package their organically grown produce such as kale, celery, and many other vegetables. I learned to considerably value labor-intensive work and continue to pursue my education during my duration at my internship in order to continue to develop innovative and creative solutions to farming.

Gabriel Ortiz

Major: Agriculture Production

Cape Solution Drone Project



Sergio Parra

Mentor: Walt Duflock

Cape Solution

CAPE

The CAPE solution provides real-time drone imagery (both picture and video) with remote control capabilities and the ability to have multiple simultaneous viewers. The solution provides easy-to-use controls to allow people that are located anywhere in the world to control the drone with a keyboard and see exactly what the drone is seeing in a browser window.

CAPE provides a drone solution in two primary markets – law enforcement and energy. For law enforcement, the CAPE solution provides first responder capabilities at a speed that is 90% less than traditional first responders. CAPE drones are able to get to the scene of a reported crime faster than traditional police officers because they don't have to worry about traffic or red lights. Once the CAPE drone is on the scene, law enforcement can see what's happening at the scene through the drone. For energy, the CAPE solution provides remote asset management across large energy production facilities to make sure that equipment is working as expected and if maintenance or on-site inspection is required.

For agriculture, there are many potential use cases. Anytime there is a situation where real-time imagery could help the farmer operate more effectively and/or efficiently, there is a possible use case.

For this internship interns tested the capabilities of the CAPE drone solution for agriculture operations and compared the economics of using the CAPE solution to other options for completing the same activities.

Sergio Parra

Major: Engineering

Fresh Produce Wash Solution Pilot Plant Research Intern



Dominic Pina Montes

Mentor: Dr. Eric Wilhelmsen

Smartwash

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SmartWash Solutions is at the forefront of technological advances in the food processing industry. Years of investment and research have resulted in the integration of SmartWash® in food processing plants across the country with spectacular results. SmartWash Solutions' system of products is the single, most effective solution to prevent food-borne illness outbreaks in processed food. In food processing and fresh-cut produce environments, chlorine is the gold standard in sanitizing product wash water and equipment rinses. Chlorine will destroy bacteria, yeasts, molds, spores and viruses; however, keeping chlorine working at effective levels can be difficult. In addition, organic materials released from cut produce react with chlorine and degrade its efficiency. In food processing and fresh-cut produce environments, chlorine is the most effective sanitizer used for product wash water, food transport flumes, equipment rinses and hand dips due to its ability to significantly reduce levels of bacteria, yeasts, molds, spores and viruses. The key, however, is balance. Of the multiple forms of chlorine added to wash water, sodium hypochlorite is the most widely used for food processing. When dissolved in water, sodium hypochlorite forms three derivatives of free chlorine: hypochlorite ion, chlorine diatom and hypochlorous acid. In concentration, hypochlorous acid is the most effective biocidal form of chlorine. In addition, the chlorine diatom is able to breach bacterial cell walls, generating additional hypochlorous acid in the cytoplasm. This combination allows for the greatest antimicrobial effect in solution. When SmartWash® chemicals are introduced to chlorine-based wash systems, they increase the formation of hypochlorous acid and chlorine diatom while minimizing creation of the more ineffective hypochlorite ion. The SmartWash family of chemicals includes revolutionary food wash solutions that boost and stabilize the pathogen-fighting power of chlorine-based wash systems. SmartWash is able to substantially reduce the spread of harmful pathogens and the USDA has verified these findings. Our integrated system of products enables you to monitor, control and maintain optimal levels of free chlorine to ensure consistent and effective removal of microbial contaminants, stopping outbreaks and recalls before they happen. This internship is located at the SmartWash pilot plant and interns perform investigations regarding the efficacy of various solutions on preventing food-borne pathogens from entering the food system.

Dominic Pina Montes

Major: Biology

Motion Following Camera Base

Nicole Polo

Mentor: Dr. Pimol Moth

Hartnell College/California Space Grant Consortium



Motion sensors are primarily used for home security systems. With the development of new technology, the use of motion sensors has expanded to everyday life; they are used in the military, agriculture, and even in automatic doors in department stores. Motion sensors use the fundamentals of radar to ultrasonic waves, which is a high frequency that humans cannot hear. These waves are able to travel through air, water, and metal. The aim of this project is to build a motion-following camera base that automatically updates the direction that the camera is pointing in, following where the motion is detected. A wireless camera that streams video and audio is being used for this project, which can be controlled by a phone application. We utilized five motion sensors to cover a visual range of up to 180 degrees. These sensors are connected to a standard servo motor that moves to wherever the motion is detected. This project has a diversity of uses, including use for military and astronomical purposes.

Nicole Polo

Major: Engineering

AG Tech Robotic Vision

Nicole Polo

Mentor: Dr. Sewan Fan

Hartnell College



HARTNELLCOLLEGE

Robotics have been evolving greatly in recent years; making progressive movements in all industries, including agriculture. The aim of this project is to implement computer vision, the process of analyzing and understanding digital images, to acquire the information needed to pinpoint an object. The information will be sent to the robotic arm, which will then move to the specified location. This arm will make it easy to harvest produce (strawberries) because it will allow for autonomous harvesting. Since the project is in the beginning stages, the main goal is for the arm to move in the correct orientation and at the specified speed. Using a 3D camera, such as the Picoflexx, and an object tracking camera, like the Pixy2, coordinates will be obtained. With a C program, the Picoflexx will help to acquire the exact location of the object, as well as using the program with the Pixy 2 to help with color recognition. This will help the robotic arm locate the specific produce that needs to be harvested, thus, allowing for mechanical.

Nicole Polo

Major: Engineering

Cape Solution Drone Project



Nicole Polo

Mentor: Walt Duflock

Cape Solution

CAPE

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Nicole Polo

Major: Engineering

Canary, Wireless Four-Wheeled Land Rover

Alejandra Nathalie Ponce

Mentor: Dr. Pimol Moth

Hartnell College/California Space Grant Consortium



Unknown to most, it was not until the late 1980's that the mining tradition of using canaries in coal mines, to detect carbon monoxide and other toxic gases before they harmed humans, ended. The purpose behind this project was to create a machine capable of exploring potentially hazardous environments without risk to any life. The approach used to successfully achieve this goal, was to build a wireless four wheel drive land rover, appropriately named Canary. The rover will be programmed using C/C++ code and equipped with various gas analyzing sensors as well as an ultrasonic sensor to avoid obstacles. Not only will it tell the temperature of the surrounding area, the rover can also alert explorers of the different levels of gases in the atmosphere, such as methane and oxygen. This information allows workers to determine whether a specific environment is potentially dangerous or at no risk. The exploring Canary rover is handy, easily portable, automated, and notably inexpensive.

Alejandra Nathalie Ponce

Major: Biology

Improving, Conserving and Protecting Natural Resources



Alex Ramos

Mentor: Javier Flores

USDA-Natural Resource Conservation Service

Soil erosion and inefficient use of natural resources can have a detrimental effect to our environment as seen during the Dust Bowl in the 1930s. Incorrect farming practices were being implemented causing damage to the ecology and agriculture of American soil. As a result, wind erosion of the topsoil created severe dust storms that reached across the nation forcing people to move out of the affected areas. The Natural Resources Conservation Service (NRCS) under the United States Department of Agriculture, dedicates their time and resources helping farmers and ranchers help the land to prevent a similar problem from reoccurring. They achieve this goal by applying the best practices to improve, conserve, and protect the client's natural resources. Our task was working alongside the field office engineer in creating CAD drawings in AutoCAD Civil 3D that best worked with the client's need as well as doing field inspections on finished projects. This consisted of us going out to the field surveying plots using the Trimble R10 survey equipment in order to collect data such as elevation, benchmarks, and anything that may cause an issue within our design concept. When projects are completed, the construction on the project site is given a final inspection to make sure everything was done up to standards and specified CAD designs. The result of doing all this important work allows the NRCS to prevent and minimize soil erosion and the inefficient use of natural resources.



Alex Ramos

Major: Engineering

Crop Yield Forecasting Database Development



Joseph Randolph

Mentor: Brian Palmer

Hartnell College/Food Origins

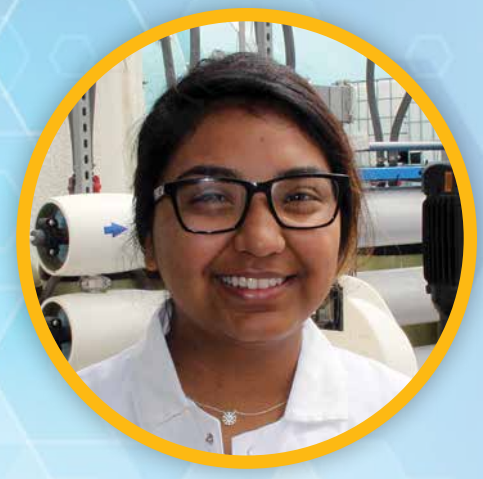
Crop yield forecasting is an important tool needed for the agriculture business to thrive. Yield forecasting will not only benefit farmers' efficiency, but it will create benefits from the farmer through the supply chain to the consumer. It is necessary to model the multiple variables of the farming process in order to produce an accurate yield forecast. Current farming yield forecast has too much uncertainty. By adding additional management variables into the forecast, we greatly reduce the error in yield forecasts.

Raw data for strawberry harvests was entered into data sets, and farmers were consulted to interpret raw data for use in the model. Statistical programing was used to sort and combine data sets. Data was sorted and refined for interpretation, and refined data was graphed for further analysis. A second team of interns build a forecasting model based on this data.

The internship resulted in a greatly improved data set for forecasting, which will contribute to the production of algorithms in order to create forecasting tools in the future.

Joseph Randolph

Fresh Produce Wash Solution Pilot Plant Research Intern



Paola Razo

Mentor: Dr. Eric Wilhelmsen

Smartwash

SmartWash Solutions is at the forefront of technological advances in the food processing industry. Years of investment and research have resulted in the integration of SmartWash® in food processing plants across the country with spectacular results. SmartWash Solutions' system of products is the single, most effective solution to prevent food-borne illness outbreaks in processed food. In food processing and fresh-cut produce environments, chlorine is the gold standard in sanitizing product wash water and equipment rinses. Chlorine will destroy bacteria, yeasts, molds, spores and viruses; however, keeping chlorine working at effective levels can be difficult. In addition, organic materials released from cut produce react with chlorine and degrade its efficiency. In food processing and fresh-cut produce environments, chlorine is the most effective sanitizer used for product wash water, food transport flumes, equipment rinses and hand dips due to its ability to significantly reduce levels of bacteria, yeasts, molds, spores and viruses. The key, however, is balance. Of the multiple forms of chlorine added to wash water, sodium hypochlorite is the most widely used for food processing. When dissolved in water, sodium hypochlorite forms three derivatives of free chlorine: hypochlorite ion, chlorine diatom and hypochlorous acid. In concentration, hypochlorous acid is the most effective biocidal form of chlorine. In addition, the chlorine diatom is able to breach bacterial cell walls, generating additional hypochlorous acid in the cytoplasm. This combination allows for the greatest antimicrobial effect in solution. When SmartWash® chemicals are introduced to chlorine-based wash systems, they increase the formation of hypochlorous acid and chlorine diatom while minimizing creation of the more ineffective hypochlorite ion. The SmartWash family of chemicals includes revolutionary food wash solutions that boost and stabilize the pathogen-fighting power of chlorine-based wash systems. SmartWash is able to substantially reduce the spread of harmful pathogens and the USDA has verified these findings. Our integrated system of products enables you to monitor, control and maintain optimal levels of free chlorine to ensure consistent and effective removal of microbial contaminants, stopping outbreaks and recalls before they happen. This internship is located at the SmartWash pilot plant and interns perform investigations regarding the efficacy of various solutions on preventing food-borne pathogens from entering the food system.

Paola Razo

Major: Engineering

Canary, Wireless Four-Wheeled Land Rover



Andres Reyes

Mentor: Dr. Pimol Moth

Hartnell College/California Space Grant Consortium

Exploration has been a big part of human life, from traveling across the Atlantic, to travelling to the Moon. Animals have been used in the past as a way to avoid human harm, an example would be canaries used in caves to test if the cave would be suitable for exploration. If the canary returned that meant that the cave was suitable for exploration, else it meant it was too dangerous for humans. Technology has advanced from those days and now robots can be sent to do tests instead of harming animals. This project consisted of designing a rover, named Canary, which will be able identify temperature, oxygen levels, and proximity to objects. An Arduino is being used to control the rover and collect data.

Andres Reyes

Major: Engineering

Synthesis and Characterization of Bulk Boron Nitride Nanoplatelets



Andrew Reyes

Mentor: Dr. Andy Nieto

Naval Postgraduate School

Boron Nitride (BN) is a ceramic material which is brittle and stiff in its pure bulk form. Boron nitride nanoplatelets (BNNP) consists of stacks of approximately 10-40 layers of BN. BNNP exhibit kinking and bending of sheets, similar to those observed in other 2D nanomaterials, such as Graphene Nanoplatelets (GNP). These unique structures found in the 2D form can endow a composite with high toughness and efficient strain energy dissipating mechanisms. BN possesses other impressive qualities such as high thermal conductivity and chemical inertness. When incorporated into composites as reinforcement, BN leads to improved mechanical properties such as tensile strength, elasticity, and hardness. This project investigates the possibility of consolidating bulk BNNP composites by incorporating a secondary metallic phase (aluminum) as a binder to aid in the structural stability and integrity of the bulk BNNP material. Bulk BNNP composites could find applications in nuclear shielding and thermal management applications.

Andrew Reyes

Major: Engineering

Development of Educational Modeling Tool FUSED

Chris Rodriguez

Mentor: Dr. Brandon Naylor

Naval Postgraduate School



The Navy has recently made fuel efficiency a priority, but efficient fuel usage often comes at a cost. Policies and practices for surface ship operation have been established to minimize the risk to which ships are exposed, but these often involve operating in a way that reduces overall fuel efficiency. But lowered fuel efficiency introduces its own risks; ships are very vulnerable while refueling, and needing to refuel frequently reduces operational capability. FUSED can be used to model the fuel usage of the surface fleet while operating under different policy sets. The user can then see how different policy changes affect how often a ship or group needs to refuel. With this information, the user can make an informed decision when comparing the benefit of a new policy or practice against the expected risk.

Chris Rodriguez

Major: Computer Science and Information Systems

The Importance of Melanocortin Receptor Accessory Protein 2 Dimerization in the Regulation of Receptors and Ion Channels.



Rosa Sanchez

Mentor: Dr. Glenn Millhauser

University of California, Santa Cruz

The melanocortin receptor accessory protein 2 (MRAP2) is a single pass-transmembrane protein involved in the regulation of melanocortin receptors. MRAP2 exists as an anti-parallel homodimer at the cell surface. Currently it is not known whether dimerization is important for the function of MRAP2. MRAP2 is found in the hypothalamus part of the brain where it behaves as a regulator for the melanocortin-4 receptor (MC4R). The purpose of MRAP2 and MC4R is to maintain energy balance and glucose homeostasis in mammals. The oligomeric state by which MRAP2 regulates MC4R is not well understood. The goal of this experiment is to discover if MRAP2 dimerization is necessary for its function and we will test this by generating a monomeric mutant. It has been previously shown that the dimerization interface of MRAP2 is its transmembrane domain. We created a mutant of MRAP2 by replacing its transmembrane domain with the transmembrane domain of receptor activating membrane protein 1 (RAMP1). We used gene design, co-immunoprecipitation, and western blotting to reach our goal. We expect that results will shot that MRAP2 dimerization is necessary for its regulation over receptor proteins and ion channels.

Rosa Sanchez

Major: Biology

Math Modeling for Strawberry Production



Jerri Schorr

Mentor: Brian Palmer

Hartnell College/Food Origins

Crop yield forecasting is an important tool needed for the agricultural business to thrive. Yield forecasting will not only benefit farmers' efficiency, but it will create benefits from the farmer through the supply chain to the consumer. It is necessary to model the multiple variables of the farming process in order to produce an accurate yield forecast. Current farming yield forecasting has too much uncertainty, but by adding management variables into the forecast, we greatly reduce the error in yield forecasts. The modeling team used statistical programming to create graphs modeling multiple variables of the crew management. Results include models showing the seasonal curves for each crop variety, distance traveled per unit harvested, time spent per unit harvested, among others, that gives the farmer a management-based forecast to better predict the yields throughout the season. The results of these models will help the farmer better prepare and manage the fields for maximum yields, and will help distributors in managing sales contracts and protecting price integrity. The models will further assist in future research when the individual harvester information is imported in to the research data set.

Jerri Schorr

Major: Mathematics

Our Night Sky: A Closer Look into the Universe



Leslee Still

Mentor: Ron Dammann

Fremont Peak Observatory

Through astronomy people can observe for themselves the wonders of the universe and experience firsthand the beauty of the cosmos. As an ambassador for the Fremont Peak Observatory, assisting the astronomers at the observatory during open public nights, held a few nights a month, was the main objective of the internship. Through the process of hands on training and independent work, I gained hands-on experience setting up, aligning and focusing telescopes ranging in size from 4 - 16 inches in diameter. In addition to working with telescopes I also became accustomed to working with Dobsonian and Equatorial style mounts and using an array of optical equipment. More challenging, in depth and hands-on training was received by working directly with astronomers in order to operate the impressively large 30" Newtonian telescope nicknamed, the "Challenger". I was able to use the experience and skillsets obtained from in classroom studies, to a real-world, hands-on approach manually operating different combinations of astronomy equipment to engage with attending visitors. Using my knowledge and skills I was able to effectively communicate and present the night sky in a fun, educational and interactive way creating an enjoyable and memorable experience for visitors. The summer sky delighted with stunning celestial objects, and through observational astronomy we were able to view an assortment of constellations, binary systems, planetary and deep sky objects. The most popular of the objects viewed included: Jupiter and its moons, Saturn and its rings, globular and open star clusters, the Ring and Swan nebulae, the Whirlpool galaxy, and the moon in conjunction with other various Messier objects.

Leslee Still

Major: Mathematics

Canary Rover for Cave Exploration



Ismah Suddin

Mentor: Dr. Pimol Moth

Hartnell College/California Space Grant Consortium

Unknown to most, it was not until the late 1980's that the mining tradition of using canaries in coal mines, to detect carbon monoxide and other toxic gases before they harmed humans, ended. The purpose behind this project was to create a machine capable of exploring potentially hazardous environments without risk to any life.

Technology has advanced from those days and now the option to send robots to complete these tests instead of harming animals is an option. Rovers have been used in recent years to explore space and have evolved greatly. Rovers can now find water in rocks, measure temperature and oxygen levels.

Canary, the rover developed for this project, runs off of Arduino code, sensors, an Arduino, a Bluetooth relay, and a motor driver. It uses a Li Ion battery to power the system, and has four DC motor wheels. It works by surveying the land and communicating back to users the condition of the rover's environment. Canary can communicate with an android phone. During the testing phase, Canary will be run over various types of terrain similar to what would be encountered in real life scenarios.

Ismah Suddin

Major: Computer Science and Information Systems

Motion Following Camera Base



Lisette Tapia

Mentor: Dr. Pimol Moth

Hartnell College/California Space Grant Consortium

Motion sensors are primarily used for home security systems. With the development of new technology, the use of motion sensors has expanded to everyday life; they are used in the military, agriculture, and even in automatic doors in department stores. Motion sensors use the fundamentals of radar to ultrasonic waves, which is a high frequency that humans cannot hear. These waves are able to travel through air, water, and metal. The aim of this project is to build a motion-following camera base that automatically updates the direction that the camera is pointing in, following where the motion is detected. A wireless camera that streams video and audio is being used for this project, which can be controlled by a phone application. We utilized five motion sensors to cover a visual range of up to 180 degrees. These sensors are connected to a standard servo motor that moves to wherever the motion is detected. This project has a diversity of uses, including use for military and astronomical purposes.

Lisette Tapia

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Lisette Tapia

Hartnell College Innovation Farm



Mitzy Tejada

Mentor: Laurence London

Hartnell College

HARTNELLCOLLEGE

For my summer project I worked with a group of other students to renovate and refurbish the new innovation farm. The land had been left unattended for a long period of time which caused challenges to get the farm up and going quickly. A lot of the tasks were hands-on as well as research based.

The internship consisted of complete renovation from the weeding of the land to completing an assessment of the irrigation system. As a group we were also tasked with researching various types of crops to see what could be grown based on the different seasons and soil types. An agreement was reached and a plan was presented to our mentor.

Aside from our group projects, I was tasked with completing a risk assessment of the farm. The risk assessment provided us with hazards (biological, physical, and chemical) we had at the farm. I then evaluated each hazard and noted the harm it could cause.

Throughout my internship I enjoyed the challenges that came along every day and knowing that I helped set the foundation for the new innovation farm, as well as learning the values and importance of safety in agriculture.

Mitzy Tejada

Major: Food Safety

Fresh Produce Wash Solution Pilot Plant Research Intern



Ruben Tinajero

Mentor: Dr. Eric Wilhelmsen

Smartwash

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Ruben Tinajero
Major: Biology/Chemistry

Spacecraft Research and Design Center

Nancy Valdez

Mentor: Dr. Brij Agrawal

Naval Postgraduate School



Due to the growing progression of machine learning and increased usage of artificially intelligent drones, it has become a concern for national safety during warfare as to how this could be combatted. Swarms of thousands of drones may be able to work together to attack targets in a coordinated and sustained manner, which makes withstanding against them an incredibly difficult and complicated task. Any country with tenacious manufacturing is able to produce these weapons, therefore defending against them is vital to national security. Our goal was to train object detection classifying algorithms to recognize drones and identifying the type of drone it is. This would allow military forces to track them down, target them, and neutralize them with high energy lasers. Using Tensor Flow, which is an open-source software library, we narrowed our focus to three algorithms: Retina Net, YOLO, and SSD, which are three of the fastest publicly available algorithms for object detection. From these three algorithms, we wanted to compare their speed and accuracy when training and testing the same data set of drones. We were provided with a data set of ten different drones and over two hundred thousand synthetically generated images of each drone tilted in a different position, with a difference of six degrees from the previous image. To begin this process, we were provided tutorials on jupyter notebook by our mentor regarding Convolutional Neural Networks (CNN) and deep learning fundamentals to give us a good basis for understanding how the process is carried out. We then began learning the theory behind each algorithm and how their functions differ behind the scenes. We also attempted to follow several step by step tutorials online that applied to well-known data sets consisting of common objects to get a feel for how implementing the algorithms works. I was able to successfully run an object detection classifier with common objects using YOLO through the computer's webcam in real-time, however, implementing this to our custom drone data set proved to be more complicated. Through trial and error, we were able to convert our json files into csv file versions and divided them into an 80 to 20 ratio of training and testing files, respectively, that Tensor Flow is able to work with. We then utilized these files with Retina Net and got excellent results with a mAP of 1.000 and 4.4 fps. Keeping in mind that in data sets that are less uniform and reflect the real world better, it may be necessary to test and train on more diverse images. The continuation of this project would consist of attempting to train and test with SSD and YOLO to then compare the three. We would have also liked to include the detection of the drones' angle position. To determine the drones' positional angle, we would use the Dahlgren data set and supplement that with data from the adaptive optics testbed. The adaptive optics testbed will have a 3D printed model drone moving through different positions on a video feed while simultaneously sending us the drone's position. This will allow us to train the model with video that can incorporate turbulence. If we know the pose and how the drone has moved previously, we will be able to predict where it will move to. If we know where the drone will be and the type of drone, we will be able to hit its weakest point when the system is combined with a high energy laser.

Nancy Valdez

Major: Computer Science and Information Systems

Multi-Wire Proportional Chamber (MWPC) to Accurately Locate Muon Count using GPS Time Tracking



Connie Valles

Mentor: Dr. Sewan Fan

Hartnell College

HARTNELLCOLLEGE

A multi-wire proportional chamber (MWPC) is used gain details and information of a particle. This project is designed to accurately locate muon count using GPS time tracking. This will be done using gas detectors in a multi-wire proportional chamber. A muon is a subatomic particle similar to an electron that comes from cosmic rays. The wire chamber frame was designed using computer-aided drafting (CAD) software. A gas mixture of carbon dioxide and argon is filtered into the chamber. Copper was used to cover the top and bottom of the wire chamber. Using computer-aided manufacturing (CAM) software, a circuit board was designed to place inside of the wireframe chamber. This allows a signal to be used to detect the location of muons. A frame was built using plexiglass by cutting the plexiglass using a mill. The multi-wire proportional chamber is powered by a 3000 volt, high voltage power supply. This will cause the wires to create an electric field which will attract electrons and muons to the wires. Future work will include collecting data of pulse shaping wave forms by using Field Programmable Gate Array (fpga) and verilog code for muon coincidences. Final results will be written at the completion of the project.

Connie Valles

Major: Engineering

Self Sufficient Dual Axis Solar Tracker



Frances Wong

Mentor: Dr. Pimol Moth

Hartnell College/California Space Grant Consortium

Solar panels, and solar arrays are very expensive to install and run on various facilities, if the panels are not outputting as much as they potentially could per situation - light conditions- then money is being lost, and potential power is not being generated. An optimization of how each panel captures light could fix the problem and allow the panels to run optimally, without the need to manually track the sun. The optimization refers to the automation of movement of the solar panel towards the most sunlight.

We chose to approach the problem using low cost, low power solutions: we made use of the Arduino microcontroller and simple servos along with a 3D printed structure that allows the servos to move the solar panels based on the light that is present, making use of photoresistors to determine in which direction light is most present, thus moving the panel in that direction. The movement is done by rotating two servos which are each respectively attached to a horizontal gear and a vertical gear, this allows the solar panel to position itself until it is most appropriately facing the brightest direction. The self sufficient aspect comes from the solar panel actually powering the Arduino, allowing it to work continuously. Between the solar panel and Arduino there is a lithium ion polymer (LiPo) battery which simultaneously charges and offloads into the Arduino to power it. The battery allows power to whatever the solar panel is connected to at any time of day, not just while there's sun.

This project represents a concept in pushing solar power even further. This project will allow solar panels to be more optimally used, thus reducing costs and making it more beneficial for people to integrate less solar panels for more power output.

Frances Wong

Major: Engineering

Cosmic Ray Array and SiPM Detector Project



Jose Zavala

Mentor: Dr. Sewan Fan

Hartnell College

HARTNELLCOLLEGE

Cosmic rays are atom fragments that rain down on the Earth from outside of the solar system. Showers of high energy particles occur when energetic cosmic rays strike the top of the Earth's atmosphere. To measure and analyze these cosmic rays, power boxes, containing power supplies and Photomultiplier sensors, connected to scintillator sheets by enclosed optical fibers that detect and capture cosmic ray events were used. Fixtures, to replace two cosmic ray light sensors, inside wooden power boxes were designed. By having multiple power boxes, the experiment was set up to collect four-fold coincidence data for one detector placed separately at distances from the other two detector boxes. In addition, three cosmic ray detectors placed inside large wooden boxes to make an array of three coincidence detectors were commissioned. Using a program in the Linux OS, this data was analyzed with the use of various statistical methods.

Jose Zavala

Major: Engineering

Natural Resource Conservation Service



Angelica Zavala

Mentor: Javier Flores

USDA-Natural Resource Conservation Service

Natural resources are materials that occur naturally. There are lots of natural resources, but two of the most important are soil and water. If we over use them or don't know the correct practices to take care of them, it can affect the environment and all living things. The Natural Resources Conservation Service (NRCS) is dedicated to improve, protect, and conserve natural resources on agricultural lands where soil erosion and low quality of water are a concern. Also, NRCS offers financial and technical assistance through conservation practices to help farmers make and maintain improvements on their land. For each new project, alongside the field office engineer Javier Flores, we identify the current problems of the client's property, and analyze the issues by utilizing certain websites such as Web Soil Survey and NOAA Atlas 14. Such websites serve to facilitate the evaluation of what type of soil there is in the area and to examine its hydrology. Sometimes it is necessary to survey the land to make a CAD design in order to provide the client with the best practice to solve his/her problem. Finally, we provide the client with a solution, we inspect it and if everything looks good, the engineer approves it and makes the necessary recommendations to maintain it. By doing this internship, I learned how valuable and important our natural resources are. Without them, living things would fail to flourish and thrive.

Angelica Zavala Lara

Major: Engineering

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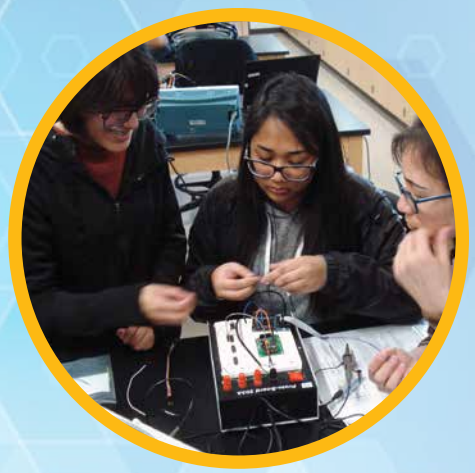
STEM

INTERNSHIP PROGRAM 2019

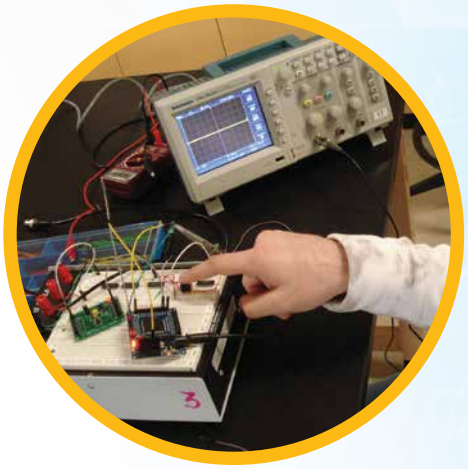
Micro Internships

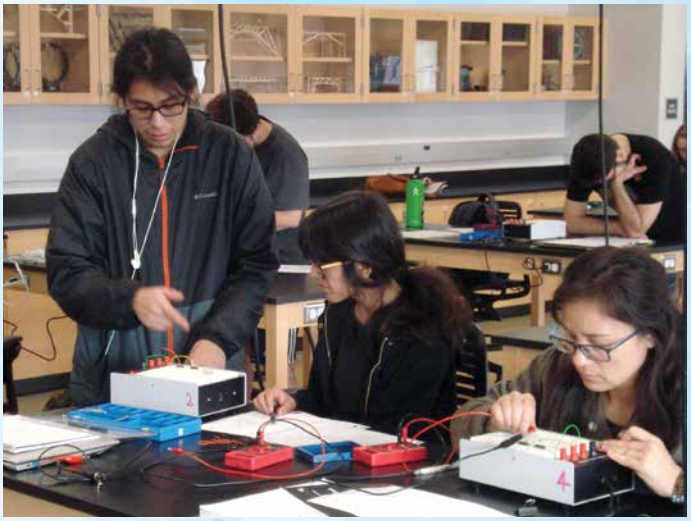
MICRO INTERNSHIP:
Applied Learning Experience in Modern Digital Logic Design (ALE-MDLD)

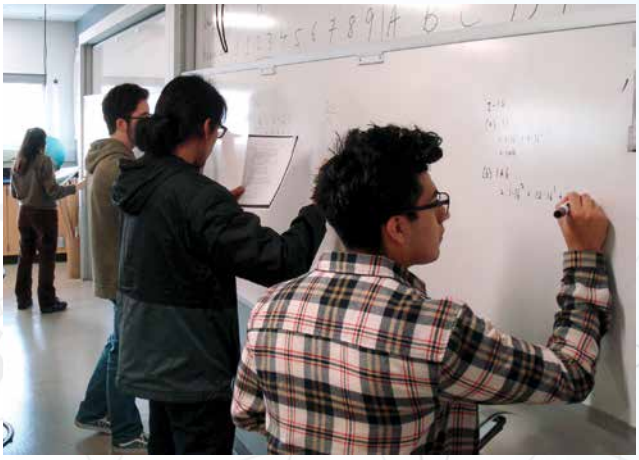
Mentor: Dr. Sewan Fan



The ALE-MDLD project involved 8 Hartnell College National Science Foundation Applied Learning fellows to apply, learn and develop hardware and software using configurable semiconductor logic integrated circuit, the field programmable gate array (FPGA) device. This project involved Applied Learning fellows to conduct 25 hours hands-on learning with in-depth activities during winter break of January 2019. The following items were completed at the ALE meetings.









MICRO INTERNSHIP:
Arduino and Oscilloscope

Mentor: Tito Polo



This goal of this micro internship was for students to learn and understand what Arduino is and how it works. The students designed and built several projects using Arduino. They learned Arduino programming concepts and best practices for programming. At the same time, concepts on different electronics components, reading resistors, capacitors, and working with breadboards were discussed. Digital and Analog circuits were discussed as well as how they work with the Arduino board. Students learned to use measurement electronic equipment such as the oscilloscope, voltmeter, and ammeter to measure signal from Arduino using the oscilloscope.

Skills learned:

- Arduino / Arduino Programming (C/C++)
- Reading Resistors / Capacitors
- Breadboard Circuit Building
- Introduction to Digital and Analog Circuits
- Computer Programming Best Practices
- Oscilloscope / Multimeter





MICRO INTERNSHIP:
Artificial Intelligence and Machine Learning

Mentor: Mohammed Hussain



Students:

Adam Goodell
Adan Navarro Cruz
Adolfo Jimenez
Alejandra Ponce
Alex Lujan
Alexis Chavez
Alexis Zarate
Andres Garcia Esparza
Andres Soria Cisneros
Anthony Rubio
Breanna Holloman
Carlos Mendez Morales
Cesar Virgen
Chris Rodriguez
Christophe Essert
Deborah Meda
Deion Hernandez
Diana Bernal
Diego Llamas
Eduardo Diaz
Eduardo Sediles
Elizabeth Tulud
Enzo Flores
Erika Pina Vasquez
Frances Wong
Hernan Hernandez
Isabel Perez
Ismah Uddin
Jamielle Maniulit
Jared Lopez Leon
Jaskaran Chohan
Jennifer Martinez
Jerrod Gamotan
Jesus Rodriguez Canseco
Jesus Sanchez
Jim Cabrera
Joe Monteagudo
John Black
Jonathan Nachazel
Jose Oviedo-Woo
Jose Zavala
Joseph Sloan
Joshua Gonzales
Justin Garcia
Kimberly Manzano
Kyle Batalla
Lorenzo Ontiveros
Luis Resendiz Blas
Marco Ochoa Ruiz
Michael Delgado
Michael Garcia-Perez
Miguel Estrada
Mike Sanchez
Misael Guijarro
Nicole Polo
Noah Sheets
Noemi Amezcua Moreno
Oscar Ramirez Hernandez
Pedro Leal MacHado
Raul Perez
Rodolfo Hernandez Lorenzo
Ruben Bravo
Sergio Garcia Cortez
Sergio Parra
Shane Martinez
Suzanne Frausto
Thomas Balian
Tyler Doolittle
Tyler Koran
Victor Mesina
Wyatt Conner
Xavier Vela-Crespo
Yeritzi Victoria

Artificial Intelligence (AI) already touches many aspects of our everyday life and is likely to touch almost every facet of our lives in the near future. It is one of today's data driven cutting edge technologies. Students learned about AI through application of basic mathematical concepts such as exponential and logarithmic functions, and matrices; concepts understandable for a student who has taken intermediate algebra. Students used publicly available datasets and analyzed them using AI/Machine Learning (ML) models, particularly using two of the most important data analysis ML models, regression and classification problems. Participants explored applications of advanced computer science topics such as, computer vision, object detection, self-driving cars, etc. Activities focused on application to specific real life problems, including those in industry, business and economics.

MICRO INTERNSHIP:
Bacteria in Monterey Bay Water Systems



Mentor: Victoria Hutchins

Students: Abbey Plascencia, Alejandra Alvarez, Berenice Lopez, Cesar Virgen, Evanita Delafuente, Karina Almanza

During this project students looked at the abundance of bacteria in various locations within Monterey County. Students designed their own project around this idea by using the scientific method to design an experiment and test their hypotheses. Students used the following lab equipment and procedures for their project: multiple tube fermentation, serial dilution, incubators, and computers.

Student outcomes:

- Practiced lab technique and proper use of equipment
- Organized raw data for analysis
- Created graphs and tables
- Wrote a research paper based on findings





MICRO INTERNSHIP:
Electronic Soldering, EAGLE software, and Power Supply Assembly



Mentor: Tito Polo

Students: Frances Wong, Sergio Parra, Ronel Ordona, Nicole Polo, Israel Galaz, Angelica Zavala, Jose Ramos, Alejandro Bueno, Deion Hernandez, Adam Goodell

Arduino design has been at the front of user-friendly software and hardware development, especially for students. In this project, students developed their skills in this area by learning Arduino programming concepts and best practices for programming. Students took part in 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.

At the same time, students learned the concepts of different electronic components, like reading resistors, capacitors, working with breadboards, and measuring signals from Arduino boards using oscilloscopes. Digital and Analog circuits were discussed and how they work with Arduino boards. Students soldered electronic components onto breadboards and learned to use electrical measuring equipment such as the oscilloscope, voltmeter, and ammeter.

Students Learned:

- Arduino / Arduino Programming
- Reading Resistors / Capacitors / Diodes
- Breadboard Circuit Building
- Introduction to Digital and Analog Circuits
- Soldering through-hole mounting and surface-mount technology.
- Oscilloscope / Multimeter / Function Generator





MICRO INTERNSHIP:
Math Modeling and Computer Simulations of CRE Antibiotic-Resistant Infections



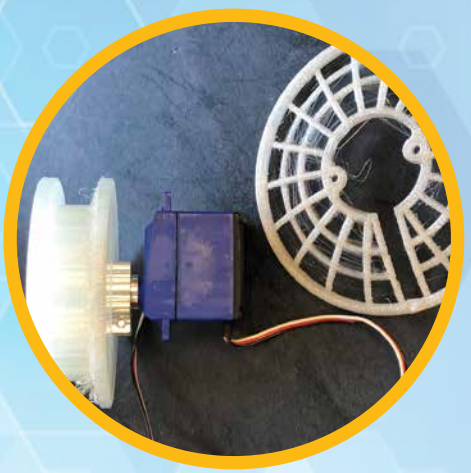
Mentor: Dr. Mohammed Yahdi

Students: Aaron Zeile, Alejandra Soto Trujillo, Andrew Brown, Angelica Zavala, Danny Olf, Denize Ignacio, Evelia Leyva, Guadalupe Cisneros, Jazmin Sanchez, Jerri Schorr, Jesus Melchor, Kevin Guzman, Martin C. Flores, Paulo Jauregui, Prashant Naidu, Resa-M. Pilar, Teresa Ealeman, Timothy Bhanneman, Tyler Koran, Dolores Mora, Jessica Politron, Frances Wong

Antibiotic-resistant bacteria infect more than two million people costing more than $55 billion in health care and productivity loss, and causing 23,000 deaths. Carbapenem-resistant Enterobacteriaceae (CRE) bacteria, deadly for patients in Intensive Care Units (ICU), are listed by the Center of Disease Control (CDC) as an immediate health threat requiring urgent and aggressive action. The scarcity, high cost, and toxicity of new antibiotics in the pharmaceutical industry's pipeline, make it critically urgent to examine special preventive measures to efficiently and effectively control CRE. This project incorporates robust mathematical modeling approaches to derive accurate models of CRE infections in ICUs, simulate the mechanism underlying the emergence of CRE, and determine the impact of up-to-date special preventive measures. Those measures include daily chlorohexidine baths for patients and peroxide spray in ICU rooms that have shown to reduce infections and clear contamination for other antibiotic-resistant infections. Patients are divided into susceptible, colonized and infected staying for a long-term or a short-term in an ICU. Thirty independent parameters such as the compliance rate, the effect of antibiotic use, and level of special preventive measures and treatments were also used. Results ultimately showed that special preventive measures should be considered as a strategy to efficiently and effectively prevent and control CRE.

MICRO INTERNSHIP:

Remote Operated Vehicle Competition



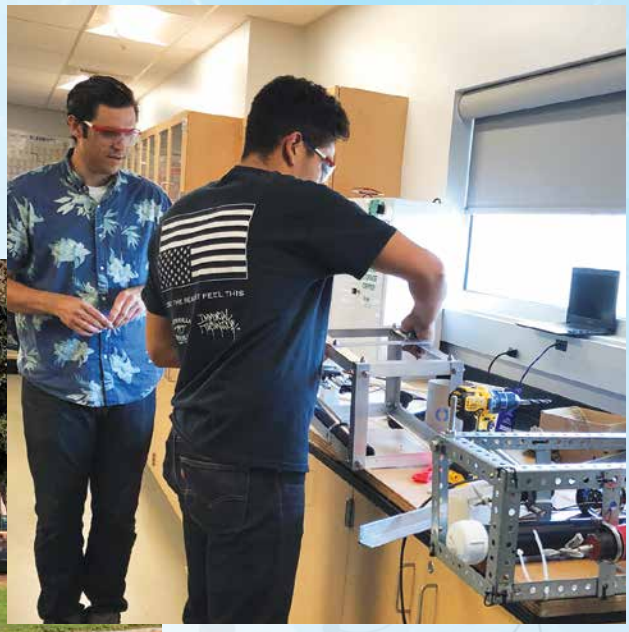
Mentor: Tito Polo

Students: Eduardo Diaz, Daniel Phillips, Lorenzo Ontiveros, Alejandro Bueno, Israel Galaz

During this project students designed and assembled a Remotely Operated Vehicle, ROV. The class of the competition was called the Ranger. During this competition, the ROV will have to fulfill three main tasks:

1. Dam Inspection and Repair
2. Maintaining Healthy Waterways
3. Preserving History

Each task had several demonstrations and steps to follow for the ROV. During the ROV construction, the team had to write a technical report that included a budget for the project.





MICRO INTERNSHIP:

The complete mitochondrial and plastid genomes of Corallina chilensis (Corallinaceae, Rhodophyta) from Tomales Bay, California, USA



Students:

*Hartnell College Genomics Group, 1 Ivan A. Alejo, 1 Teresa E. Aleman, 1 Karina Almanza, 1 Whiliam U. Alonso Torres, 1 Maria Guadalupe Altamirano Manriquez, 1 Tyler E. Armbrister, 1 Yoshio A. Astudillo, 1 Lyric Batistiana, 1 Adrian Bermudez-Aguilera, 1 Jonathan S. Blas Guido, 2 Danilo E. Bustamante, 2, 3 Martha S. Calderon, 1 Jovany D. Camacho Gonzalez, 1 Suiry Cardoso, 1 Jose A. Castro, 1 Maria N. Chombo Garcia, 1 Lissa P. Colin, 1 Karina G. Cortina, 1 Andrea P. Delgado, 1 Daniel Espinoza Castro, 1 Isabel Estrada-Sanchez, 1 Eduardo I. Felix, 1 Stephanie Felix, 1 Martin Flores, 1 Suzanne Frausto, 1 Eli D. Garcia, 1 Malia R. Garcia, 1 Gabriela Gasca Garcia, 1 Daniela Gomez, 1 Christian Gonzalez Balcazar, 1 Bianca Gonzales Miramontes, 1 Victor A. Gonzalez, 1 Clarissa D. Guzman, 1 Edgard Guzman, 1 Timothy B. Hanneman, 1 Julissa M. Hernandez, 1 Jeffery R. Hughey, 1 Victoria N. Hutchins, 1 Eli R. Kallison, 1 Sebastian Lepe, 1 Serena M. Lopez, 1 Feifei Z. Lorenzo, 1 Evelyn Macias Reyes, 1 Fernando Madrigal, 1 Nayeli G. Madrigal, 1 Rodolfo Mandujano Pineda, 1 Ricardo Manzo, 1 Paloma L. Martinez, 1 Sergio Martinez, 1 Bianey A. Medina Garcia, 1 Mario A. Mendez, 1 Jose J. Mendoza Contreras, 1 Ana I. Meza, 1 Kevin R. Miller, 1 Anna M. Morales, 1 Eduardo Munoz, 1 Johnna M. Myers, 1 Priya-Anjali P. Patel, 1 Dominic Pina, 1 Alejandra N. Ponce, 1 Alicia E. Ramirez, 1 Elias Rico, 1 Aide Rodriguez, 1 Jasmine Rodriguez, 1 Angel I. Ruiz, 1 Andrea V. Saldana, 1 Rosa A. Sanchez, 1 Taylor N. Santa Ana, 1 Jessica Santana, 1 Alfredo Silva, 1 Francisco D. Solano, 1 Sarai J. Soto, 1 Alyssa T. Springs, 1 Alicia Steinhardt, 1 Melisa Talavera, 1 Monik M. Tapia, 1 Odalis Tapia, 1 Maria O. Taveras Dina, 1 Brenda J. Torresillas, 1 Clarissa Vasquez-Ramos, 1 Frances L. Wong

1 Division of Mathematics, Science, and Engineering, Hartnell College, Salinas, California, USA

2 Instituto de Investigación para el Desarrollo Sustentable de Ceja de Selva (INDES-CES), Universidad Nacional Toribio Rodríguez de Mendoza, Amazonas 01001, Peru

3 Laboratorio de Ecosistemas Marinos Antárticos y Sub-antárticos (LEMAS), Universidad de Magallanes, Punta Arenas, P.O.Box 113D, Chile

*All authors contributed equally to the analysis and writing of this paper

Mentor: Dr. Jeffrey Hughey

Genomic analysis of the marine alga *Corallina chilensis* from Tomales Bay, California, USA, resulted in the assembly of its complete mitogenome (GenBank accession number MK598844) and plastid genome (GenBank MK598845). The mitogenome is 25,895 bp in length and contains 50 genes. The plastid genome is 178,350 bp and contains 233 genes. The organellar genomes share a high-level of gene synteny to other Corallinales. Comparison of rbcL and cox1 gene sequences of C. *chilensis* from Tomales Bay reveals it is identical to three specimens from British Columbia, Canada and very similar to a specimen of C. chilensis from southern California. This is the second genetic confirmation of C. chilensis from California.

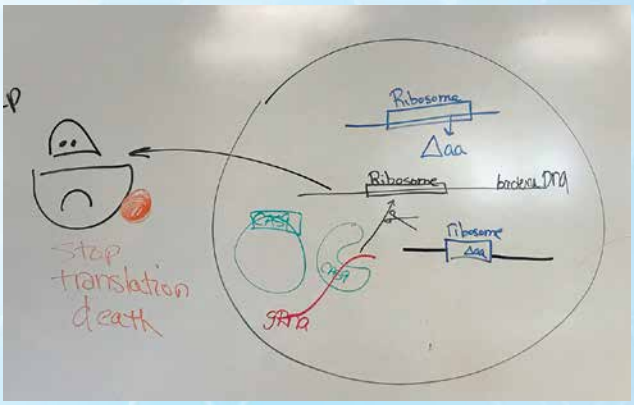
MICRO INTERNSHIP:
CRISPR Workshop And Literature Review



Students:

Bryan Alvarado Cruz, Noemi Amezcua Moreno, Jim Cabrera, Silvia Campos, Andrea Delgado, Maria Diaz Angel, Alade Diehuti-Mes, Rodolfo Hernandez Lorenzo, Amanda Hernandez, Bernice Lopez Garcia, Alex Lujan, Jennifer Martinez, Mayra Ortiz, Ricardo Patino, Cecilia Perez Gallegos, Alejandra Ponce, Rosa Sanchez Garcia, Francisco Solano, Alejandra Soto Trujillo, Cesar Virgen, Alexis Zarate

Mentor: Alicia Steinhardt





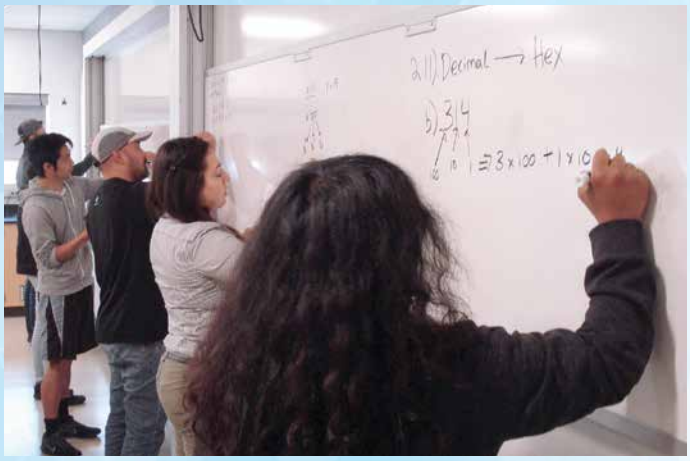
Students explored Science Magazines "2015 Breakthrough of the Year", CRISPR-Cas9 gene editing technique. This hands on workshop allowed students to edit a bacterial gene using CRISPR-associated RNA guided endonuclease Cas9. Chinese Scientists, led by He Jiankui, created the first gene edited babies. Two girls, named Lulu and Nana were born in November of 2018. This highly controversial experiment attempted to remove a gene known as CCR5, which could make the girls resistant to HIV, smallpox and cholera. This powerful microbial defense system has become a tool that is driving innovative applications in biotechnology and medicine.

MICRO INTERNSHIP:

Modern Digital Logic Design

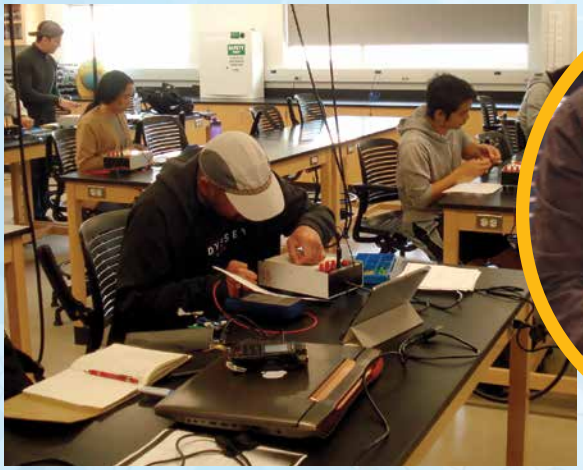
Mentor: Dr. Sewan Fan



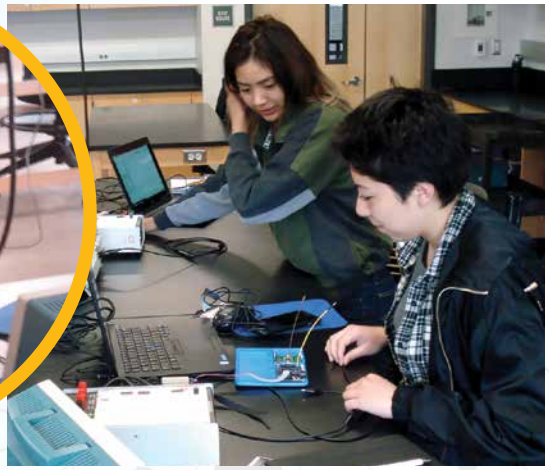




The MDLD project engages Hartnell STEM students to apply, learn and develop hardware and software using configurable semiconductor logic integrated circuit, the field programmable gate array (FPGA) device. The students will perform 25 hours hands-on learning with in-depth research activities during Hartnell Spring break of March, 2019. All participants will be fully explore and learn how to use modern FPGA circuit boards and vendor specific synthesis software tools to develop and design digital logic using the hardware description language Verilog. This includes working with (1) Intel-Altera Quartus FPGA development software (2) Mentor Graphics Modelsim digital logic simulation software (3) Intel-Altera FPGA circuit board and (4) Analysis of the synthesized digital design using hardware logic analyzers to confirm the working of logic designs.







We thank our

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