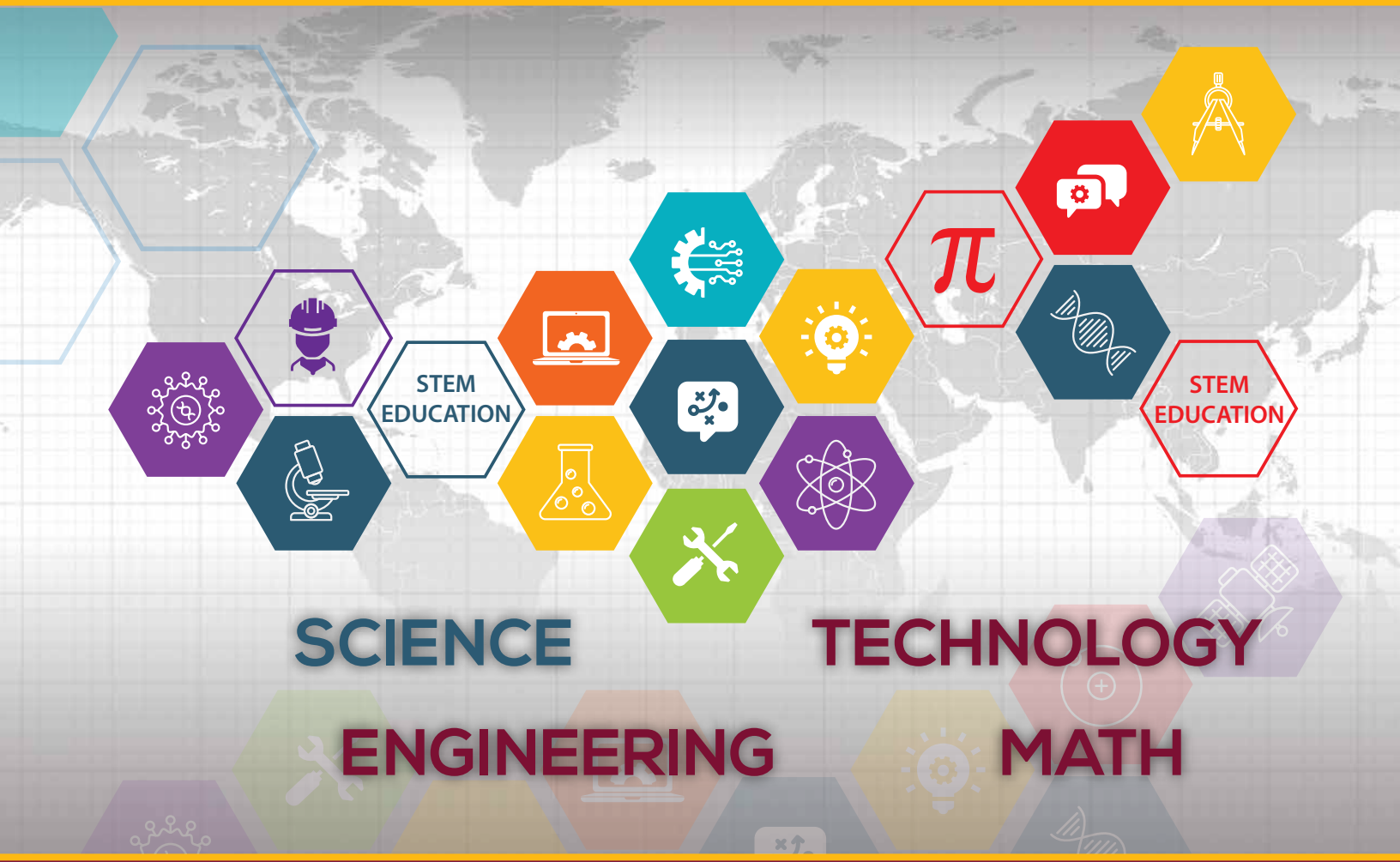
STEM

12th Annual Hartnell College
Summer STEM Internship Program





HARTNELLCOLLEGE

Summer Internship Symposium

Saturday, August 18, 2018



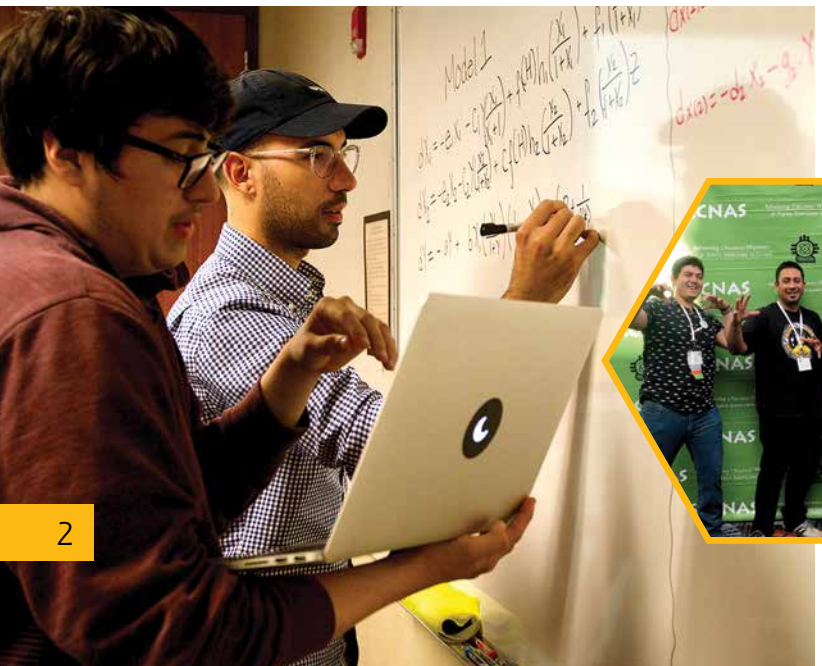


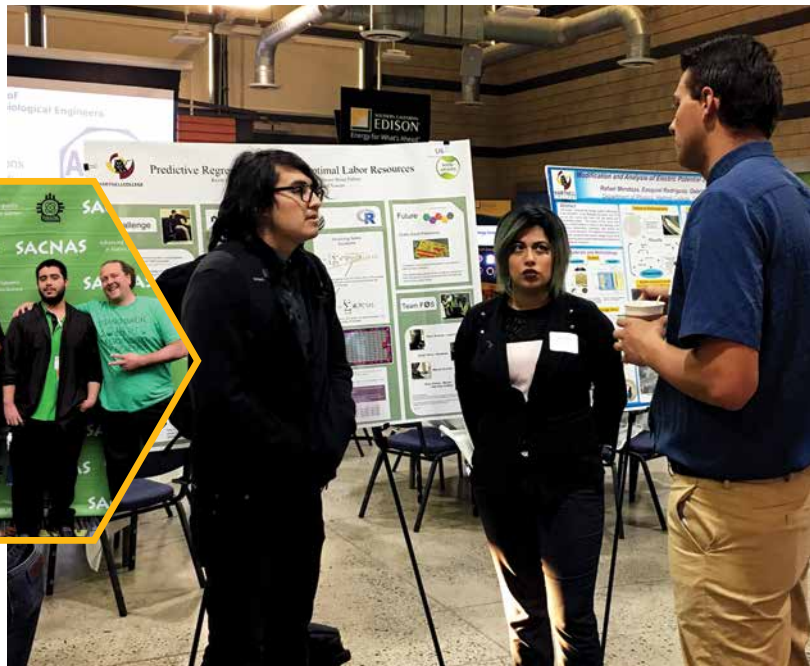
12th Annual Hartnell College Summer Internship Program

STEM

SCIENCE TECHNOLOGY ENGINEERING MATH

HARTNELLCOLLEGE





The Program

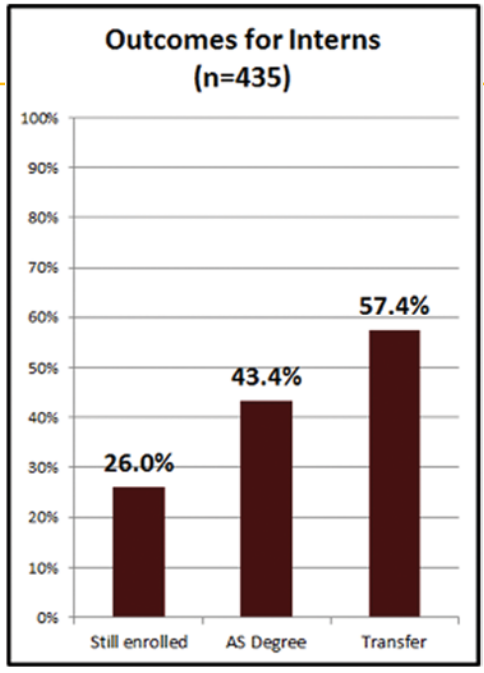


Hartnell STEM Internship Program

The STEM (Science, Technology, Engineering and Math) Internship Program at Hartnell College 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 College 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 last twelve 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 6 student interns. Since then, the program has placed over 900 students in undergraduate research and professional internship opportunities. In addition to program growth over the 12-year period, the program has demonstrated higher success rates than non-participating students. 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 that have transferred, **45% have earned their Bachelor's degree and 44% are still in progress; 13% are pursuing graduate work**. Evidence shows that STEM internships have been a valuable resource not only for skill building, but for overall student success and degree completion.



Funding Sources

Funding Sources

Hartnell College

Hispanic Serving Institutions STEM Title III Grants

Hartnell College Foundation

ACCESS Program (National Institutes of Health)

California State University - Monterey Bay

The Team

Hartnell College STEM Internship Program Team

Shannon Bliss
Dean of Academic Affairs, Science, Technology, Engineering, and Math (STEM)

Moises Almendariz
Director, Hispanic Serving Institution Initiatives

Esmeralda Montenengro Owen
Director, Communications, Marketing, and Public Relations

Joy Cowden
Director, Science and Math Institute

Dr. Ann Wright
Faculty

Dr. Melissa Hornstein
Faculty

Brian Palmer
Faculty

Dr. Jennifer Moorehouse
Faculty

Ana Martinez-Aguilar
Program Assistant

Leda Polio
Program Assistant

Hartnell College Mentors

Dr. Sewan Fan
Brian Palmer
Tito Polo
Dr. Mohammed Yahdi

Science 124 Faculty

Shannon Bliss
Dr. Jeffery Hughey
Dr. Kelly Locke
Dr. Ann Wright
Dr. Mohammed Yahdi

University Collaborative Support

University of California - Santa Cruz
Pam D'Arcey
Yulianna Ortega
Xingci Situ

California State University - Monterey Bay
Chloe Keller
Natasha Oehlman
Holly Unruh
Meghan Stell

Naval Post Graduate School
Alison Kerr

Hartnell Community College District Governing Board

Manuel M. Osorio - President
Aurelio Salazar, Jr. - Vice President
Patricia Donohue - Trustee
Ray Montemayor - Trustee
Erica Padilla-Chavez - Trustee
Candi DePauw - Trustee
Rafael Mendoza - Student Trustee
Dr. Willard Lewallen - Board Secretary and College Superintendent/President

HARTNELLCOLLEGE

Contents





Welcome 6

Internship Partners/Mentors 7

The Andy Newton Partner Award Winner 8

Program Schedule 9

Student Interns 10

Student Abstracts 11

Hartnell College

- Differential Equations Group 76
- Genomics Group 78

HARTNELL COLLEGE

STEM

INTERNSHIP PROGRAM 2018





Welcome

Dear Friends of Hartnell College,

Welcome to the 12th 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 College 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 Hartnell 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 very empowering tools, not only for university preparation, but also for real-world success.

This year, the symposium offers poster sessions, an informational panel of internship alumnus, and 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

HARTNELLCOLLEGE

Hartnell College Vision

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

Hartnell College Mission

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

STEM Internship Partners&Mentors

Bureau of Land Management
Greg Middleton

California State University, Monterey Bay
Dr. John Goeltz
Dr. John Silveus
Dr. Judith Canner
Dr. Nate Jue

Central Coast Surveyors
Dave Edson

Engie
Caren Perlmutter

Fremont Peak Observatory Association
Ronn Dammann

Hartnell College Research Scholars Institute
Dr. Sewan Fan
Dr. Jeffery Hughey
Brian Palmer
Tito Polo
Dr. Mohammed Yahdi

Naval Postgraduate School Community College Catalyst Program
Dr. Peter Ateshian
Dr. Christopher Brophy
Dr. Duane Davis
Dr. James Newman
Alison Kerr

SmartWash Solutions
Dr. Eric Wilhemsen



University of California at Davis
Dr. Slava Bekker
Dr. Igor Vorobyov

University of California at Santa Cruz
Dr. Grant Hartzog
Zachary Morton
Dr. Graham Roseman
Dr. Ann Wright

United States Department of Agriculture
Juan Alvarez



USDA - Agricultural Research Service
Dr. Neil Adhikari
Dr. Steve Klosterman

USDA - Natural Resources Conservation Service
Adriana Campagna

Whitson Engineers
Katie Lee





Special thank you to our

Andy Newton STEM Internship Partner Award Winner

SmartWash Solutions, Inc.

SWS™
SmartWashSolutions





12th Annual Hartnell College Summer Internship Symposium

STEM

SCIENCE TECHNOLOGY ENGINEERING MATH

Saturday, August 18, 2018

Hartnell College Student Center

2:00 p.m. **Opening and Introductions**

2:30 p.m. **Poster Session A**

3:30 p.m. **Alumni Panel**

4:00 p.m. **Poster Session B**

5:00 p.m. **Recognition Ceremony**

Welcome

Partner and mentor recognitions

Andy Newton STEM Internship Partner Award

Presentation of Internship Certificates

HARTNELLCOLLEGE

HARTNELL COLLEGE

STEM

INTERNSHIP PROGRAM 2018

Student Interns

Gustavo Aguilar 11
Jose Arevalo 12
Crystal Arroyo 13
Jennifer Bravo 14
Alejandro Bueno 15
Jose Camacho Rodriguez 16
Carlos Cisneros 17
Carlos Cisneros 18
Celeste Cisneros 19
Sara Clore 20
Sara Clore 21
Lizbeth Cordova 22
Eduardo Diaz 23
Meghan Dyck 24
Leah Edwards 25
Oliver Enriquez 26
Daniel A. Enriquez 27
Enzo "Ren" Flores 28
Israel Galaz 29
Anayeli Gomez Ruiz 30
Marvin Gutierrez 31
Marvin Gutierrez 32
Kevin Guzman 33
Christian Hernandez 34
Hernan Hernandez 35
René Jaramillo 36
Paulo Jauregui 37
Richard Levin 38
Felipe Lopez 39
Nayeli Madrigal 40
Rene Martinez 41
Jesus Melchor 42
Ricardo Mendez 43
Rafael Mendoza 44
Dolores Mora 45
Aram Nino-Canizal 46
Lorenzo Ontiveros 47
Sergio Parra 48
Dominic Pina Montes 49
Cristina Perez 50
Daniel Phillips 51
Nicole Polo 52
Alejandra Ponce 53
Fausto Preciado 54
Maria Ramirez 55
Jose Ramos 56
Julian Ramos 57
Maribel Ramos-Peredia 58
Joseph Randolph 59
Paola Razo 60
Andrew Reyes 61
Martin Reyes, Jr. 62
Chris Rodriguez 63
Citlali Sanchez 64
Melody Sanchez 65
Arnulfo Soria 66
Tommie Starling III 67
Palmit "Paul" Takhar 68
Julio Tena 69
Ruben Tinajero 70
Ian Ulrich 71
Christian Vargas 72
Frances Wong 73
Adela Zamora 74
Jose Zavala 75
Differential Equations Group 76
Genomics Group 78

Dye-Sensitized and Perovskite Solar Cells

Gustavo Aguilar
Mentor: Dr. Sewan Fan
Hartnell College



HARTNELLCOLLEGE

Solar cells are efficient means of energy for many types of appliances, converting sunlight into electricity. There are many types of solar cells used as eco-friendly energy alternatives towards the common silicon solar cell. The objective is to make and explore dye-sensitized and perovskite solar cells to discover how they could be used as an efficient and low-cost alternative to a silicon solar cell. Measuring at the sun's spectrum outdoors was a key element in understanding how the solar cells react to different light intensities and how it relates to their levels of efficiency. Using a spectrophotometer, that measures specific color absorption, the solutions of the perovskite and dye-sensitized solar cells were tested and compared to the sun's spectrum, to show how different colors of light affect the power output of the solar cell. This data demonstrated how efficient dye-sensitized and perovskite solar cells are when compared to an average silicon cell and how they could possibly be improved in the future.

Gustavo Aguilar
Major: Bio Chemistry

Land Surveying with Central Coast Surveyors



Jose Arevalo

Mentor: Dave Edson

Central Coast Surveyors

Land Surveying is the application of new and conventional methods of measuring and locating existing man-made structures, natural features, elevations, angles and boundaries of a property using the principles of mathematics, geometry, and other related sciences. It is a technique that is used to report the features of a land area in a descriptive survey map. Survey maps can serve a variety of purposes and therefore there are many types that a surveyor can construct such as topographic and ALTA. This summer I had the pleasure to assist two surveyors in a variety of surveying projects at Central Coast Surveyors. While working here, I was able to see and participate in the development of many reported descriptive survey maps. Using a schonstedt metal detector and a shovel I assisted in the digging and identification of property corners by searching for the pipes that identified them. Using an S6 robotic total station I assisted with the collection of raw data points that were used to create the descriptive map. Finally, using a drafting software I assisted with the drawing and drafting of a land area. Overall, I had the opportunity to experience the full process of many surveying projects in different cities across the central coast. This is important because surveying is an important area of civil engineering that can help an engineer understand the nature of land before designing a structure of any kind.

Jose Arevalo
Major: Civil Engineering
Transfer major: Civil Engineering
Intended transfer date: Cal Poly SLO, Fall 2018

Deep Eutectic Solvents

Crystal Arroyo

Mentor: Dr. John Goeltz

California State University, Monterey Bay



Deep eutectic solvents are salts that are liquid but still ionic at or near room temperature. Our laboratory builds redox functionality directly into the solvent through molecular design. We seek students interested in helping to design and study new mixtures by electrochemistry and spectroscopy.

Student researchers will formulate and combine mixtures of chemicals, measure freezing points, and learn electrochemistry and spectroelectrochemistry, as well as analysis and presentation of their own data in concert with earlier data -- all skills and techniques of broad applicability throughout the sciences.

Crystal Arroyo
Major: Chemistry
Transfer major: Chemistry

Observing the Night Sky at Fremont Peak

Jennifer Bravo

Mentor: Ron Dammann

Fremont Peak Observatory

The Fremont Peak Observatory Association hosts a popular venue where the community can go enjoy deep space observation. Founded in 1986, the FPOA provides outreach to the general public, offering guidance, equipment and resources for astronomy enthusiasts, amateurs and anyone curious about the night sky. The FPOA has several telescopes of varying sizes operated by members and volunteers utilized for deep space observation. Located roughly 3,000 feet above sea level, the observatory offers an excellent vantage point conducive to viewing celestial bodies, stars, globular clusters, planetary nebulae, comets and more through the use of sophisticated telescopes. Education and information is provided by experienced members, volunteers and interns. Interns from Hartnell College are responsible for set up, operation and maintenance of the Dobsonian telescopes all while engaging visitors, providing information regarding the locality and general facts about the stellar subjects being viewed. In addition to engaging the public, interns are given the opportunity to present on any astronomical topic, including the different varieties of telescopes, life cycles of the many different types of stars, the creation of the solar system and the geology of the moon. By the end of the summer, the interns are expected to acquire a common knowledge of the night sky, be able to confidently engage others in astronomical conversation and gain experience researching and presenting new material and information.

Jennifer Bravo
Major: Astronomy
Transfer major: Astronomy
Intended transfer date: UCSC, Fall 2018

Remotely Operated Underwater Vehicle

Alejandro Bueno

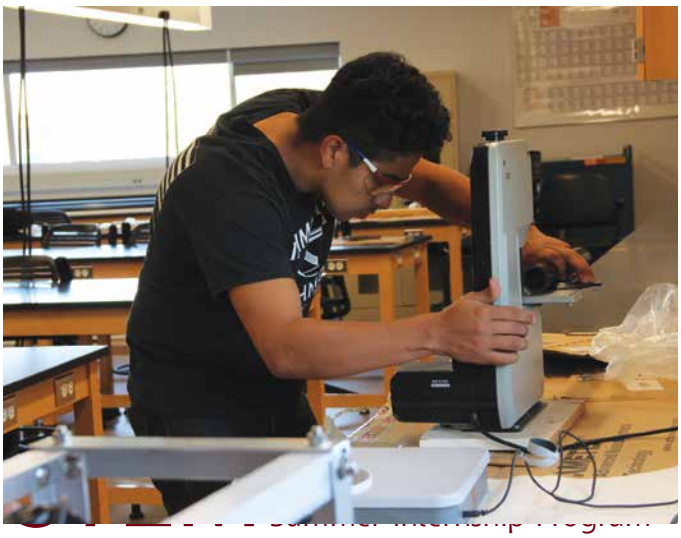
Mentor: Tito Polo

Hartnell College



HARTNELLCOLLEGE

Would you like to know more about our cool, controllable submarine? Our project involved creating a remote operated vehicle that can do multiple tasks underwater; tasks such as moving fast underwater, picking up objects, and attaching lift bags to debris. After following the design guidelines for our remote operated vehicle, we gathered the parts and assembled the unit. We cut, drilled, and fastened metal together to get our frame completed. In between building, we also coded an Arduino and placed it into an enclosure to control the propellers connected to the vehicle. We are also designing our own claw, using a 3-D printer, to grab and attach items underwater. We will be testing the vehicle in a pool to see what needs improvement. Our remote operated vehicle should be able to swim underwater in all directions and pick up objects. Doing this project gave us the experience we need to make more complex remote operated vehicles in the future, vehicles that search the ocean or explore other planets. We could use this knowledge in the future to make a device that will help us learn about unknown places.



Alejandro Bueno
Major: Mechanical Engineering
Transfer major: Mechanical Engineering
Intended transfer date: UC Irvine, Spring 2019

Data Implementation and Function Modeling for Strawberry Production

Jose Camacho Rodriguez

Mentor: Brian Palmer

Hartnell College/Food Origins



California is the top strawberry producing state in the country, producing 91% of all strawberries eaten in the US. During strawberry season, farmers are tasked with estimating how many berries will be produced in the near future and using those estimates to pre sell to distributors. The problem with these estimates is that farmers' yield predictions are inherently uncertain due to the fact that many are based on small samples of berries, leading to possible yield prediction miscalculations that can cause supply chain disruptions of as much as a million dollars per day. Field-level data and figures for farmer prediction vs. actual production was obtained through Food Origins and associated local farmers for the 2017 strawberry season. Weather data from the National Oceanic and Atmospheric Administration (NOAA) through the statistical platform R was also obtained during the project. All collected data was used in developing a predictive formula that can take input variables related to field potential, labor-level data, temperature, etc., and outputs a prediction of harvest potential and yield predictions for a given field. This formula will be implemented into a user friendly app that farmers can use to better predict the yield production in their fields and increase their field's income potential.

Jose Camacho Rodriguez
Major: Engineering
Transfer major: Electrical Engineering
Intended transfer date: UC Davis, Fall 2018

Testing QR Codes in Free-Space Optics

Carlos Cisneros
Mentor: Dr. Peter Ateshian
Naval Postgraduate School



Transmission in wireless communications using radio signals is susceptible to interception and attack. This also puts the receiver at risk of either receiving an erroneous message or none at all. Free-Space Optics (FSO) provides a promising alternative with greater security. It allows information to be transmitted directly while limiting what can receive the signal. The use of QR codes grants the chance to improve the rate of transmission, rising as the size of the code increases. The experiment measured how accurately a web camera could read QR codes displayed in quick succession on an LED matrix. The code was displayed in different color patterns to measure wavelength diversity and subjected to physical obstructions to test resiliency. The receiver had trouble reading the QR code under bright conditions but was able to read and convert messages well in darker settings despite minor interferences. Programs used to compare the original message with the received message aided in comparing successful reception rates between different tests. The QR code has the potential to transmit large quantities of information, but various technological limitations prevent further testing.

Carlos Cisneros
Major: Computer Science and Information Systems
Transfer major: Computer Science and Information Systems UCSC
Intended transfer date: Fall 2018

Observing the Night Sky at Fremont Peak



Carlos Cisneros

Mentor: Ron Dammann

Fremont Peak Observatory

The Fremont Peak Observatory Association hosts a popular venue where the community can go enjoy deep space observation. Founded in 1986, the FPOA provides outreach to the general public, offering guidance, equipment and resources for astronomy enthusiasts, amateurs and anyone curious about the night sky. The FPOA has several telescopes of varying sizes operated by members and volunteers utilized for deep space observation. Located roughly 3,000 feet above sea level, the observatory offers an excellent vantage point conducive to viewing celestial bodies, stars, globular clusters, planetary nebulae, comets and more through the use of sophisticated telescopes. Education and information is provided by experienced members, volunteers and interns. Interns from Hartnell College are responsible for set up, operation and maintenance of the Dobsonian telescopes all while engaging visitors, providing information regarding the locality and general facts about the stellar subjects being viewed. In addition to engaging the public, interns are given the opportunity to present on any astronomical topic, including the different varieties of telescopes, life cycles of the many different types of stars, the creation of the solar system and the geology of the moon. By the end of the summer, the interns are expected to acquire a common knowledge of the night sky, be able to confidently engage others in astronomical conversation and gain experience researching and presenting new material and information.

Carlos Cisneros
Major: Computer Science and Information Systems
Transfer major: Computer Science and Information Systems UCSC
Intended transfer date: Fall 2018

Investigation of Nanoparticles using QCM and DC

Celeste Cisneros

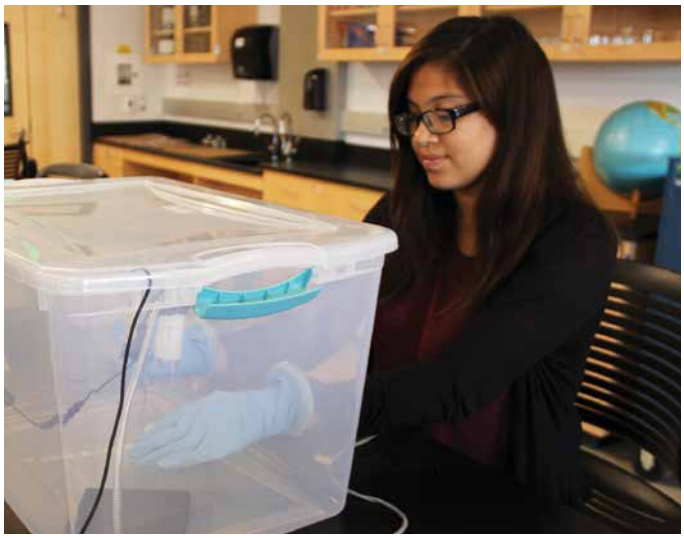
Mentor: Dr. Sewan Fan

Hartnell College



HARTNELLCOLLEGE

The purpose of this study was to construct a Dip Coating Chamber (DCC) and to develop a method to quantify nanoparticle concentration using a very sensitive apparatus known as the Quartz Crystal Microbalance (QCM). The QCM results in shifts in frequency when small drops of nanoparticles are introduced to it. When the liquid drop evaporates, the QCM measures the nanoparticle concentration by the dry residue that is left on the quartz surface. The nanoparticles will be used in the DCC as the solution. The DCC is controlled through an Arduino. A mechanical arm, Linear Actuator, is connected to the Arduino to dip glass films into a solution. The project was to present the effect of different concentration of the nanoparticles suspension by using the QCM. This leads to the nanoparticles being used being dipped in by the actuator. With the QCM and DCC combined, both projects will yield more information about nanoparticles.



Celeste Cisneros
Major: Chemistry
Transfer major: Human Biology
Intended transfer date: UCSC, Fall 2019

Interpretation of the Cretaceous Panoche Conglomerate formation of the San Joaquin Valley in Panoche Hills, California

Sara Clore

Mentor: Greg Middleton

Bureau of Land Management/USDA



Panoche Hills Recreational area has been extensively researched due to the presence of oil in the San Joaquin Valley and the area just South of Coalinga . By studying other formations, such as the Cretaceous Panoche Conglomerate (KPC) found in Panoche Hills, California, researchers are able to better understand the geologic occurrences of natural resources as well as the geologic history which led to these formations. Although it has been determined that oil is not present, other resources such as gypsum have been found in abundance. Visiting researchers from Hartnell College used field observations and techniques to determine the outcrop scale, occurrence, distribution and lithological composition of the conglomerate formation. Spatial sampling methods were applied to collect clasts per meter of conglomerate and were analyzed on site and post field duration. Researchers utilized GPS and recorded the strike and dip for the locality of collected samples. By employing photo documentation, clast analysis, and geographic locations of the obtained samples, the researchers aimed to gain an understanding of how the KPC units were emplaced, the geologic history of the formation and the mineralogical composition of the matrix and the conglomerate clasts. Understanding these complicated formations and their underlying strata will provide insight into the past as well as the future.



Sara Clore

Major: Ocean Sciences

Transfer major: Ocean Sciences

Intended transfer date: UCSC, Spring 2020

Observing the Night Sky at Fremont Peak

Sara Clore

Mentor: Ron Dammann

Fremont Peak Observatory



The Fremont Peak Observatory Association hosts a popular venue where the community can go enjoy deep space observation. Founded in 1986, the FPOA provides outreach to the general public, offering guidance, equipment and resources for astronomy enthusiasts, amateurs and anyone curious about the night sky. The FPOA has several telescopes of varying sizes operated by members and volunteers utilized for deep space observation. Located roughly 3,000 feet above sea level, the observatory offers an excellent vantage point conducive to viewing celestial bodies, stars, globular clusters, planetary nebulae, comets and more through the use of sophisticated telescopes. Education and information is provided by experienced members, volunteers and interns. Interns from Hartnell College are responsible for set up, operation and maintenance of the Dobsonian telescopes all while engaging visitors, providing information regarding the locality and general facts about the stellar subjects being viewed. In addition to engaging the public, interns are given the opportunity to present on any astronomical topic, including the different varieties of telescopes, life cycles of the many different types of stars, the creation of the solar system and the geology of the moon. By the end of the summer, the interns are expected to acquire a common knowledge of the night sky, be able to confidently engage others in astronomical conversation and gain experience researching and presenting new material and information.

Sara Clore
Major: Ocean Sciences
Transfer major: Ocean Sciences
Intended transfer date: UCSC, Spring 2020

Fresh Produce Wash Solution Pilot Plant Internship

Lizbeth Cordova

Mentor: Dr. Eric Wilhelmsen

Smart Wash Solutions

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.

Lizbeth Cordova

Major:

Transfer major:

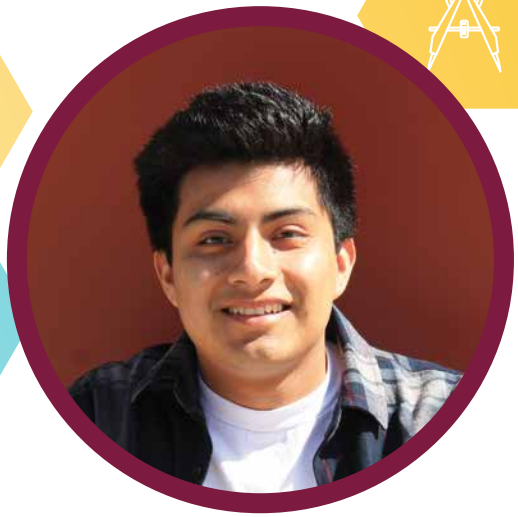
Intended transfer date:

Dye-Sensitized and Perovskite Solar Cells

Eduardo Diaz

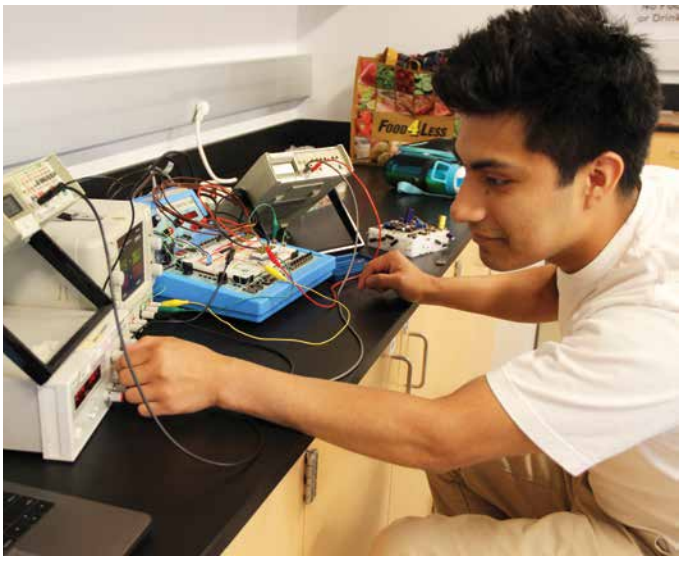
Mentor: Dr. Sewan Fann

Hartnell College



HARTNELLCOLLEGE

Solar cells are efficient means of energy for many types of appliances, converting sunlight into electricity. There are many types of solar cells used as eco-friendly energy alternatives towards the common silicon solar cell. The objective is to make and explore dye-sensitized and perovskite solar cells to discover how they could be used as an efficient and low-cost alternative to a silicon solar cell. Measuring at the sun's spectrum outdoors was a key element in understanding how the solar cells react to different light intensities and how it relates to their levels of efficiency. Using a spectrophotometer, that measures specific color absorption, the solutions of the perovskite and dye-sensitized solar cells were tested and compared to the sun's spectrum, to show how different colors of light affect the power output of the solar cell. This data demonstrated how efficient dye-sensitized and perovskite solar cells are when compared to an average silicon cell and how they could possibly be improved in the future.



Eduardo Diaz

Major: Mechanical Engineering

Examining the Amount of Pathogen in Seeds and Seed Treatment Testing to Eliminate the Pathogen from Seeds

Meghan Dyck

Mentor: Dr. Steve Klosterman

USDA Agricultural Research Service (ARS)



The Salinas Valley is known as "the Salad Bowl of the World", but what if it could no longer support the growth of its trademark crops? Verticillium dahliae is a fungus that can infect many crops, including lettuce, tomatoes, strawberries, and spinach, causing wilt that makes the crops inedible. The fungus is also fairly widespread and can live for many years in the soil, making it difficult to wait out by rotating crops; other treatment methods are also fairly ineffective. Several methods attempting to treat V. dahliae are being tested. The first approach is to determine which seed lot might be most infected; this is done most commonly with spinach seeds. Sets of one hundred seeds are treated with a bleach wash and rinsed with water and allowed to dry. After this, the seeds are placed on NP-10 growth medium in Petri dishes, with ten seeds per plate; forceps are sterilized between plates to reduce contamination. The seeds are then placed in an incubator for three weeks to allow for V. dahliae growth; the plates are checked under a microscope and the number of infected seeds recorded. V. dahliae growth looks similar to ash spreading out from the seed, but when zooming in further, the fungus has the appearance of beads strung together. Another method of trying to treat V. dahliae infection is to plant seeds and let the plant grow. Some of the young plants are infected with V. dahliae, others are infected with a less harmful species of Verticillium, and some are left without infection. They are either treated by placing beads for treatment near the roots of the plant or by a foliar spray. After around three months, the plants are uprooted and their vascular tissue examined for signs of infection and rated on a scale from 0 to 5, with 0 meaning the plant has no infection and 5 indicating that the plant's vascular tissue has a 100% infection rate; the infection presents itself as a dark brown coloring. A highly infected spinach seed lot (62219) was identified by plating seeds, and several fumigation treatments were developed to test on the infected seed lot; results have not yet been determined, but the seeds will both be plated and planted to determine the treatment effectiveness. V. dahliae currently is treatable only by the use of methyl bromide, which is now banned because it is capable of depleting the ozone layer. If this research identifies a more environmentally-friendly fumigant, it will allow farmers to continue growing popular crops such as tomatoes and lettuce without running the risk of losing the crop to Verticillium wilt or having to drastically alter growing methods to avoid heavy infection.

Meghan Dyck
Major: Chemistry
Transfer major: Astrochemistry
Intended transfer date: Fall 2019

Stanford Summer Community College Premedical Program

Leah Edwards

Stanford University



Stanford University

The Stanford Summer Community College Premedical Program (SSCCPP) targets current community college students considered low-income and/or underrepresented in medicine providing exposure to medicine and health through topics in health disparities, leadership challenges in health provision and administration, science success strategies, professional development, clinical exposure, successful preparation for the medical school application process, postsecondary and graduate/professional school financing. SSCCPP is a six-week residential program, allowing talented and motivated community college students interested in medicine to immerse themselves in the Stanford School of Medicine network through a variety of personal and professional development experiences. Participants reside on campus for the duration of the program and will be immersed in topic areas including: Critical reading and research of medical literature; Civic engagement, leadership, and political activism in medicine; Science preparatory classes (previously anatomy, molecular cellular biology, chemistry); An introduction to the MCAT; Academic success and test-taking strategies; and The medical school admissions and financing process. Additional activities promote: Peer networking; Medical student mentorship; and Clinical shadowing and research opportunity education.

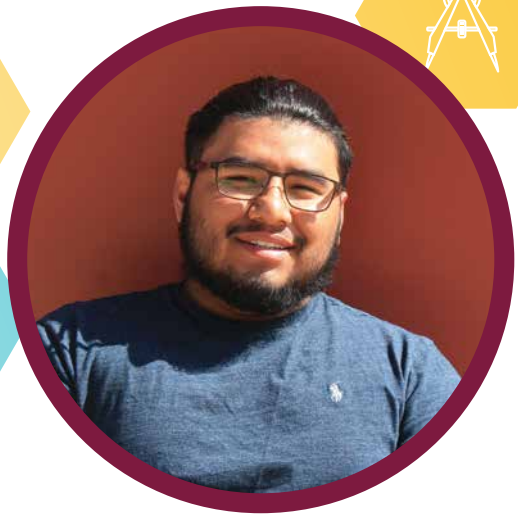
Leah Edwards
Major: Biology
Intended transfer date: Fall 2018

Fountain War Design

Oliver Enriquez

Mentor: Tito Polo

Hartnell College



HARTNELLCOLLEGE

The Fountain War is a hands-on project that allows the participants to create, build, and test their engineering model design. The project consists of two design tasks: *Putting from the Drink* and Balancing Act. *Putting from the Drink* consists of using water pressure to lift a Frisbee from a pool and launching it 25 feet away with a height of six feet while accurately hitting the target. *The Balancing Act* consists of keeping a beam in equilibrium by the pressure of the water at each end. To create the balancing system, hydro pistons were used to increase the water pressure to compensate for the weight of the structure. A ball will be placed on top of the beam to determine if it is balanced. A 3-D printer was used to design parts for the fountain which allowed participants hands-on experience with new technology. With participant skill development in mind, the Fountain War was designed to allow interns to gain a better understanding of water pressure.

Oliver Enriquez
Major: Engineering
Intended transfer date: Fall 2018

Data Implementation and Function Modeling for Strawberry Production

Daniel A. Enriquez

Mentor: Brian Palmer

Hartnell College/Food Origins



California is the top strawberry producing state in the country, producing 91% of all strawberries eaten in the US. During strawberry season, famers are tasked with estimating how many berries will be produced in the near future and using those estimates to pre sell to distributors. The problem with these estimates is that farmers' yield predictions are inherently uncertain due to the fact that many are based on small samples of berries, leading to possible yield prediction miscalculations that can cause supply chain disruptions of as much as a million dollars per day. Field-level data and figures for farmer prediction vs. actual production was obtained through Food Origins and associated local farmers for the 2017 strawberry season. Weather data from the National Oceanic and Atmospheric Administration (NOAA) through the statistical platform R was also obtained during the project. All collected data was used in developing a predictive formula that can take input variables related to field potential, labor-level data, temperature, etc., and outputs a prediction of harvest potential and yield predictions for a given field. This formula will be implemented into a user friendly app that farmers can use to better predict the yield production in their fields and increase their field's income potential.

Daniel A. Enriquez
Major: Physics and Math
Transfer major: Civil Engineering
Intended transfer date: CSU San Jose, Spring 2019

Investigation of Nanoparticles using QCM and DC

Enzo "Ren" Flores

Mentor: Dr. Sewan Fan

Hartnell College



HARTNELLCOLLEGE

The purpose of this study was to construct a Dip Coating Chamber (DCC) and to develop a method to quantify nanoparticle concentration using a very sensitive apparatus known as the Quartz Crystal Microbalance (QCM). The QCM results in shifts in frequency when small drops of nanoparticles are introduced to it. When the liquid drop evaporates, the QCM measures the nanoparticle concentration by the dry residue that is left on the quartz surface. The nanoparticles will be used in the DCC as the solution. The DCC is controlled through an Arduino. A mechanical arm, Linear Actuator, is connected to the Arduino to dip glass films into a solution. The project was to present the effect of different concentration of the nanoparticles suspension by using the QCM. This leads to the nanoparticles being used being dipped in by the actuator. With the QCM and DCC combined, both projects will yield more information about nanoparticles.

Enzo "Ren" Flores
Major: Computer Science
Transfer major: Computer Science
Intended transfer date: UCSC, Fall 2019

Fountain War Design

Israel Galaz

Mentor: Tito Polo

Hartnell College



HARTNELLCOLLEGE

The Fountain War is a hands-on project that allows the participants to create, build, and test their engineering model design. The project consists of two design tasks: *Putting from the Drink* and Balancing Act. *Putting from the Drink* consists of using water pressure to lift a Frisbee from a pool and launching it 25 feet away with a height of six feet while accurately hitting the target. *The Balancing Act* consists of keeping a beam in equilibrium by the pressure of the water at each end. To create the balancing system, hydro pistons were used to increase the water pressure to compensate for the weight of the structure. A ball will be placed on top of the beam to determine if it is balanced. A 3-D printer was used to design parts for the fountain which allowed participants hands-on experience with new technology. With participant skill development in mind, the Fountain War was designed to allow interns to gain a better understanding of water pressure.



Israel Galaz
Major: Mechanical Engineering
Transfer major: Biomedical Engineering
Intended transfer date: Cal Poly, Spring 2019

Math Modeling for Optimal Economic Environment, and Pest Management of Organic Alfalfa: California Model



Anayeli Gomez Ruiz

Mentor: Dr. Mohammed Yahdi

Hartnell College

HARTNELLCOLLEGE

California is the nation's leading dairy state producing more than one-fifth of the nation's total milk production valued at more than $21 billion. Due to its high levels of protein, calcium, and high-quality fiber, alfalfa is the main forage in a dairy cow's diet. California is the largest producer of alfalfa. Pest infestations pose huge damage to crops and financial loss to the farmers, estimated at $120 billion in 2015.In California the biggest threats to alfalfa are the weevil and aphids. The pest damage is costly and chemical pesticides/herbicides can be unsafe and costly. Studies have shown polycultures to be better able to control pest infestation, through plant and predator diversity, while monocultures are more prone to pest outbreak. This project develops mathematical models and computer simulations for cost-effective and environmentally-safe strategies to minimize plant damage from pests using Enemies and Movement Hypotheses as well as plant diversity and harvesting schedule, while maximizing farmer profits. Early plant harvest has the benefits of both controlling pests and getting alfalfa at its peak nutritional value. Each mathematical model includes four variables and eighteen parameters linked via a system of nonlinear differential equations using the Shannon plant diversity index, implicit age structures, and scramble competition, logistic and Allee effect approaches. Ultimately, the framework provides polyculture planting strategies for farmers that are cost-effective and pesticide/herbicide-free to minimize the alfalfa damage while maximizing farmer profits through a higher sell price for both the alfalfa crop and the dairy produced.

Anayeli Gomez Ruiz

Interpretation of the Cretaceous Panoche Conglomerate formation of the San Joaquin Valley in Panoche Hills, California



Marvin Gutierrez
Mentor: Greg Middleton

Bureau of Land Management/USDA

Panoche Hills Recreational area has been extensively researched due to the presence of oil in the San Joaquin Valley and the area just South of Coalinga . By studying other formations, such as the Cretaceous Panoche Conglomerate (KPC) found in Panoche Hills, California, researchers are able to better understand the geologic occurrences of natural resources as well as the geologic history which led to these formations. Although it has been determined that oil is not present, other resources such as gypsum have been found in abundance. Visiting researchers from Hartnell College used field observations and techniques to determine the outcrop scale, occurrence, distribution and lithological composition of the conglomerate formation. Spatial sampling methods were applied to collect clasts per meter of conglomerate and were analyzed on site and post field duration. Researchers utilized GPS and recorded the strike and dip for the locality of collected samples. By employing photo documentation, clast analysis, and geographic locations of the obtained samples, the researchers aimed to gain an understanding of how the KPC units were emplaced, the geologic history of the formation and the mineralogical composition of the matrix and the conglomerate clasts. Understanding these complicated formations and their underlying strata will provide insight into the past as well as the future.



Marvin Gutierrez
Major: Geology
Transfer major: Geology
Intended transfer date: CSU, San Jose, Summer 2018

Observing the Night Sky at Fremont Peak



Marvin Gutierrez

Mentor: Ron Dammann

Fremont Peak Observatory

The Fremont Peak Observatory Association hosts a popular venue where the community can go enjoy deep space observation. Founded in 1986, the FPOA provides outreach to the general public, offering guidance, equipment and resources for astronomy enthusiasts, amateurs and anyone curious about the night sky. The FPOA has several telescopes of varying sizes operated by members and volunteers utilized for deep space observation. Located roughly 3,000 feet above sea level, the observatory offers an excellent vantage point conducive to viewing celestial bodies, stars, globular clusters, planetary nebulae, comets and more through the use of sophisticated telescopes. Education and information is provided by experienced members, volunteers and interns. Interns from Hartnell College are responsible for set up, operation and maintenance of the Dobsonian telescopes all while engaging visitors, providing information regarding the locality and general facts about the stellar subjects being viewed. In addition to engaging the public, interns are given the opportunity to present on any astronomical topic, including the different varieties of telescopes, life cycles of the many different types of stars, the creation of the solar system and the geology of the moon. By the end of the summer, the interns are expected to acquire a common knowledge of the night sky, be able to confidently engage others in astronomical conversation and gain experience researching and presenting new material and information.

Marvin Gutierrez
Major: Geology
Transfer major: Geology
Intended transfer date: CSU, San Jose, Summer 2018

Math Modeling for Optimal Economic Environment, and Pest Management of Organic Alfalfa: California Model



Kevin Guzman

Mentor: Dr. Mohammed Yahdi

Hartnell College

HARTNELLCOLLEGE

California is the nation's leading dairy state producing more than one-fifth of the nation's total milk production valued at more than $21 billion. Due to its high levels of protein, calcium, and high-quality fiber, alfalfa is the main forage in a dairy cow's diet. California is the largest producer of alfalfa. Pest infestations pose huge damage to crops and financial loss to the farmers, estimated at $120 billion in 2015.In California the biggest threats to alfalfa are the weevil and aphids. The pest damage is costly and chemical pesticides/herbicides can be unsafe and costly. Studies have shown polycultures to be better able to control pest infestation, through plant and predator diversity, while monocultures are more prone to pest outbreak. This project develops mathematical models and computer simulations for cost-effective and environmentally-safe strategies to minimize plant damage from pests using Enemies and Movement Hypotheses as well as plant diversity and harvesting schedule, while maximizing farmer profits. Early plant harvest has the benefits of both controlling pests and getting alfalfa at its peak nutritional value. Each mathematical model includes four variables and eighteen parameters linked via a system of nonlinear differential equations using the Shannon plant diversity index, implicit age structures, and scramble competition, logistic and Allee effect approaches. Ultimately, the framework provides polyculture planting strategies for farmers that are cost-effective and pesticide/herbicide-free to minimize the alfalfa damage while maximizing farmer profits through a higher sell price for both the alfalfa crop and the dairy produced.

Kevin Guzman
Major: Computer Science

Cosmic Ray Detector Project

Christian Hernandez

Mentor: Dr. Sewan Fan

Hartnell College



HARTNELLCOLLEGE

Supernovae across the universe eject cosmic rays that impact atomic nuclei in Earth's atmosphere to create secondary particles like muons. The muon is an unstable particle that decays quickly and it can penetrate deep into matter. To measure the cosmic rays, we used light sensitive Photomultiplier detectors connected to scintillator sheets by optical fibers enclosed in a light tight box. We assembled multiple detector boxes to measure the high speed muon particles and using 3 different detector boxes we formed an array. From data collected, the muon speed is determined by moving the detectors to different distances and running a program in the Linux OS to determine and analyze the time that the muon strikes the detectors. The time differences are gathered and plotted onto a time vs. distance graph from which the slope is determined to be 99% of the speed of light.



Christian Hernandez
Major: Mechanical Engineering
Transfer major: Mechanical Engineering
Intended transfer date: Cal Poly SLO, Spring 2019

Remotely Operated Underwater Vehicle

Hernan Hernandez

Mentor: Tito Polo

Hartnell College



HARTNELLCOLLEGE

Would you like to know more about our cool, controllable submarine? Our project involved creating a remote operated vehicle that can do multiple tasks underwater; tasks such as moving fast underwater, picking up objects, and attaching lift bags to debris. After following the design guidelines for our remote operated vehicle, we gathered the parts and assembled the unit. We cut, drilled, and fastened metal together to get our frame completed. In between building, we also coded an Arduino and placed it into an enclosure to control the propellers connected to the vehicle. We are also designing our own claw, using a 3-D printer, to grab and attach items underwater. We will be testing the vehicle in a pool to see what needs improvement. Our remote operated vehicle should be able to swim underwater in all directions and pick up objects. Doing this project gave us the experience we need to make more complex remote operated vehicles in the future, vehicles that search the ocean or explore other planets. We could use this knowledge in the future to make a device that will help us learn about unknown places.

Hernan Hernandez
Major: Software Engineering
Transfer major: Software Engineering
Intended transfer date: Cal Poly SLO, Fall 2020

Repercussion of Mutating the Selectivity Filter of Kv 1.2 Potassium Ion Channel to hERG Potassium Ion Channel



René Jaramillo

Mentor: Dr. Slava Bekker and Dr. Igor Vorobyov

University of California, Davis

Human ether-a-go-go gene codes for a voltage-gated potassium ion channel, commonly referred to as hERG, which is prevalent in cardiac myocytes. This ion channel is responsible for repolarization of the membrane during action potential, however obstruction of potassium ion current through the channel may lead to a condition known as long QT syndrome and ultimately to lethal cardiac arrhythmias. Deformations of the selectivity filter that render hERG inactivated, thus delaying the current, occur on a millisecond timescale, compared to ~s for other voltage-gated channels, and are one of the culprits of delayed repolarization. In this study we compare the stability of the selectivity filters of hERG and Kv1.2, another mammalian voltage-gated potassium ion channel, in an effort to understand the forces that lead to hERG's quick inactivation. The comparison was carried out through mutating Kv1.2 selectivity filter to look like hERG's selectivity filter using Foldit, Chimera, and Visual Molecular Dynamics (VMD) software. The anticipated result is that wild type Kv 1.2 mutated to hERG selectivity filter will become unstable, possibly due to added clearance between atoms. Preliminary results have identified shifts in protein structure selectivity filter and change in free energy associated with the mutations. Ultimately, these findings may lead to improved understanding of hERG structure and function, and in turn, to better therapies for cardiac arrhythmias.

René Jaramillo
Major: Physics/Chemistry/Biology
Transfer major: Biochemistry
Intended transfer date: UC Davis Fall 2018

Math Modeling for Optimal Economic Environment, and Pest Management of Organic Alfalfa: California Model



Paulo Jauregui

Mentor: Dr. Mohammed Yahdi

Hartnell College

HARTNELLCOLLEGE

California is the nation's leading dairy state producing more than one-fifth of the nation's total milk production valued at more than $21 billion. Due to its high levels of protein, calcium, and high-quality fiber, alfalfa is the main forage in a dairy cow's diet. California is the largest producer of alfalfa. Pest infestations pose huge damage to crops and financial loss to the farmers, estimated at $120 billion in 2015.In California the biggest threats to alfalfa are the weevil and aphids. The pest damage is costly and chemical pesticides/herbicides can be unsafe and costly. Studies have shown polycultures to be better able to control pest infestation, through plant and predator diversity, while monocultures are more prone to pest outbreak. This project develops mathematical models and computer simulations for cost-effective and environmentally-safe strategies to minimize plant damage from pests using Enemies and Movement Hypotheses as well as plant diversity and harvesting schedule, while maximizing farmer profits. Early plant harvest has the benefits of both controlling pests and getting alfalfa at its peak nutritional value. Each mathematical model includes four variables and eighteen parameters linked via a system of nonlinear differential equations using the Shannon plant diversity index, implicit age structures, and scramble competition, logistic and Allee effect approaches. Ultimately, the framework provides polyculture planting strategies for farmers that are cost-effective and pesticide/herbicide-free to minimize the alfalfa damage while maximizing farmer profits through a higher sell price for both the alfalfa crop and the dairy produced.

Paulo Jauregui

Major: Computer Science

Autonomous UAV Swarm Development

Richard Levin

Mentor: Dr. Duane Davis

Naval Postgraduate School



Next-generation military weapons technology soar the skies in assembly as autonomous unmanned aerial vehicle (UAV) swarms - aircraft capable to communicate and perform tasks through a robotics operating system (ROS). Defense against evasive, combative UAV is lacking in modern warfare, therefore it is imperative to develop low-risk machines able to execute otherwise the toughest intelligence missions. Developing executable behaviors for the UAV swarm was my primary focus, incorporating ROS which provides a middleware architecture of communicating nodes within the aircraft. The resulting swarm has a list of these behaviors that caters enough capability to level with fighter pilot maneuvering, avoiding endangerment of life and enabling numerous applications past enemy lines.

Richard Levin
Major: Computer Science
Transfer major: Computer Science
Intended transfer date: UC Los Angeles, Fall 2018

Deep Eutectic Solvents

Felipe Lopez

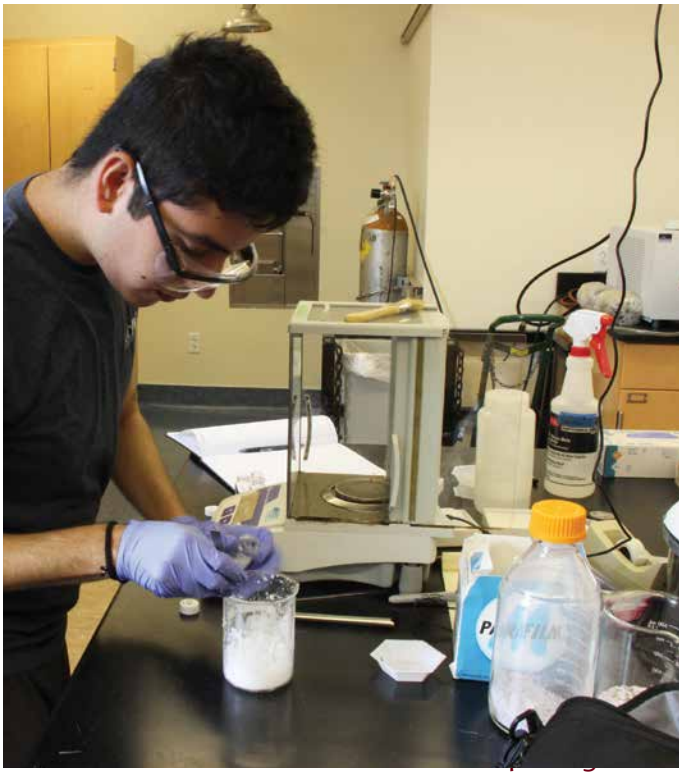
Mentor: Dr. John Goeltz

California State University, Monterey Bay



Deep eutectic solvents are salts that are liquid but still ionic at or near room temperature. Our laboratory builds redox functionality directly into the solvent through molecular design. We seek students interested in helping to design and study new mixtures by electrochemistry and spectroscopy.

Student researchers will formulate and combine mixtures of chemicals, measure freezing points, and learn electrochemistry and spectroelectrochemistry, as well as analysis and presentation of their own data in concert with earlier data -- all skills and techniques of broad applicability throughout the sciences.



Felipe Lopez
Major: Chemical Engineering

Mutating Spt5 KOW Domain to Understand Its Functions in *Saccharomyces cerevisiae*



Nayeli Madrigal

Mentor: Dr. Grant Hartzog, Zachary Morton, Dr. Ann Wright

University of California-Santa Cruz

The project aims to understand the functional consequences of disrupting the interactions between Spt5's Kyprides, Ouzounis, Woese (KOW) domains and RNAPII in the budding yeast Saccharomyces cerevisiae. Spt5 is a universally conserved transcription elongation factor that is essential for life in every organism. Spt5 is a multi-domain protein that is composed of an acidic N-terminal domain, a NusG N-terminal (NGN) domain, multiple KOW domains, and a series of short C-terminal repeats. Previous work demonstrates that Spt5 associates with RNA polymerase II and helps regulate its speed and processivity as it traverses gene bodies. In addition, Spt5 also helps to maintain chromatin structure and promote pre-mRNA processing. Recently published crystal and cryo-EM structures of RNA polymerase II transcription elongation complexes suggest that Spt5 directly contacts RNAPII via its NGN and KOW domains. Targeted mutagenesis of Spt5 will be used to disrupt these interactions using the structures as a guide. Genetic reporters of transcription, chromatin and pre-mRNA processing defects will be used to assay yeast strains carrying these spt5 mutations for phenotypic changes relevant to Spt5's functions. Previously identified mutations in Spt5 that map to locations of putative Spt5-RNAPII interactions will also be assayed for mutant phenotypes using our reporters as well as for synthetic interactions with RNAPII. The genetic analysis of these spt5 mutations will help assign specific molecular functions to different domains in Spt5.

Nayeli Madrigal

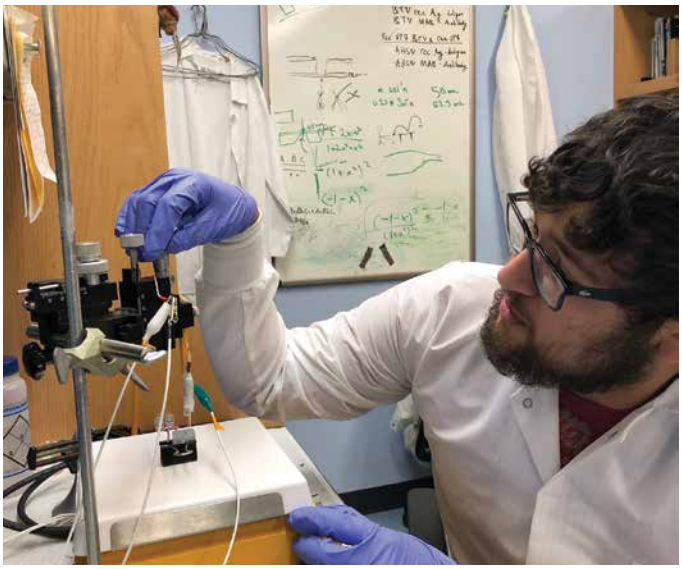
Major: Biochemistry and Molecular Biology

Exploring the Effects of Solute Composition and Concentration on Nanopipette Etching

Rene Martinez
Mentor: Gonca Bulbul and Nader Pourmand
University of California, Santa Cruz



Novel biotechnology includes nanopipettes: pipettes of a nanoliter-sized magnitude. The inner walls of the nanopipette can be lined with probe molecules that trap target compounds, creating a change in the current that can be read when an electric potential is applied to the pipette. Nanopipettes also have a use as instruments for nanosurgery. Their microscopic pores can inject or extract substances from cells without killing them. Together, these features can allow for more precise methods of identification of pathogenic cells as well as extraction of their genes for further analysis. Our goal was to study the degree to which solution conditions caused etching of the nanopipette pore, since etching had various consequences depending its desired function. Etching is the phenomenon where a nanopipette pore's diameter changes due to loss or gain of internal lining. Understanding the conditions for etching is a significant boon, as the nanopipette pore size for surgical pipettes can be tailored to extract specific-sized molecules or limit the frequency of etching experienced by biosensor pipettes. Nanopipette details will be distinguished with Scanning Electron Micrography (SEM). Photos will be taken before and after exposure to different electric potentials and solution concentrations, then compared with each other to document the degree of etching. We anticipate the discovery of definitive guidelines and conditions at which etching occurs. The results of this study can pave the way to create a consistent method to standardize the size various functionalized nanopipettes that can be of use in the future biomedical applications.



Rene Martinez

Fountain War Design

Jesus Melchor

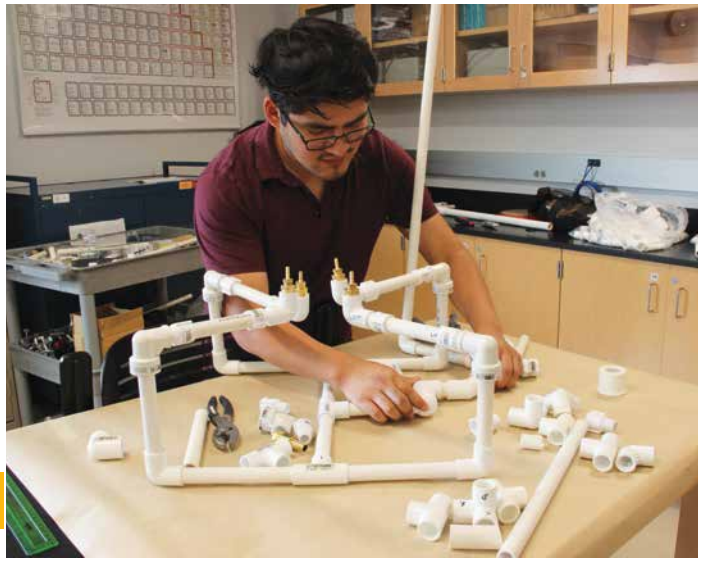
Mentor: Tito Polo

Hartnell College



HARTNELLCOLLEGE

The Fountain War is a hands-on project that allows the participants to create, build, and test their engineering model design. The project consists of two design tasks: *Putting from the Drink* and Balancing Act. *Putting from the Drink* consists of using water pressure to lift a Frisbee from a pool and launching it 25 feet away with a height of six feet while accurately hitting the target. *The Balancing Act* consists of keeping a beam in equilibrium by the pressure of the water at each end. To create the balancing system, hydro pistons were used to increase the water pressure to compensate for the weight of the structure. A ball will be placed on top of the beam to determine if it is balanced. A 3-D printer was used to design parts for the fountain which allowed participants hands-on experience with new technology. With participant skill development in mind, the Fountain War was designed to allow interns to gain a better understanding of water pressure.



Jesus Melchor
Major: Civil Engineering
Transfer major: Civil Engineering

Cosmic Ray Air Shower Monte Carlo Simulation and Coincidence Tracking System

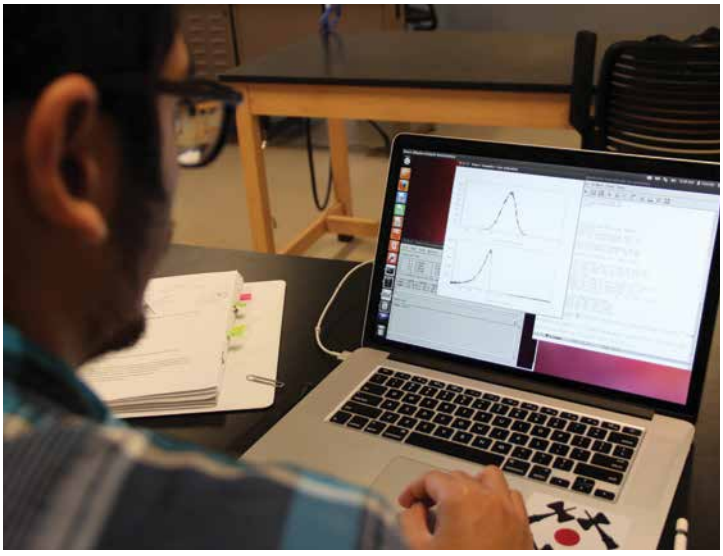
Ricardo Mendez
Mentor: Dr. Sewan Fan

Hartnell College



HARTNELLCOLLEGE

This project supports the ongoing efforts of Hartnell College's Research Institute (RSI) in their cosmic ray particle research via two parts: The development of a GPS module driven time-tagging FPGA and utilization of a simulated monte carlo cosmic ray air shower with respect to coincidence trigger delays to obtain the primary particle direction. The RSI team has collected and analyzed data from initial scintillator arrays, an investigation of data approximation to models is needed; which is obtained through C, PAW, and any data analysis tools. The use of hardware description languages verilog and VHDL with a GPS module is employed on a Cyclone II FPGA to account for clock drift and errors in relative time tags between detectors. The course for building this environment and a full toolkit will be outlined.



Ricardo Mendez
Major: Physics, Mathematics and Chemistry

Bioremediation of Agriculture Effluent Project

Rafael Mendoza

Mentor: Dr. John Silveus

California State University, Monterey Bay



Strawberry production is a $2.8 billion industry that provides livelihoods for many hundreds of growers and employs over 80,000 workers in the US. The industry was built around the use of fumigants to manage soilborne diseases and pests. Increasing restrictions on fumigant use due to health and environmental concerns make the development of effective biologically-based techniques, notably anaerobic soil disinfestation (ASD),a promising alternative to fumigation in strawberries; however the efficacy of this technique is dependent on environmental and biological variables. Improved understanding of ASD is needed to develop site and pathogen specific management strategies. Here, we propose to establish and maintain pot trials in a controlled growth chamber to understand the behavioral complexities of ASD for future large scale implementation.



Rafael Mendoza
Major: Chemical Engineering

Math Modeling for Optimal Economic Environment, and Pest Management of Organic Alfalfa: California Model



Dolores Mora

Mentor: Dr. Mohammed Yahdi

Hartnell College

HARTNELLCOLLEGE

California is the nation's leading dairy state producing more than one-fifth of the nation's total milk production valued at more than $21 billion. Due to its high levels of protein, calcium, and high-quality fiber, alfalfa is the main forage in a dairy cow's diet. California is the largest producer of alfalfa. Pest infestations pose huge damage to crops and financial loss to the farmers, estimated at $120 billion in 2015.In California the biggest threats to alfalfa are the weevil and aphids. The pest damage is costly and chemical pesticides/herbicides can be unsafe and costly. Studies have shown polycultures to be better able to control pest infestation, through plant and predator diversity, while monocultures are more prone to pest outbreak. This project develops mathematical models and computer simulations for cost-effective and environmentally-safe strategies to minimize plant damage from pests using Enemies and Movement Hypotheses as well as plant diversity and harvesting schedule, while maximizing farmer profits. Early plant harvest has the benefits of both controlling pests and getting alfalfa at its peak nutritional value. Each mathematical model includes four variables and eighteen parameters linked via a system of nonlinear differential equations using the Shannon plant diversity index, implicit age structures, and scramble competition, logistic and Allee effect approaches. Ultimately, the framework provides polyculture planting strategies for farmers that are cost-effective and pesticide/herbicide-free to minimize the alfalfa damage while maximizing farmer profits through a higher sell price for both the alfalfa crop and the dairy produced.

Dolores Mora
Major: Mathematics

Cosmic Ray Detector Project

Aram Nino-Canizal

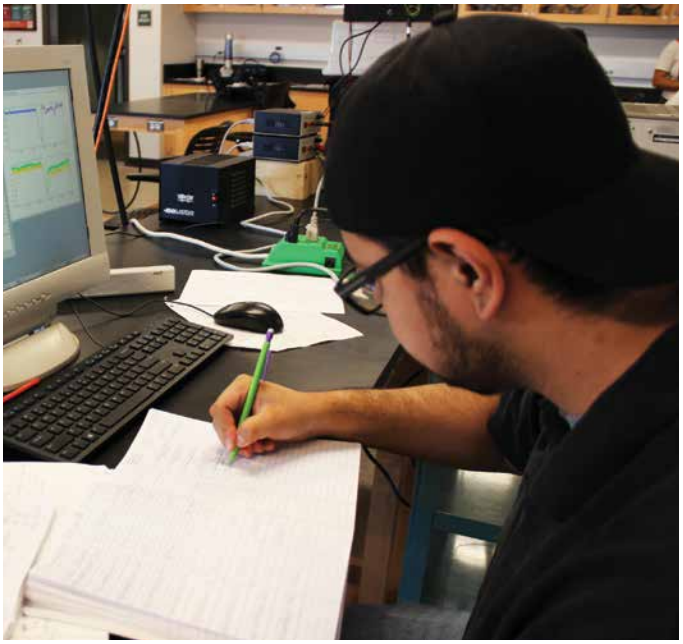
Mentor: Dr. Sewan Fan

Hartnell College



HARTNELLCOLLEGE

Supernovae across the universe eject cosmic rays that impact atomic nuclei in Earth's atmosphere to create secondary particles like muons. The muon is an unstable particle that decays quickly and it can penetrate deep into matter. To measure the cosmic rays, we used light sensitive Photomultiplier detectors connected to scintillator sheets by optical fibers enclosed in a light tight box. We assembled multiple detector boxes to measure the high speed muon particles and using 3 different detector boxes we formed an array. From data collected, the muon speed is determined by moving the detectors to different distances and running a program in the Linux OS to determine and analyze the time that the muon strikes the detectors. The time differences are gathered and plotted onto a time vs. distance graph from which the slope is determined to be 99% of the speed of light.



Aram Nino-Canizal
Major: Mathematics
Transfer major: Mathematics
Intended transfer date: UC Davis, Spring 2019

Remotely Operated Underwater Vehicle

Lorenzo Ontiveros

Mentor: Tito Polo

Hartnell College



HARTNELLCOLLEGE

Would you like to know more about our cool, controllable submarine? Our project involved creating a remote operated vehicle that can do multiple tasks underwater; tasks such as moving fast underwater, picking up objects, and attaching lift bags to debris. After following the design guidelines for our remote operated vehicle, we gathered the parts and assembled the unit. We cut, drilled, and fastened metal together to get our frame completed. In between building, we also coded an Arduino and placed it into an enclosure to control the propellers connected to the vehicle. We are also designing our own claw, using a 3-D printer, to grab and attach items underwater. We will be testing the vehicle in a pool to see what needs improvement. Our remote operated vehicle should be able to swim underwater in all directions and pick up objects. Doing this project gave us the experience we need to make more complex remote operated vehicles in the future, vehicles that search the ocean or explore other planets. We could use this knowledge in the future to make a device that will help us learn about unknown places.

Lorenzo Ontiveros
Major: Mechanical Engineering
Transfer major: Mechanical Engineering
Intended transfer date: CSU San Jose, Fall 2020

Prediction of tumor growth for small sample size: von Bertalanffy and power law models

Sergio Parra
Mentor: Dr. Judith Canner

California State University, Monterey Bay



Background: In an experiment involving animal subjects to collect information on tumor growth rates, the costs and effectiveness of the medical intervention is a critical issue to medical research. What remains unknown in the existing literature is how to determine the minimum number of observations necessary to parameterize a predictive mathematical model and select the correct mathematical model. Methods: von Bertalanffy and Power Law models were assessed against data from two in vivo systems: lung and breast carcinoma. By using R programming, we investigated measurement frequency and time scales of tumor growth measurement with a small number of sample size. Results: We developed a protocol to identify the minimum number of samples and frequency of samples to select and parameterize different mathematical models. Conclusion: This cost-effective and ethical planning approach not only directly affects economic return from medical research, but also establishs adequate precision of the anticipated estimation for treatment of experiments for the entire medical community.

Sergio Parra
Major: Physics

Stanford Summer Community College Premedical Program

Dominic Pina Montes

Stanford University



Stanford University

The Stanford Summer Community College Premedical Program (SSCCPP) targets current community college students considered low-income and/or underrepresented in medicine providing exposure to medicine and health through topics in health disparities, leadership challenges in health provision and administration, science success strategies, professional development, clinical exposure, successful preparation for the medical school application process, postsecondary and graduate/professional school financing. SSCCPP is a six-week residential program, allowing talented and motivated community college students interested in medicine to immerse themselves in the Stanford School of Medicine network through a variety of personal and professional development experiences. Participants reside on campus for the duration of the program and will be immersed in topic areas including: Critical reading and research of medical literature; Civic engagement, leadership, and political activism in medicine; Science preparatory classes (previously anatomy, molecular cellular biology, chemistry); An introduction to the MCAT; Academic success and test-taking strategies; and The medical school admissions and financing process. Additional activities promote: Peer networking; Medical student mentorship; and Clinical shadowing and research opportunity education.

Dominic Pina Montes
Major: Biology

Stanford Summer Community College Premedical Program



Cristina Perez

Stanford University

Stanford University

The Stanford Summer Community College Premedical Program (SSCCPP) targets current community college students considered low-income and/or underrepresented in medicine providing exposure to medicine and health through topics in health disparities, leadership challenges in health provision and administration, science success strategies, professional development, clinical exposure, successful preparation for the medical school application process, postsecondary and graduate/ professional school financing. SSCCPP is a six-week residential program, allowing talented and motivated community college students interested in medicine to immerse themselves in the Stanford School of Medicine network through a variety of personal and professional development experiences. Participants reside on campus for the duration of the program and will be immersed in topic areas including: Critical reading and research of medical literature; Civic engagement, leadership, and political activism in medicine; Science preparatory classes (previously anatomy, molecular cellular biology, chemistry); An introduction to the MCAT; Academic success and test-taking strategies; and The medical school admissions and financing process. Additional activities promote: Peer networking; Medical student mentorship; and Clinical shadowing and research opportunity education.

Cristina Perez
Major:Bio-Chemistry

Remotely Operated Underwater Vehicle

Daniel Phillips

Mentor: Tito Polo

Hartnell College



HARTNELLCOLLEGE

Would you like to know more about our cool, controllable submarine? Our project involved creating a remote operated vehicle that can do multiple tasks underwater; tasks such as moving fast underwater, picking up objects, and attaching lift bags to debris. After following the design guidelines for our remote operated vehicle, we gathered the parts and assembled the unit. We cut, drilled, and fastened metal together to get our frame completed. In between building, we also coded an Arduino and placed it into an enclosure to control the propellers connected to the vehicle. We are also designing our own claw, using a 3-D printer, to grab and attach items underwater. We will be testing the vehicle in a pool to see what needs improvement. Our remote operated vehicle should be able to swim underwater in all directions and pick up objects. Doing this project gave us the experience we need to make more complex remote operated vehicles in the future, vehicles that search the ocean or explore other planets. We could use this knowledge in the future to make a device that will help us learn about unknown places.



Daniel Phillips
Major: Mechanical Engineering
Transfer major: Mechanical Engineering
Intended transfer date: CSU San Jose, Fall 2019

Low Cost Countermeasures Against Drone Swarm Threats

Nicole Polo

Mentor: Dr. Christopher Brophy

Naval Postgraduate School



In recent years, there has been a significant increase in the usage of Unmanned Aerial Vehicles or drones, both offensively and defensively. These low cost, high tech aerial vehicles are available to the general public and have impressive capabilities. They can be easily modified to carry explosives and are hard to detect. In Iraq, terrorist organizations have already used off the shelf drones to drop ordnance on coalition forces. Furthermore, a swarm of these drones could be capable of causing even more damage by saturating all available defense systems. Currently, there are few cost effective ways of dealing with drone threats. As demonstrated by Israel's use of a $2-3 million dollar Patriot missile to take down a drone that one can easily purchase at a retail store. There are currently numerous government agencies investigating other alternatives. The purpose of this project is to build a low cost solution to the UAV-swarm threat. Currently, this project is focused on building an off-the-shelf rocket that carries submunitions which will destroy or disable the incoming UAVs. The delivery vehicle which utilizes a solid rocket motor has already been tested and its aerodynamic properties observed. The submunitions, also referred to as bomblets, are currently in the design/testing phase. The general plan of attack is as follows: the rocket launches and heads towards the threat, separates and dispenses the submunitions which then track the UAVs, and guide themselves in front of the threat. Once the bomblets are in the correct position, they will disperse an appropriate countermeasure which will then disable the UAVs and render them useless.

Nicole Polo

Major: Mechanical Engineering

Sequencing multiple genomes of Diazinon-degrading bacterium for expression of organophosphate remediating genes in *Pseudomonas, Bacillus, Pantoea, and Serratia Rahil*



Alejandra Ponce

Mentor: Dr. Nate Jue

California State University, Monterey Bay

According to California's Department of Pesticide Regulation, in 2015 a total of 9,181,358 pounds of pesticides were used in Monterey County alone. Pesticides are an ongoing and increasing problem that contaminate our food, land and water resources primarily through agricultural runoff. Toxic insecticides Diazinon and Imidacloprid, are widely used in agriculture to control insects on produce. Recently, studies have identified multiple strains of bacteria with the ability to remediate some of these harmful organophosphates from our local soil and water. Obtaining the genomic sequences of bacteria capable of metabolizing pesticides such as Diazinon will better allow scientists to understand the genetic pathways and therefore, the gene expressions that enable certain bacteria to bioremediate contaminants from our environment. For this experiment, our team cultured approximately 10 bacterial strains from The Molera Treatment Wetland. Isolated colonies were completely suspended in minimal media of Diazinon. Growth rate of the bacteria was carefully measured using a Jenway 7205 UV/ Visible Spectrophotometer with OD600. Colonies with observed substantial growth in the media were further streaked for bacterial DNA isolation of each individual strain using a CTAB method. Ultimately, the DNA of these particular strains were visualized using an agarose gel electrophoresis and then sequenced using MiSeq technology to construct a complete genomic library of each Diazinon remediating bacterial species. Implications for this study will be substantial for branches of environmental science and engineering involved in restoration of polluted areas. There is also the possibility of commercialization of agricultural products that may stem from this research. Overall, the fundamental nature of this conclusion holds significance for various fields of study including microbiology, phylogenetics, ecology, and bioinformatics. Further studies can be conducted to measure effectiveness of specific species of bacteria as well as the overall effect of introducing such bacteria into an active environment along with other naturally occurring organisms.

Alejandra Ponce
Major: Biology

Data Implementation and Function Modeling for Strawberry Production

Fausto Preciado

Mentor: Brian Palmer

Hartnell College/Food Origins



California is the top strawberry producing state in the country, producing 91% of all strawberries eaten in the US. During strawberry season, famers are tasked with estimating how many berries will be produced in the near future and using those estimates to pre sell to distributors. The problem with these estimates is that farmers' yield predictions are inherently uncertain due to the fact that many are based on small samples of berries, leading to possible yield prediction miscalculations that can cause supply chain disruptions of as much as a million dollars per day. Field-level data and figures for farmer prediction vs. actual production was obtained through Food Origins and associated local farmers for the 2017 strawberry season. Weather data from the National Oceanic and Atmospheric Administration (NOAA) through the statistical platform R was also obtained during the project. All collected data was used in developing a predictive formula that can take input variables related to field potential, labor-level data, temperature, etc., and outputs a prediction of harvest potential and yield predictions for a given field. This formula will be implemented into a user friendly app that farmers can use to better predict the yield production in their fields and increase their field's income potential.

Fausto Preciado

Major: Software Engineering

Data Implementation and Function Modeling for Strawberry Production

Maria Ramirez

Mentor: Brian Palmer

Hartnell College/Food Origins



California is the top strawberry producing state in the country, producing 91% of all strawberries eaten in the US. During strawberry season, famers are tasked with estimating how many berries will be produced in the near future and using those estimates to pre sell to distributors. The problem with these estimates is that farmers' yield predictions are inherently uncertain due to the fact that many are based on small samples of berries, leading to possible yield prediction miscalculations that can cause supply chain disruptions of as much as a million dollars per day. Field-level data and figures for farmer prediction vs. actual production was obtained through Food Origins and associated local farmers for the 2017 strawberry season. Weather data from the National Oceanic and Atmospheric Administration (NOAA) through the statistical platform R was also obtained during the project. All collected data was used in developing a predictive formula that can take input variables related to field potential, labor-level data, temperature, etc., and outputs a prediction of harvest potential and yield predictions for a given field. This formula will be implemented into a user friendly app that farmers can use to better predict the yield production in their fields and increase their field's income potential.

Maria Ramirez
Major: Engineering
Transfer major: Civil Engineering
Intended transfer date: UC Davis, Fall 2018

Dye-Sensitized and Perovskite Solar Cells

Jose Ramos

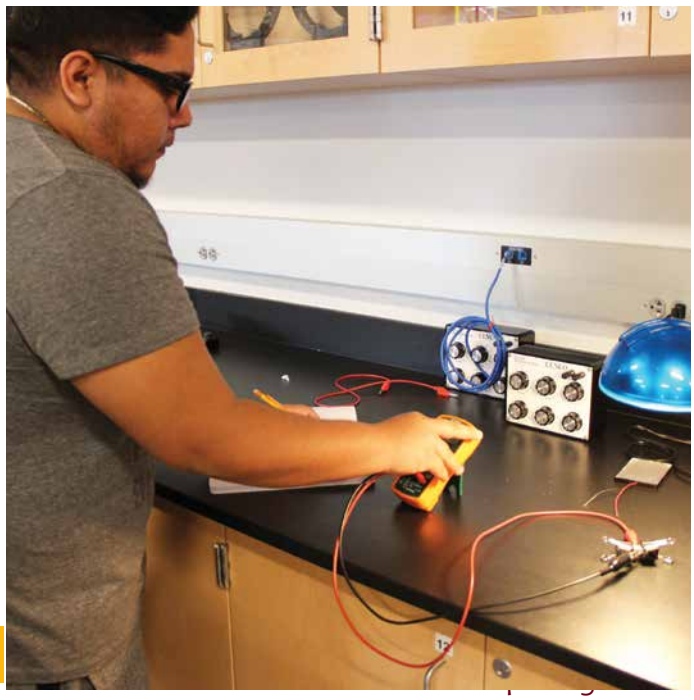
Mentor: Dr. Sewan Fan

Hartnell College



HARTNELLCOLLEGE

Solar cells are efficient means of energy for many types of appliances, converting sunlight into electricity. There are many types of solar cells used as eco-friendly energy alternatives towards the common silicon solar cell. The objective is to make and explore dye-sensitized and perovskite solar cells to discover how they could be used as an efficient and low-cost alternative to a silicon solar cell. Measuring at the sun's spectrum outdoors was a key element in understanding how the solar cells react to different light intensities and how it relates to their levels of efficiency. Using a spectrophotometer, that measures specific color absorption, the solutions of the perovskite and dye-sensitized solar cells were tested and compared to the sun's spectrum, to show how different colors of light affect the power output of the solar cell. This data demonstrated how efficient dye-sensitized and perovskite solar cells are when compared to an average silicon cell and how they could possibly be improved in the future.



Jose Ramos

Major: Mechanical Engineering

Testing QR Codes in Free-Space Optics

Julian Ramos

Mentor: Dr. Peter Ateshian

Naval Postgraduate School



Transmission in wireless communications using radio signals is susceptible to interception and attack. This also puts the receiver at risk of either receiving an erroneous message or none at all. Free-Space Optics (FSO) provides a promising alternative with greater security. It allows information to be transmitted directly while limiting what can receive the signal. The use of QR codes grants the chance to improve the rate of transmission, rising as the size of the code increases. The experiment measured how accurately a web camera could read QR codes displayed in quick succession on an LED matrix. The code was displayed in different color patterns to measure wavelength diversity and subjected to physical obstructions to test resiliency. The receiver had trouble reading the QR code under bright conditions but was able to read and convert messages well in darker settings despite minor interferences. Programs used to compare the original message with the received message aided in comparing successful reception rates between different tests. The QR code has the potential to transmit large quantities of information, but various technological limitations prevent further testing.

Julian Ramos
Major: Engineering
Transfer Major: Aerospace Engineering

Civil Engineering Internship

Maribel Ramos-Peredia

Mentor: Katie Lee

Whitson Engineers



WHITSON ENGINEERS
CIVIL ENGINEERING ▪ LAND SURVEYING ▪ PROJECT MANAGEMENT

Whitson Engineers is an award winning Civil Engineering, Land Surveying and Project Management firm located in Monterey, CA. As an Engineering Aid the goal is to get an understanding of the process a project goes through before development starts, specifically oriented towards the Civil Engineering part of the process. After understanding the clients needs, a proposal is written up by a Project Manager and agreed upon by the client. Next, a survey is conducted, the points obtained from the total station are imported into AutoC3, the points are integrated with real world coordinates and elevation information. These points, along with pictures are a guide to draft an existing proximity and use the integrated information for creating a topographic map for the Civil Engineer to design on. In conclusion once the construction documents are finished they are submitted to the City's planning department for approval.



Maribel Ramos-Peredia
Major: Engineering
Transfer major: Engineering

Observing the Night Sky at Fremont Peak

Joseph Randolph

Mentor: Ron Dammann

Fremont Peak Observatory



The Fremont Peak Observatory Association hosts a popular venue where the community can go enjoy deep space observation. Founded in 1986, the FPOA provides outreach to the general public, offering guidance, equipment and resources for astronomy enthusiasts, amateurs and anyone curious about the night sky. The FPOA has several telescopes of varying sizes operated by members and volunteers utilized for deep space observation. Located roughly 3,000 feet above sea level, the observatory offers an excellent vantage point conducive to viewing celestial bodies, stars, globular clusters, planetary nebulae, comets and more through the use of sophisticated telescopes. Education and information is provided by experienced members, volunteers and interns.

Interns from Hartnell College are responsible for set up, operation and maintenance of the Dobsonian telescopes all while engaging visitors, providing information regarding the locality and general facts about the stellar subjects being viewed. In addition to engaging the public, interns are given the opportunity to present on any astronomical topic, including the different varieties of telescopes, life cycles of the many different types of stars, the creation of the solar system and the geology of the moon. By the end of the summer, the interns are expected to acquire a common knowledge of the night sky, be able to confidently engage others in astronomical conversation and gain experience researching and presenting new material and information.

Joseph Randolph
Major: Biology

The Design and Process behind Engineering Technical Assistance with NRCS



Paola Razo

Mentor: Adriana Campagna

USDA Natural Resources Conservation Service (NRCS)

Eighty percent of the water used in California flows into the state's multi-billion-dollar agricultural sector. In recent years, the demand for water has increased, along the Central Coast Valley in particular. This has caused major issues. To add on, the amount of rain California has been getting over the past few years is quite low. Water demand has been a huge issue in California, as water levels go down. In 2000, almost 34 percent of the water withdrawn from surface water and groundwater was used in irrigated agriculture. In addition, agricultural runoff can impact water quality, carrying potential pollutants into the Nation's streams, lakes, ground water supplies, and estuaries. As the leading Federal agency for assisting in restoring watershed health on private land, National Resource Conservation Service (NRCS) provides technical and financial assistance to producers. NRCS implements conservation practices and management strategies, including the restoration and protection of wetlands, to benefit water quality and improve water management. NRCS, in an effort to in order to prevent the excessive use of water, works with land owners in the disciplines of hydrology and hydraulics, stream restoration of wetlands and in the agricultural setting, agronomy, management of animal waste, pests, salinity, irrigation, and nutrient management. This project involved several smaller projects that varied in classification. The project included hydraulics: calculating the head, pressure needed for water to flow at different elevations; designing a layout for a water stock system that fit the terrain of the desired area: correctly sizing the pipeline to have the right flow of water. Designing livestock water pipelines was one of the few repeated projects others required surveying, road planning as well as the design of tanks and troughs, springs, wells, and pumps. One of the roles for these projects was to design a plan that contractors/producers could easily read and understand the requirements and standards needed for the project. There are several special case practices that are needed within this project including consulting with biologists and/or rangers. One of the goals when designing the project was to improve the usage of water and increasing the design efficiency. This was done by designing an irrigation plan that met the requirement for the crop. For livestock water, we tried to provide storage for at least three days in order to maintain the cattle in good condition if something were to happen. Usually stock water requires a well which is usually designed to run the pump utilizing through solar panels in an effort to be more ecofriendly. Overall, the NRCS engineering process requires a great deal of planning which can vary in detail based on the project.

Paola Razo
Major: Biology Civil Engineering
Transfer major: Civil Engineering
Intended transfer date: CSU San Jose, Fall 2019

Cosmic Ray Detector Project

Andrew Reyes

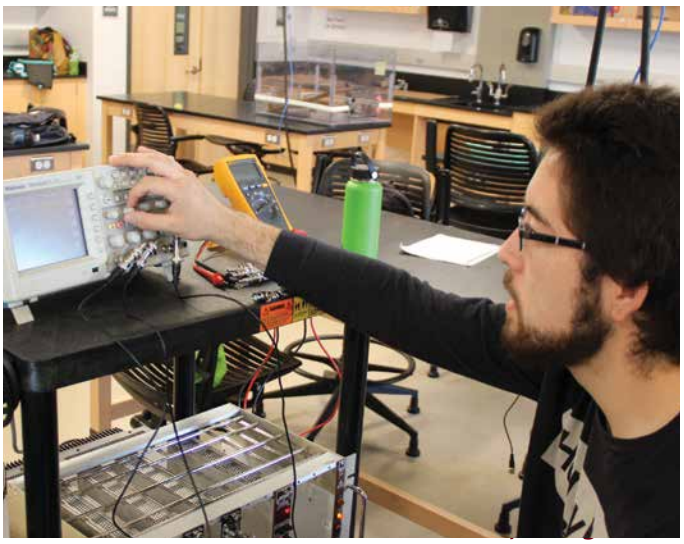
Mentor: Dr. Sewan Fan

Hartnell College



HARTNELLCOLLEGE

Supernovae across the universe eject cosmic rays that impact atomic nuclei in Earth's atmosphere to create secondary particles like muons. The muon is an unstable particle that decays quickly and it can penetrate deep into matter. To measure the cosmic rays, we used light sensitive Photomultiplier detectors connected to scintillator sheets by optical fibers enclosed in a light tight box. We assembled multiple detector boxes to measure the high speed muon particles and using 3 different detector boxes we formed an array. From data collected, the muon speed is determined by moving the detectors to different distances and running a program in the Linux OS to determine and analyze the time that the muon strikes the detectors. The time differences are gathered and plotted onto a time vs. distance graph from which the slope is determined to be 99% of the speed of light.



Andrew Reyes
Major: Mechanical Engineering
Transfer major: Aerospace Engineering
Intended transfer date: CSU San Jose, Spring 2020

Nanosystems Engineering Research Center for Translational Applications of Nanoscale Multiferroic Systems (TANMS)



Martin Reyes, Jr.

University of California, Berkeley

Berkeley
UNIVERSITY OF CALIFORNIA

The Nanosystems ERC for Translational Applications of Nanoscale Multiferroic Systems (TANMS) is a multi-institutional Engineering Research Center focusing on research, technology translation, and education associated with magnetism on the small scale. TANMS's vision is to develop a fundamentally new approach coupling electricity to magnetism using engineered nanoscale multiferroic elements to enable increased energy efficiency, reduced physical size, and increased power output in consumer electronics.

This new nanoscale multiferroic approach overcomes the scaling limitations present in the century-old mechanism to control magnetism that was originally discovered by Oersted in 1820. TANMS's goals are to translate its research discoveries on nanoscale multiferroics to industry while seamlessly integrating a cradle-to-career education philosophy involving all of its students and future engineers in unique research and entrepreneurial experiences.

Martin Reyes, Jr.
Major: Mechanical Engineering
Transfer major: Mechanical Engineering
Intended transfer date: Cal Poly SLO, Fall 2018

Data Implementation and Function Modeling for Strawberry Production

Chris Rodriguez

Mentor: Brian Palmer

Hartnell College/Food Origins



California is the top strawberry producing state in the country, producing 91% of all strawberries eaten in the US. During strawberry season, famers are tasked with estimating how many berries will be produced in the near future and using those estimates to pre sell to distributors. The problem with these estimates is that farmers' yield predictions are inherently uncertain due to the fact that many are based on small samples of berries, leading to possible yield prediction miscalculations that can cause supply chain disruptions of as much as a million dollars per day. Field-level data and figures for farmer prediction vs. actual production was obtained through Food Origins and associated local farmers for the 2017 strawberry season. Weather data from the National Oceanic and Atmospheric Administration (NOAA) through the statistical platform R was also obtained during the project. All collected data was used in developing a predictive formula that can take input variables related to field potential, labor-level data, temperature, etc., and outputs a prediction of harvest potential and yield predictions for a given field. This formula will be implemented into a user friendly app that farmers can use to better predict the yield production in their fields and increase their field's income potential.

Chris Rodriguez
Major: Computer Science
Transfer major: Computer Science
Intended transfer date: CSU San Jose, Spring 2020

Fresh Produce Wash Solution Pilot Plant Internship

Citlali Sanchez

Mentor: Dr. Eric Wilhelmsen

Smart Wash Solutions

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.

Citlali Sanchez
Major: Biology

Cosmic Ray Air Shower Monte Carlo Simulation and Coincidence Tracking System

Melody Sanchez

Mentor: Dr. Sewan Fan

Hartnell College



HARTNELLCOLLEGE

This project supports the ongoing efforts of Hartnell College's Research Institute (RSI) in their cosmic ray particle research via two parts: The development of a GPS module driven time-tagging FPGA and utilization of a simulated monte carlo cosmic ray air shower with respect to coincidence trigger delays to obtain the primary particle direction. The RSI team has collected and analyzed data from initial scintillator arrays, an investigation of data approximation to models is needed; which is obtained through C, PAW, and any data analysis tools. The use of hardware description languages verilog and VHDL with a GPS module is employed on a Cyclone II FPGA to account for clock drift and errors in relative time tags between detectors. The course for building this environment and a full toolkit will be outlined.



Melody Sanchez

Major: Computer Engineering

Transfer major: Computer Engineering

Intended transfer date: UC Davis/CSU San Jose, Spring 2019

Mineral Composition Analysis of High Salinity Grown Lettuce

Arnulfo Soria

Mentor: Dr. Neil Adhikari

USDA Agricultural Research Service (ARS)



As climate changes occur in our environment, it tends to effect the soil, in which the Agriculture business uses to grow the Crops we consume. One example is the Incoming Ocean Tides, which bring in high concentrations of salt into the soil, which causes a problem to salt sensitive crops. One salt sensitive crop is lettuce, which is one of the most important salad vegetables in the United states. After harvest of the lettuce roots and stems, they be analyzed for the mineral content, and determine which system in the plant is responsible for the Salt tolerance mechanism. We chose lettuce varieties from each lettuce type that were identified from a previous study as tolerant or sensitive. Mild salt stress was applied at gradually increasing concentrations of salt in order to prevent salt shock. At the end of 4 weeks, we measured the Soil Plant Analyses Development (SPAD) index, photosynthetic CO2 assimilation, fresh weight and dry weight of the shoot and root. Including a mineral analysis of both Shoot and root samples and with the data acquired it will help to identify which lettuce types who be used in certain regions for farmers, and possibly gene isolation for salt tolerance, which can be used to insert in non-salt tolerance lettuce types.

Arnulfo Soria
Major: Biology
Transfer major: Biology
Intended transfer date: UC Merced, Fall 2018

Identification of *Peronospora effusa* Isolates Through Microsatellite Marker Screening

Tommie Starling III

Mentor: Dr. Steve Klostermanian

USDA Agricultural Research Service (ARS)



With the emergence of new discoveries about the remarkable benefits of the consumption of spinach, there also has come a markedly higher demand for the crop. *Peronospora effusa* is a microbe belonging to the Kingdom Stramenopila which specifically infects and colonizes spinach; it can quickly and easily decimate an entire field of spinach. Seven to ten days after infection, P. effusa produces heavy amounts of asexual sporangia on the underside of the leaves, which looks like purplish gray spore clusters which is where the name of the disease, downy mildew, is derived. The top sides of leaves become discolored, usually turning yellow, and is thus unmarketable. Because of the global movement of spinach seed from Europe and the Pacific Northwest of the US into California, and the knowledge that some of the seed lots are infested with P. effusa, there is a need to compare genetics of California isolates of the pathogen versus those that are imported to assess the scope of the problem. Using P. effusa spores, genomic DNA was extracted in order to run polymerase chain reactions (PCR) in regions containing microsatellites or Simple Sequence Repeats (SSRs). SSRs or microsattelites are short sequences of 2 to 6 nucleotides repeated 4 or more times in a row. SSRs are ubiquitous and conserved throughout eukaryotic and prokaryotic organisms; however, differences in the copy number of repeated motifs can be used to discern different genotypes. PCR primers were chosen that flank SSR regions that were segregated throughout the genome to obtain ample coverage of the organism's genetic information. This strategy was used to create a set of genetic markers which will be useful to identify and differentiate isolates of P. effusa from different locations or of different pathotypes.

Tommie Starling III

Low Cost Countermeasures Against Drone Swarm Threats

Palmit "Paul" Takhar

Mentor: Dr. Christopher Brophy

Naval Postgraduate School



In recent years, there has been a significant increase in the usage of Unmanned Aerial Vehicles or drones, both offensively and defensively. These low cost, high tech aerial vehicles are available to the general public and have impressive capabilities. They can be easily modified to carry explosives and are hard to detect. In Iraq, terrorist organizations have already used off the shelf drones to drop ordnance on coalition forces. Furthermore, a swarm of these drones could be capable of causing even more damage by saturating all available defense systems. Currently, there are few cost effective ways of dealing with drone threats. As demonstrated by Israel's use of a $2-3 million dollar Patriot missile to take down a drone that one can easily purchase at a retail store. There are currently numerous government agencies investigating other alternatives. The purpose of this project is to build a low cost solution to the UAV-swarm threat. Currently, this project is focused on building an off-the-shelf rocket that carries submunitions which will destroy or disable the incoming UAVs. The delivery vehicle which utilizes a solid rocket motor has already been tested and its aerodynamic properties observed. The submunitions, also referred to as bomblets, are currently in the design/testing phase. The general plan of attack is as follows: the rocket launches and heads towards the threat, separates and dispenses the submunitions which then track the UAVs, and guide themselves in front of the threat. Once the bomblets are in the correct position, they will disperse an appropriate countermeasure which will then disable the UAVs and render them useless.

Palmit "Paul" Takhar

Major: Electrical Engineering

Transfer major: Electrical Engineering

Intended transfer date: CSU San Jose State, Fall 2018

Atmospheric Temperature Collection via High Altitude Balloon with CricketSat

Julio Tena
Mentor: Dr. James H. Newman

Naval Postgraduate School



The purpose of this project is to redesign an existing temperature sensor that flies on a high altitude balloon (HAB). The existing sensor is non-linear and a change to linear temperature sensor will yield higher accuracy for measuring temperature. Previous systems depended on thermistors whose non-linearity made the acquisition of temperature a cumbersome process. The current project introduces an AD590 integrated circuit (IC) temperature transducer. Each millivolt is proportional to one-degree Kelvin which is converted into a frequency by means of a voltage-controlled oscillator (VOC) 555 IC timer. The varying frequency is sent to the ground station via the carrier wave generated by a transmitter. This telemetry module is flown to high altitudes on a HAB. In order to process the transmitted signal, a handheld radio is used to record an audio file. After removal of the carrier frequency, a 444 MHz signal, Fast-Fourier Transform with MATLAB is used to extract the transmitted frequency. Prototyping on a circuit board was crucial to testing each component before launch on the HAB. Although key concepts from previous systems remain, the current research indicates that a more efficient way of measuring atmospheric temperature is viable using the AD590 IC.

Julio Tena
Major: Computer Engineering
Transfer major: Computer Engineering
Intended transfer date: Cal Poly, SLO, Fall 2018l

Do Pathological Mutations in the Central Region of the Prion Protein (PrP c) Affect Alpha-Cleavage?

Ruben Tinajero
Mentor: Dr. Christopher Brophy

University of California, Santa Cruz



It is believed that a-cleavage in the central region of the cellular prion protein (PrPc) is important to regulate its function. Studies using deletion mutations of the PrPc have shown that deletion of the polypeptide segment susceptible to a-cleavage causes cell death that is reminiscent of prion diseases. There are pathological mutations in the central region of PrPc known to cause prion diseases, but it is unknown if these mutations effect the efficiency of a-cleavage. We hypothesize that these pathological mutations will reduce a-cleavage, thus leaving more full-length protein on the cell membrane. We tested this by transiently transfecting HEK293T cells that come with the different central region pathological mutants and measure cleavage efficiency by western blot. We then compared cleavage efficiency between the wild-type protein and the pathological mutants. Our results will show if a-cleavage efficiency can be correlated to the diseased state and will help us understand prion diseases better.



Ruben Tinajero
Major: Biology

Data Implementation and Function Modeling for Strawberry Production

Ian Ulrich

Mentor: Brian Palmer

Hartnell College/Food Origins



California is the top strawberry producing state in the country, producing 91% of all strawberries eaten in the US. During strawberry season, famers are tasked with estimating how many berries will be produced in the near future and using those estimates to pre sell to distributors. The problem with these estimates is that farmers' yield predictions are inherently uncertain due to the fact that many are based on small samples of berries, leading to possible yield prediction miscalculations that can cause supply chain disruptions of as much as a million dollars per day. Field-level data and figures for farmer prediction vs. actual production was obtained through Food Origins and associated local farmers for the 2017 strawberry season. Weather data from the National Oceanic and Atmospheric Administration (NOAA) through the statistical platform R was also obtained during the project. All collected data was used in developing a predictive formula that can take input variables related to field potential, labor-level data, temperature, etc., and outputs a prediction of harvest potential and yield predictions for a given field. This formula will be implemented into a user friendly app that farmers can use to better predict the yield production in their fields and increase their field's income potential.

Ian Ulrich

Major: Physics

Fresh Produce Wash Solution Pilot Plant Internship

Christian Vargas

Mentor: Dr. Eric Wilhelmsen

Smart Wash Solutions

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.

Christian Vargas

Prediction of tumor growth for small sample size: von Bertalanffy and power law models

Frances Wong
Mentor: Dr. Judith Canner

California State University, Monterey Bay



Background: In an experiment involving animal subjects to collect information on tumor growth rates, the costs and effectiveness of the medical intervention is a critical issue to medical research. What remains unknown in the existing literature is how to determine the minimum number of observations necessary to parameterize a predictive mathematical model and select the correct mathematical model. Methods: von Bertalanffy and Power Law models were assessed against data from two in vivo systems: lung and breast carcinoma. By using R programming, we investigated measurement frequency and time scales of tumor growth measurement with a small number of sample size. Results: We developed a protocol to identify the minimum number of samples and frequency of samples to select and parameterize different mathematical models. Conclusion: This cost-effective and ethical planning approach not only directly affects economic return from medical research, but also establishs adequate precision of the anticipated estimation for treatment of experiments for the entire medical community.

Frances Wong
Major: Electrical Engineering
Transfer major: Electrical Engineering

Energy Construction and Engineering Internship

Adela Zamora

Mentor: Caren Perlmutter

ENGIE Services



ENGIE manages a range of energy businesses in the United States and Canada, including retail energy sales and energy services to commercial, industrial and residential customers, natural gas and liquefied natural gas (LNG) distribution and sales, and electricity generation and cogeneration. In 2015, ENGIE recorded $77.6 billion in global revenues. More than 3,500 employees work in the region, and Houston serves as corporate headquarters. This Engineering internship allows students pursuing degrees in engineering an opportunity to work closely with Engie's engineering team and other departments to help design ground mounted solar systems. This is a fantastic opportunity for someone looking to gain experience in the renewable energy industry as it provides valuable experience, tangible skills using industry-standard design tools, and contacts within the field.

Adela Zamora
Major: Electrical Engineering
Transfer major: Electrical Engineering
Intended transfer date: Cal Poly, SLO, Fall 2018

Data Implementation and Function Modeling for Strawberry Production

Jose Zavala
Mentor: Brian Palmer
Hartnell College/Food Origins



California is the top strawberry producing state in the country, producing 91% of all strawberries eaten in the US. During strawberry season, famers are tasked with estimating how many berries will be produced in the near future and using those estimates to pre sell to distributors. The problem with these estimates is that farmers' yield predictions are inherently uncertain due to the fact that many are based on small samples of berries, leading to possible yield prediction miscalculations that can cause supply chain disruptions of as much as a million dollars per day. Field-level data and figures for farmer prediction vs. actual production was obtained through Food Origins and associated local farmers for the 2017 strawberry season. Weather data from the National Oceanic and Atmospheric Administration (NOAA) through the statistical platform R was also obtained during the project. All collected data was used in developing a predictive formula that can take input variables related to field potential, labor-level data, temperature, etc., and outputs a prediction of harvest potential and yield predictions for a given field. This formula will be implemented into a user friendly app that farmers can use to better predict the yield production in their fields and increase their field's income potential

Jose Zavala
Major: Computer Engineering
Transfer major: Computer Engineering

Differential equations — the mathematics of change

Mentor: Dr. Jennifer Moorehouse, Brian Palmer and Nick Pasquale



HARTNELLCOLLEGE

No matter what STEM discipline a student pursues, it is nearly guaranteed that they'll work with complicated and dynamic systems. Differential equations - the mathematics of change - are an indispensable tool for describing these systems, and are invaluable to our future STEM workforce. Because the field of differential equations is so vast, the traditional calculus and differential equations curriculum is overflowing with valuable techniques and concepts, but this leaves little room for students to practice the art and science of modeling dynamical systems. To this end, SIMIODE (The Systematic Initiative for Modeling Investigations and Opportunities with Differential Equations, a 501(c)3) now organizes a semiannual competition (Fall and Spring) to supplement students' traditional calculus and differential equations curriculum with realistic modeling. In this competition, students work in teams of three on an open-ended modeling application for a whole week. On the weekend of the competition, the teams meet at a host site, where they are given an extension of their problem, and given time to update their solutions. Each team submits an executive summary, and prepares a presentation for judging.

This year, mathematics instructors Jennifer Moorehouse, Brian Palmer, and Nick Pasquale were fortunate to receive one of Hartnell's $3500 Innovation Grants, and gained department-wide support to organize a SIMIODE competition at Hartnell College. To this end, the team prepared monthly trainings for well over 150 Hartnell STEM students, with guest lecturers from across the spectrum of differential equations modeling. Students attended monthly Saturday training sessions for three hours, with a lunch and social hour thereafter. Many students also attended one-hour sessions on Fridays, presented by various Hartnell math faculty. Hartnell was a host site for the competition this year, and we had two teams of three students compete in the competition. Youseff Al-Shinnawi, Daniel Lamas, and Ian Ulrich won first



prize for their work in modeling interactions between different social groups, and Paulo Jauregui, Dolores Mora, and Paula Razo received second place for their work in modeling the fight or flight reactions of fish depending on their relative sizes.

The team is extremely grateful for all the support from the Math Department and the college, and to the faculty and visiting presenters of the Friday and Saturday training sessions. We are also humbled by the amount of student buy-in for the program, and are excited to see such a large overlap of SIMIODE trainees with the 2018 summer STEM interns. We hope to continue to offer this competition as a stepping stone to STEM internships, and help our students see the value of real-world modeling as a supplement to their traditional coursework.

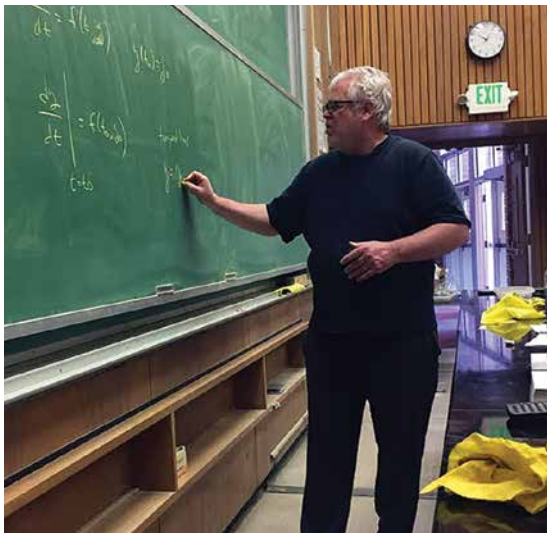
Saturday presenters, in order of their talks:

1. Brian Palmer, Hartnell College
2. James Butler, Hartnell College
3. Nai-Chia Chen, University of Minnesota
4. Andrew Marshall, Stanford University
5. Dominic Dotterrer, Stanford University and Performance Star
6. Mohammed Yahdi, Hartnell College
7. Brian Palmer, Hartnell College











Analysis of the complete organellar genomes of the rockweed Fucus spiralis (Fucaceae, Phaeophyceae) supports its infraspecific recognition as Fucus vesiculosus var. spiralis

Alejandra Alvarez, Juan Anaya, Bibiana Arellano, Austin Bartlebaugh, Michael C. Capurro, Adriana Carrillo, Isaiah R. Chacon, Lizbeth Cordova, Bethany Corral, Melina DaSilva, Giselle Del Valle, Alexis Diaz, Isaac Diaz, Carlos Donate, Isabella Fusco, Brian Garcia, Janette Garcia, Christian Godoy, Victor Gonzalez, Megan Hertzog, Nicholas Horton, Jeffery R. Hughey, Eli R. Kallison, Rafael Lopez Jr, Jennifer Martinez, Rene Martinez, Kianna Mendez, Marie Pacheco, Maria Ramirez, David M. Ramirez, Jennifer M. Rios, Franca Rossi, Jorge Rua, Alyssa Sanchez, Daniela Sanchez, Maria Sanchez, Karla Santos, Rosaura Sierra, Daniel Soto, Alicia Steinhardt, Jesus Tavarez, Mark Tupas, Rolando T. Valdez, Christian Vargas, Rudy Vargas, Frances L. Wong, Adrian Zamora

Mentor: Dr. Jeffery Hughey

Hartnell College

HARTNELLCOLLEGE

Fucus spiralis L. is a broadly distributed monoecious intertidal seaweed. The specific status of F. spiralis however is debatable. Here, we contribute to the bioinformatics and systematics of F. spiralis by analysing the complete mitochondrial and plastid genomes of a specimen from California, U.S.A. The F. spiralis mitogenome is 36,396 base pairs (bp) in length and contains 67 genes, and the plastid genome is 125,066 bp in length and contains 171 genes. The F. spiralis genomes are 99.7% and 99.8% similar in nucleotide sequence to F. vesiculosus, and support the revised classification of F. spiralis to Fucus vesiculosus var. spiralis.



We thank our

STEM Partners

HARTNELL COLLEGE

Berkeley
UNIVERSITY OF CALIFORNIA

California State University
Monterey Bay

CENTRAL COAST SURVEYORS

ENGIE

FREMONT PEAK OBSERVATORY

HARTNELL COLLEGE FOUNDATION

FOOD ORIGINS

NPS
PRAESTANTIA PER SCIENTIAM

UNIVERSITY OF CALIFORNIA
SANTA CRUZ

SWS™
SmartWashSolutions

Stanford
University

UCDAVIS
UNIVERSITY OF CALIFORNIA

USDA

USDA ARS Agricultural Research Service

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

USDA NRCS Natural Resources Conservation Service

WE WHITSON ENGINEERS
CIVIL ENGINEERING • LAND SURVEYING • PROJECT MANAGEMENT

For more information about the
Hartnell College STEM Summer Internship Program visit
www.hartnell.edu/steminternship



HARTNELLCOLLEGE

411 Central Avenue
Salinas, CA 93901

www.hartnell.edu