Hartnell College
10th Annual
STEM
Summer Internship Program
August 20, 2016

HARTNELLCOLLEGE

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STEM 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 experience for undergraduates) programs. Internships are guided by experienced mentors who provide training in research, presentation skills, communication skills, 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. Over the past several 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 700 students in undergraduate research and professional internship opportunities. In addition to program growth over the 10-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 2011 cohort, almost 80% transferred to a 4-year university. That trend continues with the recent cohorts. At partner institution UC Santa Cruz, about 71% of Hartnell students who transferred between 2013 and 2015 are still pursuing their degrees and are expected to complete. 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

ACCESS Program (National Institutes of Health)

Baker University

California State University Monterey Bay

Center for Dark Energy Biosphere Investigations

Hartnell College

Hartnell College Foundation

HeavyConnect

Hispanic Serving Institutions STEM Title III grants

National Science Foundation

Natividad Medical Center

ProteinSimple

SmartWash Solutions

Stanford University

U.S. Department of Agriculture

University of California Riverside

University of California Santa Cruz

SPCA of Monterey

STEM The Team

Hartnell College STEM Internship Program Team

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Dean of Academic Affairs –
Math, Science, and Engineering

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Director, Hispanic Serving
Institution Initiatives

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Faculty

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Leda Polio
Program Assistant

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Dr. Sewan Fan
Brian Palmer
Dr. Mohammed Yahdi

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Joe Welch
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Jade Loftus
Xingci Situ

California State University Monterey Bay

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Megan Bassett
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Dr. Willard Clark Lewallen

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STEM Contents

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STEM

INTERNSHIP PROGRAM 2016

Welcome

Dear Friends of Hartnell College,

Welcome to the 10th 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 by all of our student interns, an informational panel of internship alumnus, and a formal program recognizing some of our most valued supporters. We thank you for helping us celebrate the incredible achievements of our students and we encourage you to engage in the program by asking our students about their summer research projects.

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

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

Hartnell College Vision

Hartnell College will be nationally recognized for the success of our students by developing leaders who will contribute to the social, cultural, and economic vitality of our region and the global community.

Hartnell College Mission

Focusing on the needs of the Salinas Valley, Hartnell College provides educational opportunities for students to reach academic goals in an environment committed to student learning, achievement and success.

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STEM Internship Partners & Mentors

Baker University
Dr. William Miller

City of Monterey
Maryn Miller

California State University Monterey
John Silveus

Father Muller Medical College
N. Sumanjali

Fremont Peak Observatory Association
Ron Dammann

HeavyConnect
Jessica Gonzalez

Hartnell College Research Scholars Institute
Dr. Sonia Arteaga
Dr. Sewan Fan
Dr. Jeffery Hughey
Brian Palmer
Dr. Mohammed Yahdi

IBM
Dr. Noel Arellano

Loaves and Fishes
Jordan Azevedo

MAC REU Riverside
Dr. Weimin Zhou

NASA Ames Research Center
Dr. Erin Flynn-Evans

Naval Postgraduate School Community College Catalyst Program
Dr. Peter Ateshian
Arijit Das
Maxwell Fabian
Dr. Garth Hobson
Dr. Joseph Hooper
James Horning
Gary Parker
Dr. Neil Rowe

Protein Simple

SmartWash Solutions
Dr. Eric Wilhelmsen

SPCA
Leah Gast

Stanford University School of Medicine
Dr. Guillem Pratx

University of California at Santa Cruz
Dr. James Ackman
Jessica Alipio
Ramin Ebrahimiz
Dr. Tela Favaloro
Dr. Doug Kellogg
Dr. Raphael Kudela
Dr. Michael Isaacson
Dr. Kelton W. McMahon
Brian Mullen
Sean Pace
Dr. Melissa Peacock
Dr. Bill Sullivan

United States Department of Agriculture
Dr. Yong Biao Liu
Dr. Renee Eriksen
Gregory Simmons

Hartnell College
10th Annual
STEM
Summer Internship Symposium

Saturday, August 20, 2016

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

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INTERNSHIP PROGRAM 2016

Student Interns

Changes in global cortical brain activity and behavior with administration of isoflurane

Luis Aguilar

Mentor: Brian Mullen

University of California Santa Cruz, ACCESS

Experimental procedures rely on anaesthetics to tranquilize an animal for surgery or record neurophysiological potentials. However, not much is known about how anaesthetics affect global activity patterns in a brain. For this purpose the goal is to gain insight into how cortical activity patterns and behavioral state in a developing mouse brain change in response to two common anaesthetics: ketamine and isoflurane. Mice with a genetically encoded calcium indicator (GCaMP6s) expressed throughout the brain will allow visualization into how these two anaesthetics change brain excitation patterns. Transcranial recordings of the fluorescence due to activation of GCaMP6s in awake and behaving mice will be used at several stages of mouse development. Recordings of brain activity before and after administration of either anaesthetic will allow a greater understanding on how each affects brain activity. The expected results are that the two anaesthetics will inhibit communication between different parts of the brain that normally communicate. Benefits of this research will allow for and improve our understanding of the mechanisms behind common general anesthetics.

Luis Aguilar
Major: Chemistry
Transfer major: Chemistry
Intended transfer date: Spring 2016
Hartnell Clubs: SIMA, ASHC, Physics Club, Chemistry Club

Automatic Disease Detection in Apples Using Image Processing Techniques

Chanel Aquino

Mentor: Sonia Arteaga, Ph.D.

Hartnell College

HARTNELLCOLLEGE

Automatic disease detection in apples can yield numerous benefits. For large-scale farmers, early detection of pathogens can prevent major economic losses and efficiently increase crop harvest yield. For home-gardeners, disease detection can help distinguish between healthy and unhealthy (i.e., edible and potentially poisonous, respectively) produce, as well as provide information about diseases to help increase their crop yield. Current methods of detection and identification require extra equipment that are often expensive and not accessible for everyone. This research has utilized the availability of smartphones in order to address these issues and provide individuals with an inexpensive, accessible means of detecting diseases in their crops. Programmed into the smartphone is the disease-detecting program--made possible through OpenCV, a computer vision software library, and the Java programming language. Detection is achieved through a classification system that uses a cascade classifier and Haar wavelet transforms to train positive examples of the disease in order to recognize its unique features for future diagnosis.In previous attempts of disease detection--specifically, template matching--results yielded approximately a 70-80% accuracy rate. This extended development of the system hopes to increase detection to an 81-90% accuracy rate through other forms of image processing and computer vision techniques.

Chanel Aquino
Major: Computer Science
Transfer major: Computer Science
Intended transfer date: Spring 2017
Hartnell Clubs: CS in 3, herScript, Code2040: Train the Trainer

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Harmful Phytoplankton Identification with RAI, IFCB, and Cell Count

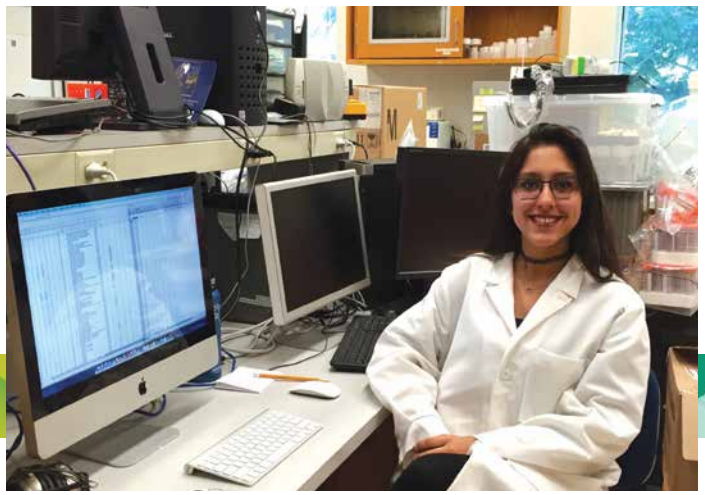
Olivia Arredondo

Mentor: Melissa Peacock, Ph.D.

University of California Santa Cruz

Phytoplankton is the photosynthetic micro-algae found in bodies of water as the primary producer. When a species of micro-algae accumulates due to environmental factors including temperature, water flow, nutrition and pH, a "bloom" occurs. Algal blooms are problematic when composed of phytoplankton species known to emit toxins, creating what is referred to as a "harmful algal bloom". In order to better understand the state of the environment and possible health hazards, analysis of the water must be done to distinguish the phytoplankton species present. Using the water from the Santa Cruz Wharf (SCW), the presence of three different species (Alexandrium spp., Pseudo-nitzschia australis, and Dinophysis spp.) and their commonality is determined using 3 methods: Relative Abundance Index (RAI), cell count, and the Imaging Flow Cytobot (IFCB). RAI is used to assign each species a status for their distribution including not present, rare, present, common, and abundant. Cell count is done by using a probe, which adds fluorescence to specific species depending on genetic sequences. IFCB takes photographs of individual plankton found in a given water sample and, at the moment, requires individual labeling. The most effective way to analyze the SCW phytoplankton variation and abundance would be to utilize a combination of these methods. Cell counts are accurate and when paired with IFCB, the user can have almost a complete picture of the SCW phytoplankton community. RAI should be loosely regarded as it is open to error in subjectivity.

Olivia Arredondo
Major: General Biology
Transfer major: Biology
Intended transfer date: Fall 2017
Hartnell Clubs: SMESA, Physics Club



Autonomous Smart Irrigation Sensor Stake

Guadalupe Arroyo-Lozano

Mentor: Tela Favaloro Ph.D., Jessica Alipio, Ramin Ebrahimi, Sean Pace

University of California Santa Cruz

In recent years states such as California, Texas and others have been constantly challenged by crop production due to drought. There have been many attempts to efficiently water crops however, none have fully depicted a precise watering scheme. The autonomous sensor stake aims to collects data using various sensors such as temperature, moisture and humidity which can then be used to acquire optimal watering conditions. The sensor stake collects data which is then sent to the feedback control which then adjusts watering times and duration based on current soil conditions and set thresholds. The sensors are held in the stake which is inserted into the soil to measure environmental conditions both below and aboveground. The system is solar powered to be self-sustainable; The system features signal multiplexing which allows the stake to use up to 16 sensors of varying types. All circuits were simulated in PSpice for functionality before being built. Data obtained from the sensors get transmitted to a single-board computer which allows the user to monitor change in plant behavior as they grow. The feedback control adjusts watering times and duration based on current soil conditions. The sensor stake will be tested to withstand rough terrains and weather conditions but further testing in real-world conditions should be done to evaluate performance of the sensor stake. The sensor stake can potentially save water, energy and extra work.

Guadalupe Arroyo-Lozano
Major: Robotics Engineering
Transfer major: Robotics Engineering
Intended transfer date: Spring 2016
Hartnell Clubs: Math Club, SIMA Club, Math Academy

Next generation NPS femto satellite design

Elijah Bigham
Mentor: Peter Ateshian

Naval Postgraduate School

Embedded systems are applied in modern technology from simple washing machines to satellite systems. An embedded system is a computer system that performs a specific function with limited to no direct user input. Currently, the Naval Postgraduate School's (NPS) femto satellites are boards approximately one square inch with a mass just under 10 grams, similar to the mass of a #2 pencil. At the moment, NPS is looking to develop the next generation of femto satellites. Over the summer, the task was to establish the viability of several selected platforms as well as modifying code to get the platforms to perform basic tasks. The project started with a variety of boards that were each tested by running an LED blinker program. Existing code was then modified to allow these devices to use on-board sensors and to communicate wirelessly through a Rockblock, which is hardware used for radio communication between satellites, or a built-in functionality. A table was created to provide easy access to each device's capabilities, advantages and disadvantages. As a result anyone can quickly identify the pros and cons of the various platforms. With the information gathered further development of the next generation of satellites will be expedited.

Elijah Bigham
Major: Engineering
Transfer major: Chemical Engineering
Intended transfer date: Fall 2017
Hartnell Clubs: Chemistry Club, Engineering Club

Tardigrades of the canopy: University of Kansas Field Station

Jasmin Camba

Mentor: William MIller, Ph.D.

Baker University

This three-dimensional research project was designed to study tardigrade (water bear) ecology. Tardigrade density, diversity, and distribution is uniform at varying heights among different species of trees. In order to evaluate the distribution of tardigrades, REU students ascended into the underexplored, deciduous forest canopy of eastern Kansas and central Massachusetts.

Jasmin Camba
Major: Biology
Transfer major: Plant Science
Intended transfer date: Fall 2017
Hartnell Clubs: MESA

Using Block Co-Polymers to Create a Metal Oxide Hard Mask for Etching Silicon and Silicon Dioxide

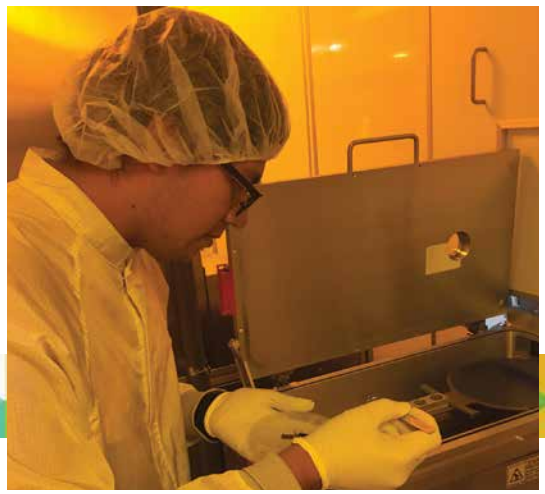
Luis Castro

Mentor: Noel Arellano, Ph.D.

IBM Almedan Research Center

The size of transistors on a computer chip has been exponentially decreasing. The smaller a transistor gets, the more that we can fit on a chip. This makes the chip more functional. However, lithography techniques are getting more expensive and difficult due to the wavelength of light and the limitations of optical systems currently used to pattern transistors. To further scale transistors we used block-copolymers (BCP) to create the patterns necessary to achieve a line width which defines the critical dimension of a transistor. BCP have been shown to create patterns with line widths around 10 to 14 nanometers with pitches of 20 to 28 nanometers. Our specific goal was to develop an etch-resistant metal oxide mask defined by a lamellae BCP pattern. We began the process by creating fingerprint BCP patterns using spin casting techniques on surface of a silicon or silicon dioxide wafer. Then, we removed one of the polymers after they have self-assembled using an oxygen plasma etch. The empty space was filled with a metal oxide using an atomic layer deposition tool. Next, we removed the top layer of metal oxide to reveal the remaining polymer block. Finally, we remove the remaining polymer block leaving behind the metal oxide mask. This allowed us to selectively etch into the silicon or silicon dioxide. While the BCP technique created line widths smaller than what is currently achievable using photolithography, the ultimate goal is to create a directed self-assembled pattern to enhance photolithography processes presently available to chip manufacturers.

Luis Castro
Major: Electrical Engineer
Transfer major: Electrical Engineer
Intended transfer date: Spring 2016



Using Block Co-Polymers to Create a Metal Oxide Hard Mask for Etching Silicon and Silicon Dioxide

Omar Cervantes

Mentor: Noel Arellano, Ph.D.

IBM Almedan Research Center

The size of transistors on a computer chip has been exponentially decreasing. The smaller a transistor gets, the more that we can fit on a chip. This makes the chip more functional. However, lithography techniques are getting more expensive and difficult due to the wavelength of light and the limitations of optical systems currently used to pattern transistors. To further scale transistors we used block-copolymers (BCP) to create the patterns necessary to achieve a line width which defines the critical dimension of a transistor. BCP have been shown to create patterns with line widths around 10 to 14 nanometers with pitches of 20 to 28 nanometers. Our specific goal was to develop an etch-resistant metal oxide mask defined by a lamellae BCP pattern. We began the process by creating fingerprint BCP patterns using spin casting techniques on surface of a silicon or silicon dioxide wafer. Then, we removed one of the polymers after they have self-assembled using an oxygen plasma etch. The empty space was filled with a metal oxide using an atomic layer deposition tool. Next, we removed the top layer of metal oxide to reveal the remaining polymer block. Finally, we remove the remaining polymer block leaving behind the metal oxide mask. This allowed us to selectively etch into the silicon or silicon dioxide. While the BCP technique created line widths smaller than what is currently achievable using photolithography, the ultimate goal is to create a directed self-assembled pattern to enhance photolithography processes presently available to chip manufacturers.

Omar Cervantes
Major: Mechanical Engineering
Transfer major: Mechanical Engineering
Intended transfer date: Fall 2017
Hartnell Clubs: President of Engineering Club, Member of Physics Club

Ambassadors to the Universe: Observing the Night Sky at Fremont Peak Observatory

Neyda Cortes

Mentor: Ron Dammann

Fremont Peak Observatory

In order to assist the resident astronomers at Fremont Peak State Park, four student interns and their mentor made monthly trips to the observatory in the part to serve as ambassadors of astronomy, and were able to take their classroom knowledge and apply it in a real-world situation. The interns were responsible for interacting with and engaging the public audience via observational astronomy. One way of doing this was via presentations the students were required to give. Each student intern made a powerpoint presentation on a topic of their interest, which included supernovae, general optics, black holes, and more. Furthermore, they underwent a training session to learn how to operate and adjust a 30 inch Newtonian telescope dubbed the "Challenger", as well as a 16" Dobsonian telescope, and others ranging in size from 4-10 inches. A multitude of objects are viewable in the summer night sky, and some of the objects shown were the ever-popular Saturn and its rings and moons, Venus, summer constellations like Scorpio, Lyra, Sagittarius, numerous galaxies, as well as numerous Messier Objects

Neyda Cortes
Major: Sociology
Transfer major: Electrical Engineer
Intended transfer date: 2018

Autonomous Smart Irrigation Sensor Stake

Luis Cruz

Mentor: Sean Pace, Jessica Alipio

University of California Santa Cruz, Engineering

In recent years states such as California, Texas and others have been constantly challenged by crop production due to drought. There have been many attempts to efficiently water crops however, none have fully depicted a precise watering scheme. The autonomous sensor stake aims to collects data using various sensors such as temperature, moisture and humidity which can then be used to acquire optimal watering conditions. The sensor stake collects data which is then sent to the feedback control which then adjusts watering times and duration based on current soil conditions and set thresholds. The sensors are held in the stake which is inserted into the soil to measure environmental conditions both below and aboveground. The system is solar powered to be self-sustainable; The system features signal multiplexing which allows the stake to use up to 16 sensors of varying types. All circuits were simulated in PSpice for functionality before being built. Data obtained from the sensors get transmitted to a single-board computer which allows the user to monitor change in plant behavior as they grow. The feedback control adjusts watering times and duration based on current soil conditions. The sensor stake will be tested to withstand rough terrains and weather conditions but further testing in real-world conditions should be done to evaluate performance of the sensor stake. The sensor stake can potentially save water, energy and extra work.

Luis Cruz
Major: Mechanical Engineering
Transfer major: Mechanical Engineering
Intended transfer date: Fall 2016
Hartnell Clubs: Physics club

Intra-Individual Differences in Neurobehavioral Performance Following Habitual Sleep/Wake Cycle

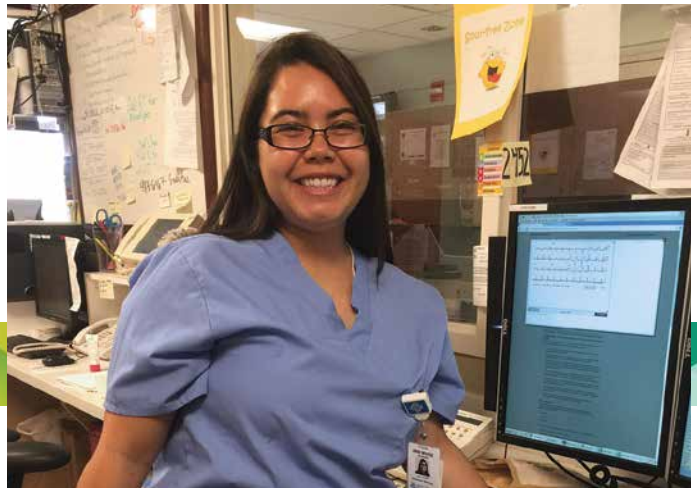
Anne Marie Davidsen

Mentor: Erin Flynn-Evans, Ph.D., MPH

NASA Ames Research Center

Individuals who do not get their daily recommended number of hours of sleep have decreased daytime alertness and neurobehavioral performance compared to those who get enough sleep. It is unclear whether one's own sleep variability in their natural bed and wake time will have adverse effects on performance the following day. The goal of this study is to determine the relationship between an individual's variability in sleep timing and their subsequent objective performance. Depending on their regular sleep/wake cycle and circadian phase, we can explore reaction time and subjective alertness using gold-standard measurements such as Psychomotor Vigilance Task (PVT) and Karolinska Sleepiness Scale (KSS). During the study, participants will be asked to keep a schedule with 8.5 hours in bed and a bed/wake time of their choosing while continuously wearing an Actiwatch for two weeks. Following the at home sleep schedule, participants will be brought into the laboratory and have them complete the PVT and KSS every hour for 16 hours. We will evaluate these measures to test the hypothesis that individuals with greater variability in bed and wake time will have poorer performance relative to those with less than 30 minutes of variability in pre-study bed and wake times.

Ann Marie Davidsen
Major: Biology, Chemistry, Physics, and Mathematics
Transfer major: Pre-Med
Intended transfer date: Spring 2017
Hartnell Clubs: SIMA and Physics Club at Hartnell College



A System Dynamics Approach for Impacting ISIS Oil Transportation

Leonardo Elizondo

Mentor: Gary W. Parker

Naval Postgraduate School

ISIS (Islamic State of Iraq and Syria) makes an estimate $1.5 million dollars a day by selling oil from captured oil fields in black markets or to other buyers. Selling crude oil makes up 43% of ISIS's revenues. The purpose of this project is to create a model of how airstrikes against ISIS oil transport impacts their revenue using System Dynamics (SD). SD uses the concepts of stocks, flows, loops and time delays in order to simulate the time behavior of a system. This model will help assist military planners to disrupt the network and impact ISIS oil transportation. Stella and iThink software is used to create the model and run the simulation. The project requires building a graphical user interface in order for military planners to be able to input parameters such as price per barrel, oil revenue, spare capacity, disruptive events, etc. and display results after an attack scenario. The implementation of the model will help predict when the next aerial attack should occur and the effect it will take on ISIS oil revenue. The model will show the time history of the oil revenues, and how long it takes ISIS to rebuild after an attack has occurred.

Leonardo Elizondo
Major: Mechanical Engineering
Transfer major: Mechanical Engineering
Intended transfer date: Fall 2016

Effects of Sleep Apnea on Cognitive Performance: Validation of the Continuous Positive Airway Pressure Machine

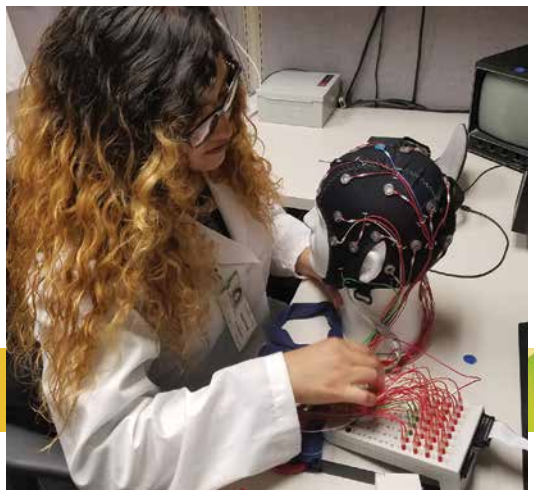
Maricruz Esparza

Mentor: Erin Flynn Evans, Ph.D.

NASA

Sleep apnea is a chronic disorder that causes pauses in one's breathing during sleep; as a result, less oxygen reaches the brain. Research supports that the prefrontal cortex region of the brain, which is responsible for many cognitive functions, is affected by sleep apnea. As such, there is a correlation between cognitive performance impairment and sleep apnea. One treatment for sleep apnea is the use of a continuous positive airway pressure (CPAP) machine which increases air pressure in the throat so that the airway doesn't collapse when breathing in during sleep. Individuals with sleep apnea will use a CPAP machine for a duration of 3 weeks as their cognitive performance is measured. To support the validity of the CPAP machine, we will also measure the cognitive performance of individuals with sleep apnea who do not use a CPAP machine. Unaffected individuals will also be included as a control group. We hypothesize that individuals with sleep apnea will perform worse on cognitive tasks than individuals who do not have sleep apnea. We also anticipate that affected individuals who use the CPAP machine will perform significantly better than those that do not use the CPAP machine.

Maricruz Esparza
Major: Biology
Transfer major: Microbial Biology
Intended transfer date: Fall 2016



Stochastic Models of Antibiotic-Resistant Infections With Analysis of the Impact of Special Preventive Measures

Jorge Flores Ortega

Mentor: Dr. Mohammed Yahdi

Hartnell College

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

Jorge Flores Ortega
Major: Mathematics
Transfer major: Computational Mathematics
Intended transfer date: Fall 2016

Loaves Fishes and Computer Quality Improvement through Data Collection

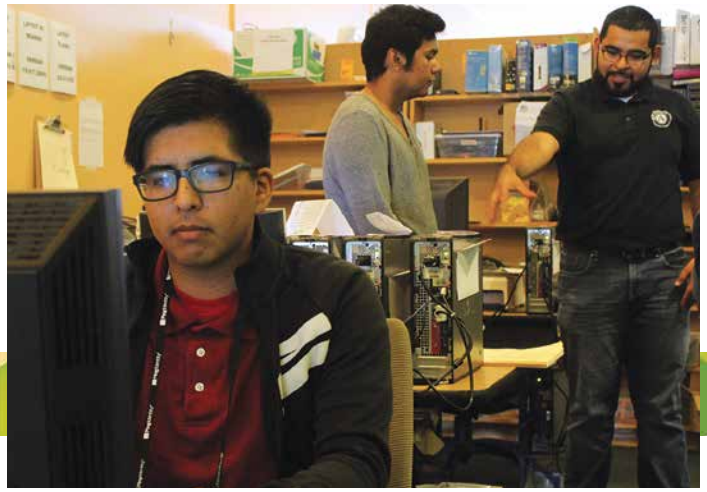
Eduardo Garcia
Mentor: Jordan Azevedo

Loaves Fishes and Computers

Loaves, Fishes & Computers

Loaves fishes and computers is a community based non-profit organization that prioritizes getting computers into the hands of low-income families. LFC (Loaves, Fishes, and Computers) is especially interested in making sure that clients are satisfied with the product and if the client is not satisfied, what improvements can be made so that the client is happy and so the problem can be prevented from showing up again. Our project is running a survey in which we call former clients and ask to see if they are willing to participate. Then there are five questions that will be asked regarding the computer purchased. The data collected from the survey will be categorized and split into charts, for example, one of the questions will be asking "What is the main use of the computer (A: Work, B: Education, C: Entertainment, etc.)? After the data is collected and analyzed it will show what needs to be improved to set a high standard for great computers and service to the community.

Eduardo Garcia
Major: Computer Science & Information Systems
Transfer major: Computer Science & Information Systems
Intended transfer date: Fall 2017



Cosmic Radiation Among Us

Jose Garcia
Mentor: Dr. Sewan Fan

Hartnell College

HARTNELLCOLLEGE

Cosmic Radiation constantly surges through the universe in the form of primary cosmic rays. Cosmic rays which pass through earth's atmosphere are known as secondary cosmic rays. A pair of micro photomultiplier (PMT) detectors and scintillators was used to detect these rays. The electrical signals produced by the micro PMT detectors were set in coincidence with a pair of PMT detector paddles to distinguish which pulses were truly produced by cosmic rays. Our research involved three main activities: 1) separation of the Micro PMT detectors to limit the arrival directions of cosmic rays 2) determining the efficiency of detecting cosmic rays at selected areas on the scintillator sheets 3) improving the efficiency with an arrangement of optical fibers based on findings from activities (1) and (2) above.

Jose Garcia
Major: Mathematics and Physics
Transfer major: Mathematics
Intended transfer date: Fall 2017
Hartnell Clubs: Math Academy, Physics Club

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Digital Forensics on Email Addresses, Phone Numbers, and Personal Names

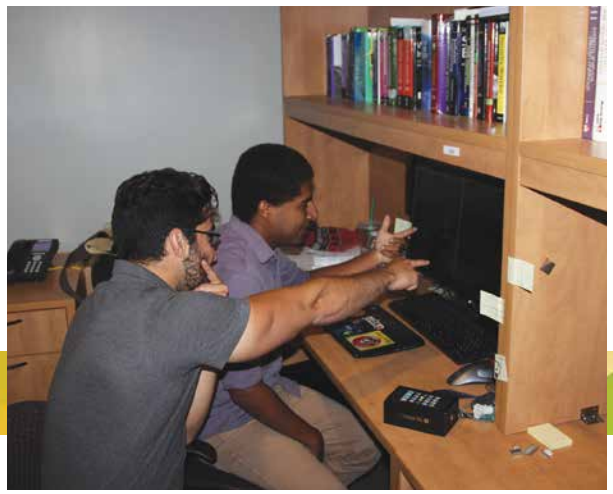
Daniel Gomez

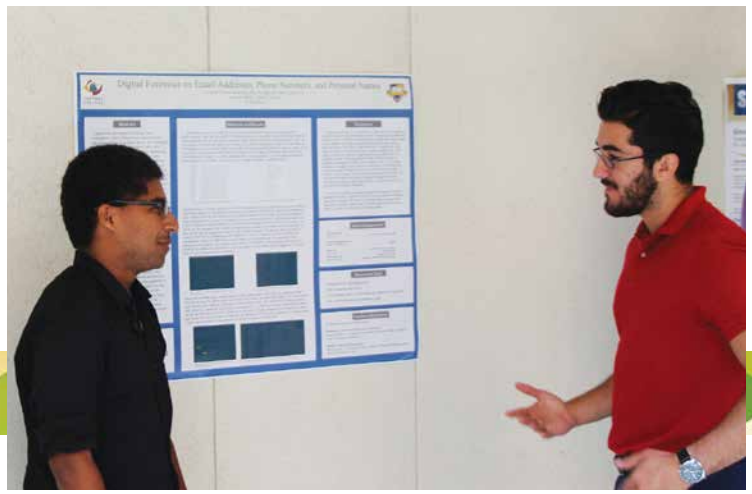
Mentor: Dr. Neil Rowe

Naval Postgraduate School

Digital Forensics entails the recovery and investigation of data collected from various devices, often in the context of computer crimes. We investigated the email addresses, phone numbers, URLs, and personal names previously captured from devices and drives. Prof Rowe utilized Bulk_extractor, an open source forensics tool to scan disk images for different types of data, to collect data from drives and devices. After obtaining formatted files from Prof Rowe, we built on existing tools and analyzed data to infer whether end users made inferences about the context of the data to determine whether the data we've collected resembled a behavioral pattern of an end user. Relevance refers to the importance of a piece of data in the investigation, or the close relation of two different pieces of data. These tools can be used to map a network of users based around a particular device for use in criminal and terrorist investigation.

Daniel Gomez
Major: Computer Science Network & Security
Transfer major: Computer Science Network & Security
Intended transfer date: 2016





Ambassadors to the Universe: Observing the Night Sky at Fremont Peak Observatory

Saul Gonzalez

Mentor: Ronald Dammann

Fremont Peak Observatory

In order to assist the resident astronomers at Fremont Peak State Park, four student interns and their mentor made monthly trips to the observatory in the part to serve as ambassadors of astronomy, and were able to take their classroom knowledge and apply it in a real-world situation. The interns were responsible for interacting with and engaging the public audience via observational astronomy. One way of doing this was via presentations the students were required to give. Each student intern made a powerpoint presentation on a topic of their interest, which included supernovae, general optics, black holes, and more. Furthermore, they underwent a training session to learn how to operate and adjust a 30 inch Newtonian telescope dubbed the "Challenger", as well as a 16" Dobsonian telescope, and others ranging in size from 4-10 inches. A multitude of objects are viewable in the summer night sky, and some of the objects shown were the ever-popular Saturn and its rings and moons, Venus, summer constellations like Scorpio, Lyra, Sagittarius, numerous galaxies, as well as numerous Messier Objects

Saul Gonzalez
Major: Mathematics and Physics
Transfer major: Mathematics and Physics
Intended transfer date: Fall 2016
Hartnell Clubs: Math Academy, Physics Club

Potential Mitotic Control of Cell Size By the Whi5 Transcription Repressor in Saccharomyces cerevisiae

Sergio Gonzalez

Mentor: Doug Kellogg, Ph.D.

University of California Santa Cruz

Cancer is caused by inappropriate cell division. Therefore, understanding the cell division cycle is important for understanding and treating cancer. Cell division requires cell growth. In normal cells, cell size checkpoints link cell division to cell growth by delaying the cell division cycle until sufficient growth has occurred. Cancer cells show severe size defects, which suggests that they have defective cell size checkpoints. The goal of the work in the Kellogg lab is to discover how cell size checkpoints work. In Saccharomyces cerevisiae, Cln3, a G1 cyclin, plays an important role in cell size checkpoints. Transcription of Cln3 in G1 is thought to be dependent upon cell growth. Cln3 activates cyclin dependent kinase 1 (Cdk1) which then inactivates a transcriptional repressor called Whi5, thereby initiating cell cycle entry when sufficient growth has occurred. Recent data suggest that Whi5 may also function in a cell size checkpoint that operates in mitosis. To test this, a version of Whi5 that can be induced to undergo proteolytic destruction in vivo upon addition of auxin will be engineered. A combination of biochemical analysis and live cell imaging by microscopy will be used to test the effects of the loss of Whi5 during mitosis. We hypothesize that inactivation of Whi5 before mitosis will cause cells to exit mitosis at a reduced cell size.

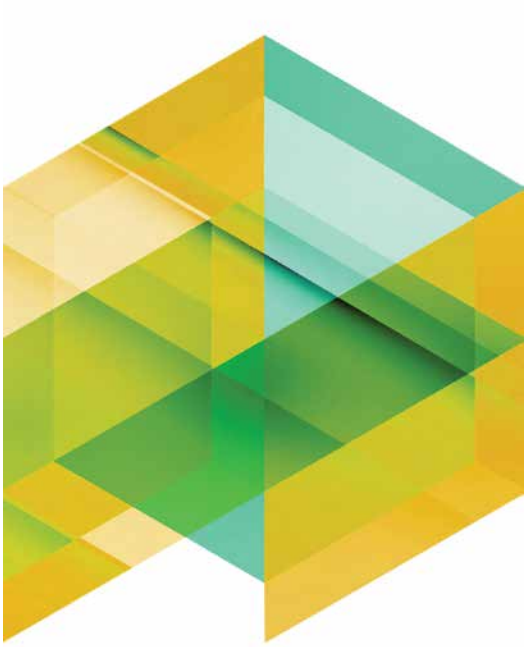
Sergio Gonzalez
Major: Biology
Transfer major: Genetics and Genomics
Intended transfer date: Fall 2016
Hartnell Clubs: Graduated Hartnell College in Spring 2016, President's Honor Roll Spring 2016, Former Treasurer of The Students Interested in Medicine Association (SIMA) Club

Monterey County Pesticide Use Report

Eduardo Gutierrez

Mentor: Jessica Gonzalez

HeavyConnect



California regulations stipulate that anyone that applies pesticide commercially must file a Pesticide Use Report (PUR). The PUR is meant to keep track of details regarding the application of pesticides throughout the state. This helps with keeping track of who's using what and how often. Monterey County sends the most PURs out of any county in the state and even though 80% of reports are now sent through electronically, the process can still take months. Communication between county officials and growers is slow, lack of error checking backs up the process, growers are fined for failing to submit reports accurately. The purpose of our platform is to provide the county and growers a system to make the process, intuitive, efficient, and expedient. Our mobile app allows for applicators to quickly and easily submit reports from anywhere and provides them with safeguards to minimize errors.

The web platform provides a streamlined user-friendly interface that organizes report submission for easy review by pesticide enforcers, as well as opening up a much needed window of communication between regulators and businesses.

Eduardo Gutierrez
Major: Computer Engineering
Transfer major: Computer Engineering
Intended transfer date: Fall 2017
Hartnell Clubs: Math Academy, Physics Club

Complete Genome Sequence of Nonhemolytic Streptococcus agalactiae Serotype V Strain 1, Isolated from the Buccal Cavity of a Canine

Leeanne Harden

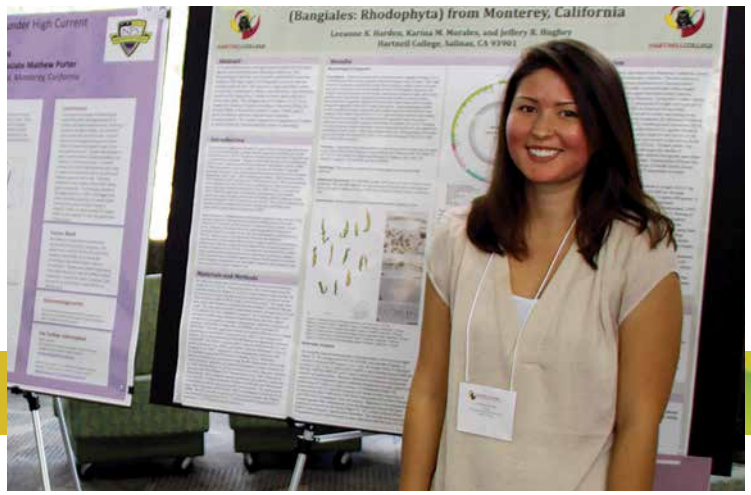
Mentor: Jeffery Hughey, Ph.D.

Hartnell College

HARTNELLCOLLEGE

The complete genome sequence from a nonhemolytic strain of Streptococcus agalactiae from the oral cavity of a canine was assembled. The genome is 2,165,968 bp, contains 2,055 genes, and is classified as group B streptococcus (GBS) serotype V, strain 1. A comparison to other S. agalactiae sequences shows high gene synteny with human and bovine strains.

Leeanne Harden
Major: Biology
Transfer major: Biology
Intended transfer date: Fall 2016
Hartnell Clubs: Graduated Hartnell College in Spring 2016, President's Honor Roll Spring 2016, Former Treasurer of The Students Interested in Medicine Association (SIMA) Club



Testing the Efficient Markets Hypothesis with Agent-Based Simulation

Jessica N. Jimenez

Mentor: Brian Palmer

Hartnell College

The Efficient Market Hypothesis (EMH) claims that it is impossible to "beat" the market because stock market efficiency causes existing share prices to always incorporate and reflect all relevant information. There are immense consequences to this hypothesis, and market participants have a major interest in knowing when and how it fails. It is important to prove that markets cannot be efficient at all times, and find when markets can hold inefficiencies where the market price differs from its true value. The purpose of this project was to construct a simulation of investors who trade bonds in a simulated market. As bonds are being traded, the market implies a probability of missed payment, and we measured levels of discrepancy between the market implied probability of missed payments and the actual probability of missed payments for the company. This summer we implemented features that make the investors more realistic by setting probability distributions to simulate real world numbers. By using the Weibull distribution, we were able to set the number of orders for our investors. The Weibull distribution allowed us to throw in a random number to set an order size for the investors. Furthermore, the results helped us see how investors are trading and how some trade more than others. We also used the generalized lambda distribution to model investor's bias, and investor sophistication. We entered many different parameters into the model to see how the bond reacted, and classified different types of inefficiencies.

Jessica N. Jimenez
Major: Computer Science
Transfer major: Computer Science
Intended transfer date: Fall 2016

Solar Collector Jet Engine Using Heat Cycling Recuperation Methods

Thomas Jimenez

Mentor: Dr. Garth Hobson, Dr. Gannon

Naval Postgraduate School

As the push to consume less fossil fuel continues, solar radiation remains the leading source of renewable energy. Solar collectors already used in households act as a direct application of the absorbed thermal energy given off by the sun. Reconfiguring the structure and design to act as a combustion chamber for jet engines, solar collectors would recuperate and heat air through copper tubing that would occupy the wings' internal compartment. Focusing mirrors placed in the wings' anterior compartment would concentrate heating points to elevate thermal gain, while a flat, metal plate located underneath the tubing would allow the free space to retain heat.

Ideal heat loss would only occur in the turbine compartment, with a small amount of heat going back to the compressor to preheat the air. Eliminating the need for refueling, the expectation is to have the solar collector airplane fly in constant motion with the sun. Maintaining constant flight velocity and elevation, the solar collector plane would act as a satellite in atmosphere gathering and sending information in real-time.

Thomas Jimenez
Major: Chemistry
Transfer major: Chemical Engineering
Intended transfer date: Fall 2018
Hartnell Clubs: IChE, MESA, Chemistry Club, Geology Club

Smart Irrigation System With Feedback Control

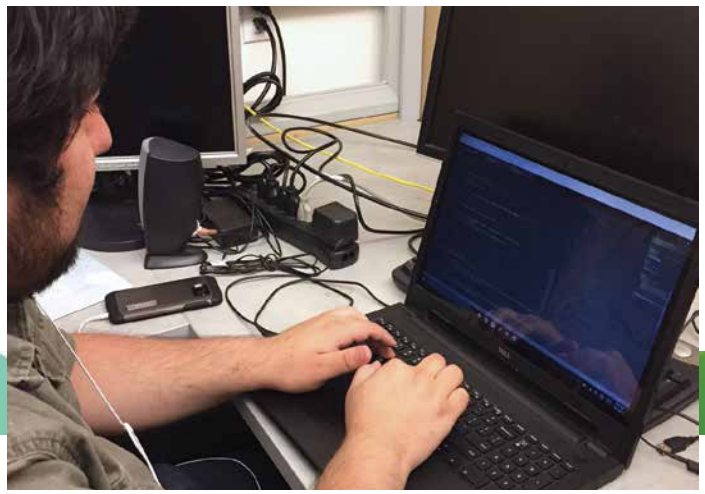
Gustavo Lopez

Mentor: Jessica Alipio, Ramin Ebrahimi, Sean Pace

University of California Santa Cruz

With California facing one of its worst droughts in recent times, it is becoming increasingly difficult to efficiently irrigate crops. Consequently, innovative methods of irrigation must be designed and implemented within the agricultural industry. For this reason, a smart irrigation system has been developed in order to adequately water crops while simultaneously being water and energy efficient. A distributed network of stakes equipped with sensors allows for automated watering via feedback control where data is wirelessly transmitted and received into a local and cloud database. The database is then visualized to a dashboard which the user can access to be better informed of the conditions of their plants. With soil moisture, temperature, humidity amongst other details being measured, the farmer can compare data and make reasonable decisions, giving the user a peace of mind about the state of his or her crops. With scalability held to the highest regard, this system enables anyone from a home gardener to an industry farmer to efficiently water their crops. This design is constrained by creating a streamlined "plug and play" user experience, which results in a more complex design for a more cost effective solution. Even with all the constraints involved, this device offers data that is very beneficial for researchers to build upon. This preludes to a new era of irrigation in which efficiency in both crop yield and saving water is achievable. This smart irrigation system is part a new green revolution the world has been waiting for.

Gustavo Lopez
Major: Computer Science
Transfer major: Computer Science
Intended transfer date: Fall 2017



Smart Irrigation System With Feedback Control

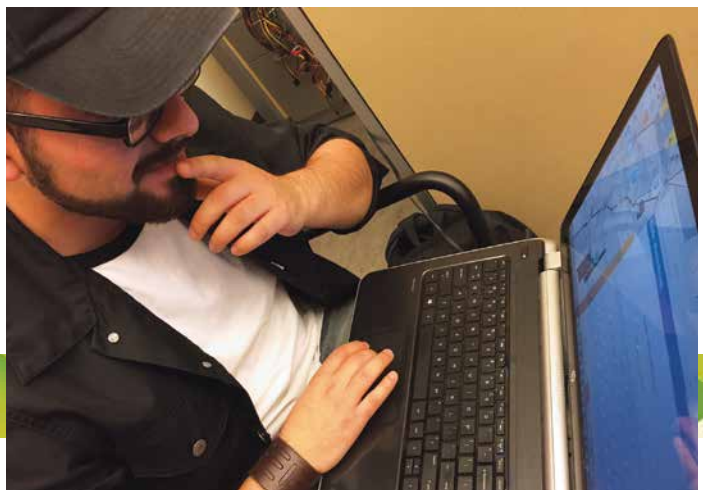
Luis Magallon

Mentor: Jessica Alipio, Ramin Ebrahimi, Sean Pace

University of California Santa Cruz

With California facing one of its worst droughts in recent times, it is becoming increasingly difficult to efficiently irrigate crops. Consequently, innovative methods of irrigation must be designed and implemented within the agricultural industry. For this reason, a smart irrigation system has been developed in order to adequately water crops while simultaneously being water and energy efficient. A distributed network of stakes equipped with sensors allows for automated watering via feedback control where data is wirelessly transmitted and received into a local and cloud database. The database is then visualized to a dashboard which the user can access to be better informed of the conditions of their plants. With soil moisture, temperature, humidity amongst other details being measured, the farmer can compare data and make reasonable decisions, giving the user a peace of mind about the state of his or her crops. With scalability held to the highest regard, this system enables anyone from a home gardener to an industry farmer to efficiently water their crops. This design is constrained by creating a streamlined "plug and play" user experience, which results in a more complex design for a more cost effective solution. Even with all the constraints involved, this device offers data that is very beneficial for researchers to build upon. This preludes to a new era of irrigation in which efficiency in both crop yield and saving water is achievable. This smart irrigation system is part a new green revolution the world has been waiting for.

Luis Magallon
Major: Computer Science
Transfer major: Computer Science
Intended transfer date: Winter 2017
Hartnell Clubs: Mesa, Computer Science Club



A System Dynamics Approach for Impacting ISIS Oil Transportation

Christina Martinez

Mentor: Gary W. Parker

Naval Postgraduate School

ISIS (Islamic State of Iraq and Syria) makes an estimate $1.5 million dollars a day by selling oil from captured oil fields in black markets or to other buyers. Selling crude oil makes up 43% of ISIS's revenues. The purpose of this project is to create a model of how airstrikes against ISIS oil transport impacts their revenue using System Dynamics (SD). SD uses the concepts of stocks, flows, loops and time delays in order to simulate the time behavior of a system. This model will help assist military planners to disrupt the network and impact ISIS oil transportation. Stella and iThink software is used to create the model and run the simulation. The project requires building a graphical user interface in order for military planners to be able to input parameters such as price per barrel, oil revenue, spare capacity, disruptive events, etc. and display results after an attack scenario. The implementation of the model will help predict when the next aerial attack should occur and the effect it will take on ISIS oil revenue. The model will show the time history of the oil revenues, and how long it takes ISIS to rebuild after an attack has occurred.

Christina Martinez
Major: Computer Science
Transfer major: Computer Science
Intended transfer date: Spring 2017
Hartnell Clubs: Peer Led Team Learning - Computer Science

An Examination of the Current Water Quality Parameters of the Salinas Valley

Toby McAllister

Mentor: John Silveus

California State University Monterey Bay

The Salinas Valley in Central California is one of the largest producers of agricultural exports in the world. The industrial production of agriculture in the area requires introducing additional amounts of nutrients to the soil to achieve the level of production desired. The excessive introduction of nu trients to ensure adequate production levels could contribute to unfavorable conditions resulting in ecological impacts such as eutrophication and adverse health effects. Anthropogenic sources provide a means of contaminating ground water. Toxic effects include methemoglobinemia. Monitoring, documenting and understanding water quality parameters in the Salinas Valley is an important first step towards ecological stability. To address this need, and to involve local college students in the study of problematic water quality issues such as temperature, pH, dissolved oxygen, turbidity, and nitrate levels a pilot program testing these water quality parameters was initiated through a collaboration between Hartnell College and CSU Monterey Bay students. Fifteen sites believed to be representative and informative of water quality conditions throughout the Salinas Valley were selected and sampled weekly. Initial data collected supports the hypothesis that water quality throughout the Salinas Valley is more than current water quality standards as set by the Environmental Protection Agency. The EPA water quality standards are designed to preserve ecosystem function and to protect human health, and that continued exceedance of these recommended nutrient limits in the water near or adjacent to agricultural areas constitutes an unsustainable situation.

Toby McAllister
Major: Natural Sciences
Transfer major: Environmental Sciences/Education Concentration
Intended transfer date: Fall 2017
Hartnell Clubs: MESA

NFC Asset Management System

Abraham Medina

Mentor: Arijit Das

Naval Postgraduate School

Asset management systems in the Department of Defense have typically been done with pen, paper, and spreadsheets. However, the drawbacks to these types of systems is that while information about a particular asset is recorded, that information is not readily available due to its spatial dependencies to particular pieces of paper or computers. What this project intends to accomplish is to take advantage of regularly accessible technologies, such as smartphones, and produce a near field communication based (NFC) application that would make the information about a particular asset readily available and simple to access. The initial step of development was to initialize communication between a NFC capable cellphone and a NFC chip. Android Developer was the main resource used in order to build the basic read and write functions of the application. Next, server based database functionality was added through Oracle XE. Lastly a comprehensive user interface was developed through the Android Studio IDE. The reason this application is valuable to the Naval Postgraduate School as a whole is that it would not only do what the current system does today in a mobile manner, but also, with future development, take advantage of other smart phone capabilities such as geolocation and image documentation through the camera.

Abraham Medina
Major: Computer Science
Transfer major: Computer Science
Intended transfer date: Spring 2017
Hartnell Clubs: MESA

Stochastic Models of Antibiotic-Resistant Infections CRE with Analysis of the impact of Special Preventive Measures

Mario Mendez

Mentor: Mohammed Yahdi, Ph.D.

Hartnell College

HARTNELLCOLLEGE

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

Mario Mendez
Major: Mathematics
Transfer major: Mathematics
Intended transfer date: Fall 2016
Hartnell Clubs: Math Club, SIMA

High Altitude Mission Balloon Guided Recovery System (H.A.M.B.G.R.S)

Diana Mikhail

Mentor: Jim Horning

Naval Postgraduate School

High altitude balloons (HAB) are unmanned balloons which fly up to the stratosphere. Our focus was to research and develop methods to guide a payload attached to this balloon to a safe location, how to release the balloon at a certain altitude, and how to have the payload free falling and deploy a parachute at a set altitude. If all was successful this would allow researchers to know that their scientific payloads would not land in a hazardous area, like a body of water, or a highway, since this could mean destruction of a valuable payload. For guidance, the payload had three stationary fins for stability. The balloon detachment system is composed of push pull servos and a 3D printed detachment rig. The parachute deployment system had a spring loaded tube with a pilot chute, a main chute and servos inside. All three systems received commands from a Raspberry Pi Sense Hat circuit board. Due to Navy regulations, this group could not have the payload be autonomously guided but research was still conducted so that future groups may complete the project if said regulations change. When this was finally launched we found that the balloon detached and the parachute deployed on its own which makes the mission successful. Unfortunately the parachute did not open fast enough causing the payload to have a crash landing of about 190 mph.

Diana Mikhail
Major: Engineering
Transfer major: Chemical Engineering
Intended transfer date: Fall 2017
Hartnell Clubs: Computer Science Club, Physics Club, Engineering Club, Chemistry Club

Cosmic Radiation: SIPM Detection and Analysis

Eduardo Molina

Mentor: Dr. Sewan Fan

Hartnell College

Deep space radiation bombards the earth constantly. This radiation hits earth's atmosphere and becomes secondary cosmic rays; most are muon particles. AdvanSiD SiPM detectors are the most recent engineered radiation detectors to use less space, use less energy, and have a better counting efficiency. This study tests AdvanSiD silicon photomultipliers (SiPM) with a scintillator sheet in detecting Muons. Using two SiPM detectors, one SiPM is tested with two PMT for true coincidence. Then, using the two SiPM detectors to test for true coincidence with each other. The data shows us multiple counts of coincidence in one window of time for each test we did with the detector. These data indicate that the SiPM show true coincidence and are successful in detecting cosmic radiation.

Eduardo Molina
Major: Mechanical Engineering
Transfer major: Mechanical Engineering
Intended transfer date: Spring 2017
Hartnell Clubs: MESA

Complete Genome Sequence of Nonhemolytic *Streptococcus agalactiae* Serotype V Strain 1, Isolated from the Buccal Cavity of a Canine

Karina Morales
Mentor: Jeffery Hughey, Ph.D.

Hartnell College

HARTNELLCOLLEGE

The complete genome sequence from a nonhemolytic strain of Streptococcus agalactiae from the oral cavity of a canine was assembled. The genome is 2,165,968 bp, contains 2,055 genes, and is classified as group B streptococcus (GBS) serotype V, strain 1. A comparison to other S. agalactiae sequences shows high gene synteny with human and bovine strains.

Karina Morales
Major: Biology
Transfer major: Bioengineering
Intended transfer date: Spring 2017

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Turnover Rates for Stable Isotopes for the Light Brown Apple Moth (LBAM), Epiphyas postvittana, as a Marker for Mass-Reared Sterile Insects

Emmanuel Muniz
Mentor: Gregory Simmons, Ph.D.

United States Department of Agriculture

We use LBAM as a model to demonstrate how the ratio of stable isotopes of carbon in moth tissues may be affected by age, activity levels and food source. Stable isotopes, are naturally occurring isotopes that vary based on photosynthetic pathway, rain fall, soil fertility, fertilizer. Differences in stable isotope signatures can be used as reliable markers for mass-reared insects used in sterile insect control programs. Stable isotopes have a different atomic weight than usual; for instance, carbon (C) has an atomic weight of 12 (12C) but approximately 1% of carbon atoms have an atomic weight of 13 (13C).

Because an insect's isotopic ratio may change over time with metabolic output, we want to determine if the isotopic signature of a newly emerged adult varies with age or after expending energy in flight. The isotopic signature may also change if adults feed on plants with different isotopic signature from the larval food.

Mass-reared LBAM will be tested to determine the effects of dispersal, age and feeding on isotopic signatures. In one group, adults will be disturbed on a regular basis causing flight for a greater period of time relative to other undisturbed control group. Additionally, adults will be compared to determine variation in carbon isotope signatures due to C3 or C4 diet. This diet experiment will determine if the food source changes the carbon isotope signature significantly when compared to unfed adult moths. The carbon isotope ratios of moths from each treatment will be measured over time with IRMS analysis.

Emmanuel Muniz
Major: Biology and Chemistry
Transfer Major: Biochemistry
Transfer Date: Fall 2016

Development of a Model for Deceleration and Recovery of Projectiles in Snow

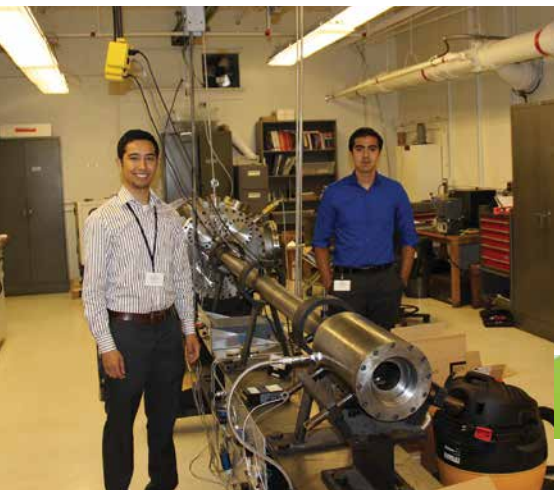
Brian Munoz

Mentor: Dr. Joe Hooper

Naval Postgraduate School

The goal of this research at the Naval Postgraduate School (NPS) this summer was to develop an experimentally validated model for deceleration of projectiles when launched into a snow medium. Snow is currently being used at NPS as a soft-catch medium to recover small fragments of reactive materials without damage to the fragments or any unwanted residue. To develop our model for ballistic penetration of snow, we fired 10 mm high-precision glass balls using a sabot launch out of the NPS 0.5" gas gun. Snow was generated immediately before each shot using a rapid ice shaving process. The penetration depth as a function of impact velocity was recorded and used to fit a Poncelet model which describes a rigid projectile moving through a medium which resists via drag forces and material strength. Though there is considerable shot-to-shot variation, the data does follow a Poncelet type form. This model will allow researchers to set suitable safety distances for firing reactive materials, ensuring that they do penetrate too deeply into the recovery vessel and potentially ignite.

Brian Munoz
Major: Mechanical Engineering
Transfer major: Mechanical Engineering
Intended transfer date: Spring 2016
Hartnell Clubs: Mesa, Trio, EOPS, Math Club, Physics Club, Engineering Club, and Trio Club



Efficient Market Hypothesis

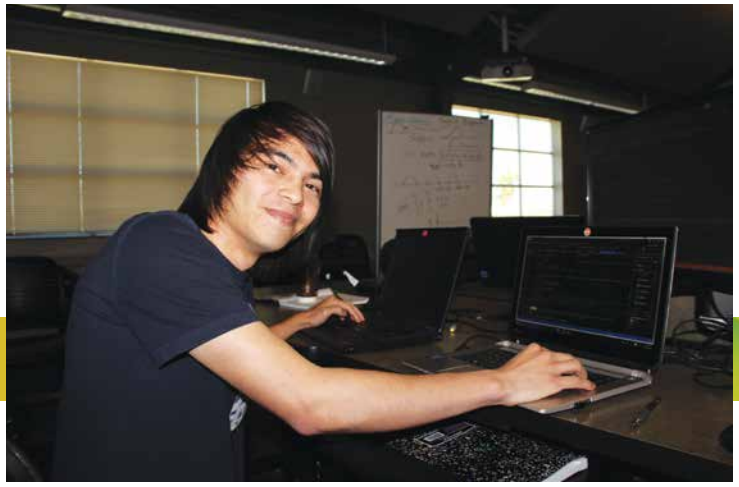
Kevin Nguyen
Mentor: Brian Palmer

Hartnell College

HARTNELLCOLLEGE

The Efficient Market Hypothesis (EMH) claims that it is impossible to "beat" the market because stock market efficiency causes existing share prices to always incorporate and reflect all relevant information. There are immense consequences to this hypothesis, and market participants have a major interest in knowing when and how it fails. It is important to prove that markets cannot be efficient at all times, and find when markets can hold inefficiencies where the market price differs from its true value. The purpose of this project was to construct a simulation of investors who trade bonds in a simulated market. As bonds are being traded, the market implies a probability of missed payment, and we measured levels of discrepancy between the market implied probability of missed payments and the actual probability of missed payments for the company. This summer we implemented features that make the investors more realistic by setting probability distributions to simulate real world numbers. By using the Weibull distribution, we were able to set the number of orders for our investors. The Weibull distribution allowed us to throw in a random number to set an order size for the investors. Furthermore, the results helped us see how investors are trading and how some trade more than others. We also used the generalized lambda distribution to model investor's bias, and investor sophistication. We entered many different parameters into the model to see how the bond reacted, and classified different types of inefficiencies.

Kevin Nguyen
Major: Computer Science
Transfer major: Computer Science
Intended transfer date: Summer 2016
Hartnell Clubs: SIMA, Math Club, Physics Club, ASHC



Network Imaging with PXE & LANDesk

Angel Oliva
Mentor: Max Fabian

Naval Postgraduate School

The purpose of imaging a machine over a network is to cut down on the time and energy needed to physically attend to a computer and go through the process of removing the hard drive and overwriting the information on it manually. Security is a large concern for the U.S. Department of Defense and imaging with this process is very helpful in the case of an infected or damaged machine.

LANDesk's desktop management software and its Provisioning tools were used to work in compliance with a UEFI-enabled PXE server. The PXE server allows a machine to boot from the network rather than its own internal hard drive then it downloads a small stub operating system which has an interface to allow the user to pick and choose from a wide variety of supported Operating System images. There is also ability to image a machine over the network without it requiring a PXE boot, only through LANDesk's software.

Angel Oliva
Major: Network Security
Transfer major: Network Security
Intended transfer date: Fall 2017
Hartnell Clubs: SIMA, Math Club, Physics Club, ASHC

HARTNELL COLLEGE
STEM
INTERNSHIP PROGRAM 2016

Testing the Efficient Markets Hypothesis with Agent-Based Simulation

Gildardo Orozco
Mentor: Brian Palmer

Hartnell College

The Efficient Market Hypothesis (EMH) claims that it is impossible to "beat" the market because stock market efficiency causes existing share prices to always incorporate and reflect all relevant information. There are immense consequences to this hypothesis, and market participants have a major interest in knowing when and how it fails. It is important to prove that markets cannot be efficient at all times, and find when markets can hold inefficiencies where the market price differs from its true value. The purpose of this project was to construct a simulation of investors who trade bonds in a simulated market. As bonds are being traded, the market implies a probability of missed payment, and we measured levels of discrepancy between the market implied probability of missed payments and the actual probability of missed payments for the company. This summer we implemented features that make the investors more realistic by setting probability distributions to simulate real world numbers. By using the Weibull distribution, we were able to set the number of orders for our investors. The Weibull distribution allowed us to throw in a random number to set an order size for the investors. Furthermore, the results helped us see how investors are trading and how some trade more than others. We also used the generalized lambda distribution to model investor's bias, and investor sophistication. We entered many different parameters into the model to see how the bond reacted, and classified different types of inefficiencies.

Gildardo Orozco
Major: Computer Science and Info Systems
Transfer major: Computer Science
Intended transfer date: Spring 2017
Hartnell Clubs: SIMA, Math Club, Physics Club, ASHC

Cosmic Radiation Among Us

Jose Andres Orozco

Mentor: Dr. Sewan Fan

Hartnell College

Cosmic Radiation constantly surges through the universe in the form of primary cosmic rays. Cosmic rays which pass through earth's atmosphere are known as secondary cosmic rays. A pair of micro photomultiplier (PMT) detectors and scintillators was used to detect these rays. The electrical signals produced by the micro PMT detectors were set in coincidence with a pair of PMT detector paddles to distinguish which pulses were truly produced by cosmic rays. Our research involved three main activities: 1) separation of the Micro PMT detectors to limit the arrival directions of cosmic rays 2) determining the efficiency of detecting cosmic rays at selected areas on the scintillator sheets 3) improving the efficiency with an arrangement of optical fibers based on findings from activities (1) and (2) above.

Jose Andres Orozco
Major: Electrical Engineering
Transfer major: Electrical Engineering
Intended transfer date: 2017
Hartnell Clubs: MESA, Physics Club, Computer Science Club, Engineering Club

SPCA Wildlife Center

Roberta Overman

Mentor: Leah Gast

SPCA Wildlife Center

The goal of the SPCA Wildlife Rehabilitation and Rescue Center of Monterey County is to rescue and care for injured or orphaned exotic pets and wildlife in our county. It is the only full functioning wildlife center serving Monterey County. Animals are treated biased on their individual needs. This included capture of the injured or orphaned animal, intake, rehabilitation and release. Animals are captured in the safest way possible both for the animal and ourselves. During intake animals are restrained thoroughly examined to note any broken bones or injuries that needed attending to and then tending to these needs. After intake, we set up enclosures where the animal stays while at the wildlife center either outside or inside for better observation. Once an animal is set up in their enclosure, we work out a diet for each animal and schedule we will follow for this animal. Once an animal is deemed ready and able to care for itself, we decide the best time of day for each animal and release them back to the same area they were found in. Releasing them back to the area they were found helps keep the ecosystem balanced and as unaffected by us as possible. This also gives the animal a better chance at settling if they're familiar with the environment. We became prepared and able to care for any wildlife situation that came through the centers doors and also helped educate the public on our wildlife.

Roberta Overman
Major: Biology
Transfer major: Biology
Intended transfer date: Fall 2018
Hartnell Clubs: Earth club

Mammography Saves a Woman's Life

Cristina Perez

Mentor: Sumanjali N. Medical Imaging Technologist Intern

Father Muller Medical College Hospital

As a certify student in Father Muller Medical College Hospital my exposure for a month was purely to observe in the field of Oncology and Radiology. Two weeks in the role of Oncology section in three disciplines Surgical, Medical, and Radiation Oncology. Then, spend two weeks in the exposure in Mammography of Radiology Department. The goal of this project is to encourage women in this undeveloped nation to utilize life saving cancer screening that are available to them through this hospital. In the third world countries women are suffering abundantly from breast cancer. Breast cancer is the development of uncontrolled malicious cells in the breast that start in the originated lining of the milk ducts called the ductal epithelium. Father Mullers Medical College Hospital provide the best achievable and successful technique called mammography to detect breast cancer. A mammogram is the use of an x-ray done on a women to diagnose and locate the origin of any malicious or benign tumor on the women's breast. Women at the age of forty must take the initiative of having a mammography done. Mammograms at an early stage detect the malignant or benevolent cancer that are too small to feel with a self-examination being done.

If cancer can be detected at an early stage it is likely to be cured by having surgery done to remove the cancer. However, if the cancer is not detected and the malicious cancer has spread throughout the breast then chemotherapy and radiation must be given to the women according to the stage of cancer she is in. Breast cancer is divided into four stages depending on the women stage of cancer a plan of treatment is given. Therefore, it is important that women have the courage to get a mammography done.

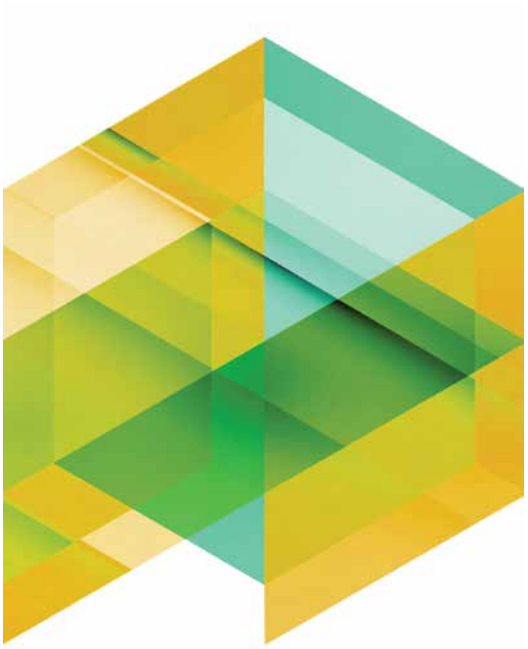
Cristina Perez
Major: Biology and Chemistry
Transfer major: Biology
Intended transfer date: Fall 2018
Hartnell Clubs: Fall 2016 SIMA Club President

Calibrating compound-specific stable nitrogen isotope analysis in avian eggs as bio-archives for paleo reconstruction.

Conrado Preciado

Mentor: Kelton W. McMahon, Ph.D.

University of California Santa Cruz/CC-RISE



Compound-specific stable isotope analysis (CSIA) has become a powerful tool for reconstructing consumer-resource relationships in modern and ancient systems. Stable nitrogen isotope analysis ($\delta^{15}N$) of "trophic" and "source" amino acids provides independent proxies of trophic position and the $\delta^{15}N$ value at the base of the food web, respectively. When applied to avian egg tissues, this approach can be used to address questions in food web architecture and biogeochemical cycling. In this study, we examined how sample-processing protocols affected the chromatography and reliability of $\delta^{15}N$ values of individual amino acids in avian (chicken and penguin) egg components (shell protein, membrane, yolk, and albumen) via gas chromatography-mass spectrometry. "Unprocessed" egg tissues underwent standard acid hydrolysis protocols prior to derivatization, and resulted in poor chromatography with highly variable $\delta^{15}N$ values across replicates. "Processed" samples were eluted through cation exchange columns prior to derivatization, followed by a P-buffer chloroform centrifugation extraction to remove unnecessary contaminants. These additional procedures greatly improved the chromatography of the "processed" samples, revealing better peak separation and baseline integration as well as lower $\delta^{15}N$ variability. Additionally, a standard lipid extraction was necessary for yolk but not membrane, albumen, and shell. While the additional procedures applied to the "columned" samples did result in a significant reduction in sample yield (~20%), it was non-fractionating and thus only affected the total sample sizes necessary for $\delta^{15}N$ CSIA (shell protein ~50mg and membrane, yolk, and albumen ~0.5mg). The protocols developed here will streamline CSIA of egg tissues for future work in avian ecology.

Conrado Preciado

Major: Biology

Transfer major: Biochemistry

Intended transfer date: Fall 2017

Hartnell Clubs: MESA, SIMA, Physics Club

Next generation NPS femto satellite design

Jose Ramirez

Mentor: Peter Ateshian, Ph.D.

Naval Postgraduate School

Embedded systems are applied in modern technology from simple washing machines to satellite systems. An embedded system is a computer system that performs a specific function with limited to no direct user input. Currently, the Naval Postgraduate School's (NPS) femto satellites are boards approximately one square inch with a mass just under 10 grams, similar to the mass of a #2 pencil. At the moment, NPS is looking to develop the next generation of femto satellites. Over the summer, the task was to establish the viability of several selected platforms as well as modifying code to get the platforms to perform basic tasks. The project started with a variety of boards that were each tested by running an LED blinker program. Existing code was then modified to allow these devices to use on-board sensors and to communicate wirelessly through a Rockblock, which is hardware used for radio communication between satellites, or a built-in functionality. A table was created to provide easy access to each device's capabilities, advantages and disadvantages. As a result anyone can quickly identify the pros and cons of the various platforms. With the information gathered further development of the next generation of satellites will be expedited.

Jose Ramirez
Major: Chemical Engineering
Transfer Major: Chemical Engineering
Hartnell Clubs: MESA, STEM, Psychology Club, Engineering Club

Cosmic Ray Telescope Assembly & Operation

Juan Ramirez Chavez

Mentor: Dr. Sewan Fan

Hartnell College

Cosmic rays are particles accelerated from super nova remnant explosions. To observe the cosmic rays that reached earth, we assembled a detector telescope equipped with two silicon photomultiplier (SiPM) coupled to plastic scintillator sheets that worked in coincidence. The SiPM signals were processed using preamplifier, a logic gate and a discriminator unit and analyzed using the CERN software package Physicists Analysis Workstation. An Arduino microcontroller was paired with a digital counter to record the coincidence counting events. Results from our measurements will be presented.

Juan Ramirez Chavez
Major: Computer Science
Transfer major: Computer Science
Intended transfer date: Fall 2017

Common Civil Engineering Projects in the Community

Maria Ramirez Martinez

Mentor: Maryn Miller

City of Monterey

Lighthouse Avenue is one the most transited streets in Monterey, CA. There have been accidents due to the heavy traffic and the narrowed parking spaces which make it hard for people to park. The city's traffic engineer came up with a solution. Making the parking spaces broader will give drivers more space to park with less difficulty. We went out the field, along with the traffic engineer, to start measuring the street and marking the parking t's. Along with that we change the street parking signs to benefit and fulfill the necessities of the business and their customers. For this project we designed and drafted the plans that will be used. This project is part of NIP which gets its funds from voting tax payers. Another project on which we helped is part Measure P which gets its funds from enacting one cent per dollar sales tax. This project consisted on fixing some traffic lights. By going out the field we did some changes to the original plans under the supervision of the traffic engineer. As also part of Measure P, we worked on Sidewalks Repair project. The project consists on fixing Monterey's sidewalks that have been damaged by street trees that represent trip hazards for the community. We went out the field looking for these trip hazards on sidewalks which we measured to enter the dimensions into the plans. All these three projects are still in progress but guaranteeing positive results.

Maria Ramirez Martinez
Major: Civil Engineering
Transfer major: Civil Engineering
Intended transfer date: Fall 2018
Hartnell Clubs: SIMA, Math Club, Physics Club, ASHC

Ambassadors to the Universe: Observing the Night Sky at Fremont Peak Observatory

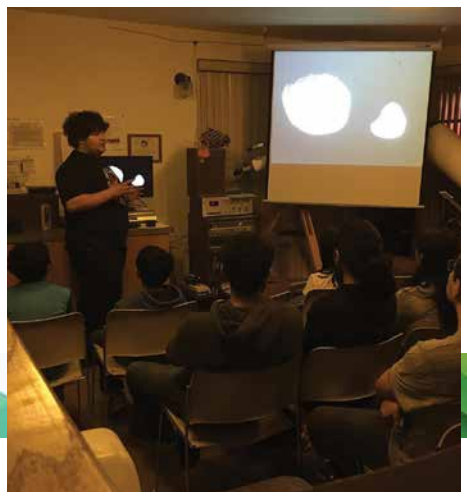
Oscar Ramirez-Perez

Mentor: Ron Dammann

Fremont Peak Observatory

In order to assist the resident astronomers at Fremont Peak State Park, four student interns and their mentor made monthly trips to the observatory in the part to serve as ambassadors of astronomy, and were able to take their classroom knowledge and apply it in a real-world situation. The interns were responsible for interacting with and engaging the public audience via observational astronomy. One way of doing this was via presentations the students were required to give. Each student intern made a powerpoint presentation on a topic of their interest, which included supernovae, general optics, black holes, and more. Furthermore, they underwent a training session to learn how to operate and adjust a 30 inch Newtonian telescope dubbed the "Challenger", as well as a 16" Dobsonian telescope, and others ranging in size from 4-10 inches. A multitude of objects are viewable in the summer night sky, and some of the objects shown were the ever-popular Saturn and its rings and moons, Venus, summer constellations like Scorpio, Lyra, Sagittarius, numerous galaxies, as well as numerous Messier Objects.

Oscar Ramirez-Perez
Major: Astronomy
Intended transfer date: Spring 2017



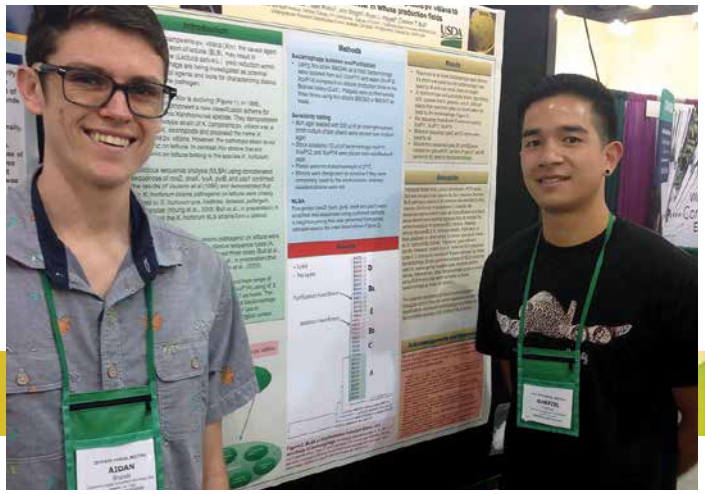
Sensitivity of Various Genotypes of Xanthomonas campestris pv. vitians to Bacteriophages Isolated from Soil and Water in Lettuce Production Fields

Gabriel Ramos

Mentor: Carolee Bull, Ph.D.

United States Department of Agriculture

Xanthomonas campestris pv. vitians (Xcv), the causal agent of bacterial leaf spot of lettuce, causes lettuce yield reduction worldwide. Bacteriophages are potential biological control agents and tools for characterizing the diversity of Xcv. Bacteriophages were isolated from soil (XcvP11) and water (XcvP12, XcvP14) from lettuce fields using strain BS0340 as a host. Xcv strains were previously categorized into at least six multilocus sequence types (A, B1, B2, C, D and E) using concatenated sequences of rpoD, dnaK, fyuA, gyrB, and gap1. Plaques were purified using either strains BS0340 or BS0347 representing sequence types B2 and B1, respectively. Bacteriophage sensitivity was evaluated for Xcv strains from a broad geographic distribution. Lysis was recorded for bacteriophage samples (5 ml) pipetted onto solidified soft agar containing test bacteria and poured over nutrient agar. All four Xcv type E strains were lysed by XcvP11, 12 and 14. Xcv strains from types A and C were negative for lysis by each bacteriophage. Approximately 81 and 45 percent of strains of types B1 and B2, respectively, were sensitive to the bacteriophages. For individual Xcv strains, reactions were consistent for all three bacteriophages. In order to use bacteriophage for disease management, bacteriophage mixtures will be needed to cover Xcv diversity. Xcv strains not lysed by XcvP11, 12 and 14 will be used as hosts to isolate additional bacteriophages to use in mixtures.



Gabriel Ramos
Major: Biology
Transfer major: Plant Science/Botany
Intended transfer date: Fall 2016
Hartnell clubs: Physics Club

Efficient Preservatives for Nitric Oxide Fumigation of Post-Harvest Strawberries

Melissa Ramos

Mentor: Dr. Yong Biao Liu

United States Department of Agriculture

Nitric oxide is a new fumigant discovered at USDA in Salinas and has the potential to be a safe and effective alternative to methyl bromide which destroys atmospheric ozone layer and is being phased out in production globally. Spotted wing drosophila (SWD) is a fruit fly pest which needs to be controlled on many fruits including strawberries in order to export the fruits to other countries. Research is ongoing at USDA Research Station in Salinas to control this pest in strawberries with nitric oxide fumigation. However, strawberries are delicate, and strawberries infested by SWD flies with eggs will decay before eggs develop to flies to be evaluated for efficacy of nitric oxide fumigation at room temperature. The purpose of the present project was to determine whether preservatives can help to delay the occurring of decay and collapse of strawberries to make it possible to evaluate efficacy of nitric oxide against SWD in strawberries. Five preservative candidates were screened including tegosept, chitosan, and calcium gluconate, cassava flour and cassava starch. Among them, chitosan and calcium gluconate at 1.5% and 0.75% respectively showed significant effects in delaying strawberry decay and may have potential to be integrated into nitric oxide fumigation treatments of strawberries. The project made a positive contribution to the USDA research on controlling SWD in strawberries.

Melissa Ramos
Major: Biochemistry
Transfer major: Biochemistry
Intended transfer date: Fall 2016
Hartnell Clubs: Physics Club, SIMA Club, MESA

Common Civil Engineering Projects in the Community

Maribel Ramos Peredia

Mentor: Maryn Miller

City of Monterey

Lighthouse Avenue is one the most transited streets in Monterey, CA. There have been accidents due to the heavy traffic and the narrowed parking spaces which make it hard for people to park. The city's traffic engineer came up with a solution. Making the parking spaces broader will give drivers more space to park with less difficulty. We went out the field, along with the traffic engineer, to start measuring the street and marking the parking t's. Along with that we change the street parking signs to benefit and fulfill the necessities of the business and their customers. For this project we designed and drafted the plans that will be used. This project is part of NIP which gets its funds from voting tax payers. Another project on which we helped is part Measure P which gets its funds from enacting one cent per dollar sales tax. This project consisted on fixing some traffic lights. By going out the field we did some changes to the original plans under the supervision of the traffic engineer. As also part of Measure P, we worked on Sidewalks Repair project. The project consists on fixing Monterey's sidewalks that have been damaged by street trees that represent trip hazards for the community. We went out the field looking for these trip hazards on sidewalks which we measured to enter the dimensions into the plans. All these three projects are still in progress but guaranteeing positive results.

Maribel Ramos-Peredia
Major: Engineering
Transfer Major: Civil Engineering
Inteded Transfer Date: Fall 2017

Fragmentation of NAVY's reactive material at High Velocities

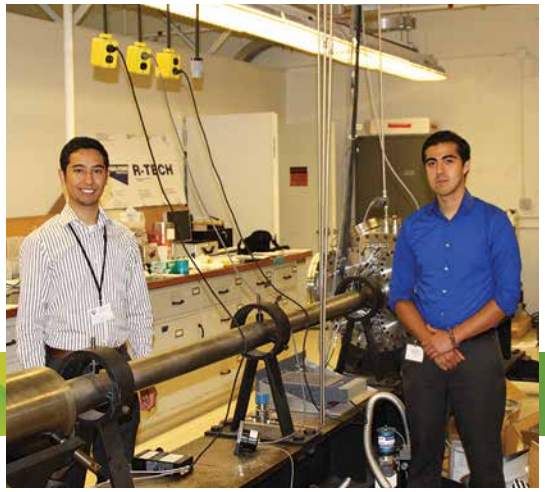
Julio Rico

Mentor: Joseph P. Hooper, Ph.D.

Naval Postgraduate School

The NAVY is currently investigating brittle metal composites for use as reactive materials. Reactive material is a brittle composite that augments a reaction debris clouds that should combust fairly well on a target. Reactive composites have been examined for several years as a replacement for inert metal warhead materials. The lethality of reactive material is closely linked to their dynamic fragmentation properties. Fragmentation of reactive material after terminal impact increases lethality by augmenting blast and fragmentation affect with additional thermal energy from metal combustion. To study the fragments after firing at high velocities a methodology had to be developed to soft catch reactive material's fragments post impact without augmenting secondary fragmentation. What successfully worked best as a medium to softly catch fragments was filling up the small catch chamber with fine snow locate at the end of the .50'' gas gun.

Julio Rico
Major: Civil Engineering
Transfer major: Civil Engineering
Intended transfer date: Fall 2018



Cascade Classifier Development for Disease Detection in Solanum lycopersicum

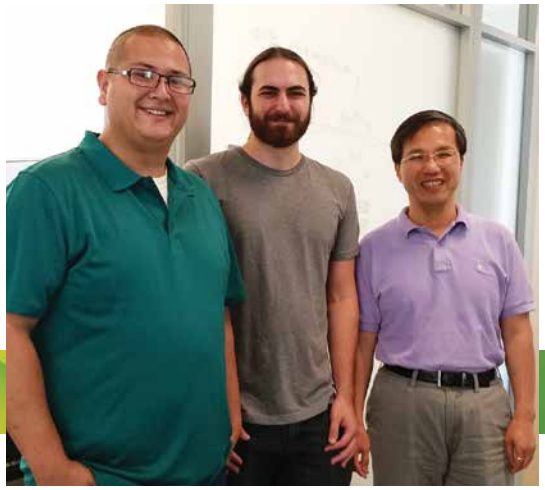
Louis Paul Romero

Mentor: Sonia Arteaga, Ph.D.

Hartnell College

Advanced technology to identify diseases in crops is costly and inaccessible to the common home grower. In America, mobile devices have become ubiquitous to such a degree that 58% of adults own a smartphone. An automatic image classification system on an Android smartphone enables identification of plant diseases in Solanum lycopersicum (tomatoes). A collection of images containing the diseases anthracnose, bacterial speck, and early blight on tomatoes are processed using an open-source computer vision library called OpenCV. The classification system consists of a cascade classifier for each disease. A Python script is then used to test the classification system and make improvements to the algorithm. The final algorithm was implemented into an Android application using Android Studio, an integrated development environment (IDE). The cascade classifier has a hit rate of 67%, 29%, and 5% for anthracnose, bacterial speck, and early blight respectively; the false alarm rates were 25%, 67%, and 95% for anthracnose, bacterial speck, and early blight. Future work to improve the detection rates will explore the use of template matching in combination with the current classification system. Another area to explore, is to gather and use more images when training the classifier.

Louis Paul Romero
Major: Computer Science
Transfer major: Computer Engineering
Intended transfer date: Fall, 2018



Turnover Rates for Stable Isotopes for the Light Brown Apple Moth (LBAM), Epiphyas postvittana, as a Marker for Mass-Reared Sterile Insects

Julissa Rosas

Mentor: Gregory Simmons

United States Department of Agriculture

We use LBAM as a model to demonstrate how the ratio of stable isotopes of carbon in moth tissues may be affected by age, activity levels and food source. Stable isotopes, are naturally occurring isotopes that vary based on photosynthetic pathway, rain fall, soil fertility, fertilizer. Differences in stable isotope signatures can be used as reliable markers for mass-reared insects used in sterile insect control programs. Stable isotopes have a different atomic weight than usual; for instance, carbon (C) has an atomic weight of 12 (12C) but approximately 1% of carbon atoms have an atomic weight of 13 (13C).

Because an insect's isotopic ratio may change over time with metabolic output, we want to determine if the isotopic signature of a newly emerged adult varies with age or after expending energy in flight. The isotopic signature may also change if adults feed on plants with different isotopic signature from the larval food.

Mass-reared LBAM will be tested to determine the effects of dispersal, age and feeding on isotopic signatures. In one group, adults will be disturbed on a regular basis causing flight for a greater period of time relative to other undisturbed control group. Additionally, adults will be compared to determine variation in carbon isotope signatures due to C3 or C4 diet. This diet experiment will determine if the food source changes the carbon isotope signature significantly when compared to unfed adult moths. The carbon isotope ratios of moths from each treatment will be measured over time with IRMS analysis.

Julissa Rosas
Major: General Studies
Transfer major: Food and Environmental Science
Intended transfer date: Fall 2016

Disease Identification of Potatoes Using Image Processing and Machine Learning Technique

Michael Sanchez

Mentor: Sonia Arteaga, Ph.D.

Hartnell College

Visual detection on crops is time consuming and very expensive due to the use of specialized equipment. This research presents an Android mobile application that uses a cascade classifier and OpenCV to detect potato diseases in images. We want to empower all individuals to have access to potato disease identification, through the use of an effective tool that detects potato diseases with a high percent of efficiency. Our tool is a mobile application that requires the user to take a picture and the application will provide the disease name along with information about the disease. This tool will not only reduce the time of detection but also the cost. In the process, we used machine learning techniques to successfully train a cascade classifier with processed red and green channel images. Once the cascade identifies the diseased region the mean pixel value of that region is calculated to improve results over the previous approach, i.e. template matching. Currently, black scurf and common scab have detection accuracy rates of 76.19% and 56.52% respectively. Future work will use template matching and the cascade classifier together in search of better accuracy rates in potato diseases along with the detecting of more diseases.

Michael Sanchez
Major: Computer Science
Intended transfer date: Spring 2017

Autonomous Smart Irrigation Sensor Stake

Rocio Sanchez-Mendoza

Mentor: Jessica Alipio

University of California Santa Cruz

In recent years states such as California, Texas and others have been constantly challenged by crop production due to drought. There have been many attempts to efficiently water crops however, none have fully depicted a precise watering scheme. The autonomous sensor stake aims to collects data using various sensors such as temperature, moisture and humidity which can then be used to acquire optimal watering conditions. The sensor stake collects data which is then sent to the feedback control which then adjusts watering times and duration based on current soil conditions and set thresholds. The sensors are held in the stake which is inserted into the soil to measure environmental conditions both below and aboveground. The system is solar powered to be self-sustainable; The system features signal multiplexing which allows the stake to use up to 16 sensors of varying types. All circuits were simulated in PSpice for functionality before being built. Data obtained from the sensors get transmitted to a single-board computer which allows the user to monitor change in plant behavior as they grow. The feedback control adjusts watering times and duration based on current soil conditions. The sensor stake will be tested to withstand rough terrains and weather conditions but further testing in real-world conditions should be done to evaluate performance of the sensor stake. The sensor stake can potentially save water, energy and extra work.

Rocio Sanchez-Mendoza
Major: Engineering
Transfer major: Electrical Engineering
Intended transfer date: Spring 2017
Hartnell Clubs: Physics Club

Sensitivity and Noise effects of double-scintillator encapsulation for Radioluminescence Microscopy (RLM)

Mark Shelor

Mentor: Tae-Jin Kim, Ph.D., Qian Wang, Ph.D.

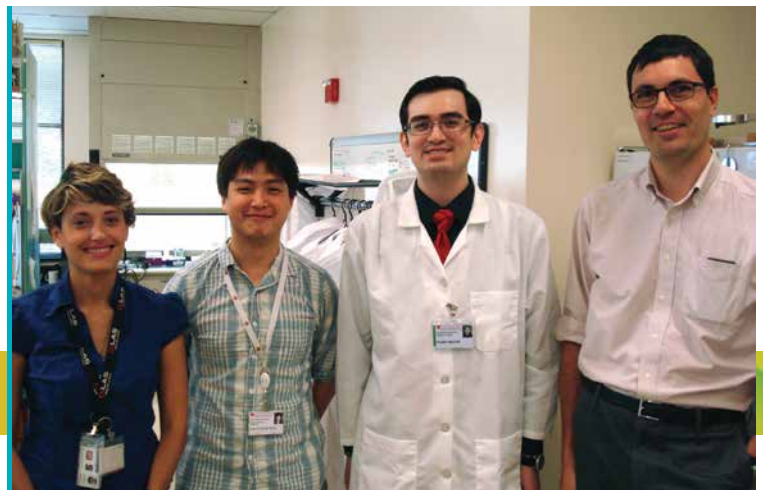
Stanford

In medical imaging, radionuclides are frequently used for in-vivo studies of live subjects such as PET/CT scans to characterize tumors. Radioluminescence Microscopy (RLM) has emerged as an imaging method for investigating radiotracer uptake with single-cell resolution. RLM involves culturing radiolabeled cells on scintillators and capturing scintillated light under light-tight conditions. However, radionuclides such as 18F can prove difficult to image when incubated in low concentrations or activities (e.g. radiotracer retained in a single cell). Thus, in order to increase RLM sensitivity, samples were 'sandwiched' between two scintillators instead of one. The sensitivity and signal-to-noise ratio of resulting images were compared to data obtained using a single scintillator.

A Stanford developed Radioluminescence Microscope was used to image MDA-MB-231 breast cancer cells labeled with 18F-Fluorodeoxyglucose previously cultured on a Cadmium Tungstate scintillator coated with Fibronectin. A second scintillator was carefully placed on top of the sample in order to increase the effective detection area of δIonization tracks recovered by the scintillators. Ionization tracks were evaluated qualitatively by capturing analog images with long exposure times, and quantitatively by using reconstruction software that provides data on ionization count and localization. Simulations were performed using both single and double scintillator arrangements using the Monte Carlo simulation in order to confirm the reliability of the experiment.

Results indicate that the gain in sensitivity in the sandwich configuration is around twofold. Effects on the spatial resolution are dependent on a number of variables which shall be discussed.

Mark Shelor
Major: Chemical Engineering
Transfer major: Bioengineering
Intended transfer date: Fall 2016
Hartnell Clubs: Associate Students for Hartnell College



Cosmic Radiation: SiPM Detection and Analysis

Jessica Silva

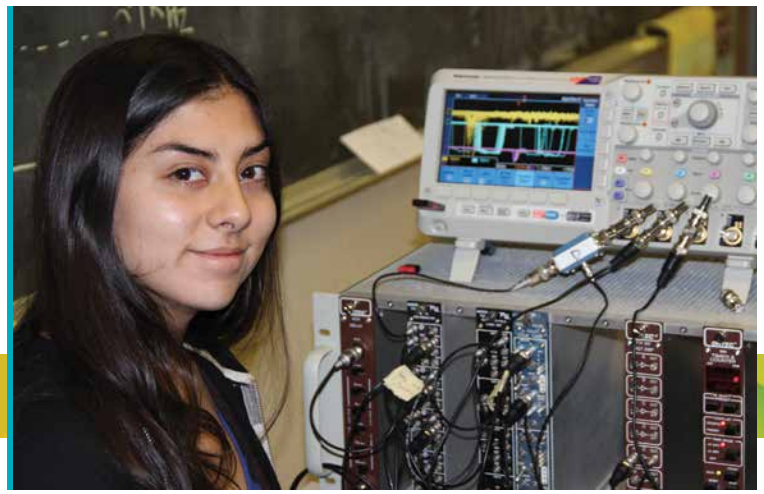
Mentor: Dr. Sewan Fan

Hartnell College

HARTNELLCOLLEGE

Deep space radiation bombards the earth constantly. This radiation hits earth's atmosphere and becomes secondary cosmic rays; most are muon particles. AdvanSiD SiPM detectors are the most recent engineered radiation detectors to use less space, use less energy, and have a better counting efficiency. This study tests AdvanSiD silicon photomultipliers (SiPM) with a scintillator sheet in detecting Muons. Using two SiPM detectors, one SiPM is tested with two PMT for true coincidence. Then, using the two SiPM detectors to test for true coincidence with each other. The data shows us multiple counts of coincidence in one window of time for each test we did with the detector. These data indicate that the SiPM show true coincidence and are successful in detecting cosmic radiation.

Jessica Silva
Major: Physics
Transfer major: Cognitive Science
Intended transfer date: Fall 2016
Hartnell Clubs: Physics, SHPES, MESA, SACNAS



RNA Extractions and Expression Patterns in NCED1 in Drought Tolerant and Drought Sensitive Cultivars of Lettuce

Jocelyn Simlick
Mentor: Renee Eriksen, Ph.D.

United States Department of Agriculture

California has been experiencing a drought for roughly 4 years. These conditions are not suitable for the Salinas Valley--"Salad Bowl of the World", where 77% of the nation's lettuce grows. This research is aimed at discovering ways to grow lettuce with less water, in order to minimize agricultural losses. In 2016, the USDA-ARS in Salinas, California published results from 3 field trials; it was found that particular green-leaf lettuce cultivars were more tolerant to drought conditions than others. Cultivars which presented drought-tolerance included the: "Australian", "Slobolt", and "Western Green". Drought sensitivity was determined in cultivars:"Xena", "Green Salad Bowl", and "Black Seeded Simpson". The present study aims to investigate physiological traits (chlorophyll fluorescence, carbon assimilation, and transpiration) and to correlate candidate gene expression patterns with these traits to understand why some cultivars tolerate low water conditions better than others. Preliminary results suggest early stomatal closure in drought sensitive cultivars. Current molecular work includes extracting RNA to assay a candidate gene panel for genes which play into the physiological role of drought tolerance in lettuce cultivars and using digital PCR to assay the candidate gene: NCED1, which is involved in the biosynthesis of Abscisic Acid (ABA), which controls stomatal closure. This work will be used in breeding programs to develop a more drought-tolerant lettuce cultivar.

Jocelyn Simlick
Major: Biology, Chemistry
Transfer major: Biology, Chemistry and
Intended transfer date: Fall 2017
Hartnell Clubs: Hartnell Chemistry Club

Wolbachia's development in Drosophila and its beneficial applications for humans

Diana Tamayo
Mentor: Bill Sullivan

University of California Santa Cruz

Wolbachia is a successful bacterial symbiont infecting about half of all insects including arthropods and nematodes. It influences host reproduction to its advantage enabling it to rapidly affect species through insect populations. For example, Wolbachia is currently spreading north from Southern California. To determine the molecular and cellular mechanisms by which Wolbachia interacts with its hosts, we are identifying natural genetic variants of Wolbachia. These will be used to identify specific Wolbachia genes that mediate these host interactions. Wild populations of Drosophila (Fruit Fly), were collected in Big creek, Big Sur reserve to identify new Wolbachia variants. We used PCR (Polymerase Chain Reacting) and Gel Electrophoresis to identify Drosophila strains infected with Wolbachia. Because of its symbiotic relationship with arthropods and nematodes and its effect on host reproduction, Wolbachia shows promise in being able to prevent disease in humans caused by these pathogenic vectors.

Diana Tamayo
Major: Biology/Chemistry
Transfer major: Microbiology
Intended transfer date: Fall 2017

Monterey County Pesticide Use Report

Julio Tena

Mentor: Jessica Gonzalez

HeavyConnect

California regulations stipulate that anyone that applies pesticide commercially must file a Pesticide Use Report (PUR). The PUR is meant to keep track of details regarding the application of pesticides throughout the state. This helps with keeping track of who's using what and how often. Monterey County sends the most PURs out of any county in the state and even though 80% of reports are now sent through electronically, the process can still take months. Communication between county officials and growers is slow, lack of error checking backs up the process, growers are fined for failing to submit reports accurately. The purpose of our platform is to provide the county and growers a system to make the process, intuitive, efficient, and expedient. Our mobile app allows for applicators to quickly and easily submit reports from anywhere and provides them with safeguards to minimize errors.

The web platform provides a streamlined user-friendly interface that organizes report submission for easy review by pesticide enforcers, as well as opening up a much needed window of communication between regulators and businesses.

Julio Tena
Major: Computer Engineering
Transfer major: Computer Engineering
Intended transfer date: Fall 2018
Hartnell Clubs:

Ambassadors to the Universe: Observing the Night Sky at Fremont Peak Observatory

Irene Torrecillas

Mentor: Ronald Damman

Fremont Peak Observatory

In order to assist the resident astronomers at Fremont Peak State Park, four student interns and their mentor made monthly trips to the observatory in the part to serve as ambassadors of astronomy, and were able to take their classroom knowledge and apply it in a real-world situation. The interns were responsible for interacting with and engaging the public audience via observational astronomy. One way of doing this was via presentations the students were required to give. Each student intern made a powerpoint presentation on a topic of their interest, which included supernovae, general optics, black holes, and more. Furthermore, they underwent a training session to learn how to operate and adjust a 30 inch Newtonian telescope dubbed the "Challenger", as well as a 16" Dobsonian telescope, and others ranging in size from 4-10 inches. A multitude of objects are viewable in the summer night sky, and some of the objects shown were the ever-popular Saturn and its rings and moons, Venus, summer constellations like Scorpio, Lyra, Sagittarius, numerous galaxies, as well as numerous Messier Objects

Irene Torrecillas
Major: Astronomy
Transfer major: Astronomy
Intended transfer date: Spring 2018

Cosmic Ray Telescope Assembly and Operation

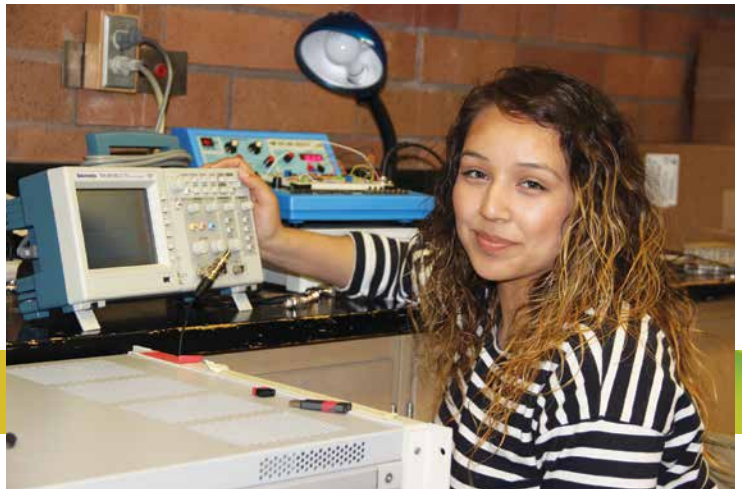
Maria Sandra Troncoso

Mentor: Dr. Sewan Fan

Hartnell College

Cosmic rays are particles accelerated from super nova remnant explosions. To observe the cosmic rays that reached earth, we assembled a detector telescope equipped with two silicon photomultiplier (SiPM) coupled to plastic scintillator sheets that worked in coincidence. The SiPM signals were processed using preamplifier, a logic gate and a discriminator unit and analyzed using the CERN software package Physicists Analysis Workstation. An Arduino microcontroller was paired with a digital counter to record the coincidence counting events. Results from our measurements will be presented.

Maria Sandra Troncoso
Major: Mechanical Engineering
Transfer major: Mechanical Engineering
Intended transfer date: Fall 2017



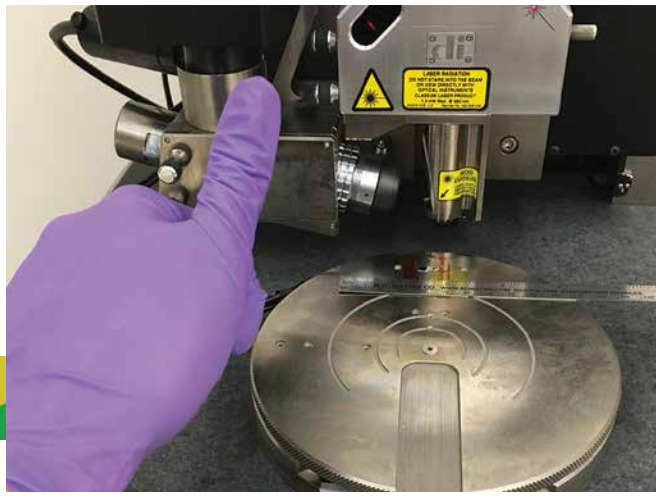
Characterization of surface composition in 2D Topological Insulators: Bismuth Chalcogenides by Atomic Force Microscopy

Connie Valles
Mentor: Weimin Zhou

University of California Riverside

Abstract not included due to copyright sensitivity

Connie Valles
Major: Biology
Transfer major: Chemical Engineering
Intended transfer date: Fall 2017
Hartnell Clubs: Hartnell SHEPS, Engineering Club-Activities Coordinator, American Physical Society Member



Stochastic Models of Antibiotic-Resistant Infections With Analysis of the Impact of Special Preventive Measures

Bryna Webb

Mentor: Mohammed Yahdi, Ph.D.

Hartnell College

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

Bryna Webb
Major: Mathematics
Transfer major: Mathematics
Intended transfer date: Fall 2016
Hartnell Clubs: Phi Theta Kappa

Digital Forensics on Email Addresses, Phone Numbers, and Personal Names

Armand Wilson

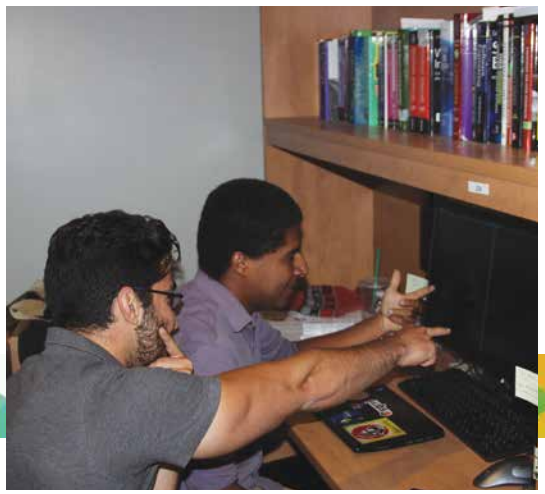
Mentor: Neil C. Rowe, Ph.D.

Naval Postgraduate School

Digital Forensics entails the recovery and investigation of data collected from various devices, often in the context of computer crimes. We investigated the email addresses, phone numbers, URLs, and personal names previously captured from devices and drives. Prof Rowe utilized Bulk_extractor, an open source forensics tool to scan disk images for different types of data, to collect data from drives and devices. After obtaining formatted files from Prof Rowe, we built on existing tools and analyzed data to infer whether end users made inferences about the context of the data to determine whether the data we've collected resembled a behavioral pattern of an end user.

Relevance refers to the importance of a piece of data in the investigation, or the close relation of two different pieces of data. These tools can be used to map a network of users based around a particular device for use in criminal and terrorist investigation.

Armand Wilson
Major: Computer Science
Transfer major: Computer Science
Intended transfer date: Spring 2017
Hartnell Clubs: MESA, EOPS



Next Generation NPS Femto Satellite Design

Adela Zamora

Mentor: Peter Ateshian

Naval Postgraduate School

Embedded systems are applied in modern technology from simple washing machines to satellite systems. An embedded system is a computer system that performs a specific function with limited to no direct user input. Currently, the Naval Postgraduate School's (NPS) femto satellites are boards approximately one square inch with a mass just under 10 grams, similar to the mass of a #2 pencil. At the moment, NPS is looking to develop the next generation of femto satellites. Over the summer, the task was to establish the viability of several selected platforms as well as modifying code to get the platforms to perform basic tasks. The project started with a variety of boards that were each tested by running an LED blinker program. Existing code was then modified to allow these devices to use on-board sensors and to communicate wirelessly through a Rockblock, which is hardware used for radio communication between satellites, or a built-in functionality. A table was created to provide easy access to each device's capabilities, advantages and disadvantages. As a result anyone can quickly identify the pros and cons of the various platforms. With the information gathered further development of the next generation of satellites will be expedited.

Adela Zamora
Major: Engineering
Transfer major: Electical Engineering
Intended transfer date: Spring 2016
Hartnell Clubs: Society of Physics Students

Hartnell College

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