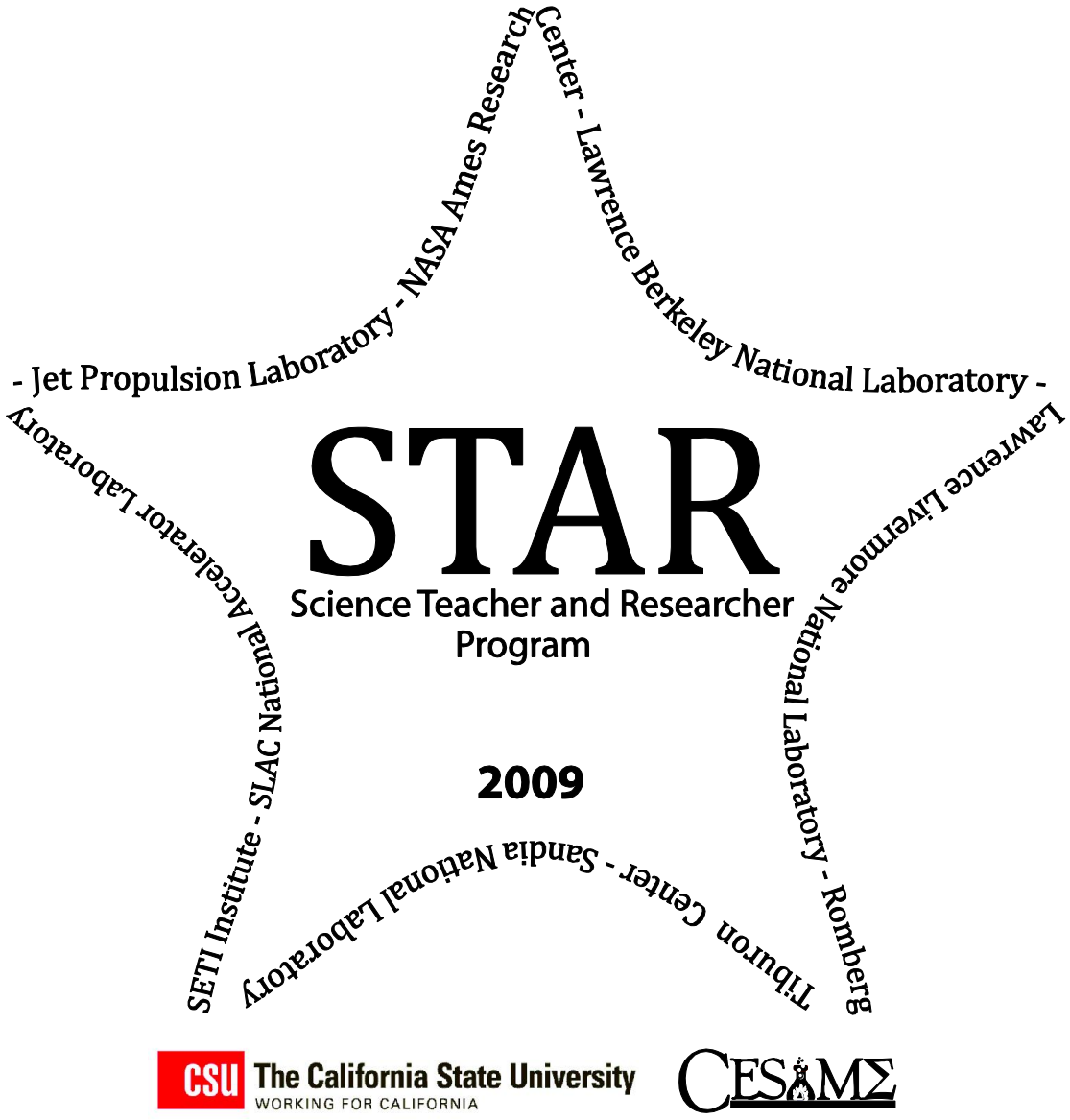

Poster Abstract Book

STAR 2009 Conference

Saturday, August 8th, 2009

SLAC National Accelerator Laboratory

Menlo Park, California

Red Group

Name: Lisa Adams ***Poster Location: R1***
Poster Title: Projection of environmental-SEM images onto the NanoGigapan website to facilitate hypothesis-based and scientific method-driven teaching to underserved populations
Research Mentor: Richard Boyle and Anthony Intravaia
Lab Site: NASA Ames Research Center
Abstract: The basic concept of the research was that the SEM cannot be available for students in high-risk, or underserved, schools/populations so we want to be able to take this technology to these students and allow them to integrate the scientific method into their everyday experiences of exposure to a technology that they would not usually be afforded the opportunity to use with hypothesis-based teaching. Based in the inquiry method of teaching and research-based instruction techniques, I propose to use the lesson plan I'm developing to bring the science I've been exposed to into the classrooms I'll teach in the future. By loading the scans of samples I collected and the ones from the site's archives onto the NanoGigapan website, we've achieved an opportunity to teach the scientific method of developing experiments and carrying them out and then writing up the results of students that would have had access to the kind of technology, nor the concepts behind it, necessary to carry this out. Hopefully, once the whole project comes together, I'll be able to put together a comprehensive "super unit" that is not only informative but experiential as well, and will expand the capacity of the minds and imaginations of the students involved. Who are the targeted "underserved" students:

- GAINS (Girls Achieving In Non-traditional Subjects)
- ELL's (English Language Learners)
- Students with IEP's (Individualized Education Plans) or 504's
- Students of low SES (Socio-Economic Status)
- Students at identified high-risk schools
- Students coming from disadvantaged homes.

Name: Daniel Diamond ***Poster Location: R2***
Poster Title: Development and testing of the Faraday Block Array at the 88-Inch Cyclotron
Research Mentor: Michael Johnson, Larry Phair, Thomas Gimpel
Lab Site: Lawrence Berkeley National Laboratory
Abstract: Measurement of heavy ion beam uniformity using rugged, reliable, and proven Faraday cup technology has long been a goal at Lawrence Berkeley National Laboratory's 88-Inch Cyclotron. Toward that objective, the Faraday Block Array (FBA) has been developed both as a quality assurance measure and an operator tuning aide. An initial design utilizing an array of standard Faraday cups was quickly ruled out due to low beam current requirements. With the recognition that only relative beam intensities were required to obtain uniformity information, the FBA emerged as the ideal solution. In a normal Faraday cup, a negative bias is applied to the front plate to suppress electrons, thus providing a more accurate beam current measurement. By instead applying a positive bias to the FBA front plate, scattered electrons are pulled away from the array blocks, leading to an amplification of the beam current reading- desirable for measuring small signals. Initial results indicate that the FBA will function as predicted, and further testing with a heavy ion beam is scheduled for mid-August 2009.

Name: Carissa Filice ***Poster Location: R3***
Poster Title: Comparing pretreatment procedures for radiocarbon dating
Research Mentor: Tom Guilderson
Lab Site: Lawrence Livermore National Laboratory
Abstract: Different pretreatment procedures were performed on wood samples to assess which method would perform best for accelerator mass spectrometry (AMS). Additional analysis included percent yield, carbon to nitrogen ratio, and carbon-13 nuclear magnetic resonance. For relatively young wood samples, the pretreatment procedures did not vary significantly. For wood that is considered "radiocarbon dead", modified procedures were more effective than the current pretreatment protocol.

Name: Saman Halabian ***Poster Location: R4***
Poster Title: Development of an automated sample processing system
Research Mentor: Luther Beegle
Lab Site: Jet Propulsion Laboratory
Abstract: The capability of detecting biomarkers, such as amino acids, in chemically complex samples is essential to establishing the knowledge required to search for chemical signatures of life in future planetary explorations. In most aqueous based analytical techniques, these important biosignatures, which would be present in trace amounts, can be masked by contaminates such as salt and metals. Therefore, the development of a robust automated system to automatically purify complex samples is essential for future in situ exploration. The Automated Sample Processing System (ASPS) is an innovative technique to purify complex samples which takes analytes that have been extracted through high temperature solvent extraction and removes potential contaminates from the solution. The current focus is to automate the desalting apparatus which consists of 7-way and 4-way selection valves, an ion exchange column, a diaphragm pump, and an injection valve. Six different solvents are required to both process the sample and condition the column before and after processing so that multiple samples can be run on the same column. Automation is achieved by utilizing National Instruments LabVIEW Software. The high temperature solvent extraction unit of ASPS will be the next topic of focus after the completion of the desalting apparatus.

Name: Madeline Hall ***Poster Location: R5***
Poster Title: Sudden oak death disease resistance in Coast Live Oak
Research Mentor: Brice McPherson and David Wood
Lab Site: Lawrence Berkeley National Laboratory
Abstract: *Phytophthora ramorum* is the introduced oomycete responsible for causing sudden oak death (SOD), a disease first noted in the Coast Ranges of California the mid 1990's. *P. ramorum* infects a broad range of host plants in North America including 14 families of native plants [1]. In 2002, 2 study plots were established in Marin County, California in order to study disease progression in coast live oaks (CLO). In each site, 40 coast live oak (*Quercus agrifolia)* trees were inoculated with *P. ramorum* and 20 were wounded without inoculation (mock-inoculation) [2]. Over the course of the years these trees and their disease progression have been observed and recorded. The disease virulence among the inoculated trees varied, resulting in symptomatic trees, killed trees as well as trees that appeared to be healthy and asymptomatic (McPherson, unpublished data). Phloem was extracted from the trees in order to investigate the possibility of a chemical resistance to the disease. The extracted samples will be sent and chemically processed by a research group at The Ohio State University, led by Pierluigi Bonello. The results of the chemical analysis will provide important chemical ecology information about the coast live oak populations in the California Coast Range and will shed light on a possible natural resistance to this disease.

Name: Patty Hay ***Poster Location: R6***
Poster Title: Pesticide detoxifying enzyme butyrylcholinesterase exploration of structural conservation
Research Mentor: Brian Bennion
Lab Site: Lawrence Livermore National Laboratory
Abstract: Butyrylcholinesterase (BChE) is of pharmacological and toxicological importance, because it hydrolyzes ester-containing drugs and scavenges cholinesterase inhibitors including potent organophosphporus pesticides before they reach their synaptic targets. The study increases understanding of BChE through homology modeling and molecular dynamics.

Name: Ernest Irish ***Poster Location: R7***
Poster Title: Designing an imager for CERN
Research Mentor: Alan Fisher
Lab Site: SLAC National Accelerator Laboratory
Abstract: The purpose of the project is to measure the dimensions of 2808 bunches of protons circulating rapidly in the Large Hadron Collider at CERN in each of the 2. Rings. It takes time for a camera to process 2808 images. A fast framing camera may be used but the camera is radiation sensitive and expensive. Instead, a simple, robust, and radiation hard method is to use an optical chopper wheel with a photomultiplier tube. A system was modeled on existing hardware this was used o specify the required parts.

Name: Sarah Langley ***Poster Location: R8***
Poster Title: Using capillary electrophoresis with indirect fluorescent detection to identify harmful algal toxins
Research Mentor: Victoria VanderNoot
Lab Site: Sandia National Laboratories / California
Abstract: Capillary electrophoresis combined with indirect fluorescence detection using the µchemlab device, is potentially a more accurate, faster, and "fieldable" method for detecting algal toxins than current methods. By altering such factors as buffer composition and pH, choice of fluorescent dye and concentration, conditions are optimized for algal toxin separation and detection.

Name: Kien Ngo ***Poster Location: R9***
Poster Title: New methods for analysis of cotton leaves' spectral transmittance
Research Mentor: Vern Vanderbilt
Lab Site: NASA Ames Research Center
Abstract: It has been the goal of remote sensing to be able to access water status of vegetation using spectral data. This project helps define new methods of analyzing cotton leaves' spectral transmittance. We are on an expedition, gaining new insights into the linkage between cotton leaves' spectral transmittance and their relative water content. Cotton leaf samples were collected for transmittance reading in the field using an integrating sphere; relative water content (RWC) was calculated in a lab. Leaves were categorized by percentage of RWC, ranging from 48% to 97%. We have plotted the data in unconventional ways: 1) compared transmittance of all leaves with respect to the most hydrated leaf and the average transmittance; 2) compared the change of transmittance of all leaves with respect to the transmittance of the most hydrated leaf and with respect to the average transmittance; 3) plotted the correlation coefficients of all the data; 4) plotted the change of transmittance from leaf to leaf with respect to change in RWC. There are new wavelength regions where the variability of transmittance is due to relative water content in method (2) which have not been identified before. There are a few regions in the visible that shows weak correlations among all the leaves in method (3). Our results suggest further investigation by other experts into certain wavelength regions of new information. We have identified these results as potential useful methods for similar research projects. There is potential in accessing RWC of cotton with spectral transmittance data.

Name: Alison Richins ***Poster Location: R10***
Poster Title: Hox A13 expression in the rostrum of *Polydon spatula*
Research Mentor: Karen Crow
Lab Site: Romberg Tiburon Center
Abstract: Genome duplications, an instance when an organism is given two copies of the entire genome during fertilization, can allow for the evolution of new traits by releasing constraints on the duplicated genome. The American paddles fish (*Polyodon spathula)* has had recent genome duplication . Hox genes are involved in axial patterning, limb elongation, as well as organ development and placement in all animals. *Polyodon spathula* embryos will have RNA extracted and real time PCR (rtPCR) done to look for the expression of Hox A13 a and b in the rostrum, as well as fins, and the anterior and posterior sections of the body. If hox A13 expression were found in the rostrum, it would be interesting because Hox gene expression has not been found anterior to the hindbrain. In addition to this, since the paddlefish are a more ancient lineage of fish, they could serve to help us to better understand the fin to limb transition and our own development. Preliminary results indicate that there is no Hox A13 expression in the rostrum, however further results are needed.

Name: Martha Rodriguez ***Poster Location: R11***
Poster Title: Urine proteome for biomarkers
Research Mentor: Brett Chromy
Lab Site: Lawrence Livermore National Laboratory
Abstract: Chronic Kidney Disease (CKD) is a major public health concern in the United States, with cases of end-stage renal disease more than doubling in the past decade. The amount of proteinuria is the single most important risk factor in loss of renal function. Nevertheless, the composition of this protenuria may also prove to be important. This project looks at the human urine proteome to identify small, low abundant proteins that may serve as additional biomarkers to indicate whether patients with CKD are either stable or are progressing to kidney failure. The 2-D DIGE approach is a discovery proteomics technique that we will use to discern new biomarkers.

Name: Jennifer Rushing ***Poster Location: R12***
Poster Title: Developing a holistic view of exoplanet spectra research
Research Mentor: Pieter D. Deroo and Mark R. Swain
Lab Site: Jet Propulsion Laboratory
Abstract: The last several years have seen dramatic expansion in our knowledge of planets beyond our solar system, more commonly known as extra-solar planets or exoplanets. Observational spectra data gathered for these exoplanets continues to rapidly increase and its analysis has proven sufficient to model their composition, conditions, chemistry, and dynamics, particularly for the hot-Jupiter planets HD 189733b and HD 209458b. Due to the volume of incoming data, the research group initiating this project recognized that additional tools for both organization and collaboration would be necessary to keep up with the required analysis. To this end, a secure web-based tool was developed using commercial wiki software to serve as a knowledge repository and a means of more efficient collaboration with remotely located team members. As the new tool is utilized, the research group will seek to organize their volumes of data and analysis into a holistic view, which will extend their ability to characterize known exoplanets and search for habitable worlds.

Name: Raj Virk ***Poster Location: R13***
Poster Title: Examining the use of insulators in overcoming position effect in To12 mediated *Xenopus transgenesis*
Research Mentor: Gabriela Loots
Lab Site: Lawrence Livermore National Laboratory
Abstract: Abstract Enhancers are gene regulatory elements to which some transcription factors ("Enhancerbinding protein") bind increasing the rate of transcription of a gene. Insulators are stretches of DNA that prevent an enhancer from inappropriately activating the promoter of a gene present in the same region of the chromosome. When a transgene is delivered into an embryo, it randomly integrates into the host genome. If the transgene lands adjacent to a strong enhancer present in host genome, the transgenic animal can give a false expression pattern; making it difficult to evaluate which expression pattern is due to the element being tested. This phenomenon is called position effect. One possible solution to this problem is to flank transgenic constructs with insulators to shield transgenes from endogenous enhancer element activation. The aim of the project is to test enhancer specificity in constructs with or without insulator elements. In this experiment, muscle anatomy and development was studied by in situ hybridization using two muscle specific gene markers MyoD and Actin. Transgenic constructs containing known muscle enhancer Mir133 was prepared. The future work includes examining the influence of insulators on the specificity of fluorescent muscle expression in transgenic tadpoles.

Green Group

Name: Allen Boltz II ***Poster Location: G1***
Poster Title: Fuel efficiency of a three-stone fire and Berkeley Darfur stove in wind simulated water boiling and controlled cooking tests.
Research Mentor: Ashok Gadgil
Lab Site: Lawrence Berkeley National Laboratory
Abstract: The conflict in the Darfur region of Western Sudan has resulted in the deaths of 300,000 people and the displacement of 5-6 million persons. These internally displaced persons (IDP's) live in makeshift camps with few surrounding resources and little access to supplies, resources, or aid. Women leaving the camps to collect firewood for cooking are subject to sexual assault and rape by roaming militias, or Janjaweed; up to 25% of women report having been sexually assaulted during their daily trips. Reducing the amount of wood used to cook could slow the deforestation occurring as a result of the Darfur conflict and decrease the amount of time women leave the safety of the camps to collect wood. The Berkeley Darfur Stove (BDS) was designed as an alternative to traditional three-stone fires, specifically to meet the need of IDP's and their native cookware and foods. Wind simulation tests were conducted using a fan to create a wind velocity between 2.0 m/s and 3.0 m/s at a distance of 0.5 m from the stove surface. Firewood was burned under these simulated wind condition in the three-stone fire, the BDS, and a modified Insulated BDS to calculate thermal efficiency for the preparation of standard dishes. The three-stone fire rated at 341.4 g/kg (grams of wood burned per kilogram of water boiled), the BDS rated 179.5 g/kg, and the Insulated BDS rated 163.45 g/kg for Water Boiling and simmering under the simulated wind tests; for the Controlled Cook Test (CCT), the three-stone fire rated at 939.45 g/kg (grams of wood burned per kilogram of food cooked), the BDS rated 619.61 g/kg, and the Insulated BDS rated 535.91 g/kg for simulated wind tests. Further tests are scheduled to determine the emissions and black carbon released during the various cooking phases of the three-stone fire and the two stoves.

Name: Laura Cooper ***Poster Location: G2***
Poster Title: Exploring energy dependence of heavy atom radiation damage in protein crystals
Research Mentor: Irimpan Mathews and Ana Gonzalez
Lab Site: SLAC National Accelerator Laboratory
Abstract: X-ray crystallography is a technique used to solve the molecular structure of proteins by analyzing the diffraction patterns that result when x-ray light is directed at protein molecules arranged in a crystal structure. Bombarding protein crystals with bright sources of synchrotron radiation can result in damage to the crystal, which may ultimately result in error in the final structure. In this study we attempt to determine if the rate of damage to specific sites in protein crystals frozen to 100K depends on the energy of the x-ray beam. Four crystals grown from a heavy metal derivative of nucleic acid binding protein 3gyd containing twelve selenium-methionine and eight cysteine residues were each subjected to 2-7 MGy of cumulative x-ray exposure by collecting eight data sets for each crystal at energies of 14 keV or 9 keV. The integrated electron density surrounding each sulfur and selenium atom was calculated for each data set and the change in electron density around each atom was compared at the two energies. The rate of electron density decrease per cubic angstrom vs. dose was determined to be slightly greater at 14 keV than 9 keV for both sulfur and selenium atoms.

Name: Susan Gendreau ***Poster Location: G3***
Poster Title: The top ten hits of the Mars Exploration Program
Research Mentor: Deborah Bass
Lab Site: Jet Propulsion Laboratory
Abstract: The Mars Program Science Office is creating a web site to showcase the scientific achievements of the last decade's Mars missions. My task is to write, reference and appropriately illustrate the content of the site's initial pages. Currently no easy way exists to locate all of NASA's information on a Mars topic. The many scientific sites and publications (NASA and non-NASA) involved are specialized, lacking in context, and unconnected. The Top Ten site begins synthesizing these scattered resources into a one-stop site that can inform the scientific reader. Each page describes a "Top Ten" achievement, with short descriptions of the science, illustrations, references, and links to further information. The site has two intended audiences: first, scientists who are not geologists or Mars specialists, with the science described to technical people on a level not available from NASA educational sites. The second audience is the interested general public, so the scientific versions of these pages will be converted into general versions either in linked pages or in a linked second site. The initial site, my pages, will include the "Top Ten" accomplishments of the Mars Exploration Program and a structure allowing additional pages to be added as time and money permit.

Name: Ashlee Girardin ***Poster Location: G4***
Poster Title: Potential effects of CO_2 sequestration on groundwater composition
Research Mentor: Susan Carroll
Lab Site: Lawrence Livermore National Laboratory
Abstract: CO_2 sequestration is desirable climate change mitigation method since it utilizes aspects of thee natural, geological CO_2 cycle, however, many geomechanical and geochemical factors need to be studied to determine the viability of this option. This study looks at the chemical behavior of common cements and brines before and after the introduction of supercritical CO_2, focusing on changes In the concentration of the dissolved groundwater contaminants, primarily those of concern by the Environmental Protection Agency (EPA).

Name: Ron Hamby ***Poster Location: G5***
Poster Title: S.I.R. Student Involved Research
Research Mentor: Brad Bebout
Lab Site: NASA Ames Research Center
Abstract: Hands on, minds on science is a best practice for engaging and retaining students in STEM disciplines. In order to enhance this concept, students will have the opportunity to work on a current NASA project by collecting data for the PhycoSat mission. Students will be examining five strains of algae and cyanobacteria in various lighting and temperature conditions. The goal of the experiments is to determine the most suitable strain of algae or cyanobacteris for the PhycoSat mission. Pulse-Amplitude-Modulated (PAM) fluorometry will be used to quantify photosynthetic activity by determining the proportion of photons captured by chlorophyll for energy production as opposed to those being lost in fluorescence. PAM fluorometry provides information about the general well being of the photosynthetic apparatus which is the key to the survival of any photosynthetic organism. This method is also a very sensitive indicator of stress. Students will be using PAM fluorometer to take readings on various strains of algae and cyanobacteria, in various conditions, to help determine the optimal strain for the mission. The collected data will be formatted and sent back to NASA for further analysis. It is proposed that a small satellite (PhycoSat) will be used to study the effects of space radiation and microgravity on the photosynthesis in algae and cyanobacteria. Due to their ability to exist in extreme conditions, algae and especially cyanobacteria (aka blue green algae) represent key target organisms for development of *in-situ* resource utilization, life support systems for oxygen production and/or carbon sequestration. Understanding algal physiology under these conditions is critical in determining their suitability for use in oxygen and food production, as well as waste recycling for long term exploration.

Name: Casey Milne ***Poster Location: G6***
Poster Title: Correlating Respiratory-Related Organ Motion with External Fiducial Displacement
Research Mentor: Grant Gullberg
Lab Site: Lawrence Berkeley National Laboratory
Abstract: The purpose of the presented work is establishing a quantitative correlation between respiration-related motion of anatomical landmarks with the motion of externally applied fiducial markers. By anatomical landmarks we mean several easily identifiable points in the heart and near the heart: left ventricular apex, interventricular septum, diaphragm lobes, carina of the trachea, andT-12 vertebra. The fiducial markers are specific points on the outside of the human torso that can be monitored during a medical imaging scan. Using Osirix DICOM viewing software, MRI data sets from five patient studies with six breathnold images for each patient were studied and processed. Three-dimensional coordinates of 5 fiducial markers and 5 anatomical landmarks were recorded for each of the 30 data-sets. Acquired data will be further processed to provide information that can enable effective respiratory motion correction in the process of data acquisition and image reconstruction for PET, SPECT, X-ray CT and MRI. Medical imaging is an important and invaluable diagnostic tool, however in many imaging modalities image quality and subsequent diagnostic value of the studies are degraded by motion artifacts. The results of the presented work will be used to justify a large scale study that will eventually lead to improved image quality and lowering the patient dose for cardiac PET and SPECT scans routinely performed for patients at risk of a heart disease.

Name: Sarwia Nawim ***Poster Location: G7***
Poster Title: Microstructural evaluation of the thermal stability of thermoelectric devices
Research Mentor: Nancy Yang
Lab Site: NASA Ames Research Center
Abstract: Thermal degradation of thermoelectric (TE) devices can affect their performance, due to interactions between the materials from which these devices are constructed. For example, the TE materials can react with the solder. In this presentation I talk about how to assess phase stability and interdiffusion between the materials used for TE interconnect assemblies at elevated temperature with emphasis on the diffusion barrier between the TE material and the solder. Focus is on changes in microstructure, grain size, hardness, and composition of material at the interconnections.

Name: Shannon Peters ***Poster Location: G8***
Poster Title: Discovering the physics of Juno through *Creative Ways of Communicating*
Research Mentor: Dan Goods
Lab Site: Jet Propulsion Laboratory
Abstract: The Juno mission is an exciting new spacecraft that is being developed by NASA to explore Jupiter and gather information about both the largest planet in our solar system and the formation of the solar system itself. Juno will use special instruments which are based on fundamental physics principles to probe the planet's thick atmosphere, explore the ionosphere, magnetosphere, and gravitational field. Public outreach is important to disseminate ideas and attract attention for the mission. Creative ways of communicating through displays and social media are perfect ways to showcase content as it generally interests and engages the public. I will present my work in developing creative ways to convey the physics to the general public in the context of the Juno mission.

Name: Genovefa Pinnick ***Poster Location: G9***
Poster Title: The role of temperature in optimal conditions for whole body regeneration in tunicates
Research Mentor: Sarah Cohen
Lab Site: Romberg Tiburon Center
Abstract: Recognized as one of the closest relatives to vertebrates, the taxon of botryllid ascidians, in the phylum urochordates , possess unique modes of propagating and regenerating that make it a robust model organism for studying the biological pathways for tissue regeneration shared by many higher order urochordates, including humans. Here we address issues of ideal temperature related to tissue regeneration via the retinoic acid (RA) pathway that is common in urochordate embryonic development. Retinoic acid (RA) signaling plays a significant role in the embryonic formation of anterior-posterior axis development along the notochord or vertebrate in urochordates. In botryllids, WBR, via RA receptor expression, occurs throughout the entire regenerating process, including regeneration in the adult stages. Thus, as a first step in further investigating this process in botryllids, we seek to more clearly understanding the significance the role that temperature plays in this regeneration pathway. We exposed botryllid ampullae, in the presence of RA, to three temperature treatments, and monitored WBR in the three temperature environments. WBR of an entire functional zooid (single adult body unit) occurred within 1-4 days in temperatures of 23°C and accounted for the majority of zooids produced. Additionally, this was the only temperature under which multiple zooids (1-4) were produced within a single ampullar clump with multiple ampullar clumps each producing at least one zooid.

Name: Lovinder Pnag ***Poster Location: G10***
Poster Title: Annotation of virulence regulatory networks of *Yersinia pestis*
Research Mentor: Patrik D'haeseleer
Lab Site: Lawrence Livermore National Laboratory
Abstract: As part of a larger project to develop flexible and rapid therapeutic countermeasures for global biosecurity, we are building a Systems Biology database describing all known metabolic and regulatory interactions in Yersinia pestis, the Plague bacterium. In the work presented here, we have started augmenting the database with high-quality genetic regulatory interactions involved in virulence, from three major papers, covering a total of 5 regulators and XYZ target genes. By analyzing the resulting regulatory networks and therefore looking at the organism as a whole (Systems Biology), a more in depth understanding of the pathogen's behavior and virulence is possible, leading to novel countermeasures that can act against this important pathogen.

Name: Trevor Tetzlaff ***Poster Location: G11***
Poster Title: Mathematical modeling of faults in electrical power systems
Research Mentor: Ole J. Menshoel
Lab Site: NASA Ames Research Center
Abstract: Researchers at NASA Ames have developed the Advanced Diagnostics and Prognostics Testbed (ADAPT) which models power systems found on many aircraft and spacecraft. As the name suggests, ADAPT is used for the purpose of studying how we can better detect and diagnose faulty behavior in power systems. We do this by using an Antagonist system to inject faults into ADAPT, and have software (such as ProADAPT) run on a User system that attempts to detect and diagnose the injections. There are three different types of faults: permanent faults, intermittent faults, and transient faults. Thus far, the only faults studied have been those of permanent nature (i.e. faults that happen and are indefinitely unrecoverable). Our goal now is to begin studying intermittent faults- those that are down for a period of time and become functional again- and cascading faults- those with faults that cause other faults. We will collect data and extend our Bayesian network and Java codes to handle intermittent and cascading faults. To do this, we will first mathematically model these two faults in a useful way using Bayesian Networks and Markov Chains. Then, we will use the same software (updated, of course) and eventually expect it to not only detect when a fault happens and make a diagnosis, but also to predict if and when it will dissipate, and the probability of it cascading.

Name: Nicole Turner ***Poster Location: G12***
Poster Title: Molecular needles, glowing plasmids, laser tweezers, and plague!
Research Mentor: Brett Chromy
Lab Site: Lawrence Livermore National Laboratory
Abstract: An invading life form approaches a potential host and the process begins. Components gather on the surface of the invader, forming a weapon that assures the life form's proliferation as readily as it insures the host's destruction. Not just the stuff of science fiction, the bacterium, *Yersinia pestis*, is a member of a group of pathogens that form molecular syringes to inject virulence factors directly into target host cells. *Yersinia pestis* (Plague) is a rod-shaped, gram negative bacterium that causes disease in rodents and occasionally humans by accident. This bacterium is best known as the agent involved in the Bubonic Plague (or Black Death) epidemic occurring from 1347-1350 and claiming the lives of 1/3 of the European population. Plague has come into the spotlight as a potential biological threat. This study will utilize the most current technologies to explore the mechanisms behind the arsenal of *Y. pestis*, including Green Fluorescent Protein labeling and OptoElectronic Tweezers. We have created an assay to screen for Type III Secretion an also have gotten *Y. pestis* to align to an electric field. The next steps are to use both technologies to test cell-cell interaction.

Name: Stuart Westerman ***Poster Location: G13***
Poster Title: Beam diagnostics at SSRL
Research Mentor: Jeff Corbett
Lab Site: SLAC National Accelerator Laboratory
Abstract: The diagnostic beamline at SSRL contains many tools for imaging and assessing visible light emission from the SPEAR3 light source. By triggering different cameras with a fast timing system the incoming light can be measured on either a time-averaged basis or in single-pulse mode. The visible light images reveal information about the stored electron bunches such as pulse length, transverse dimensions, and internal stability of the beam.

Blue Group

Name: Arron Apperson ***Poster Location: B1***
Poster Title: Using sun glint to determine spatial extent of seasonal inundation
Research Mentor: Vern Vanderbilt
Lab Site: NASA Ames Research Center
Abstract: Specular reflection, or sun glint, can be used to identify and map seasonally inundated wetlands. Processes, other than wind, deform the surfaces of protected waters in seasonally inundated wetlands. These slight deformations enlarge the area of sun glint compared to the expected area from a smooth, solid surface. The extent of this larger area of sun glint can be used to define the orbit necessary to remotely sense the area of inundation. Refining the measurements in the area of inundation of seasonal wetlands is crucial in reducing the value and structural uncertainties in methane (CH4) sources and sinks in current global climate models. Several other sensing techniques have been investigated recently including SAR and microwave reflection, however the use of sun glint to map inundation has not been thoroughly explored. By assuming that the time average distortions for a point are representative of the instantaneous distortions over the entire area a composite image was created from time lapsed photos taken at several locations in the Okefenokee and Loxahatchee swamps in Southern Georgia and Central Florida. These composite images were then converted into logical matrices, where pixel values above a threshold were assigned the value of one and pixel values under the threshold were assigned a value of zero. The area of the sun's image was then the sum of the number of pixels with a value of one. The mean observed diameter was approximately 40% larger than that expected for a reflection from a solid smooth surface.

Name: Garrett Benjamin ***Poster Location: B2***
Poster Title: An energy source for deep microbial communities
Research Mentor: Friedemann Freund
Lab Site: The SETI Institute
Abstract: This experiment is a continuation of the research done by Dr. Friedemann Freund, J. Thomas Dickinson, and Michele Cash on the Hydrogen in Rocks: An Energy Source for Deep Microbial Communities that was published in ASTROBIOLOGY in 2002. The continuation of this experiment expects to obtain information about the amount of hydrogen contained in the rock column and, hence, its availability to deep microbial communities. This will be done by measuring the slow release of hydrogen after crushing rocks in inert gas using a hydrogen detector, sensitive over the 0.1- 48 molar ppm range with an instantaneous time constant. At the time of this publication there was no additional findings or information to report. So the following are the findings from that research experiment.

To survive in deep subsurface environments, lithotrophic microbial communities require a sustainable energy source such as hydrogen. Though H2 can be produced when water reacts with fresh mineral surfaces and oxidizes ferrous iron, this reaction is unreliable since it depends upon the exposure of fresh rock surfaces via the episodic opening of cracks and fissures. A more reliable and potentially more voluminous H2 source exists in nominally anhydrous minerals of igneous and metamorphic rocks. The experimental results from 2002 indicate that H2 molecules can be derived from small amounts of H2O dissolved in minerals in the form of hydroxyl, OH-, or O3Si–OH, whenever such minerals crystallized in an H2O-laden environment. At least 70 nmol of H2/g diffused out of coarsely crushed andesite, equivalent at standard pressure and temperature to 5,000 cm^3 of $H2/m^3$ of rock.

The science behind the project is of relevance to the early Earth and Mars, giving us a mechanism for the oxidation of our atmosphere. It is also, important to Astrobiology through the availability of molecular H2 in the rock column. This is an energy source for microbes for the sustainability of life in the deep underground environments.

Name: Juliana Capra ***Poster Location: B3***
Poster Title: Measurement of habitability
Research Mentor: Pamela Conrad
Lab Site: Jet Propulsion Laboratory
Abstract: Astrobiologists have used a number of surface environments on Earth as analogs to environments on Mars. From these Earthly locations, we try to learn about Martian mineralogy, geochemistry, sedimentary processes, habitability and the preservation potential of various environments for protecting the evidence of life. By learning how to measure habitability on the Earth, we will be better prepared for its measurement on Mars if we are able to distinguish between what is peculiar to the analog environment and what might be applicable to both planets. This project involved the measurement of several environmental characteristics of Amboy Volcanic field in the Mojave Desert, CA. This site, located at 34.55 N. latitude and 115.78 W. longitude is analogous to Mars with respect to its mineralogy: the rocks are lava flows with a range of dates, the most recent of which are about 10,000 years old. On Earth, many basalt rocks are colonized by microbes living on the rock surface or in cracks to the rock's interior.

Name: Chad Gillis ***Poster Location: B4***
Poster Title: Calibrating and characterizing Xray diagnostics using the Lawrence Livermore National Laboratory's Electron Beam Ion Trap: A Physics teacher's perspective
Research Mentor: Peter Beiersdorfer
Lab Site: Lawrence Livermore National Laboratory
Abstract: Using Lawrence Livermore National Laboratory's Electron Beam Ion Trap (EBIT) as an X-ray source, we characterized a flat-field grating spectrometer and calibrated the X-ray transmission of optical-blocking filters. The flat-field grating spectrometer is being used to diagnose magnetically confined plasma and the optical-blocking filters are part of a variety of X-ray diagnostics used to study a plethora of sources including inertial confinement fusion plasma, high energy density plasma, and astrophysical plasma. I will give an overview of the calibration process and also discuss how I expect to relate this experience to teaching high school physics students. This work was performed under the auspices of the U.S. Department of Energy by the Lawrence Livermore National Laboratory under Contract DE-AC52-07NA27344 and is also supported by California State University.

Name: Rym Hannachi ***Poster Location: B5***
Poster Title: Measuring the complex dielectric properties of suspected surface materials of icy satellites
Research Mentor: Martin Barmatz
Lab Site: Jet Propulsion Laboratory
Abstract: In order to better interpret radiometric measurements from missions to icy satellites such as Jupiter and Saturn, a reference database of dielectric property measurements of suspected surface materials at low temperatures is needed. In the past, conventional microwave cavity perturbation approaches have been used to determine the complex dielectric of materials. A new technique will now be used, which, unlike conventional cavity perturbation, allows for a larger, sample size, and more than two dielectric regions inside the cavity. With this new approach, we can perform dielectric property measurements on suspected surface materials such as liquid methane and ethane inside a container. A Mathematical program is used to calculate the complete dielectric contract (real and imaginary components) based on experimental values of changes in the resonant frequency and Q Factor of the cavity due to the presence of the sample. The user inputs a guess for the complex dielectric constant of the sample, and the program calculates a value for the resonant frequency and Q factor and compares them to the experimental values. The current focus is on 2 improvements: automating the program so that a range of complex dielectric constants is input and the value yield the measured frequency and Q factor changes are solved for, and automating the program so that it can be sued for any setup in which there are many dielectric regions inside the cavity, rather than just the current setup which includes 3 regions. The next step will be to automate the calculation of the Q factor, and solve for the real and complex parts of the dielectric constants simultaneously. I will discuss the progress we are making in achieving these objectives. I will also discuss the progress we are making in performing similar room temperature dielectric measurements on components of a newly developed stimulant of the lunar regolith.

Name: Fatma Hedri ***Poster Location: B6***
Poster Title:

Research Mentor: Richard Firestone
Lab Site: Lawrence Berkeley National Laboratory
Abstract: The Isotope Project is part of The US Nuclear Data Program sponsored by the US Department of Energy. The role of this project is to compile, evaluate, and analyze nuclear structure, radioactive decay data, and neutron capture gamma-ray data. The purpose of evaluating nuclear data published in the scientific literature is to provide recommended values for nuclear level properties and decay radiation data. At the Budapest reactor, all stable elements have been irradiated with neutrons. This causes the elements to become unstable, and emit gamma rays (gamma rays are emitted when unstable elements are trying to become stable). The energy of gamma rays emitted and their production cross section (intensity) are recorded. Furthermore, they are compared to the scientific literature provided by the Evaluated Nuclear Structure Data File (ENSDF). My role in this project is to tabulate a level scheme for the nuclear reaction 09Bi(n,gamma)210Bi by using the data collected at the Budapest reactor and comparing it to data found in the ENSDF.

Name: Jonathan Kamp ***Poster Location: B7***
Poster Title: Warm dense matter: charting a new frontier between condensed matter and plasma
Research Mentor: Yuan Ping
Lab Site: Lawrence Livermore National Laboratory
Abstract: Our goal for this research project was to analyze the phase changes and properties of warm dense matter. This was done by heating a 25-30nm thick gold foil with an ultrafast laser (Europa laser at LLNL) and recording the light properties that the gold foil gave off throughout the short time it was being bombarded by the laser. Our analysis of the data is still in its beginning stages but we have noticed that with the higher power laser shots there seems to be an increase in the change of phase shift compared to the lower power laser shots.

Name: Ishrat Khatoon ***Poster Location: B8***
Poster Title: Crystallography by x-ray diffraction
Research Mentor: Stefan Mannsfeld
Lab Site: SLAC National Accelerator Laboratory
Abstract: When x-ray beam is passed through the crystalline substance (phase), the rays get diffracted and produced a diffraction pattern. Different substance produces different diffraction pattern and same substance will always produce same diffraction pattern. So these diffraction patterns are like a finger print of each pure substance.

X-rays are electromagnetic radiation of wavelength about 1 Å (10-10 m), which is about the same size as an atom. They occur in that portion of the electromagnetic spectrum between gamma-rays and the ultraviolet. We can determine the size and the shape of the unit cell for any compound most easily using the diffraction of x-rays. This gives the lattice structure of an atom.

The atoms are arranged in a regular pattern, and there is as smallest volume element that by repetition in three dimensions describes the crystal. This smallest volume element is called a unit cell. For example, a brick wall consist of many bricks arranged in a certain pattern, each single brick can be a unit cell. The dimensions of the unit cell are described by three axes: a, b, and c vectors, and the angles between them alpha, beta, and gamma.

The most common use of this diffraction is chemical analysis. This can include phase identification (search/match) and determinations of unit cell parameters of new materials. I did the research work of salt and sugar sample to see if it matches the diffraction pattern already done and it did. My mentor is working on different poly carbon samples of pentacene molecules, in which I helped identify the planes and the intensity of the planes in the determination of the structure of the sample.

Name: Gilbert Lam ***Poster Location: B9***
Poster Title: Effects of temperature for whole body regeneration in *Botrylloides diegensis* colonial tunicates
Research Mentor: Sarah Cohen
Lab Site: Romberg Tiberon Center
Abstract: The regeneration capabilities of an amphibian to re-grow lost limbs is amazing. To take things one step further would be to regenerate a whole body from 200 blood cells in a vein; which is what colonial tunicates can do. Regeneration in tunicates is initiated by the activation of receptors for retinoic acid(RA), which is produced naturally in the body as a byproduct of vitamin A. With the help of RA from an external source the whole body regeneration(WBR) process can double in speed(Rinkevich, 2007).

The purpose of this study is to determine the ideal temperature needed to maximize the effect of RA in order to have a faster WBR time. Tissue segments of ampullae ranging from 1-3 mm were extracted. Their ideal culturing temperature is 18, however growing at the slightly higher temperature of 23°C would increase metabolic rate. We also tested 13°C to see how a lower temperature would effect the WBR process. A positive result was the regeneration of a fully functional zooid. Three trials with a total of 138 ampullae segments were tested. There was 1 trial with tissue from the same genotype in all 3 temperatures. The general trend is that RA in the presence of a higher temperature increased the rate of regeneration of zooids.

Name: Darren McNally ***Poster Location: B10***
Poster Title: Formation and optimization of DNA tetrahedra and tetrahedra dimers
Research Mentor: David Robinson
Lab Site: Sandia National Laboratories / California
Abstract: The purpose of our research has been to reproduce a literature result, forming tetrahedra from 4 strands of DNA, and using a fifth strand to link the tetrahedra into dimers. We have developed conditions that have good yields of tetrahedra, minimizing unwanted additional polymerization or strands non-binding. We have not been able form dimers, though adding a linker strand does effect tetrahedra.

Name: Shelley Shaul ***Poster Location: B11***
Poster Title: Astrobiology of icy worlds: characterization of pre-biotic proto-cell membranes under simulated deep-ocean conditions
Research Mentor: Michael Russell and Steven Vance
Lab Site: Jet Propulsion Laboratory
Abstract: Alkaline off-axis hydrothermal vent field effluent has been found to provide organic building blocks from inorganic constituents. These abiotic chemicals are proposed to be possible clues to how life may have emerged on Earth and and in the interiors of icy worlds such as Europa. Research will examine the formation and stability of lipid bi-layer vesicles and micelles under simulated deep-ocean conditions. Characteristic formation of vesicles and micelles will be observed in saline solution at a given temperature and pressure where pH will vary in order to monitor stability of prebiotic structures. Although the presence of divalent cations, as seen in ocean water, inhibits organic vesicle formation, higher pressures may be more thermodynamically tolerant where the existence of prebiotic proto-cells may evolve (Monnard et al., 2002 & Chen and Szosak 2004). Decanoic acid was used to assemble structures of micelle and bi-layer vesicles. Fluorescent dye, 1,8-ANS, was employed for its high affinity for hydrophobic surfaces of proteins found in fatty acids. Ocean Optics UV LED along with TLC 50F Fiberoptic Cuvette Holder are to be utilized to measure fluorescent dye activity under varying pH at given temperatures and pressures. It is expected that under alkaline conditions with moderate temperatures of up to approximately 90°C and pressures found at deep-ocean conditions will elicit stable pre-biotic lipid structures.

Name: Kathryn Strube ***Poster Location: B12***
Poster Title: Development of molecular based assays for biothreat agents
Research Mentor: Elizabeth Vitalis
Lab Site: Lawrence Livermore National Laboratory
Abstract: In order to track the intentional release or natural outbreak of bioterroristic agents, we must develop specific and sensitive molecular based assays that can identify these organisms at the strain and/or subtype level. The assays will be tested and verified using polymerase chain reaction (PCR). The DNA signature identified for each pathogen strain/subtype will be conserved in the pathogen's genome and it will be unique when compared to all other organisms.

Name: David Tugman ***Poster Location: B13***
Poster Title: East-side aquifer treatment system
Research Mentor: Ann Clarke
Lab Site: NASA Ames Research Center
Abstract: Low concentrations of trichloroethene (TCE), tetrachloroethene (PCE), cis-1,2-dichloroethene (cis-1,2-DCE) and vinyl chloride (VC) were identified in the groundwater east of the runway near Hangers 2 and 3 in 1984. This zone of contamination was divided, based on drinking water standards, into the northern and southern plume. The southern contaminant plume is located in an aquifer that is designated by the California Regional Water Quality Control Board as a potential source of drinking water. The maximum concentration detected in groundwater monitoring wells for TCE, 1,2-DCE, PCE, and VC are 140, 90, 260, and 89 µg/L respectively. The East-Side Aquifer Treatment System (EATS) was designed to remediate the southern plume of contaminated groundwater. EATS treatment system consists of five extraction wells that deliver contaminated groundwater to a treatment train composed of an air stripper and granular activated carbon filters. During four years of operation (January 26, 1999 to July 3, 2003), EATS treated 59 million gallons of water and removed 21 pounds of contaminants. Due to low rates of contaminant removal, EATS was shutdown and an optimization study was completed by the Navy. In 2005, the Navy injected Hydrogen Releasing Compound (HRC®) into various test sites to study the effectiveness in reducing contaminant levels by bioremediation. In 2009, the Navy injected a product called EHC® near extraction well one. The goal of this pilot test is to determine the ability to reduce contaminant levels using abiotic and biotic methods. My project is performing a degradation analysis on historic groundwater data and interpreting the results.