Entry Number: 1 GB
DAILY DIARY LINKS AMONG FAMILY STRUCTURE, FAMILY CONTEXTUAL PROCESSES, AND CHILDREN'S PSYCHOLOGICAL WELL-BEING
By: Yookyung Lee, Alexandria M. Sweet, and Dr. Jeffrey T. Cookston
Developmental Psychology
Faculty Advisor: Dr. Jeffrey T. Cookston
Abstract: We explored whether family structure and family processes were related to children's psychological well-being as reported in daily diary entries. Results showed that parent time with child was significantly associated with children's stress, enjoyment, and satisfaction. Co-parenting combined with family structure significantly explained children's stress, enjoyment, and satisfaction.

Entry Number: 2 GB
A FORMATIVE EVALUATION OF YOUR BRAIN, YOURSELF!: A PROGRAM FOR ELEMENTARY STUDENTS TO REDUCE STRESS AND CHANGE BELIEFS ABOUT ABILITY
By: Allison O'Leary
Developmental Psychology
Faculty Advisor: Dr. Jeffrey T. Cookston
Abstract: Evidence suggests that a child may be at risk for psychological maladjustment later in life when they are required to take on parental roles and responsibilities within a family. Paradoxically, this role-reversal, referred to as parentification, has also been linked to positive adjustment outcomes; however, little in known about the mechanisms which account for such divergent outcomes. The current study will test the link between retrospective parentification and psychological wellbeing with cultural values and perceived unfairness as mediators. Data will come from total of 200 individuals using the online survey tool, Qualtics. Linear modeling analyses are expected to reveal a negative correlation between higher levels of parentification and psychological wellbeing, and strong cultural values are expected to attenuate this link. In addition, it will be predicted that higher perceived unfairness will be negatively correlated with psychological adjustment. Furthermore, I predict that higher cultural values will serve as a buffer between parentification and perceived unfairness. The two dimensions of parentification (i.e., emotional and instrumental) will also be examined. High instrumental parentification is expected to be positively correlated with psychological wellbeing, while high emotional and instrumental parentification are jointly expected to be negatively correlated with psychological wellbeing. Covariates will include age, gender, duration of parentification experience, birth order, age of onset, socioeconomic status, and parent education. Implications and suggestions for future research and intervention programs will be discussed.

Entry Number: 3 GB
EXAMINING MEASUREMENT INVARIANCE AND CHANGE OVER TIME IN PARENTING BEHAVIORS ACROSS ADOLESCENCE
By: Kaitlyn Fladeboe
Developmental Psychology

Faculty Advisor: Dr. Jeffrey T. Cookston
Abstract: While it is clear that parenting behaviors impact adolescent adjustment in a number of ways (Steinberg, 2001), less is known about how parenting changes over time as children develop across adolescence. The current study has two goals: first, to examine longitudinal measurement invariance of a parenting behavior measure assessing acceptance, rejection, and consistent discipline by mother and father, and second, to assess change over time in these constructs. Using four waves of data from the Parents and Youth Study, a longitudinal investigation of parenting and adolescent adjustment across adolescence and young adulthood, measurement equivalence is assessed using longitudinal factorial invariance testing and change over time is assessed using latent growth modeling, both following suggestions by Widaman, Ferrer, and Conger (2010). Implications for differences in parenting over time and differences between mother and father are discussed.

Entry Number: 4 GB
DOES EMOTIONAL INTELLIGENCE IMPACT PROBLEM BEHAVIORS AMONG CHINESE ADOLESCENTS?
By: Lanie Anton, Katy Fladeboe and Dr. Jae Paik
Developmental Psychology
Faculty Advisor: Dr. Jae Paik
Abstract: The present study is examining the relationship between emotional intelligence and problem behaviors among Chinese adolescents. Studying emotional intelligence is pertinent to further understand adolescence and the developmental changes that are occurring, as it relates to problem solving, goal attainment, and psychological adaptation. Emotional intelligence also is a predictor for life outcomes, including educational, occupational, and health. We also examine a moderating effect of parent-adolescent communication on the relationship between emotional intelligence and problem behaviors. By examining these relationships with problem behaviors, this allows us to gain more knowledge about potential risk and protective factors in problem behaviors in adolescence, specifically in a country where previous research on the subject has not been thoroughly examined.

Entry Number: 5 GB
SELF-COMPASSION, BULLYING, AND PSYCHOLOGICAL FUNCTIONING
By: Susan S. Mauskopf and Dr. Jeffrey T. Cookston
Developmental Psychology
Faculty Advisor: Dr. Jeffrey T. Cookston
Abstract: Self-compassion is a psychologically healthy way of relating to one's self when facing feelings of inadequacy, perceived failure, and distress (Neff & McGehee, 2010). While self-compassion has been an area of recent interest for psychologists, the construct has yet to be examined from a developmental perspective. The current study assessed self-compassion in relation to bullying and psychological functioning to examine whether

self-compassion might be a potential intervention target for youth who are bullied. Participants were adults 18 years of age or older who completed an online survey of demographic questions and self-report measures including a retrospective measure of past experiences of bullying. Findings from this study increase our understanding of bullying outcomes and provide an initial step towards determining whether self-compassion might be a potential intervention target for bullied youth.

Entry Number: 6 GB
EXTERNAL CONTROL OF THE STREAM OF CONSCIOUSNESS: STIMULUS-BASED EFFECTS ON UNINTENTIONAL THOUGHT SEQUENCES
By: Christina Merrick, Melika Farnia, Tiffany Jantz, and Dr. Ezequiel Morsella
Mind, Brain & Behavior Psychology
Faculty Advisor: Dr. Ezequiel Morsella
Abstract: The contents of our conscious mind can seem unpredictable, whimsical and free from external control. Despite these intuitions, previous research has shown that, under certain conditions, an individual thought can be elicited reliably and unintentionally by external stimuli (Allen et al. 2013). These effects may arise in this manner because of the encapsulated nature of conscious content. For example, when one runs barefoot across the hot desert sand in order to reach water, one cannot help but consciously experience the inclinations to avoid touching the hot sand (Morsella, 2005). These urges can be represented as different 'action options' (i.e., to walk on the hot sand or to not walk on the hot sand). Interestingly, research has shown that, in terms of neural processing, a rat represents two action options (right vs. left) regardless of which direction the rat decides to go. In Study 1, we observed if participants have conscious content of two distinct action options, regardless of which action is selected. In Study 1, we found that, on average, participants reported conscious content about the selected action option on the majority of trials and reported conscious content of the unselected action option on over half of the trials. In order to further examine the unintentional and reflexive nature of conscious content, in Study 2, we examined if similar effects are found when one thought follows another, as in the stream of consciousness. In Study 2, we found that, participants reported a sequence of unintentional conscious contents elicited from a single stimulus on one third of trials. In conclusion, these studies show that a sequence of unintentional conscious content can be elicited reliably from two distinct action options. These studies also provide some evidence for theorizing that, though action-related inclinations may be 'behaviorally-suppressible,' they are often not 'mentally-suppressible'.

Entry Number: 7 GB
ONE OF US: HOW CHANGING ONE'S PHENOTYPE TO APPEAR MORE WHITE AFFECTS RACIAL CATEGORIZATION
By: Jordan Seliger and Jordan McDaniel
Mind, Brain & Behavior Psychology
Faculty Advisor: Dr. Avi Ben-Zeev

Abstract: Whites perceive racial categorization to less essentialized/fixed when a racial out-group member takes actions to appear White. Participants were given racial-phenotypic transformation scenarios. In response to a vignette depicting an Asian American woman who underwent surgery resulting in Caucasian shaped eyes, participants re-categorized her as more White than baseline.

Entry Number: 8 GB
INVOLUNTARY COGNITIONS OF POSITIVE AND NEGATIVE IMAGES: BEHAVIORAL CONSEQUENCES AND EEG CORRELATES
By: Sheila Pugh, Adam Fogarty, and Hyein Cho
Mind, Brain & Behavior Psychology
Faculty Advisor: Dr. Mark W. Geisler and Dr. Ezequiel Morsella
Abstract: The present study was conducted to evaluate behavioral and electrophysiological indices of affective processing in the context of a valenced variation of the Reflexive Imagery Task. Specifically, this poster will present preliminary results on the relationship between behavioral responses, electroencephalographic (EEG) alpha power, and individual differences in mood.

Entry Number: 9 GB
FAMILY STRUCTURE AND CONTEXT AND PARENT PSYCHOLOGICAL WELL-BEING: A DAILY DIARY STUDY
By: Alexandria Sweet and Yookyung Lee
Psychology
Faculty Advisor: Dr. Jeffrey T. Cookston
Abstract: Using daily diary reports to gather maximum information on everyday contexts, we examined how family structure and contextual family processes were linked to parental daily well-being in both divorced and married families. Thirty-seven parent-child dyads (14 dyads from a separated or divorced family) from the San Francisco Bay Area completed a 5-day diary of daily functioning and a telephone interview of family context. Results indicated correlations between parental acceptance, parent sex, family routines, communication, acceptance, and parents' levels of enjoyment and stress. Also, coparenting and family structure combined to predict parent satisfaction and enjoyment, however, we observed no main effects for divorce.

Entry Number: 10 GB
KEEPING YOUR COOL IN RELATIONSHIP CONFLICTS: EMOTION REGULATION AND THE DEMAND-WITHDRAW PATTERN
By: Hiu Man Christine Chiu, Scott Ewing and Dr. Sarah Holley
Psychology
Faculty Advisor: Dr. Sarah Holley
Abstract: A harmful pattern that couples may fall into during conflict is termed the demand-withdraw communication pattern (e.g., Christensen, 1988). In this pattern, one partner engages in demanding behaviors such as pressuring for change, criticizing, and/or

complaining, while the other withdraws through either nonverbal disengagement or avoiding the conversation. This pattern is common in relationships and is very destructive. Demand-withdraw has been found to be strongly associated with less conflict resolution and lower relationship satisfaction (e.g., Eldridge & Baucom, 2012). An important question, then, is what couples are at risk for engaging in this deleterious pattern? While certain individual difference factors have been implicated (i.e., neuroticism, desire for closeness), very little attention has been paid to the role of how people manage their emotional states within conflict. Emotion regulation is a set of processes that enables flexible, context-sensitive modulation of emotion in order to meet longer-term personal goals (e.g., Gratz & Roemer, 2004, Werner & Gross, 2010). Research shows that emotion regulation plays a crucial role in relationship interactions (Ben-Naim et al., 2013). It may be that those who are most capable of regulating aversive emotions during conflict are better able to engage in constructive communication behaviors rather than destructive behaviors such as demanding or withdrawing. The goal of the present study was to examine the association between emotion regulation capabilities and the demand-withdraw pattern. We hypothesized that deficits in emotion regulation would be associated with higher levels of demand-withdraw behaviors. Ninety three college students (69 women, 24 men; mean age = 23.4 years) who were currently in a romantic relationship participated in the study. Participants visited the laboratory and completed a questionnaire packet. The Difficulties in Emotion Regulation Scale (Gratz & Roemer, 2004) was used to assess deficits in emotion regulation, and the Communication Pattern Questionnaire, Short Form (Christensen & Heavey, 1990) was used to assess levels of demand-withdraw within the individual's current relationship. Questionnaires also captured demographic variables and current relationship satisfaction. Data was analyzed using multiple regression models. The variables were standardized, and all analyses controlled for participants' age, gender, relationship status, and relationship satisfaction. As hypothesized, results showed that deficits in emotion regulation were positively associated with total levels of demand-withdraw behaviors reported in the relationship. Since demand-withdraw tends to be a role-differentiated pattern (i.e., one partner demands while the other withdraws), we also looked at the effect of demand-withdraw on each form of the pattern (i.e., self-demand/partner-withdraw and partner-demand/self-withdraw). Results showed that deficits in emotion regulation were strongly associated with self-demand/partner-withdraw, but not with partner-demand/self-withdraw. These findings indicate that emotion regulation skills play an important role in how individuals manage relationship conflicts. In particular, deficits in emotion regulatory capabilities appear to be associated with demanding behaviors, which may spur on greater partner withdrawing. Thus, clinical interventions that target improved emotion regulation skills may be a fruitful avenue for helping couples reduce their tendencies to engage in this destructive interaction pattern.

Entry Number: 11 GB

INDIVIDUALISM-COLLECTIVISM AND SELF-DISCLOSURE TO INGROUPS AND OUTGROUPS

By: JiYeon Seol, Eugene Eusebio, and Dr. Seung Hee Yoo
Psychology

Faculty Advisor: Dr. Seung Hee Yoo
Abstract: According to Triandis (1988), individualists tend to make fewer distinctions between their ingroups and outgroups compared to collectivists. The current study tested this theory by examining Americans and their relationships toward their friend (ingroup) and acquaintance (outgroup). Participants reported on the amount and depth of self-disclosure they engaged in to their friend and acquaintance. They also completed a measure of individualism-collectivism that assessed the four facets of the construct. The results provided mixed support for Triandis' theory. Consistent with his theory, people higher on horizontal collectivism tended to make greater distinctions between their friends and acquaintances in terms of the amount and depth of self-disclosure. However, this pattern of results was also obtained for people high on horizontal individualism. These results suggest that the relationship between individualism-collectivism and ingroup-outgroup distinction may be more complex than originally theorized.

Entry Number: 12 GB
SUBLIMINAL PRIMING OF SPONTANEOUSLY EXPERIENCED MEMORIES
By: Lara Krisst, Allison Allen, Meredith Lanska, and Dr. Ezequiel Morsella
Psychology
Faculty Advisor: Dr. Ezequiel Morsella
Abstract: Research reveals that conscious contents can be influenced by unconscious processes (Morsella & Bargh, 2011). Limited research, however, has investigated whether unconscious processes influence spontaneously experienced memories. To examine this phenomenon, we primed participants with subliminal words using backward masking and then asked participants to reflect on their autobiographical memories. In Study 1, participants (n = 38) completed three blocks that primed different life settings (e.g., Familial: e.g., 'HOME'; Artistic: 'PAINT'; Recreational: 'CAMPING'). Afterwards, participants were asked to reflect briefly (3 min) on autobiographical memories. Following the reflection period, participants rated on a scale of 1 to 8 how representative pictures (from six distinct life settings) were of the memories they experienced. Category content related to the subliminal primes was rated as more representative of the experienced autobiographical memories ($M = 4.29$, $SEM = .29$) than unrelated content ($M = 3.41$, $SEM = .21$), $F(1, 37) = 11.83$, $p = .0015$ ($\eta p2 = .24$). In Study 2, participants (n = 10) completed two blocks in which they were primed with words from different life settings (i.e., Familial and Career). Following each subliminal word presentation, participants were asked to reflect (15 sec) on autobiographical memories and then paraphrase what they happened to reminisce about. To ensure that stimuli were rendered subliminal, we included a forced-choice word selection task, revealing that stimulus detection was at chance levels (33.89%). Participants' memories revealed an effect from the familial primes, $t(10) = -2.56$, $p = 0.03$. We discuss the theoretical implications of these findings.

Entry Number: 13 GB
THEORY OF MIND DEVELOPMENT IN CHINESE PRESCHOOL CHILDREN: A CLOSER EXAMINATION OF FALSE BELIEF AND HIDDEN EMOTION

By: Stephanie Chen-Wu Gluck
Psychology
Faculty Advisor: Dr. Jae H. Paik
Abstract: This study (1) examined how Chinese preschool children gradually develops understanding of different mental states, also known as Theory of Mind (ToM). Specifically, the study focused on Chinese children's sequential development of specific ToM knowledge involved in content and explicit false belief (understanding that another person may not share the same knowledge as the child), and hidden emotion (people may mask their true feelings and display another feeling on the appearance).The study also (2) investigated Chinese children's understanding of hidden emotion under different social scenarios and (3) examined whether factors such as gender and receptive vocabulary could contribute to individual differences in ToM development in Chinese preschool children.

Entry Number: 14 GB
PERSON PERCEPTION AND CATEGORY LEVELS: HOW THE BRAIN PROCESSES MALES AND FEMALES DIFFERENTLY
By: William L. D. Krenzer, Kristina Pfeifer, Callan Lujan
Psychology
Faculty Advisor: Dr. Avi Ben-Zeev and Dr. Mark W. Geisler
Abstract: Tanaka et al. (1999) showed that when categorizing an object, such as a beagle (subordinate level), there was an increase in the N1 amplitude, compared to when the same object was categorized as an animal (superordinate level). Ito and Urland (2005) showed a difference in the P300 amplitude when individuals viewed faces of different races. By adapting Tanaka's, Ito, and Urland's studies to look at gender, we were interested to see if amplitude and latency differences occurred in the N170 and the P300, when participants studied celebrity faces categorized by gender (basic level), or by name (subordinate level). Participants took part in a gender (male or female) by categorization level (basic or subordinate) image oddball paradigm task. Within each block, one gender was the target stimuli (presented 20% of the time) and the other was the distractor (presented 80% of the time). While participants responded to the stimuli, Event-Related Potentials (ERP's) were recorded from electrodes placed along the midline of the scalp at sites Fz, Cz, and Pz, and at the temporal lobe sites T5 and T6. Eye artifacts were recorded from electrodes placed below, and to the side of the left eye. Based on preliminary data, with a sample size of 19 (11 female), we observed an increase in the P300 amplitude and a delayed P300 latency to female celebrity faces at the subordinate level versus the basic level. This could indicate that processing women's names versus processing their gender requires more effort (see Kok, 1997).

Entry Number: 15 GB

DO YOU SEE WHAT I SEE? THE ROLE OF IMPLICIT BELIEFS IN PERCEIVING A STEREOTYPIC VERSUS COUNTER STEREOTYPIC BLACK MALE

By: Sierra P. Niblett, Eric D. Splan, Monica E. Mendoza, Patrick J. Hibberd, Michael I. King, Dr. Avi Ben-Zeev, and Dr. Mark W. Geisler
Psychology (Cognitive)
Faculty Advisor: Dr. Avi Ben-Zeev and Dr. Mark W. Geisler

Abstract: We examined whether Entity vs. Incremental theorists would experience a memory distortion when a Black male target is introduced as a doctor (counter-stereotypic context) vs. as a basketball player (stereotypic context). The rationale is that Entity theorists' beliefs regarding the fixity of human nature causes them to seek stereotypic information (e.g., Eberhardt et al., 2003). Forty-six participants first studied a photograph of the same Black male target introduced as a basketball player or as a doctor. After a distractor task, participants were asked to recreate the target's face from memory using facial composite software. Entity theorists generated more Afrocentric renditions overall than incremental theorists, $b^* = .459$, $t(42) = 3.12$, $p = .003$. This effect was stronger in the doctor/counter-stereotypic condition, $b^* = .246$, $t(42) = 1.67$, $p = .102$. We present electrophysiological data that speak to this differential memory effect and situate findings in a stereotype

Entry Number: 16 GB

THOUGHT STOPPING THROUGH SUSTAINED IMAGERY: INVOLUNTARY SUBVOCALIZATIONS AND THE SENSE OF AGENCY

By: Hyein Cho, Allison K. Allen, Christine A. Godwin, Dr. Carlos Montemayor, and Dr. Ezequiel Morsella
Psychology and Philosophy
Faculty Advisor: Dr. Carlos Montemayor (Philosophy) and Dr. Ezequiel Morsella

Abstract: How do conscious thoughts interact? We examined the interaction between intended subvocalizations (e.g., a continuous hum) and stimulus-triggered, involuntary subvocalizations (e.g., unintended object naming). Involuntary, subvocalized naming occurred despite the humming task. We also investigated the relationship between such conscious contents and the sense of agency (or the 'Psychological Doer').

Entry Number: 17 GB

THE ROLE OF EMOTIONAL EXPRESSIVITY ON THE RELATIONSHIP BETWEEN COLLECTIVISM AND SOCIAL ADJUSTMENT

By: Frank Du, Amy Tran, and Dr. Seung Hee Yoo
Social Psychology
Faculty Advisor: Dr. Seung Hee Yoo

Abstract: To examine the relationship between cultural values, emotional expressivity and social adjustment, three online studies were conducted. In Study 1, participants completed online surveys that assess these variables. Horizontal collectivistic values, characterized by relationship-orientation and harmony, were related to better social adjustment including higher relationship satisfaction, social support, and lower loneliness. Horizontal collectivism was also related to greater emotional expressivity.

Mediation analyses were conducted to test whether emotional expressivity mediated the relationship between horizontal collectivism and social adjustment outcomes. Emotional expressivity partially mediated the relationship. Results from Study 2, which examined participants' cultural values, emotional expressivity, and social adjustment toward their friends replicated these results. Results from Study 3, which examined participants' emotional expressivity, and motives for expression emotions show that expressing emotions is associated with motives of improving interpersonal relationships. These results suggest that for people who endorse horizontal collectivism, emotional expressions may be used to communicate social cues to others, which help them maintain their interpersonal relationships.

Entry Number: 18 GB
ESSENTIALLY CONSERVATIVE: STATE CONSERVATISM DRIVES POLITICIAN ESSENTIALISM IN THE 2012 FEDERAL ELECTIONS
By: Matthew Kleckner and Dr. Charlotte Tate
Social Psychology
Faculty Advisor: Dr. Charlotte Tate
Abstract: Political opponents generally take different positions on the issues, with Democrats taking more liberal stances and Republicans generally taking more conservative ones. But will the linguistic frameworks employed by politicians match their own personal politics, or will they bend to accommodate their target audience? We examined the use of essentialist language, which has conceptual ties with modern conservatism, on web sites of the 2012 Senate candidates to find out.
The results were informative. Democratic and Republican senatorial candidates alike used essentialist language significantly more in states that voted for Mitt Romney, while the candidates' own party affiliation had no significant relationship with use of essentialist language.

Entry Number: 19 GL
IMPROVING THE ISOLATION OF NON-O157 SHIGA TOXIN-PRODUCING ESCHERICHIA COLI USING A MODIFIED WASHED BLOOD AGAR
By: Ninalynn Daquigan, Peng Zhang (California Dept. of Public Health), and David Kiang (California Dept. of Public Health)
Biotechnology
Faculty Advisor: Dr. Lily Chen
Abstract: Non-O157 Shiga toxin-producing Escherichia coli (STEC) are emerging as clinically relevant foodborne pathogens. Because contaminated foods have an enormous impact on public health, rapidly detecting and isolating these pathogens during a foodborne outbreak investigation is crucial. Currently, various selective plating media exist for the isolation of non-O157 STECs but each is problematic. Levine's Eosin Methylene Blue agar (L-EMB) is used to isolate E. coli but cannot differentiate pathogenic strains from commensal E. coli. Chromogenic plating media are often used to

isolate STECs but are highly specialized to target a limited number of serogroups, potentially inhibiting a future non-O157 STEC that may emerge. The colonies grown on chromogenic agars may also be difficult to interpret due to a wide range of colors. STEC heart infusion blood agar with mitomycin (SHIBAM) was developed to isolate a broader range of STECs, however recovering pure isolates from food matrices containing high levels of background flora is challenging due to the growth of swarming bacteria. We developed a modified washed blood agar with four antibiotics (4AB) to inhibit excessive background for efficient isolation of non-O157 STECs. Here, we compared 4AB to the current media used for E. coli isolation: L-EMB and SHIBAM. 4AB plates significantly inhibited background bacteria, especially swarming bacteria that overwhelmed SHIBAM, making single colonies of hemolysin-producing STEC easier to recover on 4AB plates. Recovery rates from non-O157 STEC-spiked ground meat improved using 4AB plates compared to L-EMB when suspect colonies were confirmed by real-time polymerase chain reaction. By incorporating our 4AB plate into standard investigation protocols, both E. coli O157 and non-O157 strains can rapidly be detected and isolated from food samples to potentially prevent more morbidity and mortality cases from occurring.
Funding was provided in part by the Food and Drug Laboratory of the California Department of Public Health and National Science Foundation SFSU Science Master's Fellowship.

Entry Number: 20 GL
CD13-POSITIVE SELECTION OF HUMAN ADIPOSE-DERIVED STROMAL CELLS CAN ENHANCE BONE FORMATION
By: Christopher Duldulao and Dr. Michael Longaker (Stanford)
Stem Cell Science
Faculty Advisor: Dr. Lily Chen and Dr. Carmen Domingo
Abstract: The reduced ability of bone to regenerate past the age of 2 years in humans poses significant challenges for reconstructive surgeons. An ability to drive differentiation of adult stem cells isolated from human fat towards an osteogenic lineage (together with the use of biomimetic scaffolds) have resulted in techniques that offer great promise for treating critical-sized calvarial defects, which present a significant biomedical burden. Human adipose-derived stromal cells (hASCs), however, are a heterogeneous population of multipotent cells. The aim of this study was to enrich for an osteogenic subpopulation within the heterogeneous hASC pool based on cell surface marker expression. This will ultimately offer a novel cell-based strategy for treating bone loss.

Entry Number: 21 GL
CHARACTERIZATION OF THE ROLE OF MUSCLE STEM CELLS IN BONE REGENERATION
By: Jaselle Perry, Frank Yang (UCSF), Dr. Celine Colnot (INSERM, Paris, France), and Dr. Ralph Marcucio (UCSF)
Stem Cell Science

Faculty Advisor: Dr. Lily Chen and Dr. Carmen Domingo
Abstract: Bones and muscles have an extraordinary ability to regenerate following traumatic injury. Recently, muscle has been shown to enhance bone regeneration through early molecular signaling. As muscle and long bones are adjacent structures, any insult will cause injury in both tissues. Satellite cells are unipotent stem cells that drive muscle regeneration in response to soft tissue damage; however, their specific role during fracture repair remains unknown. Here, we aim to establish the role of satellite cells during early bone regeneration by assessing healing in a transgenic mouse model capable of satellite cell ablation at the time of fracture injury. Our results illustrate that muscle stem cell defects negatively impact healing at various levels. Compared to wild-type littermates, satellite-cell-ablated mice had less bone and cartilage in their fracture calluses. Additionally, levels of bone morphogenic proteins (BMPs) were diminished in these mice. Exogenous rhBMP2 protein was given to satellite-cell-ablated mice to test its effect on fracture repair and its efficacy in rescuing muscle stem cell depletion. Mice receiving BMP2 showed enhanced bone formation compared to both non-injected and vehicle-injected mice. However, exogenous BMP2 did not significantly affect callus size or cartilage volume in the callus. Together, our results indicate satellite cells may play a role in early fracture repair by signaling cell differentiation through the secretion of osteogenic and chondrogenic trophic factors, specifically BMPs. By revealing the role of satellite cells in early fracture repair, our findings emphasize the importance of muscle in normal bone regeneration.

Entry Number: 22 GL
REGULATION OF BRAIN REJUVENATION BY CREB SIGNALING
By: Kristopher Plambeck and Dr. Saul Vileda (UCSF)
Stem Cell Science
Faculty Advisor: Dr. Lily Chen and Dr. Carmen Domingo
Abstract: Aging structurally and functionally changes the adult brain driving susceptibility to dementia-related neurodegenerative disease, making it critical to identify ways by which to protect against, or even counteract, the effects of aging. In old animals, young blood has been shown to rejuvenate stem cell function in tissues including muscle, liver, spinal cord and brain. Furthermore, we have shown that exposure to young blood increases the dendritic spine density of mature neurons and enhances associated cognitive functions in the hippocampus of old animals. However, the mechanisms by which young blood rejuvenates the old brain remain unclear. Using genome-wide microarray analysis of heterochronic parabionts, we identified Creb as a potential regulator of brain rejuvenation. We assessed changes in Creb activation within the hippocampus of old heterochronic parabionts by immunohistochemistry and observed

Entry Number: 23 GL
MICROTUBULE ACTIVITY IN MITOTIC ENDOPLASMIC RETICULUM REORGANIZATION
By: Brittany Johnson and Dr. Blake Riggs

Cell & Molecular Biology
Faculty Advisor: Dr. Blake Riggs
Abstract: The Endoplasmic Reticulum (ER) is the largest organelle in the eukaryotic cell and performs several functions to maintain cellular homeostasis, including lipid synthesis and posttranslational modification. The ER maintains contact with several parts of the cell including the Golgi Apparatus and the mitochondria by using microtubules as a scaffold. However, it is poorly understood how the ER interacts with the microtubule-based mitotic spindle during cell division. The ATPase Spastin is a microtubule severing protein that is associated with the ER but its function during cell division has yet to be determined. I hypothesize that Spastin is the protein that facilitates the ER's interactions with the mitotic spindle and controls the reorganization and division of the ER during mitosis. I will express and purify a recombinant wildtype, constitutively active and dominant negative Spastin constructs and inject them during the rapid mitotic divisions in the early Drosophila melanogaster embryo. I will assay the effects of each construct on the localization and movement of ER during mitosis. In addition, I will perform an RNAi-mediated knockdown of Spastin in the early embryo and examine ER morphology and movement around the mitotic spindle during mitosis. I will also create a fluorescently tagged wildtype Spastin construct and inject into the embryo to determine localization of Spastin during mitosis. These experiments should help us determine a molecular mechanism for ER movement and provide a better understanding of organelle inheritance during cell division

Entry Number: 24 GL
COMPARATIVE GENOMICS SHEDS LIGHT ON THE MYSTERY OF TRANS-SPLICING
By: Cameron Soulette and Oliver Oliverio
Cell & Molecular Biology
Faculty Advisor: Dr. Scott Roy
Abstract: An essential step in understanding how genotype gives rise to phenotype is to understand how the expression of genes are regulated. Regulation occurs on multiple levels including transcriptional, post-transcriptional and translational. SLTS is a step in transcriptional processing observed in several diverse eukaryotic lineages, in which a short RNA sequence is added to the 5' end of transcripts from many different protein coding genes. Despite the widespread use of SLTS, there is currently no known general function. However, recent findings in the human blood parasite Trypanosoma brucei have opened an exciting possibility that alternative trans-splicing (ATS) may be a driver of transcriptome diversification and gene expression regulation (Nilsson et. al., 2010). One possibility is that ATS leads to alternative N-terminal protein isoforms by use of an internal alternative AUG as a translation initiation site: for instance, two trans-splicing isoforms of the Isoleucyl-tRNA synthetase gene in T. cruzi encode proteins with different N-terminal cellular localization signals. Another possibility is that ATS plays roles in gene regulation, either by splicing at alternative 5' UTR sites to generate alternative 5' UTRs, or by disrupting the protein-coding sequence by splicing downstream of the functional start. We determine the generality of these ATS mechanisms by performing a

comparative genome-wide study of ATS and TS patterns between two deeply diverged trypanosome parasites. Our results indicate the functional importance of some cases of trans-splicing, and provide the first estimates of the extent and mechanism of trans-splicing function in important human parasites.

Entry Number: 25 GL
CHARACTERIZING THE ROLE OF SDF-1A SIGNALING DURING XENOPUS LAEVIS MUSCLE DEVELOPMENT
By: Ceazar E. Nave, Armbien Sabillo, and Dr. Carmen Domingo
Cell & Molecular Biology
Faculty Advisor: Dr. Carmen Domingo
Abstract: Background: Stromal derived factor-1a (sdf-1a) is a chemoattractant chemokine that has been shown to play an important role in tumor growth, angiogenesis, metastasis and embryogenesis. Recent work has shown that the sdf-1a signaling pathway is a key regulator in zebrafish muscle formation. Because of known similarities in muscle development between zebrafish and the frog, Xenopus laevis, we hypothesized that the sdf-1a signaling pathway is conserved among vertebrates. Results: We use a morpholino approach to knock down levels of sdf-1a and its co-receptor, cxcr4, during X. laevis embryogenesis. Injection of the morpholino during the early stages of X. laevis development severely disrupts normal somite development. In particular, knockdowns of both sdf-1a and cxcr4 resulted in a range of phenotypes characterized by disrupted muscle fiber organization along the antero-posterior axis. Furthermore, sdf-1a and cxcr4-morphant embryos yielded severely disorganized, and occasionally, absent somitic boundaries. Conclusion: Our findings indicate that the knockdown of sdf-1a and its receptor, cxcr4, leads to a disruption in proper muscle formation in X. laevis. The data suggests that the sdf-1a signaling pathway is conserved among vertebrates in regards to early muscle development.

Entry Number: 26 GL
POLYMORPHISMS AND SELECTION ON THE APICAL MEMBRANE ANTIGEN-1 (AMA-1) OF THE AVIAN MALARIA PARASITE P. LUCENS
By: Elvin Lauron
Cell & Molecular Biology
Faculty Advisor: Dr. Ravinder Sehgal
Abstract: The apical membrane antigen 1 (AMA1) protein, a prime candidate malaria vaccine component, is required for Plasmodium parasites to invade host red blood cells. Despite being well characterized in mammalian Plasmodium species, it is unknown whether AMA1 is expressed and conserved across Plasmodium species that infect birds. Here, for the first time, we perform whole transcriptome sequencing of the avian malaria species Plasmodium gallinaceum and provide evidence that ama-1 is expressed, and well conserved in avian Plasmodium species. Plasmodium ama-1 is highly polymorphic and appears to evolve under positive diversifying selection. To investigate the level of

selection and genetic polymorphisms in avian Plasmodium parasites we compared the hypervariable domain I region of ama-1 in Plasmodium lucens, a host specialist avian malaria species, to Plasmodium falciparum. Similar to P. falciparum ama-1, we observed high levels of polymorphisms throughout domain I and found this region to be under positive selection in P. lucens. Additionally, we identified an ortholog of the AMA1 receptor RON2 in P. gallinaceum. The conservation of these essential orthologs emphasize the functional importance and role of AMA1 during invasion in avian Plasmodium parasites. These results shed light on the evolution of essential orthologs involved in erythrocyte invasion.

Entry Number: 27 GL

CHARACTERIZATION OF DNA REPLICATION CHECKPOINT TOXICITY IN SCHIZOSACCHAROMYCES POMBE

By: Gary M. Guerrero and Dr. Sally G. Pasion
Cell & Molecular Biology
Faculty Advisor: Dr. Sally G. Pasion

Abstract: In Schizosaccharomyces pombe or fission yeast, the cdc24+ gene is required for viability. The Cdc24 protein is involved in DNA replication and an additional role for Cdc24 in DNA repair has been hypothesized. Defective replication or repair proteins can an introduce mutations into DNA and lead to an unstable genome – in humans, genome instability can lead to diseases like cancer and Huntington's disease. Our goal is to model mechanisms of genome stability in fission yeast by studying Cdc24 and its interactions with conserved replication and repair factors. We recently learned that the DNA damage checkpoint Cds1 stabilizes at 34^0C, the restrictive temperature for cdc24. This coincides with a fragmented genome phenotype exhibited by truncation mutants of cdc24 (cdc24-M38 and -G1). Interestingly, the truncation mutants also exhibit a synthetic growth defect when Cds1 is overproduced at 25^0C, a normally permissive temperature for cdc24. Thus a possibility exists that the stabilization of Cds1 leads to the catastrophic loss of genome integrity in cdc24. We investigated this possibility, first by characterizing the synthetic growth defect or toxicity. cdc24 mutants overexpressing Cds1 at 25^0C exhibited an elongated or cdc phenotype like cdc24 at 34^0C. The doubling time of cdc24 mutants in liquid media is also compromised by high levels of Cds1. Next, we determined the genetic requirements for the synthetic growth defect by assaying for the toxicity in cdc24 double mutant strains. Our preliminary analysis suggests that the toxicity is Rad3 or DNA damage response dependent and Mus81-independent. Mus81 is the endonuclease responsible for the genome cleavage phenotype in cdc24. Finally, we used two other genetic approaches to provide insight into the toxicity. We performed a mutagenesis screen to find a genetic suppressor of the toxicity and we also created cdc24 diploids. Fission yeast are haploid cells and a cdc24 heterozygous diploid will allow us study the effects of wildtype Cdc24 expressed at endogenous levels alongside mutant Cdc24 protein. Our collective study further characterizes cdc24 in S. pombe.

Entry Number: 28 GL

Red-headed Stepchildren of the Eukaryotic Genome - The Origin and Evolution of the Minor Spliceosomal Introns

By: Graham Larue, Andy Madrid, and Dr. Scott Roy
Cell & Molecular Biology
Faculty Advisor: Dr. Scott Roy

Abstract: The splicing of spliceosomal introns is key to nuclear gene expression, yet their existence represents a longstanding evolutionary mystery. Minor spliceosomal introns (MiSIs) present an even deeper puzzle; they account for only a tiny fraction of known introns yet have maintained an independent splicing pathway and are well-conserved across Eukarya. Although they have no known function, and are able to convert to their major-type counterparts, they remain conserved over long evolutionary times in highly diverse eukaryotes. Given their poor overall characterization, MiSIs pose a challenge to current gene annotation methods as well as an opportunity for new insights into the origin and functions of the spliceosomal introns. Here, we propose the following: First, the application of published and novel software tools and RNA-seq data to update existing genomes and produce a high-confidence database of MiSIs across diverse eukaryotes. Using this database, we then intend to test a number of hypotheses about MiSIs: one, whether they are being maintained in the genome through active selection; two, their possible involvement in nonsense-mediated decay targeting; three, their possible use of an autoregulatory feedback mechanism; and four, whether they represent the ancestral form of spliceosomal introns, a longstanding mystery of genome evolution. This project will provide novel, direct analyses of the evolutionary history and current functional roles of the MiSIs, as well as a tool to better identify and account for MiSIs to improve annotation confidence in a host of important genome models.

Entry Number: 29 GL

Putative protamines, SPCH-1/2/3 play a role in fertility

By: Jennifer Gilbert, Dana Byrd, Jordan Berry, Vanessa Cota, and Diana Chu
Cell & Molecular Biology
Faculty Advisor: Dr. Diana Chu

Abstract: During spermatogenesis, chromatin must be condensed correctly to allow for proper delivery of the paternal genome to the newly-fertilized embryo. Major players in chromatin condensation in many organisms are small, basic proteins called protamines. These proteins facilitate compaction by binding to the minor groove of DNA, enabling it to condense further than histone binding allows. Protamines are key elements for DNA compaction, yet their interactions with other proteins and their contribution to fertility is unknown. While protamine function is conserved, high sequence variability between species makes protamine identification in organisms such as C. elegans problematic. Through proteomic analysis we identified three novel proteins enriched in sperm chromatin, SPCH-1/2/3. We hypothesize that SPCH-1/2/3 are C. elegans protamines that contribute to fertility through proper DNA compaction. While SPCH-1/2/3 are not homologs of protamines, we show that they exhibit similar characteristics to protamines identified in mammals and invertebrates. These small, basic proteins contain amino acid motifs found in other protamines, and are highly phosphorylated (82-88%). Interestingly,

SPCH-1/2/3 are phosphorylated at sites that differentiate the three proteins. This may be a mechanism for the cellular machinery to distinguish between SPCH-2/3 and SPCH-1. We show that SPCH-1/2/3 likely function to ensure delivery of the DNA to oocytes. Imaging of fixed male germ lines has revealed an exclusive localization to mature sperm for SPCH-1/2/3. Further, SPCH-1/2/3 are removed immediately after fertilization as the paternal pronucleus decondenses. This data indicates a function for SPCH in proper DNA maintenance and delivery to the oocyte. We also demonstrate that a single protein, SPCH-2, may be contributing significantly more to fertility than its counterparts. Despite the high level of identity between all three proteins (88-99%), spch-2 mutants produce progeny at only 1/3 the amount of wild type. Further, spch-3;spch-1 double mutants produce progeny at the same rate as wild-type, undeterred by having two nonfunctional SPCH proteins. To investigate complete SPCH depletion, we are employing the CRISPR/Cas9 system to engineer spch gene deletions. This data, coupled with the localization data, supports the idea that SPCH-1/2/3 contribute to fertility through proper compaction of the paternal genome.

Entry Number: 30 GL

Enzymatic nitrite production from hydroxylamine by a thermophilic archaeal ammonia oxidizer

By: Donne Estipona, Dr. Robert Yen, and Dr. José R. de la Torre

Microbiology

Faculty Advisor: Dr. José de la Torre

Abstract: Ammonia-oxidizing archaea (AOA) are key players in the global nitrogen cycle, catalyzing the oxidation of ammonia to nitrite in numerous aquatic and terrestrial environments. However, the biochemical mechanism by which the AOA oxidize ammonia remains unknown despite over a decade of research. Genomic comparisons between AOA and better-studied ammonia-oxidizing bacteria (AOB) indicate that many of the key genes responsible for bacterial ammonia oxidation are missing in the genomes of known AOA. Most notably, the homolog for hydroxylamine oxidoreductase (HAO), the enzyme responsible for a key step in the ammonia oxidation pathway, remains unknown. We hypothesize that our model AOA, Nitrosocaldus yellowstonii, expresses a protein that functions as the equivalent of the bacterial HAO. From biochemical assays on cellular lysates of N. yellowstonii, we have found that nitrite is produced from the proposed intermediate, hydroxylamine. Our experiments have further determined that this activity is due to a protein, and that the protein appears to be associated with the cellular membrane. Here we present our latest progress in our purification of this key enzyme. Uncovering this missing protein and the mechanism behind archaeal ammonia oxidation will lead to a better understanding of how these diverse and abundant organisms influence the cycling of nutrients in our world.

Entry Number: 31 GL
Investigating Undergraduate Biology Majors' Performance on the Biology Card Sorting Task
By: Elijah Combs and Dr. Kimberly Tanner
Microbiology
Faculty Advisor: Dr. Kimberly Tanner
Abstract: The difference between experts and novices cannot be completely confined to a gap in knowledge. Experts are able to acquire integrate, and implement knowledge faster than novices. In education, where our goal is to transition of novices to more expert modes of thinking, there would be substantive value to a deeper understanding of the process by which novice thinking becomes expert thinking. Experiments in physics education research, cognitive psychology, and computer science education research, have had success in probing differences in knowledge structure through card sorting tasks (Where subjects are asked to sort several cards representing concepts into groups based upon similarity of concept). Few tools exist in biology to study the knowledge organization of biology novices. The biology card sorting task has already been shown to distinguish between faculty and biology non-majors'. This project expands the scope of analysis to include undergraduate and graduate biology majors.

Entry Number: 32 GL
BIOL446: The CRISPR/Cas Adaptive Immune System of Thermomicrobium sp. HL1
By: Sean King and Dr. Jose R. de la Torre
Microbiology
Faculty Advisor: Dr. José de la Torre
Abstract: CRISPR/Cas systems are a recently discovered prokaryotic adaptive immune system that protects against invasive genetic elements, such as viruses and plasmids. It is able to incorporate part of an invading genetic element's sequence, which can be used to provide a sequence-specific immune response during subsequent infections. These systems tend to be highly variable, but how they are conserved within closely related species and distributed to other species remain poorly understood. I intend to study the CRISPR/Cas systems present in Thermomicrobium sp. HL1 (hereafter called HL1), a newly sequenced bacterial thermophile. I will also determine the level of conservation in the CRISPR/Cas systems in HL1 and in Thermomicrobium roseum, HL1's closest relative. I will also determine if a specific type of CRISPR/Cas system dominates in these species and if they contain spacer regions for the same, or closely related, genetic elements. These results will show how CRISPR systems are conserved in these closely related organisms, if they are infected by the same kinds of genetic elements, and show if there is a specific type of CRISPR/Cas system that dominates in these species. This increased knowledge of CRISPR/Cas systems could aid in our ability to utilize these systems in biotechnological applications and to study the recent evolutionary and infectious history of CRISPR-containing microbes.

Entry Number: 33 GL
Marasmius of São Tomé or Príncipe

By: Chris L. Grace
Ecology & Systematic Biology
Faculty Advisor: Dr. Dennis Desjardin
Abstract: I am working to describe the taxonomy and systematics of thirty-two collections of Marasmius, basidiomycete fungi, species from the African islands of São Tomé and Príncipe, collected in 2009 by Drs. Dennis Desjardin and Brian Perry. Until now, no true Marasmius species have been documented from São Tomé or Príncipe. Given this, and these islands remote locations, it is probable that some of these collections represent undescribed species. My work begins to address this gap by describing these collections to better define the fungal and total biodiversity of these islands. I am using both morphological and genetic characteristics to compare these Marasmius collections to previously documented species to see if they are novel to science. Based on preliminary genetic data I have generated, all of the collections so far successfully sequenced for the Internal Transcribed Spacer barcoding region were undocumented on the Genbank nucleotide database. This further suggests that these collections may represent undescribed species.

Entry Number: 34 GL
EFFECTS OF OCEAN WARMING AND ACIDIFICATION ON THE EARLY DEVELOPMENT OF AN ANTARCTIC FISH, GYMNODRACO ACUTICEPS
By: Erin Flynn and Dr. Anne Todgham (SFSU/UC Davis)
Ecology & Systematic Biology
Faculty Advisor: Dr. Anne E. Todgham
Abstract: Predicting the response of marine fish to ocean climate change has important implications for fisheries and conservation, and recent work has suggested that early life stages of fishes may be the most vulnerable. To date very little research has focused on exposure during embryogenesis, particularly with the concurrent changes in temperature and pH predicted by the end of the century. The protracted embryogenesis (~11 months) of the Antarctic dragonfish, Gymnodraco acuticeps, provides the opportunity to examine the impacts of potential synergistic stressors on embryo physiology over a fine time scale. Using an integrative, experimental approach, our research examined the impacts of near-future warming (+ 2°C) and ocean acidification (650 and 1000 ppm CO2) on metabolic processes during gastrulation to early segmentation. Increased temperature had a greater overall impact on survival and respiration than changes in CO2 levels, suggesting that temperature may be the immediate driver of change at the organismal level.

Entry Number: 35 GL
Life under the trees: Investigating the role of the environment in shaping patterns of diversity in the forest understory
By: Kimberly Drewiske
Ecology & Systematic Biology
Faculty Advisor: Dr. V. Thomas Parker

Abstract: Disentangling the processes that shape plant community diversity across landscapes is important for furthering ecological theory and restoring biodiversity. It is known that many biotic and abiotic factors influence the composition of plant communities, but the relative importance of each biotic and abiotic factor remains a mystery in many ecosystems. I aim to discover the drivers of plant community composition in the herbaceous plant communities of the forest understory habitats in Marin County, California. Rather than simply use a species, or taxonomic, based approach to study plant communities, I will use a trait-based approach with a focus on specific leaf area (SLA). A trait-based approach allows for comparisons of plant communities that differ in species composition, and the trait SLA provides insight into how plants adapt to water and nutrient availability, which varies across the landscape. I expect to find that as soil quality and small-scale climatic conditions become harsher (i.e. thinner soil, lower soil moisture, more wind and sun exposure, less fog exposure), SLA will decrease significantly, reflecting a more conservative plant resource use strategy. Conversely, under milder, more resource-rich climate conditions, SLA will increase. Moreover, I expect to see similar SLA values under similar conditions, even where species change from site to site, indicating convergence of resource use strategies across different understory plant communities. Through my research, I hope to demonstrate the value of looking beyond species identities toward a trait-based approach, to uncover general plant community ecology principles and create more reliable trait-based habitat restoration.

Entry Number: 36 GL
Investigating Novice and Expert Conceptions of Genetically Modified Organisms
By: Lisa Turk and Dr. Kimberly Tanner
Ecology & Systematic Biology
Faculty Advisor: Dr. Kimberly Tanner
Abstract: Biotechnology has a prominent role not only in the biology field, but also in many aspects of modern society. As a result, the public is regularly being asked to help decide how best to deal with genetically modified organisms (GMOs). Many studies have tried to gage public understanding and attitudes towards GMOs, yet they neglect to target college biology students who are presumably well equipped to understand the technology due to their exposure to the molecular behavior of DNA provided by their degree. This project investigates the extent to which undergraduate biology students can apply their biology classroom knowledge to explain GMOs, a real world biology problem. We developed a novel written assessment tool to explore how entering biology majors' and advanced biology majors' GMO explanations compared to biological novices, described here as non-biology majors, and experts, described here as biology faculty. The tool revealed that undergraduate student populations are unlikely to use cellular and molecular processes in their explanations of GMOs in a real world context. While explaining GMOs in a biology context, advanced biology majors included cellular and molecular processes, but failed to connect these processes in the context of a GMO. This contrasts with expert faculty explanations that included cellular and molecular processes in both real world and biological contexts. In addition, all undergraduate student populations may hold misconceptions about what GMOs are. Comparing the transition from novice to expert

understanding of GMOs could help educators sculpt undergraduate biology education to encourage more expert thinking in students. This is essential in providing the next generation of biologists with the tools needed to succeed in the modern biology field and to navigate through society as informed citizens.

Entry Number: 37 GL
Opisthobranch populations inside and outside California's marine protected areas
By: Victoria Kentner
Ecology & Systematic Biology
Faculty Advisor: Dr. Terry Gosliner
Abstract: Opisthobranchs, a group of brightly colored mollusks, are found globally in marine environments including in the pacific coast intertidal zone. The ease of detection and high diversity of opisthobranchs make them an ideal study subject to compare populations in marine protected areas to unprotected locations. I hypothesized that opisthobranchs would be larger, more abundant and have high diversity in protected areas. To assess this assumption I conducted nine hour long surveys of the tide pools in two MPAs and two unprotected locations in north central California recording species, size and number of individuals. From a time series analysis no difference was found between diversity at protected and unprotected sites however overall more species were seen in protected areas than unprotected areas. Finally, from a one-way ANOVA dorid opisthobranchs were significantly larger in protected areas compared to unprotected areas. These results indicate some benefits for opisthobranchs living in protected areas.

Entry Number: 38 GL
Effects of thermal stress during emersion and immersion on the heat-shock protein 70 response of an intertidal limpet
By: Madeline Kinsey, Brittany Bjelde and Dr. Anne Todgham
Marine Biology
Faculty Advisor: Dr. Anne E. Todgham
Abstract: Global climate change is projected to raise mean sea surface and air temperatures as well as increase the frequency of extreme heat waves throughout the world. With these changes occurring at unprecedented rates, it is important to understand whether contemporary animals have the capacity to cope with these changes and to determine what physiological mechanisms define their ability to tolerate any further change in environmental temperatures. Lottia digitalis, the fingered limpet, is a rocky intertidal species that is routinely exposed to large fluctuations in temperature during daily aerial exposure of low tide periods. Recently it has been shown L. digitalis can better tolerate heat stress during emersed conditions (low tide) versus immersed conditions (high tide). This provides evidence that this limpet species may have anticipatory mechanisms signaled by aerial exposure that better equip them to tolerate heat stress during periods of low tide. To gain better insight into potential anticipatory mechanisms and the cellular stress response, we measured the heat shock protein 70 (Hsp70) response in limpets exposed to varying heat shocks with varying recovery times in both air and water. We provide evidence that the Hsp70 response is different in aerially

emersed limpets compared to limpets immersed in water suggesting that the environment in which a limpet is exposed to during increases in temperature is important for modulating the cellular stress response.

Entry Number: 39 GL
Development of a tool to investigate instructor and student perceptions of community college biology classrooms.
By: Stephanie Malmgren and Dr. Kimberly Tanner
Marine Biology
Faculty Advisor: Dr. Kimberly Tanner
Abstract: Over the past two decades, academic bodies have been calling for reform of college science and mathematics education to increase student engagement through scientific teaching. However, attempts to assess the extent to which instructors are using reformed teaching methods have been challenging. Previously used instructor self-report assessments have been unreliable in assessing what is actually going on in classrooms, and direct observations by an outside observer have proved to be time-consuming and expensive. To avoid these issues, we created a novel online survey in which community college instructors and their students responded to statements that pertain to teaching strategies used in their community college biology classroom. The purpose of this study was to determine if this novel tool has the capacity to distinguish between courses taught with varying teaching strategies as well as determine how best to analyze the data from the survey so it could be utilized on a larger scale in the future. We found this novel tool was able to distinguish instructor and student perceived differences between courses taught utilizing scientific vs. traditional teaching strategies. Additionally, we were able to examine if instructors and students were aligned about their perception of what teaching strategies were used in their class, which had not previously been examined. We found that as instructor and student perceptions of scientific teaching increased, so to does instructor and student alignment. Next, the tool will need to be used in more classrooms to determine its efficacy on a larger scale. Additionally, it can be used by individual instructors interested in evaluating how their own students perceive their teaching strategies.

Entry Number: 40 GL
GROWTH AND PHYSIOLOGICAL RESPONSE OF JUVENILE TIDEWATER GOBY TO INTERSPECIFIC COMPETITION
By: Daniel Chase and Dr. Anne Todgham
Physiology & Behavioral Biology
Faculty Advisor: Dr. Anne E. Todgham
Abstract: Recovery of endangered fish species can be complicated by threats from introduced species. Intentional reintroduction to historic habitat has been used as a recovery tool; however, these fish face competition from fishes that have established in their native habitat since extirpation. This study sought to investigate the physiological

response of tidewater goby (Eucyclogobius newberryi), an endangered fish species, when in the presence of threespine stickleback (Gasterosteus aculeatus), a native species, and rainwater killifish (Lucania parva), a non-native species. Juvenile fish were held in aquaria for 28 days under 50% and 75% feeding levels. Growth rates, survival, and indicators of stress (i.e. cortisol, glucose, and lactate) were assessed. Reduced feeding levels significantly affected survival, body condition, cortisol and glucose levels in gobies; however, this effect was similar across all species combinations. Findings indicate greater competitive impact from the native species, while the non-native killifish performed better than the goby under low food levels.

Entry Number: 41 GL
Determining The Reasons Why SFSU Students Decide To Change Their Majors From Biology
By: Hibba Ashraf and Dr. Kimberly Tanner
Physiology & Behavioral Biology
Faculty Advisor: Dr. Kimberly Tanner
Abstract: Many students in science, technology, engineering, and math fields are switching to other majors. Although we know why this may we be on a national level, little is known about retention rates at specific institutions and what major concerns students have that lead them to switching out. I determined the retention rate at SFSU for the 2006 cohort, and sent a survey to students currently active on campus to understand the contributing factors that led them to leave Biology. To further probe them for reasons related to leaving the major, I interviewed a subset of student volunteers. I found that in the 2006 cohort, more than half of the students who declared Biology did not graduate within 6 years. Of the students that did, more than half of them changed their major before graduating. The most prevalent reasons from the survey data included those related to interest or career changing from Biology, and the time it took to earn a Biology degree. Reasons related to the Biology Department and teaching style came up in the closed-ended portion of the survey. However, when students were interviewed, the most prevalent reasons were those related to the Biology Department and teaching style. Ultimately, I will present this information to the SFSU Biology Department to provide insights that may suggest strategies for retaining students in Biology who left for reasons related to the department and institution.

Entry Number: 42 GL
Pspace: interactive visualization and exploration of protein structure space
By: Daniel Asarnow
Biochemistry
Faculty Advisor: Dr. Rahul Singh (CS)
Abstract: Due to the explosion of solved structures, it is now possible to invoke the entirety of protein structure space in reasoning about structure-function relationships in terms of the localization of folds in that space. Representations of the protein structure space can be created by embedding either distance matrices (obtained from alignment algorithms) or protein vector representations into low-dimensional spaces.

Recent research demonstrates the promise of such representations in deducing structure-structure relationships between proteins, as well as structure-function relationships in general. However, the construction of such embeddings and design of operators for their analysis is highly complex. Furthermore, no publicly available software tools exist that allow use of low-dimensional structure space representations in generalized contexts, where researchers can explore regions corresponding to their interests or study arbitrary, possibly novel, structures by mapping them in reference representations of structure space.
We describe Pspace, the first publicly available software that addresses the above needs. Pspace is a web-based, self-contained software system, which supports user driven exploration of the protein fold space and provides functionality for geometric and holistic conceptualization of the distribution of folds in the protein space. It can also be used for generation of hypotheses about the structural and functional relationships between known proteins as well as those between known and novel proteins. In Pspace, folds are represented by point clouds in a low (two or three) dimensional visualization-interaction space. In this representation, structural relatedness amongst the folds maps to spatial adjacency of the points. The low-dimensional projections are constructed by embedding representative samplings of the PDB using pair-wise structural alignment scores from different rigid and flexible alignment methods. Additionally, external contextual information from CATH and SCOP annotations are mapped as visual attributes in the visualization-interaction space. Users may explore the protein structure space beyond provided, representative structure space subsets (e.g. PDBSelect25) by uploading protein structures of choice and analyzing them within such reference contexts. Pspace is freely available at http://Pspace.info.

Entry Number: 43 GL
Exploring Class III HDAC inhibitors from marine-sediment derived actinobacteria
By: Hana Martucci
Biochemistry
Faculty Advisor: Dr. Taro Amagata
Abstract: Marine-derived actinomycetes have received extensive attention as a prolific source for bioactive secondary metabolites in the last decade. As part of our program to discover novel anticancer drug candidates from marine sediment-derived actinomycetes, the Streptomyces sp. CP26-58 strain separated from sediments collected in the San Francisco Bay's Muzzi Marsh has been identified as a producer of cytotoxic compounds based on the screening results against HeLa cells. The initial culture indicated four major compounds in the extract, one of which may be a novel anti-cancerous compound. The compounds will also be tested against the yeast sirtuin Sir2p. The sirtuin family is a group of NAD+-dependent histone deacetylases (HDACs) and is conserved from bacteria to mammals. In humans, it is categorized as class III HDACs (SIRT1-7). Among the seven isoforms, SIRT1 and SIRT2 have recently been recognized as target molecules for anticancer drugs. In the poster, basic structure elucidation for the major compounds will be introduced.

Entry Number: 44 GL
Engineering New Substrate Specificity into the Active Site of Styrene Monooxygenases
By: Phu Truong and Dr. George T. Gassner
Biochemistry
Faculty Advisor: Dr. George T. Gassner
Abstract:

Entry Number: 45 GP
Visible Light Absorption by Nitrogen Doped Titanium Dioxide Films with {001} Facets for Photocatalysis
By: Mana Moarrefzadeh
Chemistry
Faculty Advisor: Dr. Andrew S. Ichimura
Abstract: Titanium dioxide, is a cheap, nontoxic, and highly efficient photocatalyst, that has been extensively studied for degradation of organic pollutants in water. However, because of the wide band gap energy of titanium dioxide, only a small UV fraction of solar light (3-5%) can be utilized. Therefore, it is of great interest to find ways to extend the absorption wavelength range of titanium dioxide to the visible region without decreasing the photocatalytic activity. Theory suggests that anion doping of titanium dioxide has considerable effects on the band gap alteration (1, 2). A significant progress was made in this area by Liu and co-workers (3), who reported the synthesis of visible light responsive nitrogen doped micro-sized anatase titanium dioxide powders. In this study, in order to utilize visible light in photocatalytic reactions, nitrogen-doped titanium dioxide films were prepared hydrothermally using TiN as the titanium and nitrogen source and gold-coated silicon wafers and sapphire as substrates. The resulting anatase films are polycrystalline, continuous, and evenly coat the substrate to a thickness of approximately 800 nm. Our study shows that N-doped titanium dioxide films narrow the band gap of titania and show a significant shift of the absorption edge to a lower energy in the visible region. Therefore, nitrogen doping has important effects on the photocatalytic activity using visible light. This work used grazing angle XRD, SEM, UV-Vis, and XPS to characterize the films produced as a function of reagent concentration and time. The results of preliminary photooxidation experiments will be reported.
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Entry Number: 46 GP
Hydrothermal Synthesis of Titanium Dioxide Thin Films Exhibiting Preferred <001> Orientation on Fluorine-Doped Tin Oxide for Dye-Sensitized Solar Cell Applications
By: Peter F. Slattery
Chemistry
Faculty Advisor: Dr. Andrew S. Ichimura
Abstract: Titanium dioxide is an indirect band gap semiconductor that has attracted significant interest as a photocatalyst for solar energy applications. This attribute has been utilized for the manufacture of self-cleaning glass, decomposition of organic molecules and microorganisms, and for hydrogen generation through water hydrolysis.1 Special interest has been shown in the preparation of TiO2 dye-sensitized solar cells (DSSC) as a potential low-cost alternative to traditional silicon-based photovoltaics. Preparing films and powders of titanium dioxide on transparent conduction oxides (TCO) is necessary for the construction of standard DSSC designs2. Furthermore, <001>-orientation of anatase-phase TiO2 3 as well as the introduction of rutile-phase TiO2 4 have each been shown to increase the efficiency of the semiconductor's photocatalytic effect. In this work we present a low temperature hydrothermal synthesis method for the growth of titanium dioxide thin films on a TCO substrate that exhibit both strong preferred <001> orientation and a mixture of anatase and rutile phases.

Synthesis of <001> oriented titanium dioxide films used the method described by Ichimura, et al.5 Fluorine-doped tin oxide on glass was mounted vertically in a Teflon-lined autoclave with an aqueous solution containing varying concentrations of TiF4 and NaF. The autoclave was then subjected to a ramp-and-soak regimen with 4 periods for each segment. The influence of reactant concentration, ramp, hold, and cool times, and reaction temperature were investigated. Films resulting from this method exhibit a primary anatase phase with over 80% <001> orientation as well as a minority rutile phase as determined by grazing-angle X-ray diffraction (XRD). Scanning electron microscopy (SEM) images show the polycrystalline films are continuous and composed of ~ 100 nm diameter crystals with well-formed square facets. SEM images show that film thicknesses are ~ 1 micron with this preparation. A summary of SEM, XRD, and photocatalytic study results will be presented.
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Entry Number: 47 GP
L1 normalized graphical models of residue interaction networks for engineered proteins
By: Trevor Gokey
Computing for Life Science
Faculty Advisor: Dr. Anton Guliaev (Chemistry)

Abstract: Interpretation of activity profiles for engineered proteins can become complex if the modifications strongly impact efficiency yet are non-local to the active site. Molecular dynamics simulations have become a useful technique in describing differences between protein variants, but even this data is becoming increasingly complex as simulations become longer. The use of L1 normalized Gaussian graphical models can be utilized to succinctly describe simulation data due to their ability to act as a variable selector. Only variables which exhibit the most covariance are retained, resulting in a concise network of protein interactions. As a result, the constructed model describes both direct and indirect connections between the variables, which allows scientists to determine if modifications non-local to the active site have either a direct or indirect impact on the protein's function. In this work, this model is applied to trypsin variants which have the C42-C58 disulfide bridge adjacent to the active site removed. The constructed networks are used to explain how breaking the disulfide bridge can affect trypsin's binding interface.

Entry Number: 48 GP
City-to-City: Real-Time Animation and Sonification of Web Traffic
By: Lee Periolat, Paula Levine (Art), Dr. William Hsu, and Magee Mooney (Mathematics)
Computer Science
Faculty Advisor: Dr. William Hsu
Abstract: City-to-City is an interactive exhibit which shows users the physical paths followed by their data as they surf the World Wide Web. The Web is a massive network of interconnected servers, and we as users are rarely aware of the physical locations of these servers. City-to-City provides a wireless access hub for users to log in to. Any mobile device will work. The user's traffic is then traced and "geolocated": the physical path of the data is animated on a world map. Also, sounds are generated which increase in pitch as the data travels farther. The result is a visually and aurally interesting display of the internet traffic travelling through the wireless hub. The goal of the piece is to make users think about the internet and the data they access on it from a new perspective.

Entry Number: 49 GP
Microenvironment-based Protein Function Analysis by Random Forest
By: Lorenzo Flores, Kazunori Okada, Mike Wong, Dr. Dragutin Petkovic, and Kazunori Okada
Computer Science
Faculty Advisor: Dr. Dragutin Petkovic and Dr. Kazunori Okada
Abstract: Machine learning-based prediction of protein functions plays a key role in bioinformatics and pharmaceutical research, facilitating swift discovery of new drugs in high- throughput settings. This paper presents an adaptation of Random Forest to the structure-based protein function prediction. Our system represents protein's 3D physicochemical structural information in microenvironment descriptors whose spatial resolution is much finer than other sequence-based protein descriptors. We prepare our

datasets for seven active sites from five protein function classes by using multiple public data banks and train Random Forest classifiers to identify these seven function models in proteins. This paper presents two experiment studies: 1) a 5-fold stratified cross-validation for comparing Random Forest with Naive Bayes and Support Vector Machine and 2) systematic comparison of Random Forest's two variable importance measures. Promising results of these studies demonstrate a potential for Random Forest to improve the accuracy of the current protein function assays.

Entry Number: 50 GP
Analysis of Accuracy of Queuing Models
By: Ping Xiao and Dr. Jozo Dujmovic
Computer Science
Faculty Advisor: Dr. Jozo Dujmovic
Abstract: The problem I am trying to solve in this project is to develop a group of simulators for single server model, multiple servers model, feedback queuing model and interactive system model with general independent interarrival distribution and general service time distribution. The simulators will produce numerical result and histogram for various distributions such as interarrival time, inter-departure time and response time and so on. The results obtained using simulation will be compared with approximate analytic models. The goal of the project is to study robustness of queuing models of open and closed queuing networks.

Entry Number: 51 GP
Smart-Read: Creating new services by assessing e-book user activities
By: Selman Kahy, Dr. Ilmi Yoon, and Anagha Kulkarni
Computer Science
Faculty Advisor: Dr. Ilmi Yoon and Anagha Kulkarni
Abstract: E-Books and e-book readers are changing the way people read books in many ways. Smart-Read plans to further revolutionize the way people interact with the books by tracking reader's activities, digesting and offering services using the collected data. Unlike traditional books, e-book readers can produce very valuable assessment and information of the book readers from the natural reading activity. For example, most of the popular e-book readers provide word look-up functionality that helps users to look up the definition of unfamiliar vocabulary while reading. However, word look-up data is never used by those applications to offer services to the users. Smart-Read app extends this feature beyond the horizon by tracking the words that were looked up and also time spent on each page if allowed.
We believe that the tracking data can be effectively used for assessment of reading level as well as seeds for many possible educational and fun activities. By processing the data, many valuable services could be provided back to readers, parents (teachers), authors, and publisher. To readers, word-look-up not only presents the organized words per book but also presents images (using Google Image Search service) and word games. Parents or teachers can receive assessment results compared to similar reading level kids. To

authors and publisher, the pages that majority readers stayed longest or frequent words for look-up can provide valuable data for next book production. It can effectively help students' critical reading study or professional text book reading (by providing extra level word look-up for technical terms).
This project aims to build a showcase by creating a platform/system that tracks user's reading activity while reading e-books to provide services based on the assessment.

Entry Number: 52 GP
SETAP: Software Engineering Teamwork Assessment and Prediction Using Machine Learning
By: Swati Arora, Kazunori Okada, Dr. Dragutin Petkovic, and Marc Sosnick-Perez
Computer Science
Faculty Advisor: Dr. Dragutin Petkovic and Marc Sosnick-Perez
Abstract: Effective teaching of teamwork skills in local and globally distributed Software Engineering (SE) teams is recognized as very important for education of current and future software engineers.
Effective methods for assessment and early prediction of learning effectiveness in SE teamwork are not only a critical part of effective teaching but also of value in industrial training and project management. The project presents a novel analytical approach to the assessment and the prediction of learning outcomes in SE teamwork, based on data from joint software engineering class concurrently taught at San Francisco State University (SFSU), Florida Atlantic University (FAU) and Fulda University, Germany (Fulda). The approach differs from existing work in the following aspects: a) it develops and uses only objective and quantitative measures of team activity from multiple sources such as statistics of student time use, software engineering tool use, and instructor observations; b) it leverages powerful machine learning (ML) techniques applied to team activity measurements to identify quantitative and objective factors which can assess and predict student learning of software engineering teamwork skills. We chose the Random Forest (RF) ML approach for its accuracy, ease of implementation, availability as open source software, and for its ability to rank variables in terms of their predictive power, which can illuminate the most important factors for assessment and prediction.
[This research has been funded by NSF TUES Grant #1140172]

Entry Number: 53 GP
LSP Suitability Map Based on ArcGIS
By: Yufei Zhuang and Dr. Jozo Dujmovic
Computer Science
Faculty Advisor: Dr. Jozo Dujmovic
Abstract: Suitability analysis is a GIS-based process used to determine the appropriateness of a given area for a particular use, it typically answer the question, "Where is the best location?" Whether it involves finding the best location for a new park, a new housing development, or agriculture development. Suitability is determined through systematic, multi-factor analysis of the different aspect of the terrain. Model

inputs include a variety of physical, cultural, and economic factors. Such attributes may describe physical characteristics of terrain (slope, distance, longitude and latitude), available infrastructure (supply of water, energy, transportations, etc.) urban characteristics (population density, entertainment, health facilities, etc.) economic development (employability, business), pollution (water, air), etc. All of the input attributes may affect the overall suitability of specific location for a selected type of use. The results are displayed on a map that is used to highlight areas from high to low suitability.

Logic Scoring of Preference (LSP) method invented by Prof. Jozo Dujmovic helps to overcome the inadequacies present in traditional approaches. LSP method is well suited to produce so-called dynamic geographic suitability which provide specialized information on the suitability degree of selected geographic regions for a specific purpose. LSP method is a professional system evaluation method that is based on mathematical models that use GCD (a function that implements a parameterized continuous transition from conjunction to disjunction, and enables adjustable mixing of conjunctive and disjunctive properties) and other CPL (A continuous logic of decision models that are based on GCD) functions.

The Project specify the main concepts of LSP maps, identify some of the potential applications areas and to develop LSP-maps based on ArcGIS environment with accurate and reliable data sources. This project works on the server side and the users can access the suitability map of San Francisco through their web browser. We focus on how to set different elementary criteria, aggregation structures for specific application areas, how to abstract attributes from the Geo-database in ArcGIS and how to combine LSP method with ArcGIS platform to compute the degree of overall suitability, plot suitability maps with different colors that indicate the degree of suitability on the top of a base map, and then help us make a better decision.

A link to the application: http://thecity.sfsu.edu/~yufei/

Entry Number: 54 GP

Low-Power Comparator Circuit for Switch Based Wireless Power Transfer in Implants

By: Casey Hardy and Dr. Hao Jiang
Electrical Engineering
Faculty Advisor: Dr. Hao Jiang

Abstract: Many implanted medical devices rely on large batteries that require surgery for replacement. Charging the battery through wireless power transfer (WPT) may reduce the battery size and the frequency a patient requires surgery.

An output voltage (VOUT) of ~5VDC is needed to charge the battery. Traditional diode rectifier AC-DC converters require an AC receiving coil voltage (Vind) >5VPK to overcome the diode turn-on voltages resulting in strict proximity requirements and large coil sizes.

A switch based AC-DC boost converter enables the generation of a 5VDC output with low Vind voltages (~200mVPK). A low power comparator based circuit is the essential functional block for the boost converter as it provides Vind peak detection and generation of a control signal (VCTRL) for the boost switch.

Entry Number: 55 GP
Advantages of NDN data naming over TCP/IP for V2V communications
By: Madura Balasubramanian and Dr. Hamid Shahnasser
Electrical Engineering
Faculty Advisor: Dr. Hamid Shahnasser
Abstract: The main objective of Vehicle- to-Vehicle communications is to ensure a safe and comfortable driving experience. In order for V2V communications to function efficiently it is necessary that it function in a real-time environment. Vehicles today use TCP/IP as a communication medium which is not feasible. The aim of this paper is to address this challenge by exploring an alternative approach called NDN data naming. Case studies
are used to identify the design requirements and to understand its advantages and limitations.

Entry Number: 56 GP
Miniaturized RFID Tag for Biomedical Implants
By: Shi Jie Chen and Lok Kee Loh
Electrical Engineering
Faculty Advisor: Dr. Hao Jiang
Abstract: Anastomosis is a common surgical procedure using staples or sutures in an open or laparoscopic surgery. A less invasive, but more effective alternative (called magnamosis) is developed by using the attractive force between two permanent magnets to form the anastomosis over a period of several days. To ensure the two magnets are perfectly aligned during the surgery, a batteryless Radio Frequency IDentification (RFID) tag is developed to wirelessly telemeter the status of a pressure-sensitive mechanical switch, which indicates whether the two magnets are snapped together. The challenge to employ the batteryless RFID technology in this application is miniaturizing its antenna size. The antenna of a RFID tag often has the size of a credit card so that it can harvest enough power to drive the RFID circuit. In this project, by using the multi-layer Printed Circuit Board (PCB) technology and the elaborate metal routing scheme, we are able to shrink the antenna to a 10 mm diameter coil, while maintaining 17.5 cm reading distance from the center of the transmitter. And among several sizes of coil tested, a maximum distance of 37 cm is achieved with a 19 mm diameter coil. Operating at 13.56MHz, the RFID's read-range is unaffected when the tag is immersed in saline, or close to a permanent magnet. This work reveals the RFID technology's potential in the biomedical implant applications.

Entry Number: 57 GP
MEETING CHALLENGES OF LTE ADVANCED THROUGH SMALL CELL DEPLOYMENT
By: Juhi Bagaria
Embedded Electrical & Computer Systems
Faculty Advisor: Dr. Hamid Shahnasser
Abstract: The paper focuses on how operators can meet challenges of LTE Advanced, LTE-A through small cell deployment. LTE A is revolutionizing features such as Real time HD voice, video services and coverage with reduced cell drops. According to the performance targets defined by 3GPP LTE A will boost data rates from 150Mbps (LTE-Rel8) to 1Gbps. It will also ensure higher cell throughput, lower cost per bit, increased cell edge performance and upsurges of network efficiency. The answer lies in small cell deployment. The world is scaling down its parameters and so are the cell sites, allowing people to get more connected. Giant macro cell towers are being taken over with smaller units as also carriers are increasingly relying on small cell options. Small cells enhance cellular coverage and capacity in homes, enterprises, buildings and rural public areas. "They are low power wireless access points ranging from femto cells to microcells" [1]. This paper will review the enhancements that LTE Advanced will bring to the mobile network and the vital role that small cells play in realizing the advancement.

Entry Number: 58 GP
An Ultralow-input-voltage RF to DC Boost Converter for Wireless Powered Biomedical Implants
By: Kang J. Bai
Embedded Electrical & Computer Systems
Faculty Advisor: Dr. Hao Jiang
Abstract: Biomedical implants have been used to increase longevity for patients; due to its battery's lifespan and long-term financial burden, wireless power transfer technology becomes a critical technology to improve the efficiency for biomedical implants. However, the performance of the existing wireless power transfer systems is limited by the size of receiving coil as well as its operating distance. In this scheme, the ultralow-input-voltage RF to DC boost converter is demonstrated for the first time to accomplish that regulating the received radio-frequency (RF) power, which is induced by a pair of inductively-coupled coils, into a desirable DC power for recharging the battery of implants wirelessly. With a rechargeable mechanism that is supported by the wireless power transfer technology, the performance of implants could be significantly extended, and the size of receiving coil could be dramatically reduced.

Entry Number: 59 GP
Wireless navigation and remote control of a robot using an embedded accelerometer
By: Pinku Xavier
Embedded Electrical & Computer Systems
Faculty Advisor: Dr. Hamid Shahnasser

Abstract: Project aims at remotely controlling M3Pi robot using accelerometer and gyroscope embedded on the development board from ST Micro called STM32F3 Discovery board. It is based on a 32 bit Cortex M4 ARM processor and can easily interface with external peripherals. M3Pi robot has two wheels that can be independently controlled and turned in any direction. Both STM32F3 board and the robot are programmed in C language. M3Pi robot is connected to a HC-05 Bluetooth module and is controlled wirelessly over Bluetooth.

Entry Number: 60 GP
Embedded Wireless Sensor Network For Environment Monitoring
By: Vinay B. Raghavan
Embedded Electrical & Computer Systems
Faculty Advisor: Dr. Hamid Shahnasser
Abstract: This project involves building a Wireless Sensor Network using Arduino and Raspberry Pi for remote Environment Monitoring. Atmospheric factors like Temperature, Humidity and Pressure are measured using XBee sensor nodes, which transmit the sensor data to a central data aggregator node which is the Arduino. A lightweight web server built on the Arduino displays this information on a web page. Another remote data aggregator node, in the form of MySQL server is configured on a Raspberry Pi, and a backup of sensor data is stored onto this database server as well. So sensor data is stored for local and remote access. This MySQL server can also be viewed and controlled using an Android App.

Entry Number: 61 GP
Analog Integrate-and-Fire Circuit for Neuromorphic Systems
By: Weijie Zhu and John Laberinto
Embedded Electrical & Computer Systems
Faculty Advisor: Dr. Hao Jiang
Abstract: The neuromorphic system has the potential to be widely used in a high-efficiency artificial intelligence system, such as the optical character recognition (OCR). The development of the memristor technology provides a promising technological path to realize a high-efficient neuromorphic system. However, the readout circuit that is used to interface rest of the neural circuits is made of operational amplifiers, with power-hungry, slow and sensitive to noise. This project is to develop an integrate-and-fire circuit (IFC), which turns the input current into a frequency modulated pulse train, to facilitate the memristor crossbar array based neuromorphic system. This IFC is based on 0.18um technology of integrated circuit design. This project will improve the efficacy of the existing IFC so that it can be widely used in other bio-inspired neural system.

Entry Number: 62 GP
Heavy Rail Retrofit: Prioritizing Post-Earthquake Strategies for Network Restoration
By: Brenton Santos-Smith

Structural/Earthquake Engineering
Faculty Advisor: Dr. Cheng Chen
Abstract: Several studies have outlined methods for hazard estimation, risk assessment and resource allocation strategies for structure retrofit or replacement. This paper builds on an established multi-objective optimization method; creating a general framework for identifying post-earthquake damage within rail transit network and the optimal restoration strategies that maximize resilience and minimize restoration cost and time. While other factors influence network functionality, the scope of the analysis is limited to aerial structures and stations.
This paper uses a network functionality metric modified from De-Los-Santos et. al (2012) and resilience and restoration cost metrics based on the Bocchini & Frangopol (2012) methodology. The functionality and cost models were modified to include bus-bridge travel time and rental cost when used as detours between stations. The seismic event and resulting damage were modeled using Hazus (Hazus-MH 2012). MATLAB was used to solve the multi-objective optimization problem and produce a Pareto front of solutions.

Entry Number: 63 GP
Evaluating Effects of Actuator Delay in Real-Time Hybrid Simulation Involving Strength and Stiffness Degradation
By: Hezareigh Ryan
Structural/Earthquake Engineering
Faculty Advisor: Dr. Cheng Chen
Abstract: Real-time hybrid simulation is a viable experimental technique to evaluate the performance of structural models and components under earthquake loads. In this method, the structure consists of an analytical substructure and a physical substructure. Actuators are used to impose displacements on the physical substructure based on the load applied and the reactions are measured and used to calculate the response of the analytical substructure and the structure as whole. However, there is a delay in the response of the actuator that introduces an error in the real-time hybrid testing results. This research focuses on effects of this delay on the result of a system exhibiting stiffness and strength degradation. Computational simulation of single-degree-of-freedom structures with no, slight, moderate, and significant stiffness and strength degradation has been analyzed and compared. The result suggests that stiffness degradation increases the error caused by actuator delay, while strength degradation has no effect.

Entry Number: 64 GP
Application of a Very-Low-Cost Unmanned Aerial Vehicle (UAV) and Consumer Grade Camera for the Collection of Research Grade Data: Preliminary Findings.
By: Peter Christian, Dr. Jerry David, and Dr. Leo Blesius
Geography
Faculty Advisor: Dr. Jerry David and Dr. Leo Blesius

Abstract: The use of UAV technology in the field of geoscience research has grown almost exponentially in the last decade. UAVs have been utilized as a sensor platform in many fields including geology, biology, climatology, geomorphology and archaeology. A UAV's ability to fly frequently, at very low altitude, and at relatively little cost makes them a perfect compromise between free, low temporal and spatial resolution satellite data and terrestrial based survey when there are insufficient funds to purchase custom satellite or manned aircraft data. Unfortunately, many available UAVs for research are still relatively expensive and often have predetermined imaging systems. However, the proliferation of hobbyist grade UAVs and consumer point and shoot cameras may provide many research projects with an alternative that is both cost-effective and efficient in data collection. This study therefore seeks to answer the question, can these very low cost, hobby-grade UAVs be used to produce research grade data.
To achieve this end, in December of 2012 a small grant was obtained (<$6500) to set up a complete UAV system and to employ it in a diverse range of research. The system is comprised of a 3D Robotics hexacopter, Ardupilot automated flight hardware and software, spare parts and tool kit, two Canon point-and-shoot cameras including one modified for near infrared imagery, and a field laptop. To date, successful research flights have been flown for geomorphic research in degraded and restored montane meadows to study stream channel formation using both visible and near infrared imagery as well as for the creation of digital elevation models of large hillslope gullies using structure from motion (SFM). Other applications for the hexacopter, in progress or planned, include landslide monitoring, vegetation monitoring and mapping using the normalized difference vegetation index, archaeological survey, and bird nest identification on small rock islands. An analysis of the results produced so far indicates that this low-cost approach can be used to gather relevant research data but there are significant downsides to using equipment designed for hobbyists and the public rather than that which has been designed primarily for research. Specifically, the repurposing and maintenance of the low-cost equipment greatly increases the time needed before quality data can be obtained.

Entry Number: 65 GP
P-T-t-d History of the Greater Himalayan Sequence in the Zanskar Shear Zone, NW India
By: Emma Beck
Geology
Faculty Advisor: Dr. Mary L. Leech
Abstract: A synthesis of pressure-temperature-time-deformation (P-T-t-d) conditions describe the evolution of the Great Himalaya Sequence (GHS) deformed and exhumed along the Zanskar Shear Zone (ZSZ), which spans the entirety of the Himalayan range. Samples from Malung Tokpo become progressively more sheared with increased proximity to the ZSZ and develop an S-C foliation with shear banding. The dominant mineralogy is Qz + Kfs + Pl + Bt + Grt + Ilm + Sil(Fi) ± Ms ± Ky ± St. P-T paths constructed from Perple_X-generated pseudosections have a 4-stage clockwise trajectory: (1) nearly isothermal burial; (2) progressive temperature increase to peak P-T conditions, (3) decompression, and (4) exhumation. Each portion is constrained by mineralogical/

microstructural growth associations, garnet geochemistry, and Fe-Mg exchange in garnet and biotite thermometry. Garnets are weakly zoned and record a retrograde history. U-Pb SHRIMP dating of metamorphic and igneous zircon constrains the timing of peak regional metamorphism to ~20-21 Ma and indicates that anatectic leucogranite crystallization begins prior to peak metamorphism but stops shortly thereafter (~20-25 Ma). Quartz CPOs suggest a progressive increase in deformation temperature with increased distance from the ZSZ. Absolute deformation temperatures are not designated due to the variable deformation history and degree of foliation development. The evolution of the GHS in Zanskar includes rapid burial (c. 33-27 Ma), closely followed by leucogranite generation (c. 25-20 Ma), leading to a melt-weakened crust and relaxation-facilitated normal faulting (c. 21-19 Ma) and rapid exhumation. This history is best described as a combination of the critical-taper wedge and the channel flow model.

Entry Number: 66 GP
The Tectonometamorphic Evolution of the Greater Himalayan Sequence along the Zanskar Shear Zone, NW India
By: Seniha Ozum Basta, Theodore D. Burlick, Emma N. Beck, and Dr. Mary L. Leech
Geology
Faculty Advisor: Dr. Mary L. Leech
Abstract: The Greater Himalayan Sequence (GHS) has been exhumed along the Zanskar Shear Zone (ZSZ) in the Zanskar region of the western Himalaya. Granites and metapelites collected along the the ZSZ in the Suru River valley provide how and when the GHS rocks exhumed and were deformed. There are two suites of Paleozoic granites deformed within the ZSZ: Pan-African Cambrian–Ordovician granites at the cores of gneiss domes and Mississippian–Permian granites related to Panjal Traps magmatism. Anatectic leucogranite crystallization from c. 28 to 16 Ma occurred within the GHS. The metamorphic grade in the GHS increases from biotite to sillimanite zone from E to W along the Suru River toward the Suru dome and comprises Qz + Kfs + Pl + Bt + Ms ± Grt ± Sil ± Ky ± St ± Chl ± Tur ± Rt ± Zrn ± Opq. Rotated garnets, recrystallized quartz grains, irregular grain boundaries, kink bands, microfolds, and deformation bands suggest different deformation mechanisms and temperatures corresponding to changing strain with distance from the ZSZ. Isochemical phase diagrams using Perple_X, mineral chemistries, and electron backscatter diffraction, combined with geo/thermochronology data from U-Pb and 40Ar/39Ar, methods reveal the exhumation history of the GHS rocks within the ZSZ, and tests the mid-crustal channel flow model. I have modeled metapelite mineralogy, using an internally consistent thermodynamic database, several well-calibrated mineral solution models, and the program Perple_X suite of programs to compute pseudosections. Solution models include biotite, chlorite, staurolite, feldspar, white mica, garnet, and ideal cordierite; and were modeled over the pressure-temperature range of 0.3-1.2 GPa and 400-800°C. Specific equilibrium assemblage diagrams of rocks were calculated in the simplified model system Na2O-CaO-K2O-FeO-MgO-Al2O3-SiO2-H2O-TiO2 (NCFMASHTO). According to the calculations using Perple_X, the maximum pressure for garnet growth in sample ZH-35 is approximately 1.3 GPa. 40Ar/39Ar dating of muscovite and biotite constrains cooling and exhumation ages of the GHS at ~20-19 Ma and ~15 Ma, respectively. A metamorphic pressure-temperature-time-

deformation history of the GHS rocks, generated in light of these combined data, fills gaps in the understanding of the tectonic and metamorphic evolution of the GHS in the Suru River Valley which is less well-studied than the comparable evolutionary history of the GHS in the eastern Himalaya.

Entry Number: 67 GP
Productivity Along the California Margin Through the Last 5 Million Years
By: Valerie Schwartz and Dr. Petra Dekens
Geosciences
Faculty Advisor: Dr. Petra Dekens
Abstract: Primary productivity in upwelling systems is important in regulating climate on a global and regional scale, and serves as the base of the marine food web. There is little consensus on how productivity in upwelling regions will respond to future global warmth. The early Pliocene (3-5 Ma) is the most recent time in Earth history when atmospheric CO2 concentrations were similar to today and temperature average global temperature were warmer (3-4˚C), and is a widely regarded as the best analogue for future climate in the paleo-record. This study examines the response of productivity in the California upwelling region to those conditions of global warmth. We reconstructed records of productivity at ODP site 1016 (34.3˚N, 122.16˚W, 3846 m water depth) and ODP site 1022 (34.3˚N, 122.16˚W, 3846 m water depth) using smear slide analysis and a laser particle size analyzer. At both sites the % diatoms decreases from 4.5 to 2.5 Ma, while the % coccolithophorids increases through the same time period. Given that diatoms in the modern ocean thrive under regimes of high upwelling and high nutrient input, we interpret the higher % diatoms prior to 3.3 Ma as an indication of high nutrient input driven by either increased upwelling and/or higher nutrient content of the subsurface water. Unlike in the modern ocean, productivity and SST were not linked. Further work should include higher resolution records to better constrain the timing of changes in productivity.

Entry Number: 68 GP
Eulerian Numbers in Unit Cubes
By: Emily McCullough
Mathematics
Faculty Advisor: Dr. Matthias Beck
Abstract: My research is in geometric and algebraic combinatorics, specifically in Ehrhart theory. This work has applications in linear modeling and optimization. My research involves the delta-polynomials (also known as Ehrhart h-polynomials) for a family of lattice polytopes called parallelepipeds and a related object called half-open parallelepipeds. Schepers and Van Langenhoven recently proved that the delta-polynomials for closed parallelepipeds is unimodal; that is, the coefficients increase up to some point, then decrease. Our goal is to extend this result to half-open parallelepipeds. Such a result would contribute to the problem of classifying delta-polynomials.

Entry Number: 69 GP
Triangulations of Gale Duals of Root Polytopes
By: Hannah Winkler
Mathematics
Faculty Advisor: Dr. Federico Ardila and Dr. Matthias Beck
Abstract: We study a family of polytopes, namely, the Gale duals of the type-A root polytopes. These polytopes appear in many branches of mathematics, including representation theory and combinatorics. We use a connection with the complete graph to study the polytope's structure and to determine if there exists a unimodular triangulation in every dimension.

Entry Number: 70 GP
Estimating the Fractal Dimensions of Sets Arising in Dynamical Systems
By: Joseph Squillace
Mathematics
Faculty Advisor: Dr. Yitwah Cheung
Abstract: In 1969 William Veech constructed a class of subsets K_i of the unit circle which are known to contain information about the dynamics of certain skew products of the unit circle. We show that for any number x between 0 and 1 we can create subsets K_i which have dimension x.

Entry Number: 71 GP
A Geometric Approach to the Littlewood Conjecture
By: Kyla Quillin and Dr. Yitwah Cheung
Mathematics
Faculty Advisor: Dr. Yitwah Cheung
Abstract: The Littlewood Conjecture is an open problem in Diophantine approximation that was proposed in the 1930's. Lui gave a geometric interpretation of the Littlewood Conjecture in 2013. In effort to proceed in determining the conjecture's validity through this interpretation, we must understand the distinguished lattice points, called pivots, of the lattice utilized in Lui's interpretation. Given a vector with integer components, our project seeks to determine precisely in which lattices this vector is a pivot.

Entry Number: 72 GP
Proper Colorings of Bidirected Graphs
By: Nina Cerutti
Mathematics
Faculty Advisor: Dr. Matthias Beck
Abstract: Techniques for enumerating proper colorings of a graph are well established and have many applications to, for example, scheduling problems for networks. We extend these concepts to bidirected graphs, which are graphs that are equipped with

additional structure. In particular, this additional structure has connections to signed graphs, which allow us to model situations containing two types of relationships.

Entry Number: 73 GP
Statistical Analysis of Glycoprotein Data in Breast Cancer Cells
By: Spencer Bowen
Mathematics
Faculty Advisor: Dr. Alexandra Piryatinska and Dr. Leslie Timpe (Chem & Bio chem)
Abstract: We analyze the presence of glycoproteins in breast cancer cell lines in order to find potential biomarkers which may be used to distinguish between various subtypes of breast cancer. We also use methods including LASSO Logistic Regression and Random Forest to create models to predict a cell line's breast cancer subtype and discuss the accuracy of these methods.

Entry Number: 74 GP
Combinatorial Approach to Multiple zeta Functions
By: Leonardo Bardomero
Mathematics
Faculty Advisor: Dr. Matthias Beck
Abstract: The formal study and definition of Multiple Zeta Functions is due to Don Zagier and Michael Hoffman. Surprisingly enough, these functions also appear in physics and engineering. In this project I intend to provide novel proofs to several identities for multiple zeta functions. Our proofs will use the combinatorial theory of partially ordered sets and the Möbius inversion formula.

Entry Number: 75 GP
Calibration and First Images from the Refurbished Leuschner 30-inch Telescope
By: Adam Fries, Eileen Gonzales, Dr. Adrienne Cool, Nabeel Naqvi, and Dana Zhu
Astronomy
Faculty Advisor: Dr. Adrienne Cool
Abstract: The 30-inch Leuschner telescope, now jointly operated by SFSU and

Entry Number: 76 GP
Testing the refurbished Leuschner 30-inch telescope and its ability to detect planets around other Stars
By: Eileen Gonzales, Adam Fries, and Dr. Adrienne Cool
Astronomy
Faculty Advisor: Dr. Adrienne Cool
Abstract: The 30-inch Leuschner telescope is now jointly operated by SFSU and UC Berkeley; SFSU students have access to it for more than 100 nights per year. The telescope has recently been refurbished and is now routinely operated remotely from

Thornton Hall. For the past year, we have been testing the refurbished telescope and characterizing the site where it is located, 30 miles east of the SFSU campus in Lafayette, California.

Entry Number: 77 GP
Measuring Dark Matter in Galaxy Clusters with Weak Gravitational Lensing
By: Angela Berti
Astrophysics
Faculty Advisor: Dr. Andisheh Mahdavi
Abstract: Gravitational lensing is a distortion of the path taken by light from a background object (the source) as it passes through the gravitational field of a lensing object (the lens). Measurements of the degree and orientational of distortion can be used to infer certain properties of the lens, such as its mass. We use observations of the weak lensing of background galaxies by the total mass (gas, stellar, and dark matter) of galaxy clusters to study the distribution of dark matter in a sample of 50 clusters at redshifts between $z = 0.15$ to 0.55. We also compare the merits of six different mass density models used to fit the dark matter distribution of a cluster over the entire sample.

Entry Number: 78 GP
Using optical tweezers to study bacterial toxicology
By: Chensong Zhang
Physics
Faculty Advisor: Dr. Zhigang Chen
Abstract: Investigating bacterial response to chemical exposure is important for understanding bacterial toxicology. We use optical tweezers to trap and monitor a single bacterium because of its ability to control nano- or micro-sized objects. We have successfully detected the response of Escherichia coli in the presence of ethanol. Our goal is to apply optical tweezers to investigate bacterial toxicology of Psudomonas Aeruginosa.

Entry Number: 79 UB
External Control of the Stream of Consciousness: Stimulus-Based Effects on Involuntary Thought Sequences
By: Sabrina Bhangal, Christina Merrick, Melika Farnia, Tiffany Jantz, and Dr. Ezequiel Morsella
Mind, Brain & Behavior Psychology
Faculty Advisor: Dr. Ezequiel Morsella
Abstract: The Reflexive Imagery Task reveals that conscious content can be elicited, reliably and unintentionally, by external stimuli. Using this task, we observed effects of word-frequency on involuntary subvocalizations and demonstrated for the first time that, not just one thought, but a sequence of two thoughts can be triggered into consciousness.

Entry Number: 80 UB
Event-related potentials (ERP's) reveal White participants reduce attention towards counter-stereotypic out-group members.
By: Alfredo D. Bolanos, Sierra P. Niblett, Trevor Jackson, Jocelyn Miller, Dr. Avi Ben-Zeev, and Dr. Mark Geisler
Psychology
Faculty Advisor: Dr. Avi Ben-Zeev and Dr. Mark W. Geisler
Abstract: Does racial stereotypic information for out-groups affect early attentional resource allocation in the preservation of status-quo beliefs? We ask whether White individuals allocate more attentional resources to Black faces primed with Black stereotypic (e.g., athletic) versus Black counter-stereotypic (e.g., intelligent) traits. Evidenced by ERP's, research in social cognitive neuroscience has shown that the cognitive system appears to allocate greater attentional resources, occurring around 100ms, towards racial out-group members; specifically increased N1 amplitude (Dickter & Bartholow, 2007; Ito & Urland, 2003, 2005). However, whether stereotypic information would moderate this effect remains an open question (but see Dickter and Gyurovski, 2012 regarding work on neural processing of race). We conducted a preliminary study to investigate this question. Five White perceivers viewed Black and White male faces in an oddball paradigm and were asked to indicate when a target face appeared on the computer screen. This task consisted of 400 trials in which electroencephalography (EEG) was recorded. During each trial, face stimuli were primed supraliminally with cues shown to be stereotypical of Black individuals or White individuals. Preliminary results indicated a significant Target Race x Stereotype interaction, $F(1,4) = 33.35$, $p = .004$, $\eta 2p = .893$. Simple effects analyses revealed reduced attention towards stereotype-incongruent ($M = -2.52$, $SE = 2.11$) as opposed to stereotype-congruent ($M = -6.15$, $SE = 1.58$) Black targets, $t(4) = 4.87$, $p = .008$. The effects of social context (herein, racial stereotypic vs., counterstereotypic information) on processing of ingroup and outgroup faces in service of stereotype maintenance are discussed.

Entry Number: 81 UB
The Association of Emotion Regulation Style and Conflict Behaviors in Relationships
By: Alina Belohlavek and Donish Cushing
Psychology
Faculty Advisor: Dr. Sarah Holley
Abstract: The present study examined the association between emotion regulation style and behaviors during romantic relationship conflict. Results showed that a tendency toward suppression is associated with destructive communication patterns (i.e., mutual avoidance and withholding, the partner-demand/self-withdraw behavior), whereas a tendency toward reappraisal is associated with mutually constructive communication patterns.

Entry Number: 82 UB
Response Interference during Working Memory-Based Action Control: A New Interference Paradigm for Neuroimaging
By: Andrew C. Garcia, Dr. Mark W. Geisler, and Dr. Ezequiel Morsella
Psychology
Faculty Advisor: Dr. Mark W. Geisler and Dr. Ezequiel Morsella
Abstract: Response interference can be caused by the presence of external visual distractors that are goal-incompatible (e.g., as in the flanker task; Eriksen & Eriksen, 1974) or by representations held in working memory (WM) that are incompatible with action goals (Hubbard et al., 2013). Building on this research, we developed a paradigm in which participants (n = 24), after learning to press certain buttons when presented with certain letters, are presented with two action-related letters (the memoranda) but must withhold responding (4 s) until cued to emit the response associated with one of the two letters. In the Congruent condition, the action corresponds to the cue (e.g., memoranda = AB, cue = B, response = B); in the Incongruent condition, the action corresponds to the other item of the memoranda (e.g., memoranda = AB, cue = B, response = A). Another condition (Spatial Cueing) presented a non-letter cue (a dot) associated with the spatial location of a target; in the Incongruent condition, participants responded to the item that was not cued spatially. Response times (RTs) were longer for Spatial Cueing than Letter Cueing, $F(1,23) = 7.069$, $p = .014$; and RTs were longer in the Incongruent than Congruent conditions, $F(1, 23) = 63.057$, $p = .001$. We also examined the subjective aspects (trial-by-trial 'urges to err') and neural aspects (electroencephalography) of performance. Our results are discussed alongside findings showing increased fronto-parietal coherence within the theta band (4-7 Hz) during goal-directed WM (Sauseng et al., 2005).

Entry Number: 83 UB
Creativity and Well-Being: How Your Engagement in Creative Acts Can Make You Happier
By: Jacqueline Diggs and Jessica Lam
Psychology
Faculty Advisor: Dr. Ryan T. Howell
Abstract: Existing research suggests that those who regularly engage in creative activities possess certain qualities that can benefit well-being. Furthermore, observational studies found that when individuals engage in creative activities (e.g. painting, creating music), positive health outcomes can result (e.g. high self-esteem, a sense of purpose). (Bungay, 2010; Huxley, 1997). The goal of the study examines if the production of creative engagement can lead to increased well-being. We hypothesized that there is a positive relationship between engagement in creative expression and an individual's well-being. In study 1, we asked participants (N = 502) a series of questions pertaining to their engagement in creative activities and multiple measures of well-being, such as their satisfaction with life, subjective happiness, self-perceived success, and overall well-being. On average, participants who engaged in in creative acts felt a higher sense of well-being. In sum, the results demonstrate that individuals who engage in production of creative expression may benefit in positive health outcomes.

Entry Number: 84 UB
The Effects of Television Violence on Memory
By: James Sculthorp
Psychology
Faculty Advisor: Dr. Margaret F. Lynch
Abstract: There has been an abundance of researcher linking violent media to priming of violent behavior and decreased cognitive ability. This experiment aims to add to this research and specifically look into the effect that television violence has on memory. To do this, two approximately seven minute clips from the television show "True Detective" were used, one containing a significant amount of violence and the other without. Inner spliced within the clips were a series of 20 words which were flash onscreen for periods of half a second every 20 seconds for the duration of the clips. Afterword, participants were asked to recall as many words as possible and participate in a survey about their television viewing habits. It was predicted that those who watched the violent clip would have a lesser rate of recall than those who viewed the nonviolent one. (Data will be collected on 4/29/2014)

Entry Number: 85 UB
Characteristics Fostering Effective Teamwork in Asynchronous Space Flights
By: Kathy Gonzalez and Dr. Kathleen Mosier
Psychology
Faculty Advisor: Dr. Kathleen Mosier
Abstract: Space flights are strenuous by nature. With the added drawback of asynchronous communication once crews go outside of Low Earth Orbit effective teamwork and communication become essential to successful missions and the avoidance of dangerous situations becoming life threatening. Exploring the individual and group factors that are related to, and affect, how crews work together is essential for high performance on missions. An experimental study at San Francisco State University investigated whether flexibility to situations, conflict management style, and leadership style were positively related to group performance, group cohesion and efficacy. After administering questionnaires before and after a space-flight simulation, correlation matrices and a regression analysis were used to explore the hypotheses.

Entry Number: 86 UB
Measuring Gender Bias through Helping Behavior
By: Le Nguyen, Carly Clapham, and Mason Marruffo
Psychology
Faculty Advisor: Dr. Margaret F. Lynch
Abstract: This study intends to measure current gender biases by recording the amount of attention directed toward a male or female when providing requested direction information. In a field experiment, unwitting participants were verbally asked for directions by a female or male confederate. The researchers are investigating to see if the participant will favor one gender over another when delivering the directions to the two

confederates. Sixty participants will be chosen using convenience sampling. With the only criteria that the participant must be alone. The research team will conduct a three-part series field experiment, involving three separate locations. The two research confederates alternatingly will ask for directions from an unknowingly selected participant. The amount of time that the participant spends directing their response to each of the confederates will be recorded. It is hypothesized that due to gender bias, more time will be directed to the male confederate even when asked for directions by the female confederate. Timing will be done by a third member of the research team who will be the observer.

Entry Number: 87 UB
The Daily Behaviors and Well-Being of Grateful Individuals
By: Eric Nestingen
Psychology
Faculty Advisor: Dr. Ryan T. Howell
Abstract: There is an emerging literature that demonstrates the benefits of possessing a grateful disposition (e.g. vitality, satisfaction with life, and happiness; McCulloughs, 2002). The purpose of this research is to demonstrate the potential contributing factors to these benefits in well-being, as well as some of the behaviors that are associated with a grateful disposition. Previous research has demonstrated the benefits of making experiential purchases (i.e. those that afford some type of experience but leave only a memory), compared to material purchases (i.e. those that are physical and tangible in nature), which have a stronger and longer lasting impact on well-being (Howell & Hill, 2009). Visitors to the "Beyond The Purchase" who completed a gratitude questionnaire and multiple consumer behavior and happiness measures were examined. Overall, grateful people spend their money on life experiences and social activities: for example, they have experiential tendencies, allocate more of their income to experiential purchases and charitable donations, score higher on an implicit measure of experientialism, prefer dinning experiences instead of shopping experiences as well as social purchases, are intrinsically motivated to purchase life experiences, and more frequently spend a social evening with friends and relatives. It comes as little surprise then they their needs for belongingness, self-esteem, and self-actualization are more satisfied when compared to ungrateful people. These data suggest that gratitude interventions might increase experiential consumption, and ultimately, psychological need satisfaction.

Entry Number: 88 UB
To Smell or Not to Smell
By: Jeanna Marie Ross and Marc Nunez
Psychology
Faculty Advisor: Dr. Margaret F. Lynch
Abstract: Body odor and psychological and interpersonal relationships.

Entry Number: 89 UB
Jesus in the Clouds: Context and Priming Effects on the Perception of Ambiguous Stimuli
By: Lyndsey Wallace
Psychology
Faculty Advisor: Dr. Margaret F. Lynch
Abstract: The purpose of this study is to examine context effects and priming on the perception of an ambiguous image. The experiment involves a control and experimental group, which will be shown a series of images with differential context and priming elements; the neutral context condition, will be shown a series of images neutral in relation to the target image, and the experimental group will be shown images that are religious in context. The hypothesis being tested is that there is an effect of priming, with religious imagery, on the perception of the ambiguous stimulus, specifically that it is significantly more likely to be interpreted as a religious image.

Entry Number: 90 UB
The Unhappy Hedonist: Exploring the Tendency to Sacrifice for Pleasure
By: Masha Ksendzova, Ravi Iyer, Graham Hill, and Dr. Ryan Howell
Psychology
Faculty Advisor: Dr. Ryan T. Howell
Abstract: While past work has measured individual differences in how much people value pleasure, little is known of the possible costs of pursuing pleasure. For this reason, the present study measured people's tendency to pursue pleasure excessively (i.e., hedonism). We examined data from two independent academic research websites: YourMorals.Org and BeyondThePurchase.Org. Hedonists were less conscientious than non-hedonists ($r = -.31$; $r = -.32$; both ps $< .001$) and, surprisingly, more neurotic ($r = .17$, $p < .001$; $r = .22$, $p < .01$) and less agreeable ($r = -.20$, $p < .001$; $r = -.16$, $p < .10$). More importantly, hedonists, compared to non-hedonists, reported less psychological well-being, including less life satisfaction ($r = -.17$, $p < .001$; $r = -.21$, $p < .01$) and subjective happiness ($r = -.22$, $p < .05$). These results support our conceptualization of hedonism as maladaptive - a pursuit of pleasure that actually undermines happiness.

Entry Number: 91 UB
How Materialistic is your Subconscious? Investigating an Implicit Measure of Materialistic Desires
By: Patrick Kerwin, Masha Ksendzova, and Dr. Ryan Howell
Psychology
Faculty Advisor: Dr. Ryan T. Howell
Abstract: The belief that material possessions can improve individuals' personal and social well-being permeates America. However, contrary to this belief, previous research robustly shows that materialists, compared to non-materialists, have lower social and personal well-being. Yet, the vast majority of these findings utilize self-report measures of materialism. This practice is problematic because explicit measures of materialism are

correlated with socially desirable responding. Thus, the goal of the present research was to develop an implicit measure of materialism. In order to do so, 193 visitors to the academic websites BeyondThePurchase.Org and YourMorals.Org were presented with a set of words to classify into groups as quickly as possible. The four categories represented life experiences (e.g., concerts, dining, restaurants), material items (e.g., jeans, watch, dress shoes), self (me, I, mine), and others (other, they, them). By comparing reaction times, we measured how strongly associated the two categories (Self, Other) were to life experiences compared to material items. Higher scores, which represented a stronger association between the self and life experiences, predicted increased income allocation to life experiences and less allocation to material items as well as a higher experiential buying tendency and lower material values. These results indicate implicit materialism can be measured, and future research can use this tool to capture subconscious materialistic desires.

Entry Number: 92 UB
Gender Differences in Multitasking
By: Rachel Gonzalez, Daniel Feeney, and Gabrielle Lectora
Psychology
Faculty Advisor: Dr. Margaret F. Lynch
Abstract: The purpose of the present study is to compare multitasking abilities between males and females and discover if one gender performs better under such conditions than the other. Participants were taken from Dr. Lynch's PSY 400 Research Methods classes. The researchers read a list of words to participants while they were simultaneously asked to work on a maze, and at the end of the task they were asked to record how many words they could remember. Data was collected for this experiment on April 29, 2014, and results will be assessed in time for the showcase. The researchers have hypothesized that females will outperform males on this task, and hope that this will show in the data.

Entry Number: 93 UB
Authority Perception and Gender
By: Rachel Hurd and Isela Garcia
Psychology
Faculty Advisor: Dr. Margaret F. Lynch
Abstract: How we communicate is important in many ways. We communicate verbally as well as nonverbally. The manner in which we communicate conveys a lot about how we perceive ourselves and others. We may see some people as more socially dominant or submissive. We might even see dominance and submissiveness differently depending on our genders. We hypothesize that each gender will perceive and label dominant/submissive postures differently. A power point slide was shown to two classes where they had to answer multiple choice questions about pictures depicting at work scenarios. They had to choose the option that described what was going on and later had to choose descriptive qualities that represented dominant and submissive qualities. So far, we are in the process of collecting data.

Entry Number: 94 UB

Who is More Oblivious to the Embarrassing Faux Pas of Others?

By: Regina Anders and Haley Rose
Psychology
Faculty Advisor: Dr. Margaret F. Lynch

Abstract: Embarrassment is a self-conscious emotion felt by an individual after he or she has publicly made a transgression. The most common causes of embarrassment are when someone experiences a social faux pas. It is essential to follow social standards and rules in order for society to maintain social norms, social interaction, and overall function properly as a group. Based on previous research findings, a field study has been inspired to test the outcome between males and females and their reaction to an embarrassing faux pas. The theory is that men will be less likely than women to notify someone and aware them that they have committed an embarrassing faux pas. The procedure begins with a researcher applying red lipstick to her teeth and then asking one hundred convenient sampled participants (50 men and 50 women) located at San Francisco State University for directions to the Bursar's office. The researcher will make the lipstick on her teeth noticeable by smiling and talking for 5-10 seconds with a participant to ultimately see if that person will notify the researcher of her faux pas. Another researcher observes each interaction and records the data. The limitations and further research for the study are discussed.

Entry Number: 95 UB

Materialistic Impressions lead to Negative Personality Judgments: A Social Interaction Study

By: Ross Philip Crothers and Dr. Ryan T. Howell
Psychology
Faculty Advisor: Dr. Ryan T. Howell

Abstract: In today's society, research has shown that those who make materialistic purchases tend to be less happy than those who make experiential purchases. Along with the negative social stigma towards materialism, research has supported the idea that people stigmatize those perceived as materialistic purchasers. The goal of our study was to examine if this negative evaluation would potentially lead to the social exclusion of materialistic purchasers. Using an experimental design, the current study was conducted to determine if people socially excluded those who are perceived as materialistic and thus rate them more negatively than experiential purchasers. The study asked participants to interact with a materialistic or experiential confederate and rate their perceived personality traits. Ratings showed that participants perceive materialistic interview partners more negatively than experiential interview partners.

Entry Number: 96 UB
How happy is your subconsciousness? Developing an implicit measure of happiness
By: Samuel Stark, Masha Ksendzova, and Dr. Ryan Howell
Psychology
Faculty Advisor: Dr. Ryan T. Howell
Abstract: Improving people's well-being benefits both individual and society at large. Consequently, there has been an increased focus on determining intentional behaviors and activities that enhance well-being. And yet, the effectiveness of positive psychology interventions are typically only examined using self-report measures of happiness. Thus, the goal of the present research was to develop an implicit measure of happiness. In order develop a happiness IAT, 101 adult visitors to the "Beyond The Purchase" websites were presented with a set of words to classify into groups as quickly as possible. The four categories were happy (e.g., happy, cheerful, content), sad (e.g., sad, gloomy, somber), self (me, I, mine), and others (other, they, them). By comparing reaction times, we measured of how strongly associated the two categories (Self, Other) were to happiness compared to sadness. Higher scores, which represented a stronger association between the self and happiness, predicted increased explicit happiness as measured by the satisfaction with life scale and the UK happiness index. These results indicate implicit happiness can be measured. Our future research aims to determine if intentional behaviors and activities which have previously increased explicit well-being, also result in higher implicit happiness scores

Entry Number: 97 UB
Dental Anxiety, Dental Avoidance and Dental Drills
By: Victoria Paoloni
Psychology
Faculty Advisor: Dr. Margaret F. Lynch
Abstract: The aim of this project is to investigate the relationship between the sound of the dental drill and dental anxiety. Previous literature indicates that dental phobic patients find dental drills anxiety-provoking, but in a study unrelated to dental anxiety, participants found the sound of the dental drill relaxing. In this study, participants will view the same dental training video, but only one group will experience the sound effect. After viewing the video, participants will fill out a copy of the Modified Dental Anxiety Scale as well as a brief questionnaire regarding experiences with dental appointments.

Entry Number: 98 UB
Attitudes Towards E-Cigarettes Versus Nicotine Patches as Tools for Smoking Cessation
By: Vincent Miller and Joseph Moglia
Psychology

Faculty Advisor: Dr. Margaret F. Lynch
Abstract: In order to more accurately understand the attitude of college students towards electronic cigarettes (e-cigs), my partner and I devised a survey with the purpose of discretely discerning participant's feelings about e-cigs. Participant's consisted of students in both of Dr. Margaret Lynch's Introduction to Research Methods classes receiving a short description about a fictitious college student and were asked to rate the model students traits/behavior as negative, neutral or positive. In one description the student is an e-cig user, in the other description the student is a nicotine patch user. Both classes received the same survey with only one question differing (the e-cig/nicotine patch question). The other questions on the survey were distracters to avoid demand characteristics. Demographic data was also gathered to find possible demographic correlations.

Entry Number: 99 UL
BIOL446: Metabolic Pathways of Novel Prokaryote Thermomicrobium HL1
By: Gerid Ollison and Dr. Jose R. de la Torre
Cell & Molecular Biology
Faculty Advisor: Dr. José de la Torre
Abstract: The "Assembling the Tree of Life" project enriched the phylogenetic diversity represented in the available sequenced bacterial genomes by sequencing the ge- nomes of species such as Thermomicrobium roseum (T. roseum). To understand- ing the nature of any organism it is necessary to assemble the network in which those annotated proteins interact. Metabolism is one of the four basic characteristics of any living organism, yet the metabolic growth requirements for Thermomicrobium HL1 remains unde- fined. T. HL1's closes relative,T. roseum, contains a genome which encodes all necessary proteins of complete oxidative phosphorylation and oxidative pentose phosphate pathways, a complete Citric Acid Cycle, and both glycolytic and glu- coneogenic pathways.(Wu, D et al. 2009). Additionally, its chemoheterotrophic nature has been experimentally confirmed (Jackson, TJ et al. 1973). We may observe conservation between the closely related thermophiles, Thermomicro- bium roseum, Spearbacter thermophilus and Thermomicrobium HL1.

Entry Number: 100 UL
BIOL446: In wine there is wisdom, in beer there is freedom, in water there is Thermomicrobium HL1: A study of CO and H2 utilization
By: Amanda Gomez and Dr. Jose R. de la Torre
Microbiology
Faculty Advisor: Dr. José de la Torre
Abstract: CO and H2 are like coffee and tea. Both give you energy, but one helps you get through the day more than the other. This research seeks to observe what "drink" Thermomicrobium HL1 prefers as its source of energy. Energy from the oxidation of CO and H2 is captured by an electron transport chain then utilized by bacterial cells. HL1 is a

rod shaped, gram-negative chemoheterotroph, which thrives in extremely hot environments. It was found in Heart Lake, a hot spring in Yellowstone National Park, the same park as its closest relative Thermomicrobium roseum. HL1 defies the role of a typical Chloroflexi. It oxidizes CO aerobically, which is a mechanism specifically used by Actinobacteria and Proteobacteria. CO is used as an energy source based on the presence of molybdopterin-containing carbon monoxide dehydrogenase. H2 is a second possible electron source. T. roseum contains large and small hox genes that encode for H2 uptake by membrane bound Ni-Fe hydrogenase, and three hyp genes encoding for hydrogenase maturation, assembly, and nickel incorporation. Therfore, if HL1 contains the required genes it would be able to utilize CO and H2 as sources of energy. IMG, KEGG, TMHMM, PSORT-B, SignalP and Phobius will be used as bioinformatics tools to look for genes ih HL1 and their location in the membrane.

Entry Number: 101 UL
BIOL446: "Long Lost Twins: A Search for Gene Duplication in Thermomicrobium HL1 and Relative Species"
By: Andy Madrid
Microbiology
Faculty Advisor: Dr. José de la Torre
Abstract: Gene duplication allows for the possibility of mutation and divergence of duplicated genes from one another, leading to potential novelty in functions. Genes that are found to be of use can be conserved across species and further duplicated, allowing the spread of new traits through this form of evolution [2]. A unique trait that has evolved in Thermomicrobium HL1 is its ability to withstand extreme temperatures, also known as thermophilicity. Genes responsible for such a capability like thermophilicity have yet to be characterized in HL1 and its sister thermophiles. Yet, although heat-correlated genes have not been classified yet, it is reasonable to believe that such genes would be conserved through speciation and resemble each other to a certain extent and would not be found in the genomes of non-thermophilic species. Through a bioinformatics approach, using the available HL1 genome, genes of the organism can be found and compared amongst themselves to find any genes that match each other, sequentially, and classified as putative gene duplications. These methods can be utilized across other neighboring species as well and any duplicated genes can be compared to one another, displaying which genes have been conserved through evolution. Since no wet lab work is being performed, any findings cannot confirm that any of the found genes that have been putatively duplicated are responsible for thermophilicity, but findings can narrow down the possibilities, to a certain extent, shedding some light on the cryptic genes responsible for thermophilicity.

Entry Number: 102 UL
BIOL446: Comparative genomic analysis of septation process in Thermomicrobium HL1
By: Anita Setiawan and Dr. Jose R. de la Torre
Microbiology
Faculty Advisor: Dr. José de la Torre

Abstract: Septation is a simple yet important and highly regulated process of cell division in bacteria. This can be seen through involvement of many genes in the septation process. In a widely studied gram negative bacteria of Eschericia coli, there are eight genes involved in the pathway (Lutkenhaus & Addinall, 1997). In this study we are looking at Thermomicrobium HL1 (HL1), which is a gram negative rod-shaped bacteria isolated from thermal spring in Yellowstone National Park. Genomics analysis of septation process of HL1 and its close relative including Thermomicrobium roseum will provide an insight of the cell cycle regulation of the organism. By comparing the genes involved in the septation process of this organism with widely studied gram negative bacteria such as E. coli and Caulobacter crescentus, we can learn whether similar regulation mechanism also occur in HL1. Using genomics tools such as IMG, BLAST, KEGG, and Phylogenetic tree program I compare the genes involved in septation process and look for the evolutionary relationship. I predicted that T. roseum and HL1 have similar pathway in the septation process.

Entry Number: 103 UL
BIOL446: *Thermomicrobium* sp. HL1 Synthesizes Coenzyme A Through an Alternative Pathway: Combining L-valine and Spermidine Metabolism
By: Austin Spencer Lee and Dr. Jose R. de la Torre
Microbiology
Faculty Advisor: Dr. José de la Torre
Abstract: Coenzyme A (CoA) is involved in hundreds of metabolic reactions and is a required cofactor for a wide array of enzymes. Thus, CoA is essential for life in both prokaryotes and eukaryotes. CoA can be derived from pantothenate in a universal five-step process shared throughout bacteria, plants and mammals. Pantothenate is derived from β-alanine and (R)-pantoate, which is converted from L-aspartate and ketopantoate respectively. Thermomicrobium sp. HL1 does not possess the enzymes aspartate α-decarboxylase (ADC) and ketopantoate reductase (KPR), which catalyze the conversion of L-aspartate to β-alanine and ketopantoate to (R)-pantoate respectively. However, all of the enzymes required for synthesis of CoA from pantothenate are present in HL1's closest relative, Thermomicrobium roseum.[3] Using a KEGG and IMG, I will attempt to provide a feasible biosynthetic pathway for CoA by analyzing:

Entry Number: 104 UL
BIOL446: Possible Carbon Fixation in Thermomicrobium sp. HL1
By: Christine Quach and Dr. Jose De La Torre
Microbiology
Faculty Advisor: Dr. José de la Torre
Abstract: Abstract: An extensively studied genome, Thermomicrobium roseum, was recently sequenced and this information can be used to look at other closely related genomes such as Thermomicrobium sp. HL1. T.roseum is a very unique organism and phylogenomic analyses has led to it to being removed from the phylum Thermomicrobia and assigned to the phylum Chloroflexi . Though we have a complete genome sequence

of T.roseum there are still gaps in knowledge about other Thermomicrobium species such as HL1. For example, we can focus on the carbon fixation pathway for both genomes and by determining which genes are present or missing in the pathways in HL1 and comparing it back to T.roseum we can see how other relatives of T.roseum have evolved.

Entry Number: 105 UL
BIOL446: The Search for Carbon Monoxide Oxidation in Thermomicrobium sp. HL1
By: Connie Jang and Dr. Jose R. de la Torre
Microbiology
Faculty Advisor: Dr. José de la Torre
Abstract: The purpose of this research is to examine Thermomicrobium Sp. HL1, a thermophilic hot spring bacterium, for the presence of CO oxidation. HL1 is a relatively newly discovered bacterium found at the Yellowstone National Park, WY, USA, that still needs to be research extensively. There will be no lab work done on this experiment, but purely genome analysis and data collection extracted from online databases. Genes involved in CO oxidation for T.roseum will be searched for in HL1. If HL1 has the same or similar genes as T.roseum for CO oxidation it will be evidences for HL1 that it may have the same process. HL1 will be compared to its other close relatives such as Sphaerobacter thermophilus and Chloroflexus species to see if they might contain the genes for CO oxidation. Preliminary results showed that there are genes in HL1 that are involved in CO oxidation based on the genes found in T.roseum. This research can allow us to understand other potential electron sources HL1 may possess and give us a better understanding about this recently discovered bacterium.

Entry Number: 106 UL
BIOL446: You are what you eat: Formate metabolism in Thermomicrobia
By: Curtis Halpin and Dr. José R. de la Torre
Microbiology
Faculty Advisor: Dr. José de la Torre
Abstract: The biosynthesis and degradation of formate has been widely studied among many gram negative as well as thermophilic bacteria. Formate is a carboxylate that is an important intermediate in many metabolic processes, and has been long studied to be generated from CO2. Formate dehydrogenases are enzymes with the potential to catalyze the reduction of CO2 into formate, although they have been typically observed to favor the reverse process, i.e., the oxidation of formate to CO2. Thermophilic microorganisms demonstrate great metabolic flexibility, possibly growing chemoorganoheterotrophically, eating carbon that is possibly provided by formate. In order to better understand the way in which formate is regulated among thermomicrobia, more analysis of the underlying genetic mechanisms involved in its integration concerning key metabolic steps is needed.

Entry Number: 107 UL
BIOL446: Comparison of Genes Encode for Flagellar Assembly of Thermomicrobium roseum and HL1
By: Ellen Lin and Dr. José R. de la Torre
Microbiology
Faculty Advisor: Dr. José de la Torre
Abstract: The flagellum is one of the most common mechanisms in bacterial motility. Thermomicrobium roseum is known as a non-motile bacterium; however, previous study has suggested that its megaplasmid seems to encode a complete flagella apparatus. It is predicted that T. roseum and its closest relative, Thermomicrobium HL1, share a similar genome for flagella. In this study, the genes encoded for Thermomicrobium flagellar system will be identified and the amino acid sequences will be aligned for gene comparisons. This comparison hopefully will provide an additional point of reference for motility study of Thermomicrobium sp. in the future.

Entry Number: 108 UL
BIOL446: Flagellar Proteins in Nonmotile Thermomicrobium HL1
By: Eric Lee
Microbiology
Faculty Advisor: Dr. José de la Torre
Abstract: Thermomicrobium HL1 and its closest known relative Thermomicrobium roseum are classified as nonmotile bacteria but both organisms contain the proteins for chemotaxis and genes for synthesizing, assembling, and regulating flagellum. A third species, Sphaerobacter thermophilus, from their phylum Chloroflexi will also be analyzed since evidence of flagellar proteins was also determined to be present from another study. Analysis of the T. HL1, T. roseum, and S. thermophilus genomes will be done to identify key similarities and differences in the flagellar apparatus operons. Orthologous regions of the genome and GC content will be analyzed using comparative genomics to determine if the chemotaxis and flagellar proteins are the result of horizontal transmission.

Entry Number: 109 UL
BIOL446: The relationship of beta-lactamase
By: Jia Qi Fang and Dr. Jose R. de la Torre
Microbiology
Faculty Advisor: Dr. José de la Torre
Abstract: This research is to analyze the penicillin and cephalosporin Biosynthesis within Thermomicrobium HL1 and to compare the pathway to better understand how it has adapted to the presence of beta-lactam. There are two genes found within the genome that codes for Beta-lactamase class A and Beta-lactamase class C used to break down beta lactam but there was also a gene within the genome that codes for an ntn-superfamily that is believed to synthesis beta-lactam. The goal from here is to identify the purpose for an

ntn-super family within the genome and what is the relationship between the Beta-lactamase between species.

Entry Number: 110 UL
BIOL446: Phylogenetic Analysis of Flagellar Assembly Proteins in Thermomicrobium sp. HL1
By: Jorreca Mangonon and Dr. Jose R. de la Torre
Microbiology
Faculty Advisor: Dr. José de la Torre
Abstract: Prior research has concluded the presence of flagellar genes in the non-motile organism Thermomicrobium Roseum thus, it is likely the case for Thermomicrobium sp. HL1, a member of the Chloroflexi phylum which possesses highly similar characteristics. Upon using bioinformatics programs such as BLAST, IMG, and phylogenetic.fr, a comparison was made between flagellar proteins found in organisms within the Firmicutes phylum. It is concluded that T. sp HL1 also possesses genes encoding for a complete flagellar system within its megaplasmid due to the level of synteny observed. In addition, our findings may support that T. sp. HL1 has also obtained these flagellar assembly proteins through lateral transfer.

Entry Number: 111 UL
BIOL446: Reconstruction of the divisome complex in Thermomicrobium spec. HL1 with comparative genomic studies of THL1, its closest relatives and E.coli.
By: Julia Philipp and Dr. Jose R. de la Torre
Microbiology
Faculty Advisor: Dr. José de la Torre
Abstract: As cell division is a central aspect of life for every bacterium, the protein complex involved in constriction and separation, called divisome, is well examined in Escherichia coli, which was then claimed a model organism for bacterial cell division. Knowing that Thermomicrobium spec. HL1 significantly differs from E.coli in many aspects, I wonder if the knowledge about the divisome in E.coli can be used to reconstruct the divisome in HL1. Using BlastP, TMHMM, SignalP, PSORT-B, Phobius, PFAM, and KEGG and amino acid sequences of proteins associated with cell division in E.coli, HL1, Thermomicrobium roseum and Sphaerobacter thermophilus, I will try to do the reconstruction and gather information about the conserved proteins as well as the process of cell division in HL1.

Entry Number: 112 UL
BIOL446: Determining the Properties of Carbon Fixation in Thermomicrobium HL1 via Comparison with Thermomicrobium roseum
By: Mary Jean Padilla and Dr. Jose R. de la Torre
Microbiology
Faculty Advisor: Dr. José de la Torre

Abstract: E. Carbon fixation is the process by which an organism converts carbon dioxide into the organic compounds necessary to sustain itself. The bacterium Thermomicrobium HL1 (HL1) is suspected to have the potential to perform this process, but the exact pathway and its precise characteristics have yet to be documented. Due to its strong biological resemblance to the bacterium Thermomicrobium roseum (T. roseum), it is plausible to infer that HL1 will have a carbon fixation pathway very similar in design and function to either one or both of the defined pathways of T. roseum. The first pathway for T. roseum is a variation of the Wood-Ljungdahl pathway and the second pathway is a form of the Calvin Benson Bassham (CBB) cycle (Wu et al, 2009). To determine the similarity between the carbon fixation pathway of HL1 and T. roseum, the specific genes that encode for the required enzymes of the defined pathways in T. roseum will be ascertained and then entered into Basic Local Alignment Search Tool (BLAST) for comparison with the genome of HL1.

Entry Number: 113 UL
BIOL446: An atypical outer membrane in Thermomicrobium HL-1 inhibits formation of flagella
By: Rachel Bhaskar and Dr. Jose R. de la Torre
Microbiology
Faculty Advisor: Dr. José de la Torre
Abstract: Thermomicrobium sp. HL-1 is a thermophillic bacterium cultivated from the hot springs of Yellowstone National Park. Its genome was sequenced in San Francisco State University and has been found to share closest synteny with Thermomicrobium roseum of the Chloroflexi group, and hence was used as one of the main genomes used to compare with the Th. HL1 genome. Bacterial chemotaxis is characterized for motile bacteria that respond to environmental cues that attract them toward a food source or deter them from toxins. Th. HL1 is known to be non-motile, as are most Chloroflexi. Interestingly, this non-flagellated organism's megaplasmid encodes a complete flagellar apparatus. It is understood that the genes were acquired through horizontal gene transfer across the Chloroflexi and Firmicutes (Wu, et al. 2009). Computational databases were used to find the homologues of proteins in the flagellar apparatus of Th. HL1. Signal transduction proteins, such as the Che proteins were compared in related organisms by generating KEGG's two-component system schematic pathways. It can be inferred from the data that Th. HL1 may possess homologues that suggest it has the potential to build a flagellum in the future.

Entry Number: 114 UL
BIOL446: Genomic Analysis of Possible Aerobic Carbon Monoxide Metabolism in Thermomicrobium HL1 spp.
By: Rolan Ginete and Dr. Jose R. de la Torre
Microbiology
Faculty Advisor: Dr. José de la Torre

Abstract: Despite its toxicity to many organisms, there exists a diverse group of bacteria that can metabolize carbon monoxide. Prior to 2001, only 14 isolates from 12 genera comprised the documented CO-oxidizing bacteria. Since then, the list of documented CO oxidizers has grown steadily. Aerobic CO oxidation is found only in a few groups of bacteria, specifically in many Actinobacteria and Proteobacteria. Its presence in a member of the Chloroflexi is new. In fact, the organism Thermomicrobium roseum is the first thermophile discovered to oxidize CO. Its close relative, Thermomicrobium HL1 spp., was isolated from Yellowstone National Park in 2006. There are several fates for the reducing equivalents of carbon monoxide, and I intend to show through genomic analysis and bioinformatics that Thermomicrobium HL1 spp. is capable of aerobically oxidizing carbon monoxide into energy as an alternative energy source.

Entry Number: 115 UL
BIOL446: How Does Thermomicrobium sp. HL1 Move?
By: Ryan Wicorek and Dr. Jose R. de la Torre
Microbiology
Faculty Advisor: Dr. José de la Torre
Abstract: E. coli and Salmonella typhimurium both have three flagellar motor switch proteins called FliG, FliM, and FliN which gives them there unique motility method of switching between free swimming and tumbling. Thermomicrobium sp. HL1 has two of these three genes, which leads me to believe it may also posses the genetic potential to have the same motility. Using blastp, phylogeny.fr/, KEGG, TMHMM, SignalP, PSORT-B, and Phobius I will compare HL1s' flagellar motor switch proteins to those found in E. coli and Salmonella typhimurium along with T. roseum and other closely related species. With this data I will determine whether or not HL1 possesses all three flagellar motor switch proteins, FliG, FliM, and FliN and decide if they are similar enough to be give HL1 the genetic potential for the free swimming and tumbling motility method.

Entry Number: 116 UL
BIOL446: A study of dissimilatory nitrogen metabolism in Thermomicrobium HL1
By: Saramarie Hage and Dr. Jose R. de la Torre
Microbiology
Faculty Advisor: Dr. José de la Torre
Abstract: Little is known about nitrogen metabolism in the genus Thermomicrobium. This study aims to compare the dissimilatory nitrogen metabolic process in related organisms, focusing on denitrification and nitrate reduction. The similarities between Thermomicrobium HL1 and its close relatives, Thermomicrobium roseum, Nitrolancetus hollandicus, and Sphaerobacter thermophillus will be analyzed in the capacity of the dissimilatory processes. In this study, I aim to identify the homologous nitrogen dissimilation genes in this group of organisms as well as the genes that may be unique to Thermomicrobium HL1. The nitrate reduction and denitrification pathways as well as the enzymes produced and utilized will be identified and compared.

Entry Number: 117 UL
BIOL446: Thermomicrobium sp. HL1, A Possible Carbon Monoxide Chemotroph
By: Stanley Lin and Dr. Jose R. de la Torre
Microbiology
Faculty Advisor: Dr. José de la Torre
Abstract: Carbon monoxide (CO) is known to be a toxic substance, yet there are bacteria that are able to use CO as an energy source. This study will be focused on Thermomicrobium sp. HL1, and its potential to oxidize CO for energy by taking at look through the genome for a carbon monoxide dehydrogenase and other proteins needed for CO metabolism. This will then be compared to other bacteria, within the phylum Chloroflexi and other known CO chemotrophs, using online databases such as Blastp and IMG. Enzymes ThHL1_02415, ThHL1_00785 and ThHL1_02575 have been found to be orthologs to a known CO dehydrogenase in Thermomicrobium roseum.but is scattered throughout the genome of HL1. Other genes such as an ABC transporter and molybdopterin synthase are known to play a part in CO metabolism in T. roseum, these gene need to be identified in HL1. By comparing the CO metabolism of HL1 to other microbes, a better understanding of the evolutionary development may be gained.

Entry Number: 118 UL
BIOL446: Evolution of 1,2-Diols in Thermicrobium Roseum and Thermomicrobium HL and How It Supports The Survival at High temperature
By: Ting Shen and Dr. Jose R. de la Torre
Microbiology
Faculty Advisor: Dr. José de la Torre
Abstract: Thermomicrobium roseum DSM 5159 is theoretically found in very hot environments specifically found in the alkaline hot spring, Toadstool spring, in Yellowstone national park. Glycerol-derived membrane lipids are essentially absent in the thermophilic bacterium Thermomicrobium roseum. Instead of glycerolipid found in most bacteria, the cytoplasmic membrane of T. roseum is made of a series of long chain 1,2-diols. The increase of growrh temperatures resulted in decease of branched chained diols and a slight increase of diol chain length. Besides that, the absence of the plsB gene (glycerol-3-phosphate acyltransferase) and its homologs suggests that the normal glycerol-phospholipid synthesis pathway is blocked, which leads to the subsititution of 1,2-diols in T. roseum. The study is about the characterization of long-chain 1,2 diols and the discovery of the absence of PlsB evolutionally. By studying the maxiumum-likehood tree of T rosuem and other bacteria species with available whole genome, I First try to find out if the bacteria that has closer genetic distance with T roseum have PlsB or other genes with similar function. Second I compare those bacteria with T roseum in terms of cell membrane, third I research the structure of long chain 1,2 Diols, so that I can possibly make a hypothesis that the long chain 1,2 diols is evolutional.

Entry Number: 119 UL
BIOL446: Carbon monoxide metabolism in Thermomicrobium sp. HL1
By: Travis Doty and Dr. Jose R. de la Torre
Microbiology
Faculty Advisor: Dr. José de la Torre
Abstract: We aim to investigate the possibility of carbon monoxide metabolism in Thermomicrobium sp. HL1. HL1 is a close relative to the thermophilic Thermomicrobium roseum and was cultured from a hot spring near Heart Lake in Yellowstone National Park. Close relation of HL1 to T. roseum is important because genes encoding carbon monoxide metabolism were found in the T. roseum genome by Wu et al in 2009. Wu and his colleagues obtained preliminary results that indicated that T. roseum does, in fact, utilize carbon monoxide. Here, we aim to determine if the genome for HL1 also encodes for functional genes that allow utilization of carbon monoxide as an electron donor. As of yet, HL1 has yet to be grown in pure culture in our laboratory. We aim first to examine the genome and determine if the genes are present. Once the genes have been found, they will be compared against closely related organisms, including T. roseum and other thermophilic members of the phyla Chloroflexi that have already been shown to use carbon monoxide as an electron donor. If all genes necessary for dissimilatory carbon monoxide metabolism are present and are determined to be functional, it could potentially give insight into whether or not using carbon monoxide will aid in isolation of HL1.

Entry Number: 120 UL
BIOL446: Carbon Fixation in Thermomicrobium HL1
By: Victor Luu and Dr. Jose R. de la Torre
Microbiology
Faculty Advisor: Dr. José de la Torre
Abstract: Carbon is one of many essential elements for life. Carbon is the building block of life as it is part of the biosynthesis for DNA and proteins. Many organisms have adapted different ways to use carbon as an energy source. One way is called carbon fixation, which is the ability to assimilate inorganic carbon (CO2), into an organic molecules. Currently there are six known carbon fixation pathways. Of the six known pathways, only three pathways are seen only in bacteria: Reductive citric acid cycle, reductive acetyl CoA pathway, and 3-hydroxypropionate cycle. The organism of interest is a gram-negative thermophilic bacterium, Thermomicrobium HL1, found from a hot spring in Yellowstone National Park. A close relative of Thermomicrobium HL1 is Thermomicrobium roseum DSM 5159. This bacterium will be used to compare its metabolic genes to Thermomicrobium HL1. The main goal of this research project is to determine which pathway Thermomicrobium HL1 uses for carbon fixation. The main goal will be achieved by using bioinformatics tools such as KEGG, metacyc, and BLAST

Entry Number: 121 UL
BIOL446: CONSERVATION OF PYRUVATE DEHYDROGENASE COMPLEX IN CHLOROFLEXI PHYLUM
By: Xuan Trang Luu and Dr. Jose De La Torre
Microbiology
Faculty Advisor: Dr. José de la Torre
Abstract: G. The pyruvate dehydrogenase complex (PDHC) is a critical intermediate of the metabolic pathways, and is regulated by three enzymes complexes: pyruvate dehydrogense (E1),dihydrolipoaminde (E2), dihydrolipoamide dehydrogenase (E3) that must be cooperatively coordinated with one another to efficiently carry out complete oxidation of pyruvate to acetyl CoA to feed into to Kreb cycle, amino acid biosynthesis, and other metabolic pathways. As a result, the PDHC is highly conserved across all domains of life, and is a great model system to consider evolution of multiple enzyme complexes in gram negative thermophilic bacteria in Chloroflexi phylum: Thermomicrobium HL1, Thermomicrobium roseum, Chloroflexus aurantiacus, and Chloroflexus aggregans. ThHL1 is a gram negative, rod shaped thermophilic bacterium that is a deep branching member of Chloroflexi. The majority of ThHL1's proteins are uncharacterized and hypothetical; hence, there is little known information about this organism. T.roseum is known to be the closest relative to ThHL1; hence, we can use scientific information of T.roseum from articles to figure out similarities and dissimilarities of the characteristic proteins in ThHL1's PDHC. We used comparative genomic approaches to investigate key genes in the multiple enzyme complex of pyruvate dehydrogenase, how well these enzymes are conserved across the phylum, and observe whether or not these organisms evolve to have an alternative metabolic pathway. From the genomic approaches, we discovered that pyruvate/2-oxoglutarate dehydrogenase E1 alpha, E1 beta, and E2 subunits are highly conserved and aligned to organisms within the phylum. In addition, we explored the driving force to conserve the critical intermediate metabolic pathways in Chloroflexi that might potentially contribute to the evolution of thermal adaptations to extreme environments.

Entry Number: 122 UL
BIOL446: Carotenoid synthesis proteins in Thermomicrobium sp. HL1 and its role in membrane stabilization for thermophilic spp.
By: Yuji Gomikawa and Dr. Jose R. de la Torre
Microbiology
Faculty Advisor: Dr. José de la Torre
Abstract: Thermomicrobium sp. HL1, gram-negative bacteria, was isolated from Toadstool Spring in Yellowstone National Park. The biochemical analysis is said to be that the carotenoids are modified by acylation derivatives of an oscillol-di-glycosideand glycosylation. In order to see the phylogenetic impact of carotenoid in phylum Chloroflexi and Chlorobi, I will analyze the presence of carotenoid synthesis genes using Basic Local Alignment Search Tool. The cluster of genes for carotenoid biosynthesis and modification include a gene that encodes phytoene synthase, phytoene dehydrogenase, a 1'1; hydroxylase, and group II glycosyl transferase. Thermomicrobium sp. HL1 is not known to be phototrophic, but rather classified as an aerobic chemoheterotroph. Because

carotenoid is known to be pigments for chloroplasts and chromoplasts, it is curious as to the purpose of carotenoids for Thermomicrobium sp. HL1 or T. roseum. Carotenoid decrease membrane fluidity, increase the order of alkyl chains, and increase the hydrophobicity of the membrane interior, which gives overall membrane stabilization in thermophile. To further bring in evidence of membrane stabilization in thermophiles, I will use BLAST look and see the results of top closely identical hits and compare that to each hits' optimum growth temperature. Looking at the preliminary data, I propose that similarity of gene clusters for carotenoid synthesis in Chloroflix and Chlorobi relatives have a direct correlation with optimum growth temperature. In order to show consistency of amino acid sequences of carotenoid synthesizing proteins, the conserved domains will be researched to present as an evidence to support modified carotenoids' function to stabilize membrane in high temperature environment.

Entry Number: 123 UL
BIOL 446: Bias in amino acid composition as a genetic factor for species divergence in the diverse Chloroflexi phylum
By: Julian Bustamante and Dr. Jose R. de la Torre
Microbiology
Faculty Advisor: Dr. José de la Torre
Abstract: The divergence of a variety of organisms within the Chloroflexi phylum may have been caused by a number of genetic factors. These factors allowed ancestral species to adapt to their unique environment, eventually leading to the variety of species found today. This proposal seeks to assess whether biases in amino acid composition played a role as a genetic factor during Chloroflexi species divergence. Because the cell wall and cell membrane are vital to adapting to a thermophilic environment, various genes in both the peptidoglycan and membrane synthesis pathways will be used to compare thermophiles and mesophiles.4 Organisms will range from Chloroflexi bacteria to several distantly related thermophiles and mesophiles. A Perl script will calculate the amino acid content of genes involved in cell envelope synthesis pathways, and will determine if there is a noticeable trend shared by organisms inhabiting similar environments. WebLogo will analyze the collective fasta sequences of thermophiles or mesophiles and show sites of high conservation. The resulting image will allow tracking of potentially specific sites of amino acid residue substitution. Construction of phylogenetic trees will then group organisms based on the similarities of amino acid sequences for various cell envelope synthesis genes. These three methods are expected to reveal a trend of amino acid composition bias where thermophilic organisms show a preference for heat-stabilizing hydrophobic residues in exchange for destabilizing polar residues.

Entry Number: 124 UL
BIOL446:CRISPR associated DNA: bacterial pathogenesis & the evolution of Thermomicrobium HL1
By: Eduardo Lujan and Dr. Jose R. de la Torre

Cell & Molecular Biology
Faculty Advisor: Dr. José de la Torre
Abstract: Viral pathogenesis is a problematic commonality that exists between all living cells; yet interestingly, cells within each domain of life have evolved distinct mechanisms to deal with such pathogenic assaults. In bacteria such as Thermomicrobium HL1 (a close relative of Thermomicrobium Roseum), viral pathogenesis elicits the response of the CRISPR-Cas system, a coordinated mechanism that cleaves a fragment of foreign genetic material and then integrates the fragment into the host genome allotting for acquired immunity while also serving as a marker of pathogenic encounters. Interestingly, THL1 acquired many atypical genes inconsistent with that of its phylogenetically similar counterparts, which may be suggestive of a pathogenic role in shaping the evolution of THL1.

The organism THL1 as described in this proposal was originally isolated from an alkaline hot spring in Yellowstone National Park. Research has been largely concerned with the physiological aspects of THL1 while the horizontally acquired CRISPR DNA has been largely understudied. The recent availability of the THL1 genome presents a fortuitous opportunity to gain insight into the origins of CRISPR associated genes present in THL1 and absent in phylogenetically similar groups. For these reasons we believe that the THL1 CRISPR regions are larger and more variable than its evolutionary counterparts because the DNA that was acquired through HGT allots some form of adaptive advantage.

Entry Number: 125 UL
BIOL446: The Divergence of T. roseum and ThHL1 from Photosynthetic Chloroflexi May Be Directly Attributed to Isoprenoid Biosynthesis Pathway Bias
By: Arthur Liu and Dr. Jose R. de la Torre
Microbiology
Faculty Advisor: Dr. José de la Torre
Abstract: Isoprenoids can be synthesized via two independent routes known as the mevalonate (MVA) and methylerythirotal phosphate (MEP) pathways. These compounds have essential biochemical activity and can be specifically used as precursors for carotenoid biosynthesis (5). Bacteria have been characterized to use the MEP pathway, while the majority of eukaryotes and archaea use the MVA pathway. There are exceptions however, including individuals within the bacterial phylum Chloroflexi which utilize the MVA pathway. These outliers have been reported to have photosynthetic capabilities and also lack the terminal enzyme needed to synthesize isopentenyl pyrophosphate (IPP) and dimethylallyl diphosphate (DMAPP) in the MEP pathway. Here, I propose that the pathway bias for MEP and MVA may be directly attributed to the divergence of non-photosynthesizing organisms Thermomicrobium roseum DSM5159 (T. roseum) and Thermomicrobium sp. HL1 (ThHL1) from the photosynthetic Chloroflexi. This information may lead to delineating the evolutionary origin of photosynthesis within this phylum.

Entry Number: 126 UL1
Identifying the Role of Wnt Ligands in Neural Tube Closure
By: Carl Grim, Christopher Pineda, Shea Feeney, Lisa Galli, and Dr. Laura Burrus
Cell & Molecular Biology
Faculty Advisor: Dr. Laura Burrus
Abstract: Spinal cord development is a tightly regulated process. Improper closure of the spinal cord causes neural tube defects, such as spina bifida, which is the second most common type of birth defect. The Wnt family of secreted morphogens is comprised of 19 members that play significant roles in the formation of the early embryo, all of which require acylation by the enzyme Porcupine (Porcn). Wnt ligands signal through at least three interrelated pathways:a β-catenin dependent pathway, a planar cell polarity pathway and a Ca2+ pathway. Mutations in components of both β-catenin dependent (PCP) and PCP pathways cause neural tube defects. However, the identification of specific Wnt ligands that control neural tube closure remains elusive. In situ studies have shown that Wnt3a and Wnt 5a are present during neural tube closure in the developing chick. We hypothesize that Wnt3a and Wnt5a participate in neural tube closure. Exogenous Wnt3a and/or Wnt5a will be used to rescue neural tube closure in embryos in which no Wnts have been acylated due to Porcn inhibition. Thus, inhibition of Porcn by IWP12 effectively reduces all Wnt signaling, and frequent open neural tubes in IWP12 treated embryos were observed. Before rescuing IWP12 treated embryos with different Wnt ligands, we sought to analyze the effects of exogenous Wnt3a or Wnt5a on streak stage (HH4-6) chick embryos. While embryos incubated with Wnt3a are only mildly affected, they do develop abnormalities at a higher rate than controls. Only 46% of embryos incubated with Wnt3a develop normally, compared to 70% with controls. Abnormalities such as enlarged head and heart, inadequate somite formation, and enlarged tails were seen. Further analysis of the spinal cord of abnormal embryos show altered cell morphology as compared to controls. We are currently exploring the underlying mechanism for this defect. By contrast, embryos exposed to Wnt5a have a much higher rate of abnormality at 85% as compared to 40% of controls Survival of these embryos is also compromised. Typical abnormalities include… After we complete the characterization of Wnt3a and Wnt5a phenotypes, we determine whether either or both can rescue neural tube defects in IWP12 treated embryos.Supported by NIH-AREA grant #1R15HD70206-01A1 and NSF-RUI grant #MCB-1244602 to LB, NSF grant #IOS-1239422 and NIH-MARC grant #T34-GM008574 to CP, and NIH-RIMI grant #P20MD000262 to SFSU.

Entry Number: 127 UL1
Does a rad2Δ or polδ-ts1(pol3) second site mutation suppress the Cds1-Cdc24 cdc phenotype in S. pombe?
By: Eirish Norielle S. Sison, Gary Guerrero, and Dr. Sally G. Pasion
Cell & Molecular Biology
Faculty Advisor: Dr. Sally G. Pasion
Abstract: Cdc24 is a protein necessary for lagging strand DNA synthesis in the model organism Schizosaccharomyces pombe (fission yeast). It has been proposed that Cdc24 may also be involved in repairing damaged DNA, which is important for proper

transmission of genetic material to successive generations. Characterizing Cdc24 and its interaction with other conserved proteins involved in DNA replication and repair may reveal information about genome maintenance that may have implications for humans. One interaction that has been studied is between Cdc24 and Cds1. Unpublished results from a graduate student in our lab showed that overexpression of Cds1 is toxic to cdc24 mutants, even at the permissive temperature of 25^0C. To characterize the mechanisms for Cds1-Cdc24 toxicity, we aimed to find a second site mutation in some geneX that suppresses Cds1 toxicity in cdc24-G1 geneX double mutants. In our study, we used the pREP41-cds1 plasmid, which carries the budding yeast LEU2+ marker. We aimed to determine whether overproduction of Cds1 in cdc24 mutants using pREP41-cds1 has the same effect as using pSLF272-cds1, the ura4+ plasmid used in the previous Cds1-Cdc24 toxicity study. Using a different plasmid is necessary in our experiment because available cdc24 geneX double mutants are ura+, but leu-. We transformed wt and cdc24-G1 strains with pREP41 and pREP41-cds1, and assayed for the toxicity. We found that overproducing Cds1 in cdc24-G1 mutants using pREP41-cds1 did not cause the expected toxicity at 25^0C, 28^0C, and 30^0C. However, we observed an elongated cell phenotype (cdc phenotype) at 28^0C and 30^0C. We investigated whether the cdc phenotype is suppressed by a second site rad2Δ or polδ-ts1(pol3) mutation. Rad2 is an endonuclease that removes the RNA primer during DNA lagging strand synthesis. Rad2 has been found to genetically and physically interact with Cdc24. Thus, Rad2 may possibly be mediating the Cdc24-Cds1 toxicity. Pol3 is the catalytic subunit of DNA polymerase δ, which primarily functions in synthesizing the lagging strand during DNA replication. Previous studies have shown that pol3 genetically interacts with cds1, as well as cdc24, making Pol3 another possible mediator for Cdc24-Cds1 toxicity. To test for suppression of the Cds1-Cdc24 cdc phenotype in the double mutants, we transformed the rad2Δ and polδ-ts1(pol3) single mutants, and the cdc24-G1 rad2Δ and cdc24-G1 polδ-ts1(pol3) double mutants with pREP41 and pREP41-cds1. The transformants were then streaked to single colonies on media with or without thiamine, and incubated at 25^0C, 28^0C, and 30^0C. Results from this experiment will be discussed.

Entry Number: 128 UL1

Testing the contribution of chromosome anchoring to efficient DNA transport during sporulation in Bacillus subtilis

By: Tanisha Saini
Cell & Molecular Biology
Faculty Advisor: Dr. Briana Burton and Dr. Frank Bayliss

Abstract: Bacillus subtilis sporulation is used as a model system to understand chromosome segregation. During sporulation in B. subtilis, anchoring and translocation of DNA are regulated by proteins that segregate the replicated DNA from the mother cell into the forespore. Translocation of DNA is initiated when an asymmetric septum forms, on which the motor protein SpoIIIE assembles. SpoIIIE contains a DNA binding domain that directs the motion of DNA. Without this domain, DNA translocation is significantly impaired. Currently we are investigating whether other proteins assist in translocation. One candidate, RacA, recruits and anchors the origin of the chromosome to the cell poles. Without this anchoring effect, the amount of DNA trapped inside the developing

forespore decreases and the physical constraints of tethering the DNA to the cell pole are lost. We hypothesize that although SpoIIIE and RacA are not directly linked, RacA may be important for translocation because SpoIIIE may need the DNA to be physically anchored in order for translocation to be completed. To investigate the effects of RacA on translocation of DNA by SpoIIIE, we began by transforming strains under suboptimal conditions such as when SpoIIIE is lacking the DNA interaction domain. By using fluorescence microscopy, we tagged the origin of replication to observe when translocation was initiated, and the terminus to observe translocation completion. We also tagged one region in the middle to measure the timing and efficiency of DNA transport. Our results showed that RacA was more useful in assisting in translocation at regions closer to the origin of replication, than at regions closer to the terminus. This suggests that the anchoring effect and chromosomal positioning by RacA may be specific to enhancing DNA transport only at regions that are closer to the origin of replication. By understanding which proteins are involved in optimal DNA transport, we can apply this newfound knowledge to better understand how DNA is correctly translocated during chromosome segregation in other bacterial species. Such organisms include related pathogens, Bacillus anthracis and Mycobacterium tuberculosis, which are the carriers of anthrax and tuberculosis. By understanding the molecular details of sporulation, this can allow us to extrapolate the information to understand how these disease causing agents divide and replicate their genome, in an effort to potentially hinder this unfavorable process of pathogenic growth.

Entry Number: 129 UL1

Epothilone B and paclitaxel display synthetic lethal interactions with SAC compromised cells within the D. Melanogaster compound eye

By: Torey Jacques and Dr. Blake Riggs
Cell & Molecular Biology
Faculty Advisor: Dr. Blake Riggs

Abstract: F. The spindle assembly checkpoint (SAC) ensures proper chromosome segregation during cell division and depends upon BubR1 for proper functioning. Mutations can weaken the SAC leading to high incidences of aneuploidy, a hallmark of human cancers. Several cancers including breast, lung, ovarian, and skin have been linked to mutations within the BubR1 gene. Therapeutic approaches include small molecules that disrupt normal cell cycle progression. Highly successful among these are the anti-mitotic agents, vinca alkaloids and taxanes, which disrupt microtubule dynamics. However, these agents carry a high degree of neurotoxicity presumably due to effects on neuronal populations and taxanes have been implicated in inducing a multi-drug resistance phenotype in cancerous cells leading to a resistance to the drug. In an effort to improve the efficacy of these microtubule-targeted drugs, new classes of small molecules have been developed. Epothilones are a novel class of anti-cancer drugs similar to taxanes but have a simpler structure making them water-soluble and less toxic. Here we explore epothilone B in promoting programmed cell death among cell populations deficient for the SAC component BubR1, using a synthetic lethal approach. In addition, we have generated genetic mosaics containing cells deficient for BubR1 within the

Drosophila melanogaster compound eye as a model of the heterogeneous environment found within solid tumors. Our findings suggest that epothilone B has a markedly improved efficacy than taxanes at lower concentrations. The use of epothilone B at lower concentrations may decrease the ability to induce multi-drug resistance while providing a platform to use kinase inhibitors in conjunction to target specific cancer types.

Entry Number: 130 UL1
Cdc24 Chromatin association and localization in replication mutant backgrounds
By: Eduardo Lujan, Eirish Sison, Alex Cabrera, and Dr. Sally G. Pasion
Cell & Molecular Biology
Faculty Advisor: Dr. Sally G. Pasion
Abstract: The highly regulated mechanism of DNA replication requires the coordination of multiple proteins to ensure that the DNA duplex is copied faithfully and completely in a single event. When this replication process is compromised, genetic material becomes vulnerable to mutations leading to genome instability –a hallmark of human cancers. In fission yeast Schizosaccharomyces pombe, the exact function of Cdc24 is unknown, although it encodes a necessary protein implicated in lagging strand synthesis and maintenance of genomic integrity based on its genetic and physical interactions with conserved replicative proteins. When Cdc24 function is lost, cells exhibit an elongated morphology and arrest at S-phase with an essentially replicated genome. cdc24-G1 and cdc24-M38 mutants each produce a truncated Cdc24 protein and exhibit fragmented chromosomes, consistent with the assertion that Cdc24 contributes to the maintenance of genomic integrity. Although Cdc24 has been identified as a Cds1 dependent chromatin associating protein (unpublished results), the localization and chromatin association of Cdc24 has been largely understudied in other replication mutant backgrounds. To elucidate other replicative protein dependent factors that dictate Cdc24 chromatin association and localization, a plasmid pELES was generated by sub-cloning Cdc24cDNA+GFP from pNC1 into pJK148 containing the Leu1 selectable marker. This pELES construct will allow the generation of a yeast strain with Cdc24-GFP integrated at the endogenous leu1+ locus. This Cdc24-GFP strain will further expand on our understanding of the Cdc24 protein association to chromatin and its localization in vivo.

Entry Number: 131 UL1
Factors regulating EPS-I production confer a competitive advantage during symbiosis between Sinorhizobium meliloti and alfalfa
By: Julian Bustamante and Dr. Joseph Chen
Microbiology
Faculty Advisor: Dr. Joseph Chen
Abstract: The symbiosis between Sinorhizobium meliloti and leguminous plants, including the economically significant crop alfalfa, serves as a model for elucidating the mechanisms involved in microbe-host interactions. In this model, the bacterium S. meliloti invades plant roots and fixes atmospheric nitrogen in exchange for carbon compounds from the host plant. Succinoglycan (also called exopolysaccharide-I, or EPS-I) produced by the bacterium is a necessary factor for plant invasion, and previous research detected two uncharacterized genes – encoding a lipoprotein (lppA) and a zinc-dependent protease (jspA) – that affect EPS-I biosynthesis. Fluorescence assays showed that strains with null mutations in either gene produced lower levels of EPS-I, while complementation from inducible plasmids restored EPS-I levels to that similar to or exceeding the wild type. Epistasis analysis revealed the two genes to be dependent upon each other for normal EPS-I synthesis, signifying that they may be involved in the same regulatory pathway. To assess the mutants' effectiveness at establishing symbiosis, mixtures with equal ratios of the wild-type and mutant strain were inoculated onto the roots of alfalfa (Medicago sativa). Strains deficient in EPS-I were found to have a competitive disadvantage during symbiosis compared to the wild type. Further research will investigate how lppA and jspA affect the expression of other genes involved in the EPS-I biosynthesis pathway, potentially expanding upon the current model of the EPS-I regulatory network. Additionally, orthologs of both genes were discovered in related, pathogenic α-proteobacteria, such as Brucella and Agrobacterium spp., implying the functions of these genes may be conserved during pathogen-host interactions.

Entry Number: 132 UL1
Structural-functional characterization of rus1 suppressors in Arabidopsis
By: Arthur Liu, HongYun Tong, Lisa Ly, and Dr. Zheng-Hui He
Microbiology
Faculty Advisor: Dr. Zheng-Hui He
Abstract: The active form of Vitamin B6 (vitB6), pyridoxal 5'-phosphate (PLP), is known to be an important cofactor for many enzymes and biochemical reactions. How vitB6 homeostasis is monitored and regulated is currently not understood. VitB6 is a photolytic compound that can be destroyed by ultraviolet-B (UV-B). Our genetic data suggest that organisms exposed to light can modulate PLP UV-B sensitivity and regulate vitB6 homeostasis. We have previously reported the conditions such as limiting UV-B exposure, adding exogenous vitB6, or mutating specific residues in an ASPARTATE AMINOTRANSFERASE (ASP2) can suppress the developmental arrest of the rus1 (root uv-b sensitive1) mutant. rus1 mutant is developmentally arrested at the seedling establishment stage when exposed to UV-B. Genetic and molecular analyses have shown that multiple, independent amino acid substitutions in the PLP-binding pocket of ASP2 have resulted in no PLP binding, and these mutations have led to rescuing rus

phenotypes. Detailed phenotypic analyses of rus1 asp2 double mutant in the absence of light have revealed that specific asp2 suppressor mutants act in a similar fashion as the exogenously added vitB6. Our studies showed that there is a close correlation between the PLP binding in ASP2 and the genetic suppression of rus1.

Entry Number: 133 UL1
Talk Matters: An Analysis of Explicit Instructor Talk in a Large Introductory Biology Course
By: Amanda Reggi, Shannon Seidel, Jeff Schinske, Dr. Laura Burrus, and Dr. Kimberly Tanner
Microbiology
Faculty Advisor: Dr. Kimberly Tanner
Abstract: The critical role of the teacher in student learning has been repeatedly demonstrated in education research. Importantly, teachers not only facilitate concept learning, but also design learning environments, which influence student motivation, resistance, and self-efficacy. Communications research on instructor immediacy has found that decreased social distance between instructors and students is correlated with increased learning. Despite the potential importance of how instructors create learning environments, little research has been conducted about what instructors say and do to create learning environments in college biology classes.

Entry Number: 134 UL1
Possible speciation in Arthroleptis due to Climatic change in Sub-Saharan Africa
By: Gina Geiselman, Sonia Ghose, and Dr. David Blackburn
Ecology
Faculty Advisor: Dr. David Blackburn
Abstract: The Arthroleptis variabilis species group is a widely distributed group of frog species in Sub-Saharan Africa and is composed of multiple species. It is distributed extensively across West and Central Africa and their range spans multiple recognized phylogenetic barriers like the Dahomey Gap, which separates the Upper and Lower Guinean rainforests, several large rivers like the Cross, Sanaga, and Ogooué and finally salt water barriers separating Bioko Island from the mainland. These phylogeographic barriers are believed to lead to reduced gene flow, and thus eventually, speciation. We collected mitochondrial and nuclear DNA data to estimate the evolutionary relationship within this species group and to determine whether these relationships reveal a role of phylogeographic barriers in shaping divergences. Using a molecular phylogenetic approach we can identify the genetic diversity within and between populations of Arthroleptis frog species found in Sub-Saharan Africa, and reconstruct their evolutionary relationships in respect to historical climatic change and present day phylogeographic barriers.

Entry Number: 135 UL1
Effects of Salinity Shock in Leptasterias spp.
By: Giulia C. Gargiulo
Ecology
Faculty Advisor: Dr. Sarah Cohen
Abstract: Sea stars Leptasterias spp. are experiencing speciation around San Francisco Bay Area. A possible evolutionary force driving such process is an environmental condition as salinity. San Francisco Bay experiences relatively long periods of low salinity due to river outputs. We hypothesized how low salinity might have driven speciation of Leptasterias spp. around San Francisco Bay Area. Two different species were tested at low salinity. Righting response was used to measure the activity of sea stars. We predicted how the species closest to the Bay would better tolerate the decrease in salinity. Experiment did not lead to conclusive data due to a logistical problem in the wet lab setup, but field measurements gave important information about differences in species behavior. Furthermore, laboratory observations fortuitously gave clues to the investigation of a sea stars disease that is currently wiping off West Coast populations.

Entry Number: 136 UL1
Does the evolution of manzanitas from one clade follow glacial retreat? A phylogeny using a single nuclear gene locus, RPB2.
By: Heather Lough and Craig Reading (Grand Canyon College)
Ecology
Faculty Advisor: Dr. V. Thomas Parker and Frank Cipriano
Abstract: Arctostaphylos (Ericaceae) is broken into 2 evolutionary lineages (clades). The first clade is predominantly limited to coastal California.
We asked if the geographical distribution of species in this lineage correlated with evolutionary relationships, particularly if they're subsequent evolutionary path progressed along a southern to northern distribution. Of the 96 species or subspecies found in California for the genus, this mostly coastal clade has only about 10 or 11 taxa (depending on the gene assessed).
We used a single copy nuclear gene, RPB2, as a probe to investigate the evolutionary sequence among species in this lineage. Of those 10 to 11 taxa we chose individuals based on their distributions across California and included individuals outside California that are widespread such as Arctostaphylos uva-ursi and A. pungens. Through extractions and PCR we have a total successful sample set of 52 individuals.

Entry Number: 137 UL1
The secret of the mermaid's purse: Phylogenetic affinities within the Rajidae and the evolution of a novel reproductive strategy in skates
By: Kelcie Chiquillo
Marine Biology
Faculty Advisor: Dr. Karen D. Crow

Abstract: The systematics of the skates in the family Rajidae have been contentious for over 250 years, with most studies inferring relationships among geographically clustered species, and non-overlapping taxa and data sets. Rajid skates are oviparous, and lay egg capsules with a single embryo. However, two species exhibit a derived form of egg laying, with multiple embryos per egg capsule. We provide a molecular assessment of the phylogenetic relationships of skates in the family Rajidae based on three mitochondrial genes. The resulting topology supports monophyly the family. However the genus Raja is polyphyletic, and several species assemblages need to be revised. We propose a new assemblage, the Rostrajini, which organizes rajid species into three well-supported tribal lineages for the first time. Further, these data provide an independent assessment of monophyly for the two species exhibiting multiple embryos per egg capsule, supporting their status as the unique genus Beringraja. In addition, we find that among the different size classes of egg capsules, ranging from 1 to 8 embryos per capsule in this genus, there is variation in frequency and survivorship. In Beringraja binoculata, the strategy of having two embryos per egg capsule occurs most frequently and with the highest fitness.

Entry Number: 138 UL1
The Effect of Elevation Change on Batrachochytrium dendrobatidis (Bd) Living on Pristimantis platydactylus
By: Linett Rasmussen
Marine Biology
Faculty Advisor: Dr. Vance Vredenburg
Abstract: Amphibian populations around the world are rapidly decline due to a chytrid fungus called Batrachochytrium dendrobatidis (Bd). This pathogen has caused a huge collapse of amphibian species worldwide and should be considered a global epidemic. However, there is another global threat that amphibians are facing— climate change. Amphibians are well-known for living in specific environments and show little acclimation response. Accordingly, climate change is a severe threat to amphibian species. We are investigating the effects of both climate change and Bd, on a frog population in the Andean highlands of Peru, known as the Andean Montane frogs. The Andean highlands have a steep elevation grade, causing temperatures to vary drastically as the elevation changes. Subsequently, climate change could possibly increase this phenomenon, causing even greater temperature variation across elevations. Translocation experiment data allows us to compare the effects of temperature and Bd infection on the Andean Montane frogs. Translocation experiments will include three temperature ranges. One group is in warmer temperatures, representing the increase in temperature predicted by the expected climate change. Another group lies in colder temperatures, representing species that migrate up the mountain. Lastly, there is a group at the same temperature as the current frogs' habitat temperatures to act as a temperature control. After infecting all three groups with Bd, we found that survivorship was lower in warmer temperatures than at any other temperature. However, colder temperatures also showed a lower survivorship than the group kept and the current temperatures. Our results could demonstrate that there is a relationship between temperature and Bd intensity.

Entry Number: 139 UL1
Differential Growth Rates of Chlorella Sp. As a function of Nitrogen Source
By: Maribel Albarran
Marine Biology
Faculty Advisor: Dr. William P. Cochlan
Abstract: Abstract: The focus of this experiment is on, a single cell algae named Chlorella sp. that belongs to the chlorophyta phylum. It contains green photosynthetic pigments chlorophyll-a and -b in its chloroplast, this is an important aspect of chlorella that will be the source of finding how we can detect changes in this alga. Chlorella goes through photosynthesis requiring carbon dioxide, water, sunlight, and minimal amounts of minerals to reproduce. We must also take into consideration the major sectors for cultivating Chlorella in under a process called ESNW, which means enriched natural sea water natural water, and for that recipe we also include macronutrients and micronutrients also including the trace metals. It is important to know that chlorella is an alga that reproduces quickly and is considered to be a precursor to possibly create a biofuel through its dense culture. I will also look at other sources that may be inhibiting growth and their stress response. For instance the amount of nitrogen for potential growth and examine the saturation levels. So understanding how chlorella deals with high concentration of ammonia and urea at high and low light will be important in determining their uptake rates. . Our purposes are to determine if high concentrations of ammonia and urea will affect the growth rate of c596 at high and low light. This is a precursor experiment to lipid production as a function of cellular growth on the different N-forms.

Entry Number: 140 UL1
Decreasing B-Cell Function in Overweight Latino Children Within Normal Fasting Glucose Parameters
By: Monet Jimenez, Dr. Claudia Toledo-Corral (USC), and Dr. Micheal Goran (USC)
Cell & Molecular Biology
Faculty Advisor: Dr. Claudia Toledo-Corral (USC) and Dr. Frank Bayliss
Abstract: Latino children and youth under 20 years of age diagnosed with type 2 diabetes is growing at an alarming rate, the fastest of any ethnic group in the U.S. In addition, the obesity epidemic in children continues to rise, leading them to an even greater metabolic risk. It has previously been shown that fasting glucose is inversely correlated with β-cell function, suggesting the possibility of a lower fasting glucose threshold might be recommended for prediabetes (100-125mg/dL). The study comprised a total of 182 healthy overweight Latino children, ages 7-14, with family history of type 2 diabetes. Participants were divided into one of three FG groups based on each of their respective fasting glucose value: Non-Diabetic FG group: (≤90mg/dL), proposed prediabetic/current nondiabetic FG group: (>90 to <100mg/dL), and the current pre-diabetic FG group: (≥100 to ≤126). Insulin Sensitivity (SI), acute insulin response (AIR), and disposition index (DI) were assessed using the intravenous glucose tolerance test and minimal modeling. No significant findings were found in body composition across the three groups nor SI, however AIR and DI were found to be significantly lower across all

three groups. Interestingly, there was no significance between the proposed prediabetic group, which currently lies among the nondiabetic range, and the current prediabetic group for AIR and DI. The metabolic profiling of our proposed FPG groups suggests that pancreatic β-cell dysfunction may manifest within current normal FPG parameters in overweight and obese Latino children. In conjunction with other literature in adults and children, research committees should re-evaluate the current threshold of FPG criterion for pre-diabetes.

Entry Number: 141 UL1
Creating a comparative map of the facial nerve: A cadaveric study
By: Ashley Jenkinson and Dr. Gloria Nusse
Physiology & Behavioral Biology
Faculty Advisor: Gloria Nusse
Abstract: This study will explore the facial nerve through detailed dissection of the left and right sides of a male and female cadaver with respect to major facial landmarks. A map will be created using qualitative analysis in order to compare the position and variability of the nerve branches. A photo expose will demonstrate the dissections and road map created to gain a better appreciation for the location, functionality, and importance of the nerve.

Entry Number: 142 UL1
Investigation on the Metastatic Changes to the Liver as a Consequence of Metastatic Breast Cancer, One Cadaver's Story
By: Christian Gallegos
Physiology & Behavioral Biology
Faculty Advisor: Gloria Nusse
Abstract:

Entry Number: 143 UL1
The ecdysteroid agonist RH 5992 reduces damage-induced developmental delays in the hornworm, Manduca sexta
By: Erica Mai, Mitchell Lopez, and Dr. Megumi Fuse
Physiology & Behavioral Biology
Faculty Advisor: Dr. Megumi Fuse
Abstract: The developmental timing and progression of growth in insects is controlled by neuroendocrine signaling. In particular, the release of 20-hydroxyecdysone (20-HE) into the hemolymph (blood) stimulates molting at the larval, pupal, and adult stages. It is hypothesized that the release of the neuroendocrine signal that drives development, 20-HE, is inhibited when an insect's tissue is damaged. Specifically, damage to the imaginal disc tissues of the fruitfly Drosophila melanogaster and the hornworm Manduca sexta appears to cause a delay in the release of 20-HE and thus a delay in development. We hypothesized that injection of a synthetic 20-HE analog (RH 5992) would reduce the developmental delay noted after tissue damage. The hornworm imaginal discs were

exposed to either 0 (control) or 10 kRads (damage-inducing) X-ray irradiation. At a time point when the levels of ecdysteroids were expected to be elevated, hornworms were injected with 2 □l of either 100% ethanol (vehicle) or 3 mM RH 5992 (also known as tebufenozide), a long-acting 20-HE agonist. Following treatment, time-lapse photography was used to record timing of pupation. As expected, pupation delays were noted after irradiation in the ethanol-injected animals. However, irradiated animals that were treated with RH 5992 showed shortened developmental delays. This shows that damage-induced development delays can be reduced by increasing the abundance of ecdysteroids in the hemolymph. Further studies will explore the effects of varying doses of the ecdysteroid agonist RH 5992 on its potential to reduce the delay fully.

Entry Number: 144 UL1
Are there misconceptions in the Coronary systems role in heart attacks? A novel approach to demonstrate the anatomy of a heart attack
By: Eryk Hakman
Physiology & Behavioral Biology
Faculty Advisor: Gloria Nusse
Abstract: While studying the anatomy and physiology of the heart, undergraduate students focus most of their time learning the larger vessels associated with the circulatory system. While the coronary arteries are taught as a part of the curriculum, students may not always understand their importance for heart health. This leads to misconceptions about one of the leading causes of death in the United States—Myocardial Infarction or heart attacks. Data collected by this study indicates several misconceptions about how heart attacks occur. Namely demonstrated was a misunderstanding of the coronary arteries and their role in providing the heart itself with oxygenated blood. Secondly was the misconception that a heart attack was equivalent to cardiac arrest, or the heart stops beating. The frequency of these misconceptions varied from 75 % of respondents saying that cardiac arrest was the same as a heart attack while only 4.6 % of respondents said the coronary arteries were involved in a heart attack. The purpose of this study was three fold:
1) To assess whether there were any misconceptions about heart attacks such as the misconception that heart attacks are caused by cessation in systemic circulation (Sudden Cardiac Arrest).
2) To design the Coronary Blood Flow Bio Model (CBBM), a reproducible demonstration that is easily implemented in any class setting and is inexpensive to produce.
3) To evaluate the efficacy of the CBBM on students' understanding of the coronary arteries and its role in heart attacks.

Entry Number: 145 UL1
Climate Change Expected to Increase Pathogen Invisibility in Asia

By: Laurence Cyril Henson
Physiology & Behavioral Biology
Faculty Advisor: Dr. Vance Vredenburg and Dr. Tendai Chitwere
Abstract: The ongoing effects of climate change cause species sensitive to subtle changes in their native habitat conditions to be at risk of dying out or migrating. For instance, several amphibian species' immune systems become compromised when exposed to temperature ranges beyond their native habitat. However, invasive species like the American bullfrog (Lithobates catesbeiana) may benefit from these changing conditions. Introduced worldwide, L. catesbeiana is a potential carrier of the pathogenic fungus, Batrachochytrium dendrobatidis (Bd), which causes amphibian chytridiomycosis, a disease that has been linked with hundreds of amphibian extinctions around the globe. Therefore, the invasive abilities of L. catesbeiana could pose a serious threat to the spread of the pathogen to naive hosts and environments.
For this study, we used DIVA-GIS to build HSMs of L. catesbeiana and Bd susceptible amphibians based on present (2000's) and future (2050) climate conditions, focusing on regions of high amphibian biodiversity in Asia due to its unique Bd dynamics and lack of reported amphibian die-offs despite being an ideal region for increased Bd prevalence. We then used Q GIS to calculate the percent change in overlap between L. catesbeiana and other amphibians based on the possible changes in migration patterns predicted by our HSMs.

Entry Number: 146 UL1
Selective Deficits in Social behavior in Adult Mice after Traumatic Brain Injury at Adolescence.
By: Pingdewinde N. Sam, Dr. Bridgette Semple (UCSF), and Dr. Linda Noble (UCSF)
Physiology & Behavioral Biology
Faculty Advisor: Dr. Linda Noble
Abstract: Traumatic Brain Injury (TBI) is a leading cause of death and disability in children worldwide. In spite of advances in research, we have yet to understand the full spectrum of behavioral deficits that persist into adulthood after injury to the developing brain. We have previously shown that TBI at post-natal day 21 (p21, age of a toddler), results in marked long-term deficits in social interactions. Here we investigated the behavioral consequences of TBI at p35 (adolescent) in male C57Bl/6J mice. Mice were subjected to either a focal TBI (n= 9) or sham surgical controls (n=9). Mice were behaviorally tested starting at p70 (adulthood) by an investigator blinded to treatment (Sham or TBI). Assessments included performance in an open field and evaluation of behaviors associated with scent marking, resident intruder, buried food and three-chamber tasks. We found a selective deficit in preference for social novelty using the three-chamber test, indicating impairment in social recognition and memory; however, mice expressed normal sociability, social investigation, and socio-sexual communication with normal olfactory function despite the injury. Histological analyses revealed a significant loss of white matter volume in brain-injured mice at adulthood, a finding that may in part contribute to social deficits. In conclusion, we demonstrate that TBI to the adolescent brain results in selective social deficits, a finding that contrasts the more

profound social deficits seen in mice that are subjected to TBI at a younger age. Thus, the age at time of injury should be considered when developing therapies for brain-injured children.

Entry Number: 147 UL1
Exposition of Müller AO classification of tibial fractures using cadaveric bone models
By: Victor Abdullatif
Physiology & Behavioral Biology
Faculty Advisor: Gloria Nusse
Abstract: The Müller AO classification system of bone fractures has substantially served osteology education and medicine for many decades. The present study aims to provide a physical representation using castings of cadaveric tibial bones. These models will illustrate the fracture classifications in accordance with said system. Castings will have simulated fractures using surgical and mechanical-force methods. Proximal, diaphysieal, distal, and malleolar fractures will be showcased. Cadavers are supplied by the University of California San Francisco's Willed Body Program and San Francisco State University's Human Anatomy Laboratory.

Entry Number: 148 UL2
Synthesis of Conformationally-Restricted Glutamate Bioisosteres Via a Furan Ring Scaffold
By: Sean Patrick Cleary, Elizabeth Mazza, and Ryan Hromyak
Biochemistry and Physiology
Faculty Advisor: Dr. Jean-Louis Etoga
Abstract: A synthesis was developed to produce conformationally restricted glutamate bioisosteres bearing a sulfonic acid group using a furan ring as the scaffold compound. The compounds were run through a three step process involving a sulfonating step and a hydantoin intermediate. Sulfonating/ adding an amino acid on a furan ring presents a challenge, as most methods utilize acidic conditions to perform such additions. This procedure utilizes basic conditions to achieve our target molecule, in a synthesis that is both efficient and time saving. Results show yields in the 30-70 percent range. Compounds were confirmed with nuclear magnetic resonance and mass spectroscopy.

Entry Number: 149 UL2
Characterizing the effect of Porcupine on neural tube closure
By: Shea Feeney, Lisa Galli, Gina Pay, and Dr. Laura Burrus
Biochemistry and Cell & Molecular Biology
Faculty Advisor: Dr. Laura Burrus
Abstract: Incomplete closure of the embryonic neural tube is responsible for common birth defects such as spina bifida. Wnts, a group of secreted lipid-modified signaling proteins, are known to play a critical role in embryonic spinal cord development. Wnt proteins are palymitoylated by the enzyme Porcupine (Porcn), a transmembrane protein

localized to the endoplasmic reticulum and Golgi apparatus. The proposed function of palmitoyation is to facilitate the secretion of Wnt proteins. Mutations in human Porcn can result in Focal Dermal Hypoplasia that can manifest multiple abnormalities including neural tube defects. Thus it is hypothesized that inhibition of Porcn in early stage chick embryos will cause abnormal neural tube closure. To characterize Porcn's role in neural tube closure, we developed an in vitro culture method that permitted addition of pharmacological inhibitors of Porcn IWP-1, IWP-12 and C-59. Surprisingly, although all of the compounds tested inhibited human Porcn, only IWP-12 appeared to inhibit chick Porcn. Treatment with IWP-12 revealed neural tube defects and decreased cell elongation which is consistent with a model in which IWP-12 inhibits Wnt signaling via the planar cell polarity pathway. To test whether IWP-1, and C-59 are species specific inhibitors, we are currently comparing the ability of all three compounds to inhibit human and chick Porcn using an assay that measures Wnt palmitoylation.

Entry Number: 150 UL2

Understanding how the Distal Pocket Environment Affects the Ligand Binding Affinity of Nitrite to Heme Proteins

By: Adriana Garcia, Rocio Gomez, Sylvia Wojdyla, Bushra Bibi, Lea Lough and Raymond Esquerra.

Biochemistry

Faculty Advisor: Dr. Raymond Esquerra

Abstract: Cardiovascular disease is the leading cause of death worldwide. Nitric oxide (NO) plays a fundamental role in cardiovascular health, and disruptions in normal NO physiology is associated with the progression of cardiovascular disease. Recently, it was shown that heme proteins can support vasodilation during hypoxia by converting nitrite (NO_2^-) to NO, and that this nitrite reductase activity plays an essential role in a variety of physiological processes. Due to a large range in nitrite reductase activity in heme proteins with the same active site, this research seeks to better understand how the protein environment controls the binding chemistry of NO_2^- to the heme active site. Our goal is to determine how the distal pocket environment affects the binding affinity of NO_2^- to metmyoglobin mutants. Our hypothesis is that the distal pocket environment can increase the binding affinity of NO_2^- by way of electrostatic and steric interactions. We will compare the binding affinity of a series of distal pocket mutants that affect hydrogen bonding, polarity and size of the distal pocket and correlate coordination chemistry and binding affinity to establish a clear picture of how the protein environment controls nitrite binding in heme proteins. We found that polar distal residues exhibit greater binding affinity than non-polar residues due to hydrogen bonding. This result indicates that proteins with polar distal residues will exhibit greater nitrite reductase activity. Understanding how the protein environment influences nitrite binding in heme proteins helps toward understanding how these proteins generate NO physiologically.

Entry Number: 151 UL2
Activation and Purification of Y39K Trypsin: a Variant Designed to Increase Resistance to Macromolecular Inhibitors
By: Camilo Javier-Alverio Bolds
Biochemistry
Faculty Advisor: Dr. Teaster Baird Jr.
Abstract:
Molecular modeling and previous experimental results support replacement of the Y39 active site residue as a promising means of reducing trypsin-fold protease susceptibility to inhibition by naturally occurring inhibitors. The substituted lysine may achieve this goal by repelling the K60 residue, which forms a hydrogen-bond pair with the Y39 residue in wild-type trypsin, and consequently disrupting the key interactions between them, the F41 residue, and the inhibitor(s). Our objective was to activate, and then characterize, Y39K trypsinogen/trypsin. Auto-activation of the Y39K trypsinogen variant was carried out via dialysis at pH 8.0 at two different temperatures, 4 °C and 20 °C. Characterization will involve measuring the hydrolysis of Z-GPR-pNA by the variant and using the data to calculate the kcat, KM, and inhibitor KD values for the Y39K trypsin, which will then be compared to those of wild-type trypsin. We expect the inhibitor KD value for the Y39K variant to be higher than that of wild-type trypsin, allowing us to conclude that the variant is indeed more resistant to inhibition.

Entry Number: 152 UL2
Determining the role(s) of prime-side residues in macromolecular inhibition of trypsin-fold serine proteases
By: Commodore St. Germain and Anna Batt (USC)
Biochemistry
Faculty Advisor: Dr. Teaster Baird Jr.
Abstract: Trypsin-fold serine proteases are among the most abundant of proteases. By identifying residues that are important for enzyme-inhibitor interactions in trypsin, we may advance the development of protease-based therapies in general. Lysine-60 (K60) is a highly conserved prime-side residue in trypsin-fold serine proteases. In trypsin-inhibitor co-crystals, K60 hydrogen bonds to tyrosine-39 (Y39) and is positioned to restrict conformational mobility of phenylalanine-41 (F41), possibly optimizing the observed hydrogen bond interactions between inhibitors, Y39 and F41. Substitution of K60 with other residues may disrupt these interactions and provide insight to their significance with respect to inhibitor binding. To test this hypothesis, we created trypsin variants K60G, K60A, K60V, K60I, K60M, K60R, Y39S, and Y39F and characterized them with respect to their activities and sensitivities to macromolecular inhibitors soybean trypsin inhibitor (SBTI), bovine pancreatic trypsin inhibitor (BPTI) and ecotin, an inhibitor expressed in E. coli. Our initial results show that, compared to wild-type trypsin, all variants maintain similar catalytic activity, but-K60A, K60V, K60I, K60M, and Y39F are more sensitive to inhibition while variant K60R exhibits the same sensitivity to inhibition and Y39S is less sensitive to inhibition. Collectively, these results suggest that K60 and Y39 do indeed play significant roles in inhibitor binding.

Entry Number: 153 UL2
Conformational Dynamics of Human Alkyladenine Glycosylase by MD Simulations
By: Gabrielle Garcia and Dr. Anton Guliaev
Biochemistry
Faculty Advisor: Dr. Anton Guliaev
Abstract: Exposure to environmental pollutants produces adenine mutations within DNA which are repaired by human alkyladenine glycosylase (hAAG). Stability of hAAG/DNA complex may improve hAAG's efficiency in initiating base excision repair (BER) of adenine lesions, potentially alleviating rising cancer rates. Currently, there is little known about behavior of the free hAAG and how BER is initiated when DNA and hAAG come into contact. In this experiment, conformational dynamics and behavior of free hAAG were studied with AMBER molecular dynamics simulations. Data accumulated from a 1400 ns production run of hAAG demonstrated macromolecular reorganization between bound and unbound enzyme. A similar production run of the hAAG/DNA complex revealed stabilizing hydrogen bonds within two loops tangent to the active site pocket. In the absence of DNA, the two loops were destabilized, which resulted in a more open confirmation. This indicates a possible clamping mechanism by which hAAG recognizes and binds modified DNA in order to excise the carcinogenic adenine lesion.

Entry Number: 154 UL2
Disruption of interactions between trypsin and bovine pancreatic trypsin inhibitor at the S1' site
By: Hanh Huynh
Biochemistry
Faculty Advisor: Dr. Teaster Baird Jr.
Abstract: Trypsin is a serine protease that is involve in many processes in the body. Recently, there has been an interest to use serine protease as therapeutics. However, it has been extremely difficult to use as therapeutics because they are inhibited rapidly in the body by naturally occurring inhibitors. The purpose of this research is to investigate the interactions of trypsin one of the most common serine protease, with large naturally occurring inhibitor in the body such as bovine pancreatic trypsin inhibitor (BPTI). Mutagenesis made at Y39L in hope to break the interactions of trypsin and BPTI while retaining full activity and specificity. Y39L is less active compared to wild type but showed to be less inhibited by BPTI. Also, Y39L specificity did not changed, indicating that the active site was not affected by the mutation. More research is needed to determine whether or not Y39L will be also less inhibited by other large inhibitors such as soybean trypsin inhibitor and Ecotin. This indicates that position Y39 plays an important in interactions with large inhibitors.

Entry Number: 155 UL2
Synthesis and characterization of pure silica BEA and titanosilicate BEA (Ti-BEA)
By: Heather-Rose Lacy
Biochemistry
Faculty Advisor: Dr. Andrew S. Ichimura
Abstract: Ongoing global climate disruption stimulates research into methods that reduce, recycle, and/or store greenhouse gases. Titanium-substituted zeolites such as titanosilicate-1 (TS-1) and titanosilicate beta (Ti-BEA) are excellent oxidative photocatalysts and also exhibit photo-reduction chemistry. In this study, we focus on Ti-BEA because of its 12MR ring size, which facilitates the exchange of reactants and products, compared to the MFI framework (10MR). Our goal is to study the photocatalytic reduction of CO2 and H2O to methanol using Ti-BEA powders.1
Pure silica BEA and Ti-BEA were synthesized according to modified literature methods2,3. Both doped and undoped forms of BEA were prepared and the growth conditions studied to compare and understand the growth rate and conditions of Ti-BEA. Progress of BEA crystallization from amorphous material to ordered beta zeolite framework was characterized by X-ray diffraction (XRD) and scanning electron microscopy (SEM). Hydrothermal synthesis of Ti-BEA

Entry Number: 156 UL2
Elucidating the Enzyme of orotidine-5'-monophosphate decarboxylase (ODCase)
By: Kristen Decker and Ronald Tan
Biochemistry
Faculty Advisor: Dr. Weiming Wu
Abstract: Orotidine-5'-monophosphate decarboxylase (ODCase) catalyzes the committed step in the biosynthesis of pyrimidine nucleotides, and thus is an important enzyme. With its high catalytic efficiency and an elusive mechanism, ODCase has been a target of extensive study. Inhibitors of ODCase may be of potential medicinal interest as leads in the development of anti-viral and anti-cancer drugs.
The focus of this project is the synthesis and biochemical study of nucleotides with uric acid as the base. Uric acid is deprotonated under physiological conditions and is highly polarized. Nucleotides with a negative charge at the pyrimidine moiety (such as uric acid derivatives) should be potent inhibitors of ODCase. The synthesis starts with guanosine, which will be protected on the ribose moiety. Bromination followed by hydrolysis will yield an 8-oxoguanosine derivative, which can be de-aminated to yield protected uric acid nucleoside. Deprotection followed by phosphorylation will yield the target nucleotide. The binding constant will be compared to that of xanthosine monophosphate, which is reported to be a potent inhibitor of ODCase.

Entry Number: 157 UL2
Can a Double Mutant in Trypsinogen’s S1 Prime Pocket Affect its Reactivity in its Active Site?
By: Krystal Rogers

Biochemistry
Faculty Advisor: Dr. Teaster Baird Jr.
Abstract: Trypsin is well-studied protease that is involved in the normal function of many biological processes such as digestion and the immune response. Furthermore, its 3-dimensional structure is the most commonly observed fold in the family of serine proteases making it an ideal model for study of this family of enzymes. The focus of this project is to study the road less traveled; research of the S1' sub-site of trypsin could identify interactions between it and its substrates and inhibitors that may lead to a more comprehensive understanding of the structural bases for trypsin-fold protease malfunctions and interactions between trypsin and ligands. To this end, we make mutations of specific residues and determine how properties such as catalysis, substrate selection and inhibitor binding are affected when these changes are made. The experimental design involved using PCR techniques to introduce the mutations, bacterial and yeast transformations, and SDS Page gels to express and verify the presence of our protein in a form usable for future experiments such as kinetics. The initial results of several activation attempts demonstrates that Y39G/F41G trypsin does not auto-activate suggesting that this double substitution eliminates or, at the very least, severely reduces the catalytic capability of the enzyme. Additional experiments are required to verify this conclusion.

Entry Number: 158 UL2
Combined Bilayer of Zeolite MFI and Anatase TiO2 Thin Films for Degradation of Organics
By: Kyle Kulinski
Biochemistry
Faculty Advisor: Dr. Andrew S. Ichimura
Abstract: Titanium dioxide is an effective photocatalysis for the degradation of organics in air and water under UV illumination. An effective platform for continuous flow reactors uses anatase TiO2 prepared in the form of thin films, which obviate the need for separation of effluent and powders that are more commonly studied. One disadvantage of TiO2 films is that the surface area is low relative to nanoscale powders and therefore the surface reduction/oxidation chemistry less effective. In order to overcome this limitation, we postulate that if the organics
are trapped close to the TiO2 surface there will be a greater probability of reaction. The hydrophobic nature of pure silica MFI's porous structure improves the retention of organic molecules close to the anatase surface, which may improve the effectiveness of photodegradation. To examine this hypothesis, polycrystalline anatase films were prepared using TiF4 under aqueous conditions. Next, zeolite MFI was synthesized on and sintered to the thin anatase film. X-ray diffraction (XRD) and scanning electron microscopy (SEM) were used
to characterize the films throughout the syntheses. Gas chromatography (GC) was used to study the degradation products after irradiation. By illuminating a bilayered film with ultraviolet light in the presence of an organic compound, improved efficiency of

photocatalytic degradation of the organic molecule is expected. This report will focus on the characterization of novel TiO2-MFI
composite films and preliminary results on the photo-induced decomposition of organics.

Entry Number: 159 UL2
The role of the GTP binding for the formation of the Ras-Raf complex
By: Ma. Lorena Duhaylungsod and Dr. Anton Guliaev
Biochemistry
Faculty Advisor: Dr. Anton Guliaev
Abstract: Molecular Dynamics (MD) simulation is a powerful computational approach to study the dynamic behavior of proteins and macromolecules at the atomic resolution. In this work, we employed MD simulation to investigate the stability of the Ras-Raf complex in the absence of the GTP molecule. The GTP-binding protein Ras plays a central role in the regulation of various cellular processes, acting as a molecular switch that triggers signaling cascades. Biochemical studies showed that only Ras bound to GTP is able to interact strongly with effector proteins like Raf kinase, phosphatidylinositol 3-kinase and RalGDS. However, in the GDP-bound state, the stability of the complex is strongly decreased and the signaling is interrupted. The initial coordinates for the Ras(GTP)-Raf complex was obtained from the Protein Data Bank (C-Raf1). The calculations of the binding free energy based on explicit and implicit solvent models showed that the absence of the GTP molecule resulted in increase of the steric energy between the Ras and effector. Unfavorable steric contacts at the Ras-Raf binding interface, particularly between Ile 36 and Val 181, eventually led to the dissociation of the complex in the 100 ns time scale. This work confirmed the role of the GTP molecule for the formation of the Ras-Raf complex and demonstrated how MD calculations can provide a quick estimation of the conformational dynamics and binding free energies for biological macromolecules.

Entry Number: 160 UL2
Nitric Oxide and its Role in Photodynamic Therapy
By: Marco Monroy, Pooncharas Tipgunlakant, Raymond Esquerra, and Ursula Simonis
Biochemistry
Faculty Advisor: Dr. Raymond Esquerra
Abstract: Porphyrinic pigments are used as photosensitizers (PSs) in both photodynamic detection (PDD) and therapy (PDT). PDT is a minimally invasive modality in the fight against cancer. When the PS is activated by visible light at a given wavelength, reactive oxygen species (ROS) are generated, which cause cancer cells to undergo cell death. Despite significant advances, drawbacks of the PSs in clinical use include their non-selectivity in cellular tissue-targeting leading to inflammation and discomfort. Nitric oxide (NO) has been shown to play a key role in modulating apoptotic cell death pathways and to react with reactive oxygen species to form additional lethal reactive

nitrogen species (RNS). In our efforts to enhance the efficacy of PDT, we set out to investigate the role of NO in PDT.

Entry Number: 161 UL2
Using Titanosilicate (TS-1) Zeolite to make Light Hydrocarbons from Water and Carbon Dioxide
By: Navid Singhrao and Dr. Andrew Ichimura
Biochemistry
Faculty Advisor: Dr. Andrew S. Ichimura
Abstract: Titanosilicate-1 (TS-1) is a zeolite with the MFI structure where a small fraction of silicon has been substituted with titanium. TS-1 is an important material because it is a selective oxidative photocatalyst. In addition, under UV light carbon dioxide may be reduced to methanol, methane, and other light hydrocarbons. Previous work used TS-1 powders in photolysis studies but little attention has aimed at TS-1 films. This work will demonstrate that the fluoride route may be used to prepare TS-1 films. Due to films superior light penetration and well-defined active area compared to powders, they are important for fundamental studies and other potential applications. The TS-1 films were prepared from sol gels composed of tetraethylorthosilicate (TEOS), tetrapropylammoniumhydroxide (TPA-OH), titanium tetrafluoride (TiF4) and hydrofluoric acid (HF). After hydrolysis of TEOS with TPAOH and the addition of TiF4 and HF, substrates (quartz, stainless steel) were immersed in the sol gel and placed into a Parr reactor, which was then heated to 150 oC for 24 hours. The resulting TS-1 films were polycrystalline and nearly continuous covering the substrate in a thin zeolite film. The TS-1 films were characterized by grazing angle X-ray diffraction (XRD), scanning electron microscopy (SEM), energy dispersive spectroscopy (EDS), and FTIR spectroscopy. It was found that the TS-1 films are oriented with the b-axis normal to the substrate and that the Ti content is ~0.2 %. In this report, the synthesis and characterization of the TS-1 films and preliminary results on CO2 reduction will be presented.

Entry Number: 162 UL2
Evaluation of Benzoic acid derivatives as Sirtuin inhibitors using an HDAC-based yeast assay
By: Nhu Tran, Stephanie Gee, Jeannette Bowler, Shaun Chan, Eric Suon, Dr. Weiming Wu, and Dr. Taro Amagata
Biochemistry
Faculty Advisor: Dr. Weiming Wu and Dr. Taro Amagata
Abstract: Recently, our research group has identified that 4-dimethylaminobenzoic acid produced by the Streptomyces sp. CP27-53 separated from San Francisco Bay sediment is a weak yeast/human sirtuin inhibitor. Using this compound as a scaffold, we have demonstrated that 4-tert-butulbenzoic acid is a superior potent sirtuin inhibitor based on the screening of a dozen of benzoic acid derivatives. This work has suggested that the bulkier functional group on the para position and/or larger aromatic ring system would enhance the sirtuin inhibitory activity. We have tested several more compounds against

the genetically modified yeast strain DMY2843. The bioassay results and structure activity relationship will be presented.

Entry Number: 163 UL2
Y39S: A Potential Functioning Trypsin Variant
By: Riley Statham and Dr. Teaster Baird
Biochemistry
Faculty Advisor: Dr. Teaster Baird Jr.
Abstract: Trypsin, a serine protease, is a digestive enzyme that works to break down proteins. The variant Y39S and wild-type trypsin were used in the experiment to determine how the mutation affects activity in inhibited forms of trypsin. In wild-type trypsin, the ranges of the kcat , Km, and kcat/Km 4208 - 6195 min-1,9.08 – 41.50 uM, 563.0 – 120.7 uM-1min-1, respectively. In the variant Y39S, the kcat , Km, and kcat/Km ranges were 3880 – 5229 min-1, 8.47 – 35.48 uM, and 458.7 – 119.6 uM-1min-1, respectively. Overall, the variant Y39S showed very comparable activity to that of wild-type trypsin.

Entry Number: 164 UL2
Trypsin Mutant Effects on Inhibition Resistance
By: Shangheng Sit
Biochemistry
Faculty Advisor: Dr. Teaster Baird Jr.
Abstract: Trypsin is representative of a group of proteases with similar folding and similar active amino acid residues. Advances in trypsin research could possibly assist the research of other serine proteases. Trypsin has two notable regions: the active site where the catalytic triad performs hydrolysis and the substrate specificity site that recognizes trypsin's substrates. Small competitive inhibitors only interact with these two sites of trypsin, while some bigger inhibitors like BPTI interact with the prime-side residues of trypsin in addition to the active site.
In the case of F41I, the phenylalanine at position 41 is normally positioned in such a way that the carbonyl oxygen forms a hydrogen bond with the inhibitor, but the mutation to isoleucine introduces flexibility to the residue, causing the carbonyl oxygen to lose its optimal positioning for hydrogen bonding.

Entry Number: 165 UL2
Effects of the F41L substitution on serine protease Inhibition
By: Weichao Zhuo
Biochemistry
Faculty Advisor: Dr. Teaster Baird Jr.

Abstract: Proteases have become attractive as therapeutic agents as well as therapeutic targets. Because of their specificity and efficiency, using proteases to target harmful proteins is a promising approach. However, naturally occurring inhibitors make this approach problematic. Therefore, we need to understand the protease inhibitor interactions on a molecular level to determine which specific interactions contribute to activity and inhibition.

Entry Number: 166 UL2
Adsorption Behavior of Arsenic (III) and (V) on Soil
By: Lucas Alameda and Yan Zhao
Biochemistry and Chemistry
Faculty Advisor: Dr. Bruce Manning
Abstract: The objectives of this study were to investigate the adsorption of arsenate (As(V)) and arsenite (As(III)) on a series of coastal California soils derived from sedimentary materials from the Golden Gate National Recreation Area south of Fort Funston, CA. The soil materials were characterized by X- ray diffraction (XRD), X-ray fluorescence (XRF), and acid extraction to determine mineralogical and elemental properties. Batch equilibrium and kinetics experiments were employed to determine the rate and extent of As(III) and As(V) adsorption in the range of 0-60 mg/L As(III) and As(V). The elemental and mineralogical composition of the soils showed large amounts of amorphous Fe (3-5% w:w), as determined by XRD, XRF, and wet chemical extraction followed by MP-AES analyses. Adsorption generally increased with increased Fe concentration. The results of the adsorption kinetics studies showed first-order rate constants in the range of 0.048-1.28 min-1 and 0.037-1.72 min-1 for As(III) and As(V), respectively, with As(V) generally adsorbing at a faster rate than As(III). A significant arsenic-induced pH effect occurred, where As(V) adsorbed more
strongly below pH 7 with the As(III) species becoming more strongly adsorbed above pH 7, and at higher total As concentrations. Our results suggest that the total Fe concentration, pH, and As(III)/(V) speciation are important factors for predicting the overall mobility of As in the soil-water environment.

Entry Number: 167 UL2
Efficient Synthesis of Orotic Acid Analogues for Orotidine 5’ monophosphate Decarboxylase (ODCase)
By: Caitlin Clausen, Jeanette Bowler, Daniel Blackburn, Rania, and Dr. Weiming Wu
Biochemistry, Chemistry, and Cell & Molecular Biology
Faculty Advisor: Dr. Weiming Wu
Abstract: The decarboxylation of orotic acid and its analogues has been investigated as a model for enzymatic decarboxylation catalyzed by orotidine-5’-monophosphate decarboxylase (ODCase). ODCase is one of the most efficient enzymes known in the scientific community. There has been much debate over the exact reaction mechanism by which it converts orotidine monophosphate (OMP) to uridine monophosphate (UMP). Our lab focuses on determining the mechanism through the mechanistic investigation of

substrate analogs. Part of the mechanistic investigation requires the synthesis of N1-substituted orotic acid derivatives as substrates. The currently available synthesis of N1-substituted orotic acid derivatives is rather complicated with ten reaction steps. Thus there is a need for development of a more efficient synthetic method for N1-substituted orotic acid. Our synthesis starts with the formation of dibromosuccinimide from the reaction of maleimide and liquid bromide. Subsequent reactions with amine, formation of carbamate, followed by treatment with alkaline base give the desired products. Therefore, the new synthetic method will be much shorter (four reactions in three steps) and more efficient. The orotic acid derivatives synthesized in this project will be used in subsequent kinetic studies on the rate of their decarboxylation.

Entry Number: 168 UP1
Contrasting patterns of organic carbon accumulation in two continental margin basins revealed from depth profiles of natural 14C
By: Ashley Grose
Chemistry
Faculty Advisor: Dr. Tomoko Komada
Abstract: Particulate organic carbon (POC) plays a vital role in the oceanic carbon cycle, serving as the main vehicle for the transfer of carbon from the surface to the bottom sediments, where it can potentially be stored for long periods of time. The sequestration of carbon in marine sediments is an important sink for atmospheric CO2, however only a small portion of the POC flux is ultimately buried in the sediments. There are several processes and environmental conditions that are known to affect the rates of degradation and burial of carbon in the seafloor, but they are not completely understood. The purpose of the present research is to gain a better understanding of how POC is cycled and used by microorganisms in anoxic sediments by analyzing the concentration and radiocarbon signature of POC (Δ14CPOC) at two sites in the California Borderlands, the Santa Monica and Santa Barbra Basins (SMB and SBB, respectively). POC content and Δ14CPOC values were analyzed as a function of depth, revealing distinct depositional regimes at these sites. POC content at SBB decreased exponentially with depth, while at SMB, two significant discontinuities were present, one at 2.5 cm, and a more prominent one at a depth of 20 cm. Δ14CPOC profiles were also very distinct from one another. Δ 14CPOC values at SBB showed a single discontinuity at around 2.5-3.0 cm consistent with the presence of the bomb horizon, below which Δ14CPOC decreased linearly. In the Δ14CPOC profile for SMB, the bomb horizon is also evident at 2.5 cm, but a second and larger discontinuity is present at 20 cm, coinciding with the shift in POC content. Sedimentation rates and the radioactive decay equation were used to explain these observations. While both locations had Δ14CPOC values indicating the presence of bomb-14C, only SBB portrayed a Δ14CPOC profile consistent with radioactive decay. We hypothesize that these differences are due to a change in sediment composition, in conjunction with sedimentation rates and preferential consumption of organic matter by microbial communities.

Entry Number: 169 UP1
NMR Analysis of TiF-4 solutions
By: Domanick Contreras
Chemistry
Faculty Advisor: Dr. Andrew S. Ichimura
Abstract: Anatase TiO¬2 is a photocatalyst used in water splitting and photo-degradation reactions. To improve the effectiveness of anatase, research has focused on controlling the crystal habit to deliberately expose particular facets that may be more reactive for particular processes. However, the crystal growth mechanism(s) that leads to a well-formed morphology is largely unknown, which makes the preparation of materials that are optimal for heterogeneous catalysis uncertain. At a fundamental level, the species in solution that condense to form the solid are critical to crystal growth. In particular, we are interested in the growth mechanism of anatase TiO2 films from titanium (IV) fluoride solutions that have been shown to be effective for water splitting and photo-oxdiation chemistry. To discover what species are present in aqueous solutions containing TiF4, variable temperature 19F and 47,49Ti NMR was used to study the sol-gel composition before and after hydrothermal synthesis. It was found that at least four Ti-F transition metal complexes exist in solution before synthesis including TiF62-, TiF5-, TiFOH, TiF4, and TiF3+. Interestingly, the TiF4 disproportionates into multiple species upon dissolution and all species except TiF62- exchange ligands (F- and/or solvent D2O) at rates comparable to the time scale of the NMR measurement. HF is formed during TiO2 synthesis and was observed in the product solution but not before synthesis. At low temperatures 271 K, the linewidths are narrowest allowing identification of individual transition metal complexes and their relative abundance ratios. This paper focuses on analysis of the NMR spectra to determine the species in solution that lead to the formation of highly oriented and crystalline TiO2 films.

Entry Number: 170 UP1
Visible Light Absorption of Proton Implanted [001] Oriented TiO2 Films
By: Marissa Martinez
Chemistry
Faculty Advisor: Dr. Andrew S. Ichimura
Abstract: The anatase phase of TiO2 is a versatile material for photocatalysis and photoelectrochemical applications due to its large band gap, chemical stability, and low toxicity. However, water splitting and other heterogeneous catalytic applications would be more practical if electron-hole pairs formed under visible light excitation. One way to decrease the band gap to allow the TiO2 to absorb visible light is by doping with metals, or/and nonmetals such as N, S, C, and B. Studies show that anatase could be hydrogenated, and that this treatment resulted in a strongly visible light absorbing powder. In order to simplify the introduction of H into anatase, a 3.0 keV proton ion-beam was used to implant H+ into the anatase surface. In this study, anatase TiO2 films were synthesized using TiF4 as the titanium source and fluoride as a crystallographic controlling agent. The films were dosed with a flux of 4x108 cm-2s-1 for 15, 20, 30, 45,

and 60 minutes resulting in a maximum implantation of ~1017 H+. Anatase films were characterized by grazing angle X-ray diffraction (gXRD), SEM, UV-vis spectroscopy, and FTIR. The films are polycrystalline with strong [001] texture and dominant {001} facets at the surface. UV-vis spectroscopy shows that increasing the implantation time increases the absorbance in the visible region of the spectrum The films were tested for their ability to generate hydrogen and hydroxyl radicals under UV and visible light irradiation. This report will focus on the film characterization, the effects of H+ implantation, and results of the photo-reduction/oxidation experiments.

Entry Number: 171 UP1
Methane production in anoxic continental margin sediments: Insights from isotope profiles of dissolved inorganic carbon (DIC)
By: Abraham King Cada, Huan Lei Li, David J. Burdige and Dr. Tomoko Komada
Chemistry
Faculty Advisor: Dr. Tomoko Komada
Abstract: Anaerobic sediments serve as a source of methane to the ocean that can have significant contribution to global climate control. While it is well understood that biogenic methane production occurs below the sulfate-methane transition zone (SMTZ), to date the specific pathways through which methane is produced are less clear. We determined pore water profiles of sulfate, methane, dissolved inorganic carbon (DIC), and δ13C and Δ14C signatures of DIC to better characterize the source of methane in the uppermost 2.5 m of anoxic sediments of the Santa Barbara Basin, California Borderland. Pore water DIC concentration increased steadily with depth indicating net production of DIC within the sediment. δ13C values of DIC (δ13CDIC) decreased rapidly from -0.9‰ at the sediment-water

Entry Number: 172 UP1
Detecting Climate Signals in Precipitation Records
By: Leia Gaten
Geology
Faculty Advisor: Dr. Jason Gurdak
Abstract: The project focuses on precipitation records from eight points in California's central coast over the past fifty seven years. The precipitation records have been interpreted and analyzed looking for low frequency climate signals.

Entry Number: 173 UP1
Dry Deposition Patterns and Short-Term Temperature Effects of Anthropogenic Black Carbon Emissions in Northern
By: Ryan Ford and Dr. Dave Dempsey
Geology
Faculty Advisor: Dr. Dave Dempsey
Abstract: We present a high resolution (4 km) analysis of the short-term temperature impact and deposition patterns of anthropogenic black carbon (BC) emissions in

Northern California. Unlike long lived, well-mixed greenhouse gases, BC remains in the atmosphere for 1-2 weeks and the location where BC is emitted has important implications in determining regional climate effects and evaluating potential snowpack loss. Simulations were performed using the chemistry version of the NCAR/NOAA Weather Research and Forecasting Model (WRF-Chem) to estimate depositional patterns of BC which can benefit future field experiments that aim to collect more robust in situ albedo changes.

Entry Number: 174 UP1
Observations of living-roof carbon, water vapor and heat exchanges using eddy covariance
By: Ryan Thorp, Siobhan Lavender, and Kendra Hauser
Atmospheric Sciences and Geography
Faculty Advisor: Dr. Andrew Oliphant
Abstract: Roofs cover approximately one third of the planimetric surface area of cities, which makes them a significant driver of the urban boundary layer. Conventional roofs act along with other impervious urban surfaces to greatly alter the surface energy, water and carbon budgets relative to the natural vegetation and soil surfaces they replaced. Living roofs therefore have been recommended to help limit urban hydroclimate modification due to several biophysical controls including, atmospheric carbon uptake and storage in soil and plant matter, building energy conservation via evapotranspiration and increased insulation and reduction in runoff. Micrometeorological measurements including the eddy covariance approach were used to estimate CO2, water vapor and heat fluxes on the California Academy of Sciences living roof in Golden Gate Park, San Francisco, California. The roof's area is 18,000 m2, containing 1.7 million plants from nine native Californian species and is the largest living roof in the state. Measurements were made about 10 m inside the eastern edge of the roof, at one meter above the 10-20 cm tall vegetation in order to capture adequate rooftop fetch for the prevailing summertime northwesterly flow. Following data reduction due to fetch limitations and low friction velocity (below 0.2 m s-1), diurnal summertime patterns of CO2, water vapor and heat are estimated. On a daily basis, the roof acted as a carbon sink of approximately 1.5 gC m-2 d-1 for a roof total of 2.75 kgC d-1. Turbulent heat fluxes were dominated by sensible heat with a mean Bowen ratio of approximately 1.5 and daily evapotranspiration rates of about 1.8 mm d-1. These values are similar to those found for dry summer mediterranean shrubs elsewhere.

Entry Number: 175 UP1
Investigating the Urban Heat Island Effect in Black Rock City, NV During the Burning Man Festival 2013
By: Malori Redman
Atmospheric & Oceanic Sciences
Faculty Advisor: Dr. Andrew Oliphant and Dr. Dave Dempsey

Abstract: Much is known about the Urban Heat Island (UHI) effect, but little is known about the degree to which its driving forces act. Driving forces include increased heat storage, decreased evapotranspiration, alterations to the surface energy budget as well as added anthropogenic heat flux and turbulent heat transport. Cities can be thoroughly studied in their current condition however the contribution of anthropogenic heat flux can never be fully identified. Held on a prehistoric lakebed in Black Rock City, NV, the annual Burning Man festival presents a unique opportunity to study the UHI. For 50 weeks out of the year, the site is a desolate landscape with little to no natural measurable fluxes of sensible and latent heat. However, for two weeks every August, upwards of 68,000 people inhabit the site, creating fluxes of water and heat. By measuring these fluxes before and during the event, the anthropogenic contribution to the UHI can be directly attributed. This study investigates whether or not a UHI exists during the festival, and the role of human activity within the UHI. Results show that there was not a UHI present at Black Rock City but other interesting aspects came to light. Analysis shows a negative UHI, meaning that the urban area proved to be cooler than the surrounding environment. Additionally, data show that there is an urban "moist" island where the city has a higher water vapor mixing ratio than the surrounding playa with a clear diurnal cycle. This is likely caused by higher evaporation rates of grey water pans throughout the daytime when solar absorption is highest.

Entry Number: 176 UP1
Assesing the Impact of Water Deficits on Preparedness for Climate Change in the Bay are
By: Michael Sanchez
Environmental Studies
Faculty Advisor: Dr. Nancy Wilkinson
Abstract: Natural climate variability and human-induced climate change will continue to influence the frequency, intensity, spatial extent and duration of extreme weather and climate events, including patterns of drought. In this context, human society and ecosystems will bear increased risk of severe impact and disaster. In order to better understand the Bay Area's human resilience and vulnerability to extended drought and water accessibility an analyses of data sources were made. Using historical and current data from the United States Drought Monitor, the Department of Water Resources and the California Data Exchange Center, a quantitative analysis was made of the Bay area by relating snow water equivalents, reservoir storage and demand, to resilience. A Qualitative analysis is also neces-sary of built and sociopolitical environments to provide a full measurement of resilience in the Bay area. A frame-work originally applied to measure community coping mechanisms in relation to drinking water disparities in the San Joaquin Valley, designed by Dr. Carolina L. Balazs, and Dr. Isha Ray will be used for this analysis.

Entry Number: 177 UP1
Comparing Restored and Remnant Dune Habitat in the San Francisco Presidio
By: Amy Ellevold and David Zimmerman

Environmental Studies and Natural Resource Management
Faculty Advisor: Dr. Barbara Holzman
Abstract: Coastal dunes provide vital ecological services and contribute to biodiversity by providing a habitat for rare or threatened plant and animal species. Due to factors such as urbanization these types of ecosystems are not as abundant as they once were which makes them an important area of study. This research will evaluate the restoration efforts of two coast scrub dune sites in San Francisco's Presidio. The Presidio contains restored dune scrub habitat, as well as remnant dune scrub sites. We will conduct this research by performing vegetative analysis using line transects to estimate percent cover of native and non-native species on both the remnant sites and restored sites. Data collected will be compared between the restored and remnant sites. The objective is to obtain the success rate of these restoration projects as well as develop basic criteria of how success of Presidio restoration sites should be measured.

Entry Number: 178 UP1
Research Design: Bay Area Lifestyle Responses to Climate Change
By: Sophia V. Rodriguez
Geography
Faculty Advisor: Dr. Tendai Chitewere
Abstract: In responding to climate change, the individual can play an important role by adopting a lifestyle that is more conscious of environmental and social impacts. The collective action of community members increases the scale and intensity of these efforts. These community groups can also inspire others to be more aware of their own activities. If comprehensive lifestyle adjustments are necessary to help mitigate the effects of climate change or serve as adaptation to a transformed environment, then understanding of the objectives of those living alternative lifestyles is essential. The study seeks to find: How are local Bay Area community organizations helping individuals and households to change their lifestyle as a response to climate change threats? This will be determined by conducting interviews with community leaders and through qualitative data analysis.

Entry Number: 179 UP1
Mapping Site-Specific Recombination in Circular DNA
By: Robert Stolz and Dr. Mariel Vazquez
Applied Mathematics
Faculty Advisor: Dr. Mariel Vazquez
Abstract: Polygons in the simple cubic lattice have been demonstrated to be useful for modeling enzyme driven topological changes on circular DNA. Currently, our research in this area is motivated by a desire to understand the process of DNA unlinking by the XerC/D proteins. In Escherichia coli the process of DNA unlinking has been attributed to topoIV, a type II topoisomerase. In the last decade the Sherratt lab has shown that in the absence of topoIV, the site-specific recombinases XerC/D allow E. coli cells to simplify the topologically complicated DNA links that come about naturally during DNA

replication. We aim to understand the possible unlinking pathways followed by the enzymes. We simulate this recombination process on knotted and linked conformations in the cubic lattice. By perturbing these conformations between recombination attempts using the BFACF algorithm and a Composite Markov Chain Monte Carlo process, we are able to model XerC/D driven recombination. Our goal in performing these simulations is to determine the transition probabilities associated with each topological state change. By mapping these probabilities, we may also be able to establish a mathematical basis, rooted in knot theory, for why certain transition pathways are favored over others.

Entry Number: 180 UP1

Comprehensive analysis of best game design practices

By: Nicu Listana
Computer Science
Faculty Advisor: Dr. Ilmi Yoon

Abstract: Detailing the rise of Mobile Applications as a Service or MAAS is a project that explains the emerging adoption of the free mobile app development strategy that businesses use today. This project documents the rise of free mobile apps that people use as well as it suggests future predictions in the mobile apps market. The project is based on a series of research, analysis, and case studies from top software development companies, marketing partners, and design agencies such as Gartner, QuickMobile, and SourceBits that tackles the problem of how to develop, design and market successful products that essentially produces mass appeal.

Entry Number: 181 UP1

Gamification: Creating Video Games to Solve Scientific Problems

By: Steven Taylor Ramzel and Gary Ng
Computer Science
Faculty Advisor: Dr. Ilmi Yoon

Abstract: In the age of computing, humans as problem solving creatures are far more capable than the most advanced computers. The historical ‘Deep Blue’ proved programming logic can outperform a human at chess and the Jeopardy playing machine ‘Watson’ proved that complexity of natural language could also fit within the scope of a computer program. However, ‘gamification’ stands to solve great problems from the opposite direction. Human minds are, in fact, the minds that are creating these solutions. ‘Gamification’ is the creation of video games where humans solve real-life problems for fun. It has already been proven to make valuable and impactful progress in scientific research with the game ‘Fold-it’. For instance, with ‘Fold-it’, players produced a 3D model of an enzyme important to AIDS research in just ten days what had eluded scientists for 15 years. This project explores the methods, mechanics, and organization needed to reproduce the aptitude and intrigue of gamification solutions like ‘Fold-it’. Our ‘World of Balance’ game combines complex food-web and ecosystem simulation with the appeal of ‘profit-management’ incentives seen extremely popular online games like ‘FarmVille’. The intended result is to produce eco-system simulation data governed by

the diversity and decisiveness of the natural human mind. While this data is intended to be compared to existing prediction algorithms, the data this could also reveal complex strategies or patterns found in nature as well as unseen ecosystem management methods we can apply current ecological goals. 'Gamification' is ambitious: it hinges upon many technical, organizational, artistic, and physiological paradigms. Here we present how creating a purposeful game has revealed how these challenges affect the process of 'gamification'.

Entry Number: 182 UP1
Indoor Navigation System for the Visually Impaired
By: Lowell Milliken, Thinh Nguyen, David Webster, and Alon Reich-Zilberman
Computer Science and Computer Engineering
Faculty Advisor: Dr. Ilmi Yoon (CS), Dr. Arno Puder (CS), and Dr. Sunggye Hong (Special Education)
Abstract: This project is an indoor navigation system for the visually impaired on an Android device
using Bluetooth devices as beacons and incorporating sensor data from the accelerometer and
magnetometer of the Android device. The system uses the beacons to find the position of the users and
tracks the facing and steps of the user to determine position while the user is while the user is moving.
The UI includes browsing for destinations, on demand descriptions of the immediate surroundings,
and "as you go" descriptions as the user moves within a building. The UI has text-to-speech
support for TalkBack, the built-in Android text-to-speech function

Entry Number: 183 UP1
Robotics with Haptic Feedback
By: Harold Co, Nabil Hamid, and Wilson Wong
Computer Engineering
Faculty Advisor: Dr. Thomas Holton
Abstract: The Robotics and Haptic Feedback project demonstrates basic robotics with two clamps: one acting as a controller and the other as a slave, mapping to each other's position. The user moves the controller clamp and the slave clamp moves to the same angle as the controller. An opposing torque is given as haptic feedback depending on force being sensed by the slave clamp.

Entry Number: 184 UP1
Concussion Analyzing Helmet

By: Brandon Boggs, Jose Gudino, Kristopher Ling, AND Dr. Thomas Holton
Electrical and Computer Engineering
Faculty Advisor: Dr. Thomas Holton
Abstract: Our project is a football helmet that will measure concussive impacts while players on the field playing. The helmet is outfitted with an accelerometer, a bandpass filter to filter out noise and DC voltage, a microcontroller, and an XBee wireless transmitter. The accelerometer measures the impact applied to the head and transmits the data, if an impact with concussive force is applied. The data will be sent to a computer on the sidelines, where somebody will monitor the impacts given a graphical interface.

Entry Number: 185 UP1
RASCAL – Rail Acceleration System – Compact Augmented Launcher
By: Brian Gluss
Electrical Engineering
Faculty Advisor: Dr. Thomas Holton
Abstract: This project is an investigation into the organization, simulation, and construction of basic railguns. The hardware portion of the project is a simple prototype railgun designed to minimize the maximum current drawn from wall-power socket. Simulation considerations include segmented guns, and the use of external electromagnets to increase local magnetic fields inside the barrel. Engineering challenges include achieving simplicity in circuit layout and feasibility in physical construction

Entry Number: 186 UP1
i.S.A.T. (Integrated Student Attendance Tracker)
By: Carlbert Fuertes, Joshua Hernandez and Jessy Aquino
Electrical Engineering
Faculty Advisor: Dr. Thomas Holton
Abstract: Cutting class is one of the worst habits of students. When a student is absent from class, important information is missed and he falls behind the class progression. The classroom environment is integral with the learning process of students, so there is a necessity that students' attendances be monitored properly.
Moreover, as our education system continues to lose funding, class sizes become larger, and professors find taking attendance time-consuming. Thus, many professors have given up on taking attendances and have stopped penalizing students who consistently miss class. Our project aims to create a more efficient way for professors to properly monitor attendances and encourage students to attend class more often.
We would like to design an attendance tracker that performs an efficient way of monitoring classroom attendances. Our project will consist of two parts, a fingerprint identification device and a smartphone application (app).

Entry Number: 187 UP1

Pillars of Light
By: Juan Larin, Stephanie Rosales, and Hytham Abou Youssef
Electrical Engineering
Faculty Advisor: Dr. Xiaorong Zhang
Abstract: This project is a 10x10x10 RGB LED cube that will display animations controlled by the Tiva C series TM4C123G Launchpad. Different animations will display with the push of a button.

Entry Number: 188 UP1
Self-Balancing Plane
By: Lee-Chieh Chou, Yingzhi Lu, and An Dinh
Electrical Engineering
Faculty Advisor: Dr. Thomas Holton
Abstract: The main objective for this project is to create a self-balancing system with two levels. This particular system can be able to keep the top level parallel to the ground (perpendicular to gravity) as the whole system is experiencing change in acceleration and inclination. Practically, any objects on top of the top level will not fall out from the plane while the whole system is experiencing certain sudden acceleration or inclination

Entry Number: 189 UP2
Laser Heating System used in High Pressure X-Ray Diffraction Experiments
By: Aaron Treger
Mechanical Engineering
Faculty Advisor: Dr. Kwok-Siong Teh
Abstract: Laser Heating System used in High Pressure X-Ray Diffraction at Lawrence Berkeley National Laboratory, Advanced Light Source, Beamline 12.2.2. This is an upgrade of the existing system, as it is more compact, has better vibrational stability, and can be aligned more easily. The system is used to heat Diamond Anvil Cells to 3000 K while monitoring the temperature, pressure and alignment.

Entry Number: 190 UP2
Semi-automatic Sushi machine
By: Andrew Kwan, Wan Ching Ho, and Chen Zhao
Mechanical Engineering
Faculty Advisor: Dr. Kwok-Siong Teh
Abstract: This semi-automatic sushi machine is to help people roll sushi with the ingredients with minimal user intervention. Sushi is a healthy and popular food, but requires a bit of skill to shape the roll, and people need the extra time to clean the mess after the work. Therefore, we propose an affordable machine to help people make sushi easily. The machine will make one roll after the user has placed the ingredients on the

roller track in one minute, with no extra cleaning needed. With this efficient machine, people will have a more convenient way of obtaining sushi.

Entry Number: 191 UP2
Pneumatic Valve Actuation System
By: Anthony Amador, Michael Lino, and Ivan Narvasa
Mechanical Engineering
Faculty Advisor: Dr. Kwok-Siong Teh
Abstract: Our project is a design for an alternative valve system for an engine that will improve its fuel efficiency and performance. Instead of the standard camshaft and spring system, our design has no camshaft and instead uses a pneumatic system and a microcontroller to actuate the valves. The advantage of this system over the standard camshaft is that we can change when the valves open and for how long they will stay open. This allows us to adjust these factors to achieve the best efficiency possible regardless of how hard or fast the engine is running. We will be displaying our system on a one-cylinder model engine driven by an electric motor. Although the engine will not be actually running, we will be able to display how our system works and that the valve timing can be changed.

Entry Number: 192 UP2
Hands-Free Refrigerator
By: Michael Lum and Ghaith Alawwad
Mechanical Engineering
Faculty Advisor: Dr. Kwok-Siong Teh
Abstract: Studies show that refrigerator doors are one of the most germ-infested items in a home, even more so than toilet seats. Since refrigerator doors are touched many times everyday, the chances of germs spreading is very high. One way to prevent these germs from spreading is to prevent contact with the refrigerator door, which is the goal of this project. This project also intends to allow easier access to refrigerator while hands are full.

Entry Number: 193 UP2
MAVERIC: Multipurpose Aerial Vehicle with Extended Range using an Integrated Solar Circuit
By: Nicholas Howard, Saul Martinez, Keng Yin Aw, and Bernardo Gonzalez
Mechanical Engineering
Faculty Advisor: Dr. Kwok-Siong Teh
Abstract: Unmanned Aerial Vehicles (UAVs) are autonomous, remotely piloted aircraft; commonly used by the military, law enforcement and researchers. Currently, UAVs have a constrained flight time as that is a function of energy storage this severely limits the effectiveness of the UAV. In order to improve the effectiveness of a UAV, we will utilize solar technology to extend flight time.

Entry Number: 194 UP2
Automated LabView Controlled Dip Coater for Semi Conductor Processing
By: Rabiah Harrison, Xinyi Xiao, and J. Welch
Mechanical Engineering
Faculty Advisor: Dr. Kwok-Siong Teh
Abstract: Our senior project is an open loop dip coater which will be used in research laboratories at SFSU to make thin films. The motivation behind the dip coater is that a method for controlled deposition of solution onto substrates was needed in order to achieve uniform and reproducible thin films for research. The dip coater is controlled by Arduino and LabView is the user interface.

Entry Number: 195 UP2
Low RPM HATT
By: Rachel Rybarczyk, Shahab Azizi, and Travis Jackson
Mechanical Engineering
Faculty Advisor: Dr. Kwok-Siong Teh
Abstract: Our project is the design and development of a variable pitch horizontal-axis tidal turbine. This turbine will prove to be a viable option for renewable energy in today's world. The variable pitch will prove to enhance the efficiency of the turbine at different flow rates that occur in nature, thus generating the optimal amount of power. The prototype for our project will be constructed of 3D printed plastic supported by metal rods. The mechanism for varying our blades will be constructed of a gear system connected to a stepped motor to insure precision movement that can be tracked. Our stepper motor will be controlled by Bluetooth and microcontroller connection that will allow us to change the angle of our blades from our smartphones. We then conclude our theory with testing, to prove that our horizontal-axis tidal turbine generates electricity and is a realistic option for renewable energy.

Entry Number: 196 UP2
Automatic pH Soil Mapping System
By: Patrick Lewis, Davinder Kuqi, Dirajh Singh, Tayfun Selamoglu, and Jesse Cary
Mechanical Engineering
Faculty Advisor: Dr. Kwok-Siong Teh
Abstract: pH levels not only measure acidity in a solution, but indicate a substance's quality and can insure consistency in many solution based practices like chemical manufacturing, food processing and environmental analysis. pH soil sampling and analysis is a crucial component of precision agriculture practices due to its proven method and reliability. The goal of this project is to build an economical, and user friendly Automatic pH Soil Mapping System, which purpose is to provide sample spatial recognition for the agriculturist user. This system utilizes a radio controlled off-road

vehicle to transverse, command and sample pH levels of multiple field locations, these pH samples are logged in respect to the sample's location to enable further user analysis.

Entry Number: 197 UP2
Reliability Assessment of Real-Time Hybrid Simulation for Time-Delayed MDOF Structures
By: Frank Sanchez
Civil Engineering
Faculty Advisor: Dr. Cheng Chen
Abstract: F. Experiments are critical for structural hazard mitigation. Structural experiments such as the shake-table tests allow researchers to simulate an earthquake on an entire scaled building. However, these experiments could be very expensive and are often constrained by limited laboratory space. Real-time hybrid simulation (RTHS) is an efficient alternative to the shake table test. RTHS assesses an entire structures performance through component tests by physically testing experimental substructures in laboratories and numerically simulating analytical substructures in computer programs. The experimental substructures are simple frames that are subjected to a seismic forces produced by hydraulic actuators; these represent substructures taken from the entire structure. The analytical substructure consists of using structural dynamics in computer programs to simulate the same structure subjected to the same seismic forces. Components of the structure that are well understood are numerically simulated, while the critical components of the structure are physically tested. The two tests should produce results that are equivalent, however, a time delay of the hydraulic actuator in the physical test causes a synchronization error between the analytical and experimental results. The time delay is caused by the servo-hydraulic not being able to reach the desired positions in a real-time manner. In order for RTHS results to be accurate and reliable, this time delay must be accounted for throughout the test. Research was previously conducted on the reliablity of RTHS for a SDOF structure. Findings from previous studies on SDOF structures are not directly applicable to a MDOF structure due to multiple modal participation. RTHS of a MDOF structure requires that hydraulic actuators produce desired responses at each story, thus inducing multiple actuator delays. Modal analysis technique is often used by researchers to analyze linear elastic structural dynamics under vibrational excitation. This method uses the overall mass and stiffness of each mode of the structure to find the various periods at which it will naturally resonate. To apply the modal analysis technique for RTHS reliablity analysis, the effect of time delay and nonlinear structural behavior need to be investigated. This presentation presents preliminary studies to evaluate the modal analysis technique for RTHS involving multiple actuator delay.

Entry Number: 198 UP2
San Francisco State University's Steel-Bridge (Steel-Gators)
By: Alan Chan, Noah Nordhoff, Ennya Garcia, Barnabas Negash, Kenneth Escobar, Robin Lopez, Kenneth Escobar and Dr. Tim D'Orazio
Civil Engineering

Faculty Advisor: Dr. Timonthy D'Orazio
Abstract: San Francisco State's Steel-Bridge was design to mock a real bridge that over sees a river/creek. The steel-bridge resembles 1/10 scale of the real bridge. Additionally the design incorporates a very unique triangular truss that has a total of 20 members, 3 person assembling team timed at 27.5 minutes, and weights a little under 130lbs. Our bridge has a horizontal deflection of 0.95psi load capacity.

Entry Number: 199 UP2
Roll Up Bridge
By: Erasmo De Luna, Michael J. Bradley, Cristian Fernandez, Eric Agnes, Mersedeh H-Javid, Marco Cruz, Rizwan Satti, Tianlong Liu, Xiaofan Zhang, Pengjie Du, Guodong Xuan, Yang Chao, Chunfeng Xue, and Yi Liu
Civil Engineering
Faculty Advisor: Dr. Timonthy D'Orazio
Abstract: Inspired by the Curling Bridge located in Paddington Basin, London, our timber bridge design is composed of six deck sections that fold to form a hexagonal shape. Our goal was to build our bridge with a simple mechanical system we could purchase at a low cost and assemble with ease. We also designed the bridge to abide by National Timber Bridge Design Competition, further challenging us to think outside the box and find solutions to our problems within the provided constraints. We came up with a timber bridge design 19 ft. in length and 61 in. wide, made primarily of douglas fir wood and approximately 24% non-wood materials. Weighing in at roughly 1,300 lbs., our bridge is able to cantilever itself out 195 in., roll itself into a hexagonal shape using manpowered winches and withstand a load of 4,500 lbs. All together an aesthetically pleasing design capable of meeting all the requirements set forth through competition requirements and our team's ambitious goals.

Entry Number: 200 UP2
The Original Timber Bridge
By: Henry Williams, Robby Becker, Mike Burnfield, Wenxiang Xu, Byrong Ching, Htin Lin, and Travis Wesche
Civil Engineering
Faculty Advisor: Dr. Timonthy D'Orazio
Abstract: For our 2014 Civil Engineering senior project for San Francisco State University we are entering the National Timber Bridge Competition. The diversity of our 7 members brings together a phenomenal engineering design-build team. We have members with backgrounds in construction as well as members who work for Environmental agencies and Structural firms. While an innovative design was an important to us, being Civil Engineers we were foremost concerned with building a structurally sound and safe bridge. For that reason we went with a typical truss design, which we could be sure would carry the necessary loads. However, we went with a custom truss design that required one of a kind gusset plates not available in any store. To further set us apart above our 3"x6" structural deck we have a redwood-doug fir

hardwood floor style decorative deck with a star in the center. This original Timber Bridge is a great example of strength meeting innovation.
Our subfloor is made up of 2x10" joists attached with Simpson joist hangers to two 4x10" Girders in the middle and 2x10" girders at either end. All girders are less than 2 meters long whereas the joists are approximately 1.5 meters long. A 3x6" structural deck can be found directly above the subfloor. On top of the structural deck is a redwood and doug-fir hardwood floor style deck design. The design has an intricate star pattern laid out in the middle in redwood and is meant to be both aesthetically pleasing and weather resistant. Our wood truss carries the entire load of the bridge and is therefore made up of larger members. 4x4" webs and ties connect a 4x6" top chord and a 4x10" bottom chord. The longest truss members are the top and bottom chord which are approximately 2.2 meters. The 4x4" members are all less than 1.5 meters. Custom gusset plates were required to attach everything. We bought a 4'x8' sheet of ½" of A36 steel and made the plates ourselves by cutting and drilling them. We used over 400 Simpson SDS (structural screws) to attach the gusset plates to the members. The truss is attached to both 4x10" girders with joists hangers as well as four 8" SDS screws per girder. The truss rests upon 4x10" posts on either end with a 2x10" member connected on the transverse side supporting the joists.
We were pleased to have a strong and innovative design that met the design criteria. We were equally pleased with the minimal deflection which we will discuss further in the loading section.

Entry Number: 201 UP2
National Timber Bridge Design Competition
By: Kevin Rodriguez, Nadav Djiji, Sara Noii, Jerry Pichay, Abraham Reyes, Ephraim Baclagan, and Jesse Sipes
Civil Engineering
Faculty Advisor: Dr. Timonthy D'Orazio
Abstract: Our ultimate goal for this project was to create a timber bridge that was very unique, aesthetically pleasing, cost efficient, and very practical in the real world. Our bridge was designed for the Sonoma County countryside. When publicizing our project we received interest from a family with a large farm, including creeks running throughout, and of course it was our pleasure to design something that they could use. To optimize stiffness of the bridge, we started with three 4x4 members running longitudinally. These members are resting on top of seven 4x6 members running in the transverse direction. The 4x6 members run transversely in between 4x4 members running longitudinally on either end. To reinforce our design we added steel cables running down towards the middle of the deck to provide added supports. To minimize the weight of our structure, as well as the cost, we stayed away from using excessively large members and we tried to make our deck as simple as possible without adding any extra weight. Seeing as this is a Timber Bridge Competition, we wanted to use as little non-wood material as possible. Our non-wood material only came out to 3.35% of the total weight of our bridge. We researched bridges from previous years of competition in order to present a bridge that was unique. Although we could not see all the bridges we are hoping that we are submitting something original. We believe that our triple layer bridge deck gives an aesthetically pleasing look and great results under loading. We also added a truss like

structure on top of our deck, which supported steel cables that helped support the center of our bridge. We learned a lot from this experience and are very proud of what we were able to accomplish.

Entry Number: 202 UP2
Timber Bridge Team 4
By: Nadia Makoor, Michelle Kwong, Charles Cao, Stephanie Azzolino, Kody Cooper, Elizabeth Dominguez, Aaron Duchi, and Shakila Mohammad Sharif
Civil Engineering
Faculty Advisor: Dr. Cheng Chen
Abstract: Our Timber Bridge was designed and constructed in accordance with the guidelines of the 2013 ASCE National Timber Bridge Design Competition. We chose to design an arch bridge because of its high strength characteristics as well as its aesthetic appearance. Our arch design works by transferring loads along the curve to the ground. The two arches serve as the main load bearing components of the bridge. Douglas Fir is found to be the most ideal type of wood to use on our design because of its strength-to-weight ratio. Douglas Fir is also the most inexpensive species that can be used when considering the size of the load our bridge will encounter. Our arches were made by laminating plywood to create a gradual curve that has high strength and stiffness while staying within specified competition rules for member length not exceeding 3.2 meters. By laminating the arch, it enabled us to span 13 feet long without any supports. The layers of each arch are left exposed to show the multiple different shades of the sheets. The first layer of our deck is ¾ inch plywood. The second layer consists of a border made from 2x12's with a pattern of 2x4's angled at 45 degrees leading to a centerpiece of various exotic hardwoods flipped in a grain-up pattern. Redwood 4x4's are used as beams to support the deck. We used a total of 15 Simpson Strong-Tie steel straps to connect the 5 transverse beams to the blocking. The deck is connected to the arch by steel cables and a 1" conduit pipe on each side. The cables are lightweight but can support extremely heavy loads. Galvanized fasteners such as nuts, bolts, nail and screws were used at each connection.

Entry Number: 203 UP2
Golden City (Concrete Canoe)
By: Shauna Fong, Megan Anderson, Maria Aragon, Jerry Chin, Anastastia Disbrow, Gaser Elgendy, Melchor Gutierrez, Felix Wan, and Chao Xu
Civil Engineering
Faculty Advisor: Dr. Timonthy D'Orazio
Abstract: The objective of the 2014 concrete canoe team is to develop a lightweight 20-foot long concrete canoe that can compete at the national competition level. Every year the rules are restructured to provide new and challenging engineering problems. The concrete canoe competition challenges young engineers' design skills by utilizing the principles of reinforced concrete design to create a structure not typically made from concrete. The project develops teamwork, innovation, and project management skills in a yearlong project. The design, analysis, testing, and construction of the canoe are done as

a team. Teams must not only design the canoe, but must ensure that the canoe is durable enough to stay afloat during several challenges, including racing and flotation testing.

Entry Number: 204 UP2
Concrete Canoe
By: Vincent Lee, Sherif Eldash, Ghazi Elayyan, Angelo Racca, and Danniel Alexander
Civil Engineering
Faculty Advisor: Dr. Timonthy D'Orazio
Abstract: Design and Construction of a Concrete Canoe based on the National Concrete Canoe Committee (NCCC).