Entry Number: 1 GB
CAN YOU TELL I'M DISGUSTED? LOOK AT HOW I TALK: AN EXAMINATION OF EVOLUTIONARY FUNCTIONS OF DISGUST IN LANGUAGE
By: Annecy Majoros
Psychology
Faculty Advisor: Dr. David Matsumoto
Abstract: From an evolutionary perspective, emotions function as hard-wired, organized responses for dealing with personally relevant events (Ekman, 1992; Levenson, 1999). Disgust has a specific function to eliminate or repulse contaminated objects (Matsumoto et al., 2014), and has links to anger, contempt, and morality (Rozin et al., 1999). Increased disgust may also indicate future aggressive acts (Matsumoto et al. (2014). As such, it is essential to better understand disgust from different modes of communication. We hypothesize that, when disgust is elicited, participant spoken statements about the use of a neutral object will contain a greater number of references to the functions of disgust compared to when a neutral state is elicited.
Participants at San Francisco State University (N = 76), viewed two emotion eliciting videos and described the uses for neutral objects. Participants first watched a neutral video, talked about the uses for either a paper bag or paperclip, then watched a disgust video, and talked about the uses for the object not discussed previously.
A 2(Object: paper bag vs. paperclip) x 2(Emotion: neutral vs. disgust) x 2(Reference Type: rejection vs. elimination) Mixed ANOVA was computed. For the main analysis, a significant main effect of Emotion ($p < .001$, eta squared = .037) indicated that participants made more total disgust references in the disgust elicitation. Further, a significant three-way interaction of Object x Emotion x Reference Type ($p = .001$, eta squared = .049) revealed that for rejection references in the disgust elicitation, participants made less references about the paperclip ($p = .013$), but more about the bag ($p < .001$). For elimination references in the disgust elicitation, participants made more references about the paperclip ($p = .001$), but not more about the bag ($p = .267$).
The findings demonstrated increased number of disgust function references in speech after disgust elicitation, supporting the hypothesis. This is an important first step to determine whether functions of disgust exist verbally as they do nonverbally, especially if nonverbal cues are absent.
Future research should include different neutral objects and disgust elicitors as this effect may not hold at different types or levels of disgust.

Entry Number: 2 GB
ATTRACTING WORKERS HIGH IN PSYCHOLOGICAL HARDINESS
By: David Mast
Industrial & Organizational Psychology
Faculty Advisor: Dr. Kevin Eschleman
Abstract: The goal of this research is to identify potential job applicants with dispositions that will help ensure long term career success at certain challenging occupations. Our target audience are those occupations that have a high risk of trauma, including fields such as medicine, the military, police, or social work. We want to find these individuals at the applicant stage, both to minimize the potential costs of a failed hire to the hiring organization, and to maximize the potential for success and a favorable job fit for the applicant. The current research is examining hardiness, because it has been shown to be a relatively stable personality characteristic and we seek to emphasize selecting for personal resources that are maintained across situations, such as a change in job environment. Different types of job and company descriptions are presented to participants, and high hardiness participants appeared to be more attracted to a culture of similar high-hardiness others, and descriptions of high emotional labor demands, relative to low hardiness participants.

Entry Number: 3 GB
REGULATION OF RECURRENT EMOTION IN THE AFTERMATH OF A LOST ELECTION
By: Eunhyung Ryoo and Ashish Mehta
Developmental Psychology
Faculty Advisor: Dr. Gaurav Suri
Abstract: In a subgroup of voters, the news of Mr. Trump's victory in the U.S. 2016 presidential election caused recurrent emotions that were negative, frequent, persistent over several weeks, and often intense enough to elicit attempts at emotion regulation. This afforded a rare opportunity to analyze the regulation of recurrent emotions

in a natural, non-laboratory context. We tested three hypotheses among voters who did not vote for Mr. Trump: 1) whether recurrent high-intensity emotions are more likely to be distracted, whereas recurrent low-intensity emotions are more likely to be reappraised; 2) whether reappraisal is the most effective strategy for reducing recurrent emotion; and 3) whether increased flexibility in regulatory choices is associated with desirable outcomes. We tested these hypotheses in five surveys over 25 days (11/10/16 - 12/4/16) administered to 111 participants. We found considerable support for all three hypotheses which provided new insights into the nature of recurrent emotion regulation.

Entry Number: 4 GB
AN INVESTIGATION INTO WHETHER ETHNICITY PREDICTS DEPRESSIVE RUMINATION THINKING STYLES
By: Gerald Young
Psychology
Faculty Advisor: Dr. David Matsumoto
Abstract: Depressive rumination (DR) is a self-referential process in which individuals passively and repetitively analyze themselves, their problems and concerns, and their negative emotional state. This process is harmful among those of European descent because it is causally linked with various consequences including the onset of depression. Recent cross-sectional and longitudinal studies suggest that DR may evoke fewer psychological consequences and may even provide some benefits for those of Asian descent. The mechanism(s) responsible for DR ethnic differences is(are) unknown.
In everyday life, Europeans typically think about themselves abstractly (e.g., “I'm worthless”) whereas Asians do so concretely (e.g., “I spoke insensitively”). Since DR is a self-referential process, Europeans and Asians might also think about themselves abstractly and concretely, respectively, during DR which suggests that ethnicity might predict one's DR thinking style.
To test the hypothesis that ethnicity is associated with DR thinking styles, European American (EA; $N = 17$) and 1st generation East Asian Americans (AA; $N = 21$) were administered a DR induction comprised of 2 thinking and 2 writing blocks using a participant recalled unresolved problem. Participants then provided 8 statements that described themselves within the context of their problem open-endedly. The statements were coded for the average number of adjectives and verbs per statement that represented participants' main feeling, trait, or behavior and served as separate dependent variables. Since adjectives represent an abstract thinking style and verbs denote a concrete thinking style, it was predicted that EA would use more adjectives than AA and AA would use more verbs than EA.
No differences were observed among adjectives per statement. When only the first statement was analyzed, however, AA used significantly more verbs per statement compared to EA providing the very first evidence that AA may have a concrete DR thinking style. While AA balanced their word usage per statement, EA largely used adjectives at the onset of the task and tended to use fewer adjectives and more verbs per statement as the number of cumulative statements increased. The writing portion of the DR induction may have led EA participants to describe themselves using words from their preferred category (adjectives) causing them to run out of adjectives when they got to the statement task. AA also showed this trend with respect to adjectives but they were more stable with their verb usage. While not conclusive, there is some evidence to suggest that AA may have a concrete DR thinking style.

Entry Number: 5 GB
EXPLORING THE GENDER-SPECIFIC ASPECT OF FATHERING: HOW PARENTS SOCIALLY CONSTRUCT FATHERING
By: Gretchen Cox-Andazola
Developmental Psychology
Faculty Advisor: Dr. Jeff Cookston
Abstract: Parents play a vital role in the development of their children, and mothers and fathers each uniquely contribute to this development. Most of the research on parenting has focused solely on mothers and less attention has been paid to how fathers contribute to this development. We know even less about how fathers evaluate what they do well in this gendered role and, by relation, what mothers say about good fathering.

Guided by symbolic interaction theory, we anticipated that fathers would describe good fathering as a function of their own behaviors and interactions with their children. Three-hundred and ninety-two mothers and fathers of 7th-grade children offered narratives in response to the following prompts focusing on the father's behavior: (1) Tell us two or three things that (you) do best as a father, and (2) Tell us two or three things that you would like to change about (yourself) as a father. Using a deductive coding method, we found that eight dimensions of fathering behaviors emerged in the narratives. Three of these dimensions (i.e. responsiveness, emotional quality, and investment) were the most prominent responses from both fathers and mothers in regards to what the father does best, as well as what he needs to change. This indicates that these three dimensions are the most important aspects of fathering to both parents and should be further explored to understand how fathers contribute to their childen's development.

Entry Number: 6 GB
SF STATE VALUES SURVEY
By: Hydie Pavick, Ruoying Yang, Quentin Coppler, Sarita Rose Upadhyay, Lea Lynn Yen, Jeana Herring, Eric Fethe, Hope Wear, Jacquelyn Rose Lenta, Remy Cockerill, and Brenna Huntley
Industrial & Organizational Psychology
Faculty Advisor: Dr. Kevin Eschleman
Abstract: We are collecting data from San Francisco State (SF State) students, staff, and faculty to measure perceptions of how well the university is living up to its core values. Last year's study showed Value Strength is significantly associated with university outcomes (e.g., satisfaction, citizenship behaviors, willingness to donate), therefore we will continue to explore Value Strength for students, as well as staff and faculty. In addition, we will compare how core values relate to Burnout and Organizational Citizenship Behaviors.

Entry Number: 7 GB
A CROSS-CULTURAL STUDY OF PARENTAL SOCIALIZATION OF THEORY OF MIND
By: Jacquelyn Nelson
Developmental Psychology
Faculty Advisor: Dr. Jae Paik
Abstract: An essential aspect of everyday social interactions is the ability to consider what the other person is thinking. This skill, known as Theory of Mind (ToM), has been thoroughly studied over the past thirty years. Throughout the literature, researchers cite two distinct ToM developmental patterns, one for Collectivist societies and one for Individualistic societies. However, little research has examined a measurable cause for the developmental difference. In this study, we created a measure of parental socialization of ToM. We hypothesized that parents in the two cultures may play differing yet active roles in the development of their childrens' ToM.

Entry Number: 8 GB
EMPATHY IN CHINESE CHILDREN: COGNITIVE SKILLS PREDICTING AFFECTIVE AND COGNITIVE EMPATHY
By: Kenn Dela Cruz
Developmental Psychology
Faculty Advisor: Dr. Jae Paik, Dr. Patricia Miller, and Dr. Shinchieh Duh
Abstract: Empathy is the ability to know, feel, and respond compassionately to an individual's emotional state (Eisenberg & Fabes, 1990), which is important for mediating altruistic (Blum, 1980) and moral behavior (Eisenberg & Miller, 1987). The relationship between children's cognitive skills and empathy remains an overlooked topic that can expand our knowledge on empathy development. Empathy has been positively linked to children's language skills (Peterson, 2014), but relatively little is known about how other cognitive skills relate to empathy. The present study examined associations of Chinese 6- to 8-year-olds empathy skills to cognitive skills--working memory, inhibitory control, and receptive vocabulary. Our sample included 92 Chengdu children (M= 6.77, SD = 3.26, 51% female). Empathy was measured through the Chinese version of the Basic Empathy Scale (BES; Geng, Xia, & Qin, 2012), a 20-item scale that assesses affective empathy (i.e., experiencing another person's emotion; Bryant, 1982) and cognitive empathy (i.e., understanding another person's emotion; Hogan, 1969). Cognitive skills were assessed through test of Mandarin receptive vocabulary,

backward span working memory task, and a Stroop inhibitory control task. Our results indicated an acceptable Cronbach's alpha of .64 for the BES after removing one item that showed low internal validity, suggesting that the BES can be utilized to study Chinese children's empathy skills. We found a significant positive correlation between BES and receptive vocabulary (r = .23, p = .03). A significant simple regression equation was found for predicting empathy based on language, (F(1,90) = 4.94, p = .029) with an R2 = .05. No significant correlations were found between BES and cognitive empathy or other cognitive skills.

Entry Number: 9 GB
SMALLER N400 AMPLITUDE ARE REFLECTED IN CREATIVE INDIVIDUALS
By: Kristina Pfeifer and Alejandro Heredia
Psychology
Faculty Advisor: Dr. Mark W. Geisler
Abstract: Recalling uncommon information is thought to be a unique characteristic within creative individuals (Mednick, 1962). To test this theory we examined the amplitude of the N400, which becomes larger in negativity when processing unrelated semantic information (Bentin et al., 1985). Due to the ease in which creative individuals produce meaning from unrelated associates (Benedek et al., 2012), smaller N400 amplitudes were predicted in response to remote word pairs. Participants (N = 53) were asked to try and form an association while viewing related, indirect and unrelated word pairs while electroencephalography was recorded. Three measures of creativity were examined separately: divergent thinking, creative personally, and creative achievement. Subtraction waveforms yielded two conditions of interest: the Directd effect (unrelated minus related) and the indirect effect (indirect minus related). Bivariate correlations were separately run on all creativity measures, and N400 amplitude at electrode sites Fz, Cz, Pz, F3, F4, C3,C4, P3 and P4. For creative achievement a significant positive correlation for the direct effect was found at F4 (r = .231, p = .048) while a trending positive correlation (r = . 227, p = .051) was found at P4. For divergent thinking significant positive correlations for the direct effect were found at Fz and F4 (all rs â‰¥ .238, p â‰¤ .043). For the indirect effect a significant positive correlation was found at P4 (r = .264, p = .028). For creative personality significant positive correlations were found for the direct effect across all electrode sites (all rs â‰¥ .289, p â‰¤ .018). Additionally, the indirect effect produced significant positive correlations across all electrode sites (all rs â‰¥ .238, p â‰¤ .043). These results propose that as creativity increases, N400 amplitude becomes more positive while viewing remote word pairs. This may suggest that highly creative individuals store more uncommon associates in memory.

Entry Number: 10 GB
ARE SPONTANEOUS THOUGHTS OUT-OF-THE-BLUE? STIMULUS-ELICITED INVOLUNTARY INSIGHTS AND SYNTACTIC PROCESSING
By: Ngoc-Cam Bui, Reza Ghafur, and Jessica Yankulova
Psychology
Faculty Advisor: Dr. Ezequiel Morsella
Abstract: Recent research reveals that high-level conscious thoughts can be triggered by external stimuli in a manner that is reflex-like, involuntary, and insuppressible. In three studies, we extended this research so that these involuntary effects (e.g., the task-unrelated thoughts in mind-wandering) also require high-level insight and syntactic processing (including the reading of newly learned, nonsense symbols). In Study 1, subjects (*n* = 22) were trained to associate nonsense visual symbols with real words (e.g., “green” and “sun”) and to read phrases formed from the pairing of these symbols (e.g., “green sun”). After training, subjects were instructed to not read these sentences. Involuntary reading arose on a substantive proportion of trials (*M* = .39, *SD* = .34), which was significantly different from zero, *t*(21) = 5.40, *p* < .001. Study 2 was designed to replicate this manipulation and to assess whether subjects automatically interpreted the sentences to be nonsensical or not (e.g., “green sun” would be a nonsensical sentence). In Study 3, we investigated further the phenomenon of involuntary insight. Subjects were presented with word pairs (e.g., “flame” and “wax”) and instructed to not think of any associate of these words (e.g., “candle”). Together, these three studies shed light on the mechanisms that, in everyday life, engender the often “high-level” contents that occupy our conscious minds. Knowledge of these mechanisms is important for many subfields of psychological science, including those of

mind-wandering and psychopathology, in which it is known that involuntary thoughts (e.g., obsessions, mind-wandering, and rumination) can be debilitating.

Entry Number: 11 GB
THE ROLE OF REAPPRAISAL SUCCESS IN MEMORY
By: Nicholas Yeh
Psychology
Faculty Advisor: Dr. Sarah Barber, Dr. Rav Suri, and Dr. Phil Opitz
Abstract: Previous research suggests that when people cognitively reappraise negative information, they later remember it better than if they had passively viewed it. However, it is unclear whether this benefit extends to situations which may be difficult or impossible to reappraise. The present study investigates this issue. At encoding participants (N = 47, data collection ongoing) were instructed to use situation-focused reappraisals to decrease their emotions to some negative images and were asked to passively view others. During reappraisal trials, participants also rated their success in generating a reappraisal. Memory was assessed after a one-week delay with a surprise recall test (15 minutes) followed by a recognition test. Preliminary results for the incidental recall test revealed that participants recalled significantly more images when using situation-focused reappraisals ($M = 16.2$) compared to passively viewing ($M = 11.9$), $p < .001$. The same pattern was found with a recognition test, where participants recognized significantly more images when using situation-focused reappraisals ($M = 87.0$) compared to passively viewing ($M = 84.3$), $p = .02$. Investigating the role of reappraisal success revealed a significant main effect of success, when participants were successful, $p = .037$, or failed, $p = .01$, at reappraising they recalled significantly more negative images compared to viewing. A similar pattern emerged with recognition scores, there was a memory benefit for successful reappraisals, $p < .001$, and for failed reappraisals, $p = .026$ compared to view.

Entry Number: 12 GB
EMOTION REGULATION MEDIATES THE ASSOCIATION BETWEEN SEXUAL MINORITY STRESS AND MENTAL HEALTH
By: Sarah Wagner and Margaret Schlenker
Psychology
Faculty Advisor: Dr. Sarah Holley
Abstract: In addition to the stressors of everyday life, LBG individuals must also contend with minority stress (i.e., excess stress experienced by members of stigmatized social categories). A specific component of sexual minority stress is acceptance concerns (AC; sensitivity to negative evaluations regarding ones sexual orientation), which have been shown to negatively impact mental health. This study examines whether emotion regulation (ER; the ability to manage the duration and intensity of an emotional experience) mediates the association between AC and mental health outcomes (i.e., depression, anxiety). It may be that the ability to regulate negative emotions generated from AC may in turn reduce risk for depression and anxiety. 149 LGB individuals completed an online survey. After controlling for age and gender, results indicate ER mediates the associations between AC and depression and between AC and anxiety. These findings indicate ER may be an important treatment target for LBG individuals with AC.

Entry Number: 13 GB
EXAMINING THE RELIABILITY OF VIDEO STIMULI TO ELICIT EMOTIONS
By: Shanyu Kates and Xiaoye Xu
Psychology
Faculty Advisor: Dr. David Matsumoto and Dr. Hyi Sung Hwang
Abstract: Video stimuli are regularly used in laboratory experiments to elicit emotions. Compared to other media, videos have numerous advantages including high ecological validity and standardization with little deception. (Gross & Levenson, 1995). Over the past decade, few studies have attempted to update the preexisting database of validated videos with new stimuli. Thus, we tested a new emotional video and hypothesized that it would reliability elicit its intended emotions with little to no other emotional responses. Participants (N = 47) watched a series of 5 videos, which alternated between neutral (3 videos) and emotional (2 videos) material. After each video, participants rated the extent to which they felt each of 15 discrete emotions using a 9-item Likert Scale. A 6 (Times: pre-check and 5 videos) x 15 (Emotion: guilt, fear, anger,

embarrassment, worry, contempt, excitement, disgust, amusement, nervousness, surprise, interest, sadness, pride, shame) repeated measures ANOVA was conducted, and demonstrated there was a significant interaction between video and emotions, $F(14, 644) = 23.30$, $p < .001$, $\eta 2 = .34$. We then conducted a 2 (video: first neutral, first emotional) x 15 (emotion) repeated measures ANOVA, which demonstrated there was a significant interaction between video and emotion, $F(14, 644) = 23.73$, $p < .001$, $\eta 2 = .34$.
Finally, we conducted 15 dependent samples *t*-tests, which demonstrated there were significant differences in emotion ratings between the neutral and emotional video. The change in emotion ratings were observed for excitement; $t(45) = 5.57$, $p < .001$, $d = .71$, amusement; $t(46) = 9.79$, $p = <.001$, $d = 1.50$, surprise; $t(46) = 3.93$, $p < .001$, $d = .64$, and interest; $t(46) = 3.93$, $p < .001$, $d = .65$. Participants also reported feeling significantly less sad, $t(45) = -2.71$, $p < .001$, $d = .33$. These results indicated that the emotional video was able to reliably elicit discrete positive emotions, with little/no other negative emotional responses. Furthermore, the video decreased the intensity of certain negative emotions such as sadness. Thus, our hypothesis was supported. The findings expanded upon previous findings by contributing a new video that can be used as stimuli in future emotion experiments.

Entry Number: 14 GB
EXAMINATION OF GENDER DIFFERENCES IN EMOTIONAL EXPERIENCES IN RESPONSE TO EMOTION-ELICITING VIDEOS
By: Shinichi Kogi and Annecy Majoros
Psychology
Faculty Advisor: Dr. David Matsumoto and Dr. Hyi Sung Hwang
Abstract: Existing literature provides inconsistent evidence that men and women report emotions differently. Some studies, which utilized video as the emotion-eliciting stimuli, report that women rate emotions more intensely than men (Gross and Levenson, 1995; Codispoti, 2008); while others report no gender differences (Philippot, 1993; Kring and Gordon, 1998). The current study sought to examine gender differences for emotion ratings in participant responses to video stimuli. Students at San Francisco State University (N = 38; 25 females, 13 males) watched five video clips (3 neutral and 2 emotion). After each video, they rated the intensity of 15 discrete emotions using 9-item Likert Scale. To test the research question, whether women and men experience emotions similarly or differently, a 2(Gender) x 5(Video) x 15(Emotion) mixed factorial ANOVA was conducted. Mauchley's test of sphericity indicated a violation of sphericity for both Video $\chi^2(9) = 29.225$, $p = .001$, and Emotion Assessment, $\chi^2(104) = 468.601$, $p < .001$. Therefore, all values reported are based on Greenhouse-Geisser corrections. The results revealed no interaction effects of Gender on emotion intensity ratings, $F(4.108, 147.904) = 0.641$,, $p = .638$, $\eta^2 = .000$, indicating that females and males did not differ in how intensely they rated emotions, regardless of video. There was also no three-way interaction of Gender x Video x Emotion, $F(10.741, 386.690) = .851$, $p = .587$, $\eta^2 = .000$, indicating no gender differences in emotion ratings for the different videos. Although there were no effects of gender, there was a significant interaction effect of Emotion x Video, $F(10.741, 386.690) = 23.259$, $p < .001$, $\eta^2 = .018$, such that the videos elicited emotions which differed significantly from one another. Because our research question examined gender differences, no further analyses were conducted on Emotion x Video. In conclusion, for these emotion-eliciting stimuli, there are no gender differences in self-reported emotional experiences. This may be due to factors such as, a small sample size or that not enough differences were significant, thus producing a null result. We cannot conclude that there were no gender differences in emotion ratings from the null results.

Entry Number: 15 GB
RELATIONSHIP BETWEEN PARENTAL AND YOUNG ADULT EMOTION REGULATION: THE MEDIATING ROLE OF PARENTAL EMOTION SOCIALIZATION
By: Xiaoye Xu
Psychology
Faculty Advisor: Dr. David Matsumoto and Dr. Jeff Cookston
Abstract: Parents are important emotion regulation guides for infants' and young children's emotion regulation (ER). However, few studies have examined parental influence on young adults' ER. Parent's ER and parental socialization of emotions appear to be important predictors of ER among children and adolescents (Saritas et al.,

2013). Since they have not been tested among young adults, the present study focused on their prediction to young adults' ER. From the perspective of parental socialization, parenting effort could be effective only when it matches the domain of children's interaction (Grusec & Davidov, 2006). Positive parental socialization of emotions, which refers to parents' positive responses to children's emotions (O'Neal & Magai, 2005) would be the appropriate effort to children's emotional activities, so we hypothesized it to be a mediator in the relationship between parent's ER and young adults' ER. Participants: 214 young adult (age: 18-25, *M*age = 21.92, *SD* = 2.22; 69% female)-primary caregiver dyads completed a survey online. Measures: Parents' and young adults' ER was assessed using the Difficulties in Emotion Regulation Scale (Gratz & Roemer, 2004), which includes six dimensions of difficulties in ER. Parent-reported socialization was assessed using the Coping with Children's Negative Emotions Scale (adapted version; Shortt et al., 2015), which has three positive socializations, problem-focused reactions, emotion-focused reactions and encouragement of young adults' emotion expression. Young adult-reported socialization was measured with the Emotions as a Child Scales (Magai, 1996). The only positive socialization in the scale was rewarding, which means parents' comfort, emphasis and help to solve children's problems. Results: We put all four positive parental socialization indicators into a model as mediators at the same time and analyzed the data using the SPSS program PROCESS (Hayes, 2013). Among the four mediators, young adult-reported rewarding was the only one that had confidence intervals that did not overlap with zero. After controlling for rewarding, the indirect effect between parents' and young adults' ER difficulties also had confidence intervals that did not overlap with zero. Overall, our data partly supported our hypotheses. Young adult-reported rewarding was the only partial mediator between parents' and young adults' ER difficulties whereas none of the parent-reported positive socializations were predictive. Among the few studies that compared parents' report and young adults' report on parental socialization, the study demonstrated that as young adults' lives become more independent and sophisticated, their parents' help on solving children's problems or adjusting children's emotions may be beneficial only if young adults perceive the help to be effective.

Entry Number: 16 GB
IS EMOTIONAL REACTIVITY CORRELATED WITH AGE?
By: Yohei Nishio, Gerald Young, and Anna Rachel Valdez
Social Psychology
Faculty Advisor: Dr. David Matsumoto and Dr. Hyi-Sung Hwang
Abstract: Whether a relationship between age and emotional reactivity exists is unclear. Some have suggested that emotional responses increase in intensity as you age whereas others have found an attenuated relationship. Further complicating the topic, some have found no link between emotional reactivity and age. The current study was designed to investigate the relationship between emotional reactivity and age using both positive and negative emotional videos. Participants (N = 35) watched two pairs of videos in which each pair began with a neutral video and was followed by a video intended to elicit emotion (1 positive and 1 negative video). Each neutral video served as baseline to determine the degree to which the emotional videos evoked an emotional response. After each video, participants provided self-reported ratings of various emotions and emotional reactivity was operationalized as the reported change from baseline following each emotional video (Video ratings - Baseline ratings). For the emotions that significantly changed following the emotional videos, we correlated age with the reported change in emotion. Following the positive emotional video, we failed to find a relationship between emotional reactivity and age. With respect to the negative emotional video, we also did not observe a significant relationship between emotional reactivity and age. Thus, at least in regards to the current stimuli, it appears emotional reactivity may be unrelated to age. However, 77% of the current sample was between the ages of 18 and 26 so the null finding may be due to a constrained distribution of ages. Or, the contents of the videos may not have been amenable to all age groups, which may have resulted in variation to which emotions were elicited. Thus, a relationship between a single emotion and age would be harder to detect. Future studies should recruit a sample with individuals of various age groups and employ contents of video that influence a wider range of generations to more conclusively determine if emotional reactivity is associated with age.

Entry Number: 17 GL
DOES BRD4-MEDIATED TETHERING TO ACTIVELY-TRANSCRIBED HOST CHROMATIN PROMOTE KAPOSI SARCOMA-ASSOCIATED HERPESVIRUS TRANSCRIPTION?
By: Hillary Struthers
Biomedical Science (PSM-Biotechnology)
Faculty Advisor: Dr. JJ L. Miranda, Lily Chen
Abstract: Kaposi sarcoma-associated herpesvirus (KSHV) recruits a chromatin-associating protein, Brd4, from its host to form part of the tether between the episome and human chromosomes. Although this protein is known to bind actively-transcribed host chromatin, the role of Brd4 in KSHV transcription is poorly defined. I hypothesize that Brd4 brings the viral episome toward actively-transcribed host chromatin in 3D space to facilitate viral transcription. Using a small molecule that specifically inhibits Brd4, I will measure the KSHV transcriptome in the presence and absence of Brd4-mediated tethering. I will simultaneously use Hi-C sequencing to detect decreases in proximity between actively-transcribed host chromatin and the KHSV episome. I expect that Brd4 inhibition will downregulate viral transcription, and will decrease KSHV association with actively-transcribed host chromatin. This will indicate that Brd4 promotes viral transcription by targeting specific regions of the human genome. This information is important for developing better treatments for cancers caused by KSHV and understanding how 3D colocalization fits into the regulation of viral transcription.

Entry Number: 18 GL
ENDOGENOUS NITRIC OXIDE DECREASES SENSITIZATION IN THE NERVOUS SYSTEM OF *MANDUCA SEXTA*
By: Fernando R. Curiel
Cell & Molecular Biology
Faculty Advisor: Dr. Megumi Fuse
Abstract: Nitric oxide (NO) is known as an important signaling molecule in the central nervous system (CNS) of vertebrates and invertebrates. NO is a cell permeable gas. Once it reaches its receptor soluble guanylyl cyclase, it causes an increase in cGMP formation in target nerve cells. Nitric oxide synthase (NOS), the enzyme that forms NO, and soluble guanylyl cyclase have been observed in the peripheral and central nervous system of the caterpillar *Manduca sexta.* The hornworm *M. sexta* elicits a defensive strike in response to noxious stimuli. In addition this response can be sensitized with mechanical damage, requiring less force to activate, making *M. sexta* a great model to study NO's role in nociceptive sensitivity as well as other pain models such as allodynia and hyperalgesia. The NO/cGMP pathway has many physiologic and cellular functions. It is implicated in learning and memory, long-term potentiation (LTP), synaptic plasticity, and increases neuronal firing frequency. NO has a complicated role in modulation of nociception, often having opposite effects depending on site of action. In *M. sexta* NO is involved in regulating excitability in motor neurons via cGMP and mAChRs in mono-synaptic responses like the proleg withdrawal. However the role of NO in nociception after tissue damage in more complex behaviors such as the defensive strike remains unclear. Here we attempt to elucidate whether changes in endogenous levels of NO in *M. sexta* have an effect on nociception or sensitization. We hypothesized that blocking NO formation with the NOS inhibitor NG-nitro-L-arginine methyl ester (L-NAME) would cause a decrease in sensitivity to mechanical stimulation so greater force would be required to elicit a strike (analgesic); and NO substrate L-arginine would increase sensitivity. We used a published behavioral assay where a hypersensitized state was induced with a pinch and the up-down method was used to assess nociception with calibrated von Frey filaments. The animals were injected with varying concentrations of L-NAME or L-arginine in order to block or activate endogenous levels of NO prior to testing. Additionally a hypersensitized state was created using a pinch as a noxious stimuli. We determined that L-NAME treated animals without pinching required significantly less force to elicit a striking response compared to baseline threshold. This suggestied that blocking the endogenous NO concentrations creates a hypersensitized state in the animal similar to that of a noxious stimulius like a pinch. There was no significant difference in the force required to elicit a strike between pinched and L-NAME treated animals. Animals treated with NO activator L-arginine also increased sensitization.This study attempts to show that natural endogenous levels of NO in the nervous system may serve as mild analgesics that block normal stimuli from being perceived as noxious.

Entry Number: 19 GL DISPLAY ONLY
DEFINING THE FUNCTIONAL ROLES OF HISTONE VARIANT DOMAINS INVOLVED IN SPERM-SPECIFIC GENE REGULATION
By: Monet Andrea Jimenez
Cell & Molecular Biology
Faculty Advisor: Dr. Diana Chu
Abstract: During spermatogenesis, it is imperative that the right genes are accessible at a precise time and place; therefore, the regulation of DNA accessibility is a highly complex process. DNA is organized into nucleosomes composed of the core histones H2A, H2B, H3, and H4, which are then further compacted into chromatin. Histones are central components of chromatin that influence how tightly, or loosely, DNA is packaged. Helping to diversify how chromatin compaction is regulated, core histones are replaced with respective histone variants. Histone variants have been key contributors to a multitude of cellular processes gone wrong, including cancer. Though their incorporation is conserved, it is not fully understood how they alter DNA accessibility. In C.elegans, there are two key H2A variants: the evolutionarily conserved HTZ-1 and sperm-specific HTAS-1. With unique incorporation during spermatogenesis, and since mutants lacking their expression results in sterility and sub-fertility, respectively; we are interested in understanding how these histone variants function distinctly during spermatogenesis. Upon comparison, these histone variants differ the most in their N- and Cterminal domains, thus I hypothesize that these variable domains correlate to their unique incorporation and differential influences on DNA accessibility. To test this, I will be using Fluorescent-In-Situ-Hybridization to visualize if HTZ-1 and HTAS-1 preferentially localize to “active” DNA and/or “repressed” DNA. I will also be using the CRISPR/Cas-9 genome editing system to engineer independent expression of the differing domains to identify important regions that are required for successful spermatogenesis. I expect that the N-term and C-term domains of HTZ-1 and HTAS-1 will be key, since these regions are most accessible to cell-type specific players involved in regulating chromatin. By assessing each domain on an independent basis and whether these variants are turning genes “on” or “off,” we provide insight about how histone variants work together to sustain cell-type diversity. This will not only bridge gaps in knowledge about the understudied spermatogenesis, but will provide insight about the way cells regulate DNA accessibility in a tissue-dependent manner.

Entry Number: 20 GL
SEX-SPECIFIC KINETOCHORE FEATURES IN SPERM MEIOSIS
By: Christopher Black
Cell & Molecular Biology
Faculty Advisor: Dr. Diana Chu
Abstract: Sperm chromosome segregation has unique features compared to oocyte meiosis. Oocytes undergo two rounds of asymmetrical segregation without centrosomes, while sperm have symmetrical divisions and utilize centrosomes to organize microtubule attachment to chromosomes. This attachment is mediated by a protein complex called the kinetochore, but the role of the kinetochore during sperm meiosis remains poorly understood. We have evidence that the kinetochore may be regulated by sperm-specific phosphatases GSP-3/4 that are required for chromosome segregation. gsp-3/4 mutant sperm exhibit delayed resolution of a univalent lagging X chromosome and sisters fail to separate, which suggests GSP-3/4 regulate kinetochore-microtubule connection to organize sister chromatid orientation from segregating to the same pole in meiosis I to opposite poles in meiosis II. Therefore, I hypothesize sperm uniquely require kinetochore-microtubule attachment/detachment and GSP-3/4 regulate detachment. Interestingly, GSP-3/4 localize in a kinetochore-like pattern, which suggests these phosphatases regulate kinetochore function. Sperm also have distinct kinetochore retention during anaphase compared to oocytes, where the kinetochore proteins KNL-1, KNL-3, and NDC-80 are removed, suggesting kinetochore function for sperm chromosome segregation. Recent super-resolution images of immunostained sperm in anaphase I show there is a gap between chromosomes and microtubules where NDC-80 localizes, indicating the kinetochore functions in sperm meiosis to connect chromosomes to microtubules during anaphase separation. Visualization of chromosome movement with live imaging H2B labeled DNA and GFP labeled tubulin shows sperm meiosis exhibits pole-chromosome shortening (anaphase A) in anaphase I, which contrasts to oocyte meiosis and mitosis, which rely on anaphase B mechanisms. These results support a unique sperm chromosome segregation where GSP-3/4 detaches microtubules from kinetochores. GSP-3/4-regulated detachment would allow X resolution and sisters to shift orientation towards

opposite poles. We suggest that kinetochore-microtubule detachment is unique in sperm to reconcile the combination of centrosome organized microtubules and chromosomes going through two rounds of segregation.

Entry Number: 21 GL
Histone Variant HIS-35: The Sexy Wrap Artist
By: Criszel Corpuz
Cell & Molecular Biology
Faculty Advisor: Dr. Diana Chu
Abstract: The pathological cause of infertility can be related to misregulation of DNA accessibility in germ cell nuclei. Germs cells become sperm and oocytes through histone-mediated mechanisms that establish unique gene expression patterns. During germline development, histone variants replace corresponding histones H2A, H2B, H3 and H4. In *C. elegans,* three H2A variants were identified: HTZ-1, HTAS-1 and HIS-35. HTZ-1 is a known regulator of developmental genes while HTAS-1 is a unique component of sperm. However, the role of HIS-35, which differs from core H2A by only one amino acid is unknown. Preliminary data revealed HIS-35 enrichment in sperm and oocytes, therefore, I hypothesize that HIS-35 participates in germline development to optimize fertility. To determine HIS-35 effects on fertility, we developed a mutant strain with a deletion of the *his-35* gene. Results reported a 35% reduction in progeny, indicating HIS-35 is necessary for fertility. Furthermore, *his-35; htas-1* double mutants are sterile, which is a phenotype more severe than *his-35* and *htas-1* mutants alone. These results suggest that these H2A variants may compensate for one another to optimize fertility. Since we have demonstrated that HIS-35 is an important fertility factor, this may hint that it localizes within the germ line. To assess dynamics of HIS-35 in live cells during developmental events, CrisprCas9 mediated repair system was utilized to tag the H2A variant with Green Fluorescent Protein (GFP). Surprisingly, our results depicted HIS-35::GFP localization in almost all tissues, in addition to male and hermaphrodite germ lines. HIS-35::GFP is even retained in mature sperm, oocytes and present within the newly-fertilized embryo. These findings raise the possibility that HIS-35 may be maintaining gene expression patterns throughout the developmental events of gametogenesis, fertilization and embryogenesis. Gaining knowledge on histone variant mechanisms that influence fertility can be implicated in future clinical settings to provide fertile inductions and contraceptive treatment.

Entry Number: 22 GL
INVESTIGATING A NATURE BASED INTERVENTION ON STRESS IN DIVERSE COMMUNITIES IN THE BAY AREA
By: Eric Johnson
Cell & Molecular Biology
Faculty Advisor: Dr. Leticia Marquez-Magana, Dr. Aiko Yoshini, and Dr. Jackson Wilson
Abstract: Social and environmental stress harms ethnic minorities most. Constant adaptation to these external stressors impairs internal physiological systems and amplifies damage caused by chronic disease. This is illustrated by the highest rates of mortality due to cardiac disease in African Americans and highest rates of premature death due to Type 2 Diabetes in Latinos. These health injustices require innovative interventions for improving health in marginalized communities. Exposure to nature provides a variety of physiological and psychological health benefits. Knowing this, programs such as Healthy Parks Healthy People (HPHP) have instituted park based activities as community provisions. The impact of HPHP on stress reduction however, has not been established. This project aims to investigate the benefit of a Healthy Parks Healthy People program on biological and psychological stress. We recruited underrepresented minorities for participation in a nature walk at a Bay Area park. Consenting individuals donated saliva before and after the walk for the subsequent quantification of the stress hormone Cortisol. Psychosocial measures were collected as well. In this study, we reported decreases in biological and psychological measures of stress as a result of the intervention. Additionally, positive affects increased and negative affects decreased after the walk. Stress is the engine that propels ethnic minorities towards greater rates of disease. Continued development of these stress-reducing interventions may eliminate the disease burden in communities of color. These evidence based interventions for advancing community health are necessary, as they will inform policymakers on the need to expand beneficial community provisions. It is this model of health equity that will drive sustained health and wellbeing. Social

and environmental stress harms ethnic minorities most. Â Constant adaptation to these external stressors impairs internal physiological systems and amplifies damage caused by chronic disease. This is illustrated by the highest rates of mortality due to Cardiac disease in African Americans and highest rates of premature death due to Type 2 Diabetes in Latinos. These health injustices require innovative interventions for improving health in marginalized communities. Exposure to nature provides a variety of physiological and psychological health benefits. This fact is leveraged by programs such as Healthy Parks Healthy People (HPHP) that sponsor park based activities as community provisions. The impact of HPHP on stress reduction, however, has not been investigated. This project aims to investigate the benefit of a Healthy Parks Healthy People program on biological and psychological stress. We intend to recruit underrepresented minorities for participation in a nature walk at a Bay Area park. Consenting individuals will donate saliva before and after the walk for the subsequent quantification of the stress hormone, cortisol. Psychosocial measures will also be collected. Â In this study, we expect to report decreases in salivary cortisol as the biomarker of physiological stress.
Stress is the engine that propels ethnic minorities towards greater rates of disease. Continued development of stress-reducing interventions may eliminate this disease burden in communities of color. Though once marginalized, these communities can now be represented in health promoting interventions. This shift towards health equity will be the engine that will propel all communities towards sustainable health.

Entry Number: 23 GL
GSP-3/4 PHOSPHATASES PLAY ESSENTIAL REGULATORY ROLES IN THE JOURNEY FROM SPERMATOGENESIS TO FERTILIZATION
By: James Gerh
Cell & Molecular Biology
Faculty Advisor: Dr. Diana Chu
Abstract: Sex-linked genes are pressured to evolve due to environmental changes and the importance of fertility. This competitive nature drives certain regulatory genes towards novel roles in multiple processes. Two sex-linked genes that are essential in different fertility pathways are gsp-3 and gsp-4. Knockdown of gsp-3/4 resulted in sterility. These 98% identical genes arose from a duplication event and encode sperm-specific phosphatases that are orthologous to the PP1 gamma phosphatase in humans. We find that the GSP-3/4 phosphatases in C. elegans function sequentially in sperm meiosis, sperm motility, and the completion of oocyte meiosis. First, tracking of fluorescently-labeled chromosomes during sperm meiosis show gsp-3/4 mutants take longer to segregate in meiosis I, and fail to segregate during meiosis II. In gsp-3/4 mutants CLS-2, a central spindle protein that stabilized microtubules, is dumped into the mid-zone during meiosis I. We hypothesize that GSP-3/4 dephosphorylates CLS-2 as a regulatory switch to release the plus end of microtubules. This allows for microtubule de-polymerization during chromosome segregation. Secondly, sperm are less motile in gsp-3/4 mutants. Sperm motility is driven by actin independent pseudopodial locomotion, where MSP proteins form filaments to create movement. Immunostaining and live imaging show that GSP-3/4 localize towards the disassembly end of MSP filaments. We hypothesize that GSP-3/4 play a regulatory role in disassembling MSP to complete this process of motion. Thirdly, GSP-3/4 is delivered with the paternal DNA post-fertilization. It is hypothesized that GSP-3/4 acts as a signal for the completion of oogenesis. Co-IP with mass spectrometry will uncover interacting partners and targets that these phosphatases regulate. Understanding the regulatory roles of GSP-3/4 in their journey throughout spermatogenesis, motility, and oogenesis will allow us to tackle male infertility and potential targets for male contraceptives.

Entry Number: 24 GL
CHARACTERIZATION OF CDC24 SECOND-SITE SUPPRESSORS, CSC1 AND CSC2
By: Nghiep Ly
Cell & Molecular Biology
Faculty Advisor: Dr. Sally Pasion
Abstract: The fission yeast Cdc24 protein is proposed to be required for complete processing of the lagging strand in DNA replication. When this protein gets mutated, it results in chromosome breakage and loss of cell viability at the restrictive temperature of 36°C (ts)(1). Previous research showed that, besides DNA replication, Cdc24 protein also participates in DNA repair, telomere maintenance, and chromatid cohesion (1, 2, 3, 4, 5). However, it is still unknown how this protein works. In 2012, two cold-sensitive mutants carrying second-site

suppressors of cdc24-G1 truncation mutation, csc1 and csc2, were isolated by Shani Chapman in the Pasion lab (6). The identity and function of csc1 and csc2 genes are still unknown. Using flow cytometry analysis, she showed that csc1 mutants arrest in mitosis when grown at 15°C, which implicated its role in mitosis. In this study, using random spore analysis, we showed that csc1 and csc2 genes are not mutations on the same gene, and flow cytometry analysis shows that csc2 mutants arrest in mitosis when grown at 15°C. Genomic sequencing of csc2 mutant shows that one of mutations is on the pfh1+ gene, but pfh1+ gene does not rescue the cold sensitive phenotype of csc2 at 15°C even though the cells are no longer elongated under microscope. Because of this reason, we complement csc1cdc24 and csc2cdc24 double mutants with pfh1+ to determine whether it can restore cdc24 ts lethality at 34C. As a result, no colony is forming at 34°C for the double mutants, which suggests that pfh1+ is csc2, and pfh1+ is multi-copy suppressor of csc1

Entry Number: 25 GL
PREDICTING THE EVOLUTION OF AMINOGLYCOSIDE ACETYLTRANSFERASE (AAC) MUTATIONS IN THE ROLE OF ANTIBIOTIC RESISTANCE
By: Olivia Pham
Cell & Molecular Biology
Faculty Advisor: Dr. Pleuni Pennings and Dr. Misty Kuhn
Abstract: The use of antibiotics may either cure a bacterial infection or can lead to the evolution of drug resistance. In a population of bacteria in a patient, a few of the bacteria may be resistant to antibiotics. Constant use of antibiotics kills the harmful bacteria causing the illness and surviving resistant bacteria can take over the population which can lead to the evolution of resistance. For example, bacteria have acquired antibiotic-modifying enzymes that combat the effectiveness of antibiotics. One group of enzymes adds an acetyl group to the 6' end of the antibiotic aminoglycosides. This enzyme group is called the aminoglycoside acetyltransferases (AACs). Generally, AAC enzymes have been extensively studied because they can lead to drug resistance in hospital-acquired infections but there is still a large gap in understanding the molecular function and evolutionary origin. Therefore, little is known about AAC(6')-Ig and -Ih enzymes. In a previous study, it was shown that the catalytic abilities of both AAC(6')-Ig and –Ih were 2-to-3-orders of magnitude lower than other classes of AACs *in vitro* (Stogios et al. 2016). This suggest that there is a potential for AAC(6')-Ig and –Ih enzymes to evolve and become better modifying enzymes. This present a great opportunity to study mutations that can lead to increased efficiency of AAC enzyme acetylating aminoglycosides. For my research, I will make use of the available 3D crystal structures to pick possible mutations to study. My goal is to build a AAC(6')-Ig and -Ih mutant library that will characterize these enzymes' catalytic abilities. I will create mutants with a single point mutation and characterize catalytic abilities based on different concentrations of antibiotics. Ultimately, this AAC(6')-Ig and -Ih mutant library will provide more information on how AACs evolve to combat antibiotics.

Entry Number: 26 GL
DND SULFUR RESTRICTION GENES GUARD *SALMONELLA* AGAINST PHAGE INFECTION
By: Steve Flammer, MiriamValenzuela, and Annie Lo
Cell & Molecular Biology
Faculty Advisor: Dr. Lily Chen
Abstract: Restriction modification (RM) systems contain genetic elements which allow bacteria to resist infection by viruses (bacteriophage). One specific RM system called Phosphorothioation (PT) RM, uses restriction activity of *DndFGH* gene products to cleave foreign genetic material while protecting its own genome with a DNA sulfur backbone modification. Although it is known that DndFGH cleaves non-PT modified DNA, the effectiveness of the *DndFGH* gene products to defend Salmonella enterica against viral infection has not been tested. To determine whether DndFGH restriction activity offers *S.* enterica Saintpaul SARA23 (S23) resistance to viral infection, plaque assays were used to measure the Sp6 phage titer in CRISPRi gene knockdowns for *DndFGH* genes. Plaque quantity and size increased significantly upon repression of DndFGH. The results suggest that DndFGH restriction genes play an important role in cell defense against viral infection and that DndFGH deficient S23 could act as a new host for Sp6 Elucidating the regulatory role of these RM systems can help inform the development of bacteriophage therapies.

Entry Number: 27 GL
SIZE AND LOCALIZATION OF VACUOLES IN FISSION YEAST
By: William Chadwick
Cell & Molecular Biology
Faculty Advisor: Dr. Mark Chan
Abstract: The importance of organelles, like the yeast vacuole or human lysosome, that degrade material within a cell has been established for decades, but the control mechanisms responsible remain a broad and unexplored field. Mutations and defects in the regulation of the human lysosome, our vacuole equivalent, have been found to be responsible for numerous fatal diseases, but research in yeast vacuoles has led to advancements in treatments for these diseases. Despite the potential of this research, the mechanism of regulation for the size, shape, and number of Schizosaccharomyces pombe's vacuoles relative to cell length is an understudied and

poorly understood system. The specific proteins involved in the fission and fusion of the vacuoles during osmotic stress have been categorized, but the role of vacuole localization and the relation between vacuole volume and surface area has yet to be explored. By mutating proteins believed to be involved in the localization of vacuoles (such as the myosin V motor protein myo51) within the cell, coupled with a characterization of morphologies such as shape, size, and number of vacuoles, a comparison between wild-type and mutant strains can be established. This comparison will illustrate potential aspects of the vacuole the cell prioritizes in various situations, such as maximizing volume versus surface area, or creating more vacuoles versus increasing the size of existing ones. This information has the potential to lead to discoveries within the human lysosome, which shares a considerable amount of genes with the yeast vacuole. These discoveries can also lead to innovations in the fields of biotechnology, biomedical research and advancements, and especially in the health field where similar research has already shown great promise in treating several human diseases.

Entry Number: 28 GL
DIRECT MONITORING OF NITRIC OXIDE LEVELS SHOW CARDIOGENIC SIGNALING IN EARLY STAGED CHICKEN EMBRYOS
By: Devan Shah
Cell & Molecular Biology
Faculty Advisor: Dr. Wilfred Denetclaw
Abstract: Nitric oxide is an omnipotent gaseous messenger molecule which signals in early chicken embryo development to regulate neurogenesis, somitogenesis, and early embryo morphogenesis through a canonical NO/sGC/cGMP pathway. Previously, our lab reported NO involvement in somite myotome formation through direct monitoring of NO paracrine signaling dynamics from ectoderm into the dorsal somite epithelium. However, little is known about NO paracrine signaling in embryonic cardiomyogenesis, which begins approximately 24 hours earlier to somite myogenesis. It is known that NO signals in adult heart-derived cardiac stem cells for cardiomyocyte formation, but it is presently unknown if NO levels are elevated in early embryo cardiogenesis to support its role in heart formation. To investigate, HH3-4 staged chicken embryos were loaded with DAF-2DA fluorescent NO indicator and monitored for NO changes by confocal microscopy. In addition, nitric oxide synthase inhibitor (25 mM L-NAME) was applied to block NO production, and its effects assessed in early embryo development. We show HH3-4 staged embryos have high NO levels in mesoderm and primitive streak (PS) both containing precardiac cells. Confocal serial images further show endoderm strongly elevated in NO, like mesoderm, but ectoderm with much lower NO levels. In embryos at HH5, migrating precardiac cells entering the bilateral heart fields display elevated NO presence to suggest involvement in cardiac differentiation. Subsequent embryo development at HH7 showed elevated NO in the bilateral cardiac crescent where cardiomyocytes are initiating heart tube formation. The application of L-NAME to HH3-4 staged embryo cultures for 24 hours resulted in low levels of NO in mesoderm compared to controls. Furthermore, acrylic beads saturated with L-NAME and placed on the right side of these embryos resulted in severe abnormalities in early brain development with loss of the right side proencephalon and structural abnormalities in right side mesencephalon and rhombencephalon. However, this treatment did not result in the inhibition of heart tube formation, but abnormal heart tube formation was observed. In conclusion, we show for the first time by direct DAF-2 monitoring of NO formation in early chicken embryos that NO is elevated in cardiac mesoderm and in heart forming areas. Extrinsic signals like Wnts, FGF, Shh and BMPs regulate mesodermal cardiogenic changes and may mediate their signaling activities through NO and its canonical signaling pathway.

Entry Number: 29 GL
EFFECTS OF THE CELL CYCLE ON VACUOLE SIZE IN S. CEREVISIAE
By: Jasmine Sims
Cell & Molecular Biology
Faculty Advisor: Dr. Mark Chan
Abstract: Lysosomes are vital for degrading subcellular proteins no longer needed by the body. Malfunctions in degradative ability may lead to lysosomal storage disorders such as Tay-Sachs or Sialic Acid Storage Diseases. Our research studies the changes in morphology of vacuoles in *S. cerevisiae* yeast. Vacuoles are a homologous organelle model for lysosomes in humans. We ask whether changes in vacuole size and degradative function are dependent on the cell cycle. We hypothesize that the progression of the cell cycle may influence changes in

vacuolar size. Furthermore, we hypothesize that the progression of the cell cycle also governs the vacuole's degradative ability. If we find a link between the changes in vacuolar morphology, cell cycle progression, and degradative function, our results would mean that we could potentially predict degradative functionality based on morphology. This research provides potential for future therapeutic breakthroughs.

Entry Number: 30 GL
ELUCIDATION OF THE MOLECULAR FACTORS THAT PARTITION THE ENDOPLASMIC RETICULUM ASYMMETRICALLY DURING CELL DIVISION
By: Cecelia Brown
Cell & Molecular Biology
Faculty Advisor: Dr. Blake Riggs
Abstract: The potential of cells to develop into different lineages is tightly regulated during the lifecycle of an organism. Defects in an organism's ability to regulate the developmental potential of cells can lead to abnormal proliferation and tumorigenesis. However, the mechanisms by which cells are selected for differentiation are poorly understood. Our laboratory has observed a novel phenotype in Drosophila melanogaster neural progenitor cells in which 17% of the cells partition their Endoplasmic Reticulum (ER) asymmetrically during a stage of embryonic development when maternal control of the embryo shifts to the zygotic genome, otherwise known as the mid-blastula transition. Interestingly, disruption of this ER partitioning process causes mitotic delay, mitotic failure, and death of the fly in the larval stage. These phenotypes suggest that ER partitioning plays an integral role in cellular development, yet molecular factors that may facilitate this ER partitioning are unknown. We hypothesize that genes transcribed during the mid-blastula transition regulate the asymmetric partitioning of the ER resulting in two daughter cells with unequal amounts of ER. In addition, we also hypothesize that the daughter cell that receives the least amount of ER is the cell chosen to differentiate down the neural lineage pathway. Here, the elucidation of molecular factors will be done by a novel recessive mutation screen. By eliminating portions of the Drosophila genome, we can expect to see defects in ER partitioning that can reveal the genes responsible for this process. Our results can identify the proteins involved in partitioning the ER into the daughter cells, and characterize a novel role for the endoplasmic reticulum in cell signaling and cell fate selection.

Entry Number: 31 GL
DOES THE MAKEUP MATTER? FORENSIC DATABASES.
By: Gerid A Ollison
Cell & Molecular Biology
Faculty Advisor: Dr. Rori Rohlfs
Abstract: Black men make up 6.5% of the total U.S. Population however they make up 40% of the prison population in America. In 2008, African Americans and Hispanics made up 58% of the total U.S. prison population. Coupled with the fact that nationwide African-Americans represent 26% of juvenile arrests, 44% of youth detainees, and 58% of youth sent to state prisons, it is a fair assumption that the U.S. prison population over-represents the African Americans. As a result, those that are disproportionately represented in prisons are inferred to be over represented in forensic databases.
Using NIST allele frequencies, R studio was used to generate a list of 100 suspects reflecting California census demographics. The list of suspects was then searched against a three simulated 4000 profile criminal databases of differing proportions: California Census proportions, DOJ prison demographics, and an even divide. The results were tallied and graphed and confirmed my hypothesis. The national forensic database makeup does have larger far reaching implications.

Entry Number: 32 GL
ASSOCIATION BETWEEN PERCEIVED RACISM/DISCRIMINATION AND TELOMERE LENGTH IN AFRICAN AMERICAN WOMEN IN THE BAY AREA
By: Saba Sohail
Cell & Molecular Biology
Faculty Advisor: Dr. Leticia Marquez-Magana and Dr. Amani Nuru-Jeter (UCB, School of Public Health)
Abstract: The purpose of this study is to investigate the connection between experiences of racism and discrimination, and the quantitative measure of telomere length in African American women. We hypothesize

that the participants' level of self-reported racism and discrimination will affect telomere length. To test this hypothesis self-reported racism and discrimination, as well as perceived stress were measured with validated survey tools in 140 African American women. Â Telomere length is being measured using quantitative PCR. This molecular tool will yield a measure of average telomere length from genomic DNA that was isolated from the white blood cells of participants. To date the telomere length of 100/140 samples has been determined. Once this analysis is complete a multivariable analysis will be performed to examine the correlation between telomere length, perceived racism, and chronic stress. I expect stress, due to systemic, interpersonal, and internalized racism and discrimination, to be associated with shorter telomere lengths in African American women. This is the first study to examine racism and biological markers of stress and aging in African American women in the Bay Area. Results from this study will contribute understanding of the causes of health disparities for ethnic minorities and potentially eliminate factors that contribute to premature biological aging.

Entry Number: 33 GL
INVESTIGATING RELATIONS BETWEEN INTUITIVE THINKING AND MISCONCEPTIONS ABOUT ECOSYSTEM CHANGE ACROSS LEVELS OF BIOLOGY EDUCATION
By: Alexandra Cooper, Lauren Diez, Shane Garvin, Maribel Juarez, Esteban Geo Pineda, and Khanh Tran
Ecology, Evolution, & Conservation Biology
Faculty Advisor: Dr. Michal Fux (Northeastern University), Dr. Kristin de Nesnera, Dr. John Coley (Northeastern University), and Dr. Kimberly Tanner
Abstract: Students enter educational settings with complex and well-established intuitive conceptual understandings of the world, which have important educational consequences. In biology, we hypothesize that many persistent misconceptions may have origins in these intuitive ways of knowing. In this study, we investigated (1) the relationship between student misconceptions about ecosystem change and three types of intuitive thinking (anthropic, teleological, and essentialist thinking) and (2) how formal biology education might influence this relationship. We examined non-biology major (NBM), entering biology major (EBM) and advanced biology major (ABM) student responses (n=49) to teleological, essentialist, and anthropocentric challenge statements to determine the degree to which students agree with misconceptions about ecosystem change, the degree to which students use intuitive reasoning to explain their ideas about ecosystem change, and the degree to which agreement with misconceptions is correlated with the use of intuitive thinking.
We found greater than 50% agreement with teleological and anthropocentric challenge statements across all three student populations (NBM, EBM, ABM), and 50%, 44% and 35% agreement with the essentialist challenge statement for NBM, EBM, and ABM populations, respectively. All three types of intuitive reasoning were present in student responses but varied by challenge statement and student population. The use of anthropic reasoning was strongly correlated with agreement with the anthropic challenge statement for all three student populations, The use of essentialist reasoning was correlated with agreement with the essentialist challenge statement for EBM but not NBM or ABM. And the use of teleological reasoning was correlated with agreement with the teleological challenge statement for ABM but not NBM or EBM. These findings demonstrate a clear but complex relationship between intuitive thinking and biological misconceptions at the university level.

Entry Number: 34 GL
STUDENT WITHDRAWL MAY 2 2017/ MJ

Entry Number: 35 GL
BACK IN THE BAY: POPULATION STATUS OF THE ONCE EXTIRPATED AND NOW RETURNING NORTH AMERICAN RIVER OTTERS
By: Jordan Arce
Ecology, Evolution, & Conservation Biology
Faculty Advisor: Dr. Eric Routman
Abstract: The objective of this study is to characterize genetic distinctiveness and connectivity between select populations of river otters in Marin County, using molecular genetic techniques. Recent studies have shown that this is possible using analysis of DNA extracted from non-invasive collection of scat and fecal jelly. River otter DNA has been extracted from these samples and amplified using PCR, control region products has been sequenced and microsatellite profiles will be compared to identify levels of population differentiation.

Entry Number: 36 GL
COMPARISON OF MITOCHONDRIAL AND NUCLEAR GENETIC VARIATION OF COMMON ACARTIA SPECIES IN THE SAN FRANCISCO ESTUARY
By: KeChaunte Johnson
Ecology, Evolution, & Conservation Biology
Faculty Advisor: Dr. Sarah Cohen, Dr. Eric Routman, and Dr. Wim Kimmerer
Abstract: Accurate delineation of Acartia spp. is essential to assess the biodiversity of zooplankton communities in the San Francisco Estuary (SFE). Currently, there are three species of Acartia reported in SFE (A.tonsa, A.hudsonica, and A.californiensis), of which the first two were formerly identified as A.clausi. Acartia tonsa is

reported almost globally. Acartia hudsonica is distributed along the coasts of the Northwest Atlantic and the Pacific, while A.californiensis is restricted to the California coast. Previous phylogenetic analyses of SFE and global samples show lack of monophyly for each of these species. Reported average DNA sequence divergence among some Acartia spp. include 16% for mitochondrial cytochrome oxidase c (mtCOI) and 19% for mt16S rRNA. We investigated the genetic diversity of SFE Acartia in comparison to other Acartia spp. sequences available in Genbank including outgroups A.bifilosa and A.longiremis. Copepods were collected from seven SFE sites across varying temperatures and salinities and sequenced at mtCOI and nuclear 18S loci for Bayesian phylogenetic comparison. The results of this study will show divergences between congeneric and conspecific Acartia. However further analysis of additional loci is needed to understand the phylogenetic and population structure of SFE Acartia species.

Entry Number: 37 GL
SHARED PREDATORS DRIVE COMMUNICATION BETWEEN PRIMATES AND BIRDS
By: Eliseo Parra
Ecology, Evolution, & Conservation Biology
Faculty Advisor: Dr. Vance Vredenburg, Dr. Ed Conner, and Dr. Ari Martinez
Abstract: The study of fear promises to greatly improve our unified understanding of ecology. To further explore the relationship between shared predators and eavesdropping networks, we field tested the assumption that sharing predators with another species increases the value of their predator alarms. After eliciting predator alarms from Tamarin monkeys and Antshrike birds using a trained hawk, we measured the response of birds to primate alarms (fewer shared predators) and primates to bird alarms (more shared predators). By showing Tamarins respond significantly to alarms made by Antshrikes, while Antshrikes respond only slightly to alarms made by Tamarins, we support the hypothesis that the proportion of shared predators between species drive eavesdropping networks and shape animals landscape of fear.

Entry Number: 38 GL DISPLAY ONLY
INVESTIGATING THE GROWTH RATE OF A COPEPOD IN THE YOLO BYPASS
By: Stephanie Owens
Ecology, Evolution, & Conservation Biology
Faculty Advisor: Dr. Wim Kimmerer
Abstract: The Yolo Bypass floodplain, in the northern San Francisco Estuary (SFE), offers a unique opportunity to study how management strategies may be compatible and even beneficial to ecosystem health within the floodplain. The Yolo Bypass experiences scheduled agricultural flow pulses during the summer in an attempt to boost productivity. Studies have shown that Chinook salmon increased in size substantially faster in the Yolo Bypass than in the Sacramento River (Sommer et al., 2001). An important food source for larval fish is copepods. However, it is unknown what the effects of these agricultural flow pulses are on copepod growth and what food availability best predicts copepod growth. In order to better understand the impacts of agricultural flow pulses through the Yolo Bypass I will determine dominant phytoplankton compositions and copepod growth rates in relation to these flow pulses. I will also perform in-lab experiments to better understand what food conditions best relate to increased growth rate. I expect to find an increase in quality and abundance of phytoplankton as well as copepod growth rate during and after agricultural flow pulses through the Yolo Bypass. This study will help provide insight to what environmental conditions best promote copepod growth while determining whether or not agricultural flow pulses are an effective management strategy.

Entry Number: 39 GL DISPLAY ONLY
EXAMINING THE DIETS OF LONGFIN SMELT LARVAE IN SHOALS AND TIDAL MARSHES OF THE SAN FRANCISCO ESTUARY
By: Jillian Burns
Marine Science
Faculty Advisor: Dr. Wim Kimmerer
Abstract: The San Francisco Estuary is one of the most altered ecosystems in the world. Longfin Smelt were historically one of the most abundant native fish species in the San Francisco Estuary, but population abundance has declined by over an order of magnitude in the last two-three decades. Decreases in zooplankton abundance, or food availability, is one main reason for the species' decline. Shoals and tidal marshes are important rearing

habitat for larval and juvenile longfin smelt and until recently use of these habitats by longfin smelt has been neglected. Do these areas provide high quality habitat for longfin smelt? To answer this question, I sampled larval fish and zooplankton concurrently in 2016 and 2017 in shoals, tidal marshes, and channels in the brackish northern estuary. Gut content analysis and identification of zooplankton species composition in the environment will show if the sampling sites are productive food sources for longfin smelt larvae. I will compare variations in longfin smelt larvae diets and food availability among different environmental conditions, sampling sites, regions, and years to help determine the mechanisms driving longfin smelt distribution in relation to food availability. If shoals and tidal marshes provide high quality habitat for longfin smelt, restoration could be focused on these areas to promote recovery of the species.

Entry Number: 40 GL
CLIMATE CHANGE EFFECTS ON PHOTOSYNTHETIC SYMBIONTS IN THE SEA ANEMONE ANTHOPLEURA XANTHOGRAMMICA
By: Alison Fisher
Marine Biology
Faculty Advisor: Dr. Ed Carpenter
Abstract: The giant green anemone (Anthopleura xanthogrammica) is an ecologically important species in California and Oregon. Two photosynthetic algal symbionts make these anemones important primary producers in the intertidal zone. This study investigated the effects of changes in temperature and pH on anemones and their symbionts over a natural environmental gradient along the coast of California and Oregon. Zoochlorellae responded negatively to warmer temperatures and positively to more acidic conditions, while zooxanthellae had mixed responses to temperature and pH. Temperature and pH did not affect chlorophyll a concentrations. Anemones were larger in both warmer and more acidic conditions. While climate change effects on symbionts are mixed, the host anemones are likely to benefit from climate change.

Entry Number: 41 GL
ASSESSING GENETIC DIVERSITY IN THE IRRAWADDY DOLPHIN (*ORCAELLA BREVIROSTRIS*)
By: Sam Ayyagari
Marine Biology
Faculty Advisor: Dr. C. Sarah Cohen, Dr. Ellen Hines, and Dr. Susana Caballero (Universidad de los Andes, Bogota, Colombia)
Abstract: Populations of Irrawaddy Dolphins (*Orcaella brevirostris*) residing along developing coastlines and in rivers are especially susceptible to anthropogenic effects that reduce effective population size and genetic diversity. *O. brevirostris* conservation efforts in developing countries have improved with species abundance and habitat range data, but little data detailing population vitality has been collected. Examining diversity in both neutral loci and in adaptive immune system loci (major histocompatibility complex, or MHC) in *O. brevirostris* allows us to assess the severity of genetic bottlenecking in heavily anthropogenically-impacted populations. Twenty-three individuals from the Gulf of Thailand were sequenced at the MHCIIDQB locus and one to two MHC alleles were found in this population. Further research includes amplification and sizing of microsatellite loci, and to include mitochondrial DNA diversity data analysis for this and other Irrawaddy Dolphin populations. Studying variation in highly polymorphic and adaptive loci allows us to assess this population's potential to combat environmental pathogens. Data collected can help coastal managers and conservation efforts efficiently protect this species by considering implementation of genetic rescue programs for particular populations of this species.

Entry Number: 42 GL
WHERE ARE THE CRABS GOING?: MODELING THE DISTRIBUTION OF AN INTERTIDAL ZONE INVERTEBRATE RESPONDING TO GLOBAL CLIMATE CHANGE
By: Alma Ceja
Marine Science
Faculty Advisor: Dr. Jonathon Stillman and Dr. Stephen Kane
Abstract: Rising temperatures resulting from anthropogenically induced climate change have caused population distribution shifts over latitudes and altitudes. These range shifts often result in interspecific competition. Petrolisthes cinctipes, a porcelain crab dwelling in congregations under rocks in the mid-upper rocky intertidal zone, overlaps in range with Petrolisthes manimaculis, a competing congener species inhabiting the mid-lower intertidal zone. We implement an integrative ecological approach in which interspecific competition is addressed in efforts to predict the distribution of the model organism, P. cinctipes, under future climatic scenarios. This agent-based model applies predicted temperature profiles in conjunction with observed environmental (habitat temperature), physiological (Arrhenius breakpoint temperature), and behavioral (escape temperature and competition strength) data gathered from a P. cinctipes population at Fort Ross, CA. Rising temperatures correlate with a downward shift of the population to cooler microhabitats, leading to greater densities and increased interspecific competition. Modeling the heterogeneous thermal landscape of the intertidal zone resulting from elevational differences, tidal waves, and fluctuating solar radiation allows for extrapolation in predicting larger spatial scale distribution patterns. In predicting patterns of a highly variable environment, this model is applicable to similar multivariate systems with altitudinally distributed populations responding to biotic and abiotic factors.

Entry Number: 43 GL
PETROLISTHES CINCTIPES AND THE DEATHLY SHALLOWS: TRANSDUCING ABIOTIC TO BIOTIC STRESS IN AN INTERTIDAL PORCELAIN CRAB
By: Jennifer L. Souther
Marine Science
Faculty Advisor: Dr. Jonathon Stillman, Dr. Alex R. Gunderson, and Dr. Brian Tsukimura (CSU Fresno)
Abstract: Climate change affects behavioral interactions between organisms, but this phenomenon has received relatively little attention. The porcelain crab*Petrolisthes cinctipes* experiences temperatures near its thermal limits in its current range which may cause distributions to shrink under warming. Shrinking ranges would potentially increase population density and competition for resources. This study investigated whether high temperatures cause *P. cinctipes* to behaviorally thermoregulate, causing them to experience negative interactions as a result of increased density. Using injury and mortality as an indicator for negative interactions, we hypothesize that crabs experiencing high temperature spikes will have more injuries than crabs in enclosures with ambient temperatures. Laboratory enclosures were built with two elevations: a "high" and "low" intertidal zone that allows crabs to move between them. Tides and temperatures were controlled with an automated system. Preliminary results indicate that crabs avoid the higher intertidal zone at high temperatures, and in doing so incur more injuries. The combination of abiotic and behavioral stressors may seriously impact the ability of *P. cinctipes* to survive long-term, potentially putting them at risk for local extinction. Increased understanding of the combined effects of abiotic stress and behavioral stress may help us make more realistic predictions about the response of organisms to climate change.

Entry Number: 44 GL
THE IMPACTS OF DENSITY AND COMPETITION ON THE REPRODUCTIVE FITNESS OF INTERTIDAL PORCELAIN CRABS
By: Metadel Abegaz
Marine Science
Faculty Advisor: Dr. Jonathon Stillman, Dr. Brian Tsukimura (CSU Fresno), and Dr. Alex Gunderson (UCB)
Abstract: Climate change is expected to contract the habitat range of the upper-mid intertidal porcelain crab, Petrolisthes cinctipes, increasing its population density and elevating behavioral stresses leading to decreased physiological performance. We aim to determine how increased density and competition impacts fecundity, a proxy for reproductive fitness, indexed by circulating levels of the yolk protein vitellogenin. Vitellogenin levels are closely tied to gamete quality and reduced concentrations of it under high-density conditions may result in smaller brood sizes and lower hatching success under future conditions, thereby reducing fitness. Female crabs were exposed either to high- (450 crabs/m2) or low-density (150 crabs/m2) treatments for 14 days. Hepatopancreas and ovary and hemolymph samples were harvested from each crab and analyzed using an ELISA assay to determine vitellogenin concentrations. Results were compared with heat shock proteins expression of individuals to assess degree of cellular stress response associated with cross treatments. We expected vitellogenin concentrations to be higher in low-density (low stress) treatments relative to high-density (high stress) treatments, and for heat shock proteins to have the opposite response. Understanding behavioral responses can will reveal the indirect physiological consequences through shifts in species interactions and population density

Entry Number: 45 GL
LINKING THERMOSENSORY NEUROPHYSIOLOGY AND THERMOREGULATORY BEHAVIOR IN THE PORCELAIN CRAB, *PETROLISTHES CINCTIPES*
By: Emily Lam
Marine Science
Faculty Advisor: Dr. Jonathon Stillman
Abstract: Small-scale shifts in population distributions are expected to occur in the intertidal zone under future climate scenarios and may reduce fitness. The intertidal crab, *Petrolisthes cinctipes*, experiences thermal

fluctuations that can reach lethal levels. However, both the extent to which crabs move in response to temperature and the thermal thresholds that trigger migration to cooler microhabitats remain unknown. Escape reflexes, which vary with size and reproductive state, allow organisms to remain within their preferred habitat where they are near their optimal body temperature. Smaller crabs have a higher escape temperature (T_{esc}) ($R2=0.39$, $p<0.01$) compared to larger ones. Gravid females have a lower mean T_{esc} (19.6ºC) than non-gravid crabs (22.1ºC). Behavioral responses to changes in temperature may be controlled by thermosensory neuronal systems in the walking legs, as whole organism and neural thermal tolerance are correlated with habitat temperature. We aim to define the thermal thresholds that elicit avoidance behavior, determine variance in populations, and elucidate the mechanical cause by comparing spontaneous action potentials to T_{esc} during stress. The vulnerability of marine organisms to global change is predicated on their ability to utilize and integrate these physiological and behavioral strategies to promote survival and reproductive fitness; understanding these strategies will allow predictions of species distributions under warming and the potential for local extinction.

Entry Number: 46 GL
DISEASE EMERGENCE IN PACIFIC NEWTS: A RETROSPECTIVE STUDY
By: Shruti Chaukulkar
Microbiology
Faculty Advisor: Dr. Vance Vredenburg, Dr. Andrew Zink, and Dr. Andrea Swei
Abstract: Many scientists agree that the current biodiversity crisis is considered the sixth mass extinction event . This event has caused the rapid decline of amphibian populations worldwide. One of the major drivers of this decline is the infectious disease chytridiomycosis (caused by Batrachochytrium dendrobatidis (Bd)). It is currently unclear how this disease moves through different species of amphibians. Several studies on chytridiomycosis on amphibians in California have been on anurans and terrestrial salamanders. I propose to conduct a retrospective study to look at the pattern of emergence and spread of the fungal pathogen through time. I will be looking at pacific newts because of their access to multiple habitats. The results from my study can then be used to potentially understand how other novel pathogens like Bsal (a sister species to Bd) can spread and aid in forming innovative and effective conservation plans.

Entry Number: 47 GL
TRACKING THE EVOLUTION OF HIV-1 IN PARTICIPANTS AFTER DISCONTINUING PREP TREATMENT
By: Dwayne Evans
Microbiology
Faculty Advisor: Dr. Pleuni Pennings
Abstract: HIV-1's rapid mutation rate allows it to be efficient at producing a diverse viral genome. The diversity of HIV-1's genome confers the virus drug resistance by allowing it to evade drug treatments. PrEP is used as a preventative against HIV-1 infection instead of a treatment for individuals already infected with the virus. PrEP is a relatively new drug prophylaxis that has not been extensively studied as an effective preventive strategy against HIV. Thus, the extent to which resistance to PrEP develops in HIV-1 infected individuals is not yet known. My research plans to evaluate the effectiveness of PrEP across multiple different studies. Some of these studies include the iPrEX, FEM-PREP, TDF2, and Partners PrEP Trials. In addition, I wish to examine how many individuals in the PrEP vs. placebo arm develop PrEP resistance. Ultimately, I want to determine how costly are the drug resistance mutations (DRMs).

Entry Number: 48 GL
DEVELOPMENTAL DELAYS REGULATE REGENERATION OF PROGENITOR TISSUE IN THE MANDUCA SEXTA
By: S. Janna Bashar
Physiology
Faculty Advisor: Dr. Megumi Fuse, Dr. Blake Riggs, and Dr. Kimberly Tanner
Abstract: A fundamental question in biology is how organisms sense and assess organ development in proportion to the growth of the whole body. Growth delay during metamorphosis, “the “puberty” phase in

insects, is observed when there is local damage to juvenile tissue. An unexpected benefit of the delay is a period for damaged cells to regenerate and minimize organ injury. How local cell damage to tissue causes systemic changes in developmental timing is still poorly understood. In the fruit fly, *Drosophila melanogaster*, a 'delay factor' called Drosophila-insulin-like-peptide-8 (Dilp8) is released from damaged imaginal disc cells to trigger regenerative development delays. This project attempts to characterize the mechanism of communication between damaged imaginal disc and the endocrine center in another insect model, the hornworm, ***Manduca sexta***. It is hypothesized that the hemolymph (blood) carries secreted factor(s) to the endocrine center and delays developmental hormones for adult eclosion. In this study, we monitored delays associated with tissue damage and used SDS-PAGE to measure changes of protein abundance in hemolymph of the damaged larvae, including protein bands within the Dilp8 size range. Larvae showed significant delays from damage associated with x-ray irradiation. However, there were no significant differences for the bands, suggesting Dilp8-like peptide(s) were not upregulated in the hemolymph. Analysis of the genome also did not reveal a Dilp8-like peptide. Together this could suggest another possible signaling factor or mechanism induces developmental delays in *Manduca Sexta*. The study will follow up with Western blot as a more sensitive method to screen for differences in putative regulators. Identifying the developmental delay mechanism in *Manduca sexta* will provide further insight for how organisms adapt to disturbances in tissue development and may help us understand similar puberty delays in human inflammatory diseases.

Entry Number: 49 GL
INHIBITION OF ADULT NEUROGENESIS REVERSED BY BIOGENIC AMINE OCTOPAMINE
By: Griffin Downing
Physiology
Faculty Advisor: Dr. Christopher Moffatt
Abstract: Environmental stress and food intake has been shown to alter rates of adult neurogenesis in mammals; however, the effects in invertebrates are poorly understood. Recently, we found that environmental impoverishment in conjunction with food restriction greatly decreases the rate of adult neurogenesis in the house cricket (Acheta domesticus). Crickets were housed individually in an enriched (EE), or impoverished environment (IE) for 96 hours with access to water. Half of each group had free access to food, while the remaining crickets were starved. After 96 hours in these conditions, subjects were injected with bromoxyuridine (BrdU), a thymidine analog incorporated into the S-phase of the cell cycle. In both males and females, the combination of starvation and IE decreased, but did not completely inhibit, neurogenesis. This suggests crickets maintain a basal level of neurogenesis even in environmentally stressful conditions. The neuromodulatory hormone octopamine (OA) is critical for lipid synthesis, locomotor activity, and behaviors such as aggression in insects. Interestingly, in the insect brain, OA activates insulin producing cells in the mushroom bodies, a region of the brain where adult neurogenesis occurs. We hypothesized decreases in OA activity contribute to the decrease in neurogenesis in stressful conditions. We tested this hypothesis by comparing the effects of OA and saline injections on neurogenesis in crickets that were either starved and housed in IE conditions or fed and housed in EE conditions. Following 96 hours in their respective treatment groups, OA or saline was administered and all animals were injected with BrdU approximately 25 minutes later. Animals were euthanized two hours after the BrdU and their brains processed for the detection of BrdU immunoreactivity. Preliminary data show that octopamine enhances neurogenesis in starved animals maintained in impoverished environments, and slightly increases it in animals in enriched-free feeding environments.

Entry Number: 50 GL
TISSUE DAMAGE CAUSES CHANGES IN THE HORMONE PROFILE OF AN INSECT MODEL, MANDUCA SEXTA
By: Manuel Rosero
Physiology & Behavioral Biology
Faculty Advisor: Dr. Megumi Fuse
Abstract: Size and shape of animals, from insects to mammals, is determined by their genetic make-up as well as the environment in which they develop. Thus, genetic and environmental factors are important determinants in the development of an organism. As animals develop, different tissues grow at different rates, resulting in a fully developed animal with a proportional body. This coordinated development of different tissues is called body allometry. Body allometry is possible thanks to the constant communication between tissues as they grow, but what happens when one tissue grows at a slower rate than it normally would? In the insect organism, *Manduca sexta*, damage to the imaginal discs during the last larval stage causes delays to pupation and metamorphosis to the adult stage. This suggests that with the slower development of the damaged imaginal discs, the entire body also develops at a slower rate. However, the specific mechanism that explains this phenomenon remains a mystery. We hypothesized that the slow growing imaginal discs were delaying the development of *M. sexta*, by changing the normal profile of endocrine hormones involved in development. In particular, we hypothesized that juvenile hormone (JH), essential for regulating when pupation occurs, was elevated to delay the onset of pupation. To test our hypothesis, we used a well-known proxy of juvenile hormone levels in *M. sexta*, the critical weight. Critical weight is defined as the point in development at which lack of nutrition does not affect developmental timing. In terms of hormones, however, critical weight is known as the point in development at which JH biosynthesis stops, allowing for pre-pupal behaviors to begin. We determined that the critical weight of damaged animals was greater than that of healthy animals. This increase in critical weight indicates that the normal profile of JH changes as a result of tissue damage. In addition, this result is a parallel to that observed in humans, where chronic inflammatory diseases cause delays to puberty by affecting the hormones that modulate pubertal development. This shows that physiological mechanisms to cope with tissue damage may be conserved across species.

Entry Number: 51 GL
HIGH THROUGHPUT BEHAVIOR BASED NEUROACTIVE DRUG DISCOVERY
By: Amanda Carbajal
Zoology
Faculty Advisor: Dr. Christopher Moffatt and Dr. David Kokel (UCSF, School of Medicine)
Abstract: The World Health Organization estimates that one in four persons will encounter a neurological disorder or disease in their lifetime. Though neuropharmacology has come a long way to provide medications used today, commonly used drugs to treat neurological disorders such as anxiety can have negative side effects as prevalence of substance abuse, memory loss, fatigue and weight gain. Additionally, drugs for neurodegenerative diseases alleviate some symptoms, at their best not offering any halting of the progression. These limitations are a result of the complexity of our CNS and the gaps in our understanding of the brain and disease mechanisms. To alleviate this, we conduct high throughput screens for neuroactive compounds utilizing a holistic, behavior to molecule based drug discovery process with efficiency and cost effective methods when contrasted with the cost of using mice, given that we are working with a multi target system that requires in vivo study. Our animal model is the zebrafish with 80% genetic similarity to humans, cost effective rearing, and small size. We determine whether or not a drug is neuroactive and therefore acting upon the CNS, if we can measure a change in behavior in comparison to behavior in untreated animals. We created specialized hardware of an enclosure with a camera that can hold 96 well plates to be filled with many zebrafish and chemical compounds. We are able to record behavior of treated and untreated fish while they undergo visual and auditory stimuli that is built into the machine, in this controlled microenvironment. We quantify the changes by using a motion index number derived by an algorithm, that calculates pixel intensity changes from one frame to the next, through the entire video. Compounds that are interacting on zebrafish CNS and consequently, behavior, are then fully investigated. Our results from three gargantuan screens of compound libraries from around the world have yielded many new hits , or active and potential ingredients for better medications to meet the still overwhelming needs for better, more effective medications. This research provides context for novel methods of drug discovery, full classification structure of neuroactive compounds found, and how they may be considered as choices for people who suffer from diseases of the mind.

Entry Number: 52 GL
ROLE OF ELECTROSTATIC INTERACTION IN LIGAND RECOGNITION BY OROTIDINE 5'-PHOSPHATE DECARBOXYLASE (ODCASE)
By: Jesi Lee
Biochemistry
Faculty Advisor: Dr. Anton Guliaev and Dr. Weiming Wu
Abstract: Electrostatic interactions play a crucial role in protein – ligand interactions. The calculation of Electrostatic potential (EP) maps on enzyme active sites provide pivotal information regarding ligand affinity and specificity. In this project, our goal was to investigate the role of electrostatic interactions in Orotidine 5'-monophosphate decarboxylase (ODCase) on its catalytic mechanism. As a last enzyme in the *de novo* biosynthetic pathway that is essential in all organisms, ODCase transforms orotidine 5'-monophosphate (OMP) into uridine 5'-monophosphate (UMP) which is then converted to precursors of pyrimidine nucleotides. In this project, we evaluated the electrostatic interactions between ODCase active site and its natural substrate, OMP and an inhibitor, BMP. The EP calculations of ligands indicated that BMP would bind tighter to ODCase active site rather than OMP. The EP profile revealed that BMP exhibited more localized negative electrostatic potential at position O4 of pyrimidine ring and at two hydroxyl group of ribose. In contrast, OMP showed larger distribution of negative potential at catalytic carboxylic group of C6 in pyrimidine ring. The EP map of ODCase complexed with BMP revealed areas of strong positive potentials at the enzyme active site on the contrary to the Apo form. The interactions between positive potentials at the enzyme active site and well-distributed negative potential of BMP account for the strong binding between ligand and ODCase. Moreover, the ligand induced structural changes at the enzyme active site and promoted concentrated distribution of the positive charge at the binding site. In the Apo form, the active site is more neutral in charge. EP surface calculations of the Apo protein MD simulation showed the binding site surface collected more positive electrostatic potential as protein relaxed over 500 ns. This study suggested that ODCase rely heavily on electrostatic interactions for ligand recognition and stabilization, and thereby, its catalysis. Investigating the role of EPs in mechanisms of ligand recognition will facilitate the discovery, design, and development of new drug candidates.

Entry Number: 53 GL
3D STRUCTURES OF THE BACILLUS ANTHRACIS DTDP-L-RHAMNOSE BIOSYNTHETIC ENZYME: DTDP-4-DEHYDRORHAMNOSE REDUCTASE
By: Ashley Law and Alexander Stergioulis
Biochemistry
Faculty Advisor: Dr. Misty L. Kuhn
Abstract: Bacillus anthracis is the causative agent of the deadly disease Anthrax, which can infect humans via three main routes: inhalation, ingestion and cutaneous exposure. Although this infection has been limited in most parts of the world within recent history, its use as a potential bioterror agent and ability to re-emerge as a problematic infectious agent has brought renewed interest to this organism. B. anthracis is a Gram-positive bacterium that decorates its cell wall polysaccharides with L-rhamnose using the activated donor dTDP-L-rhamnose. This activated sugar donor is produced by a series of enzymes in the dTDP--L-rhamnose biosynthetic pathway. Since this set of enzymes is not present in humans, they are ideal targets for therapeutic development to combat pathogens. Here we present the 3D protein structure determine at 2.65 Angstrom resolution of the dTDP-4-dehydro--L-rhamnose reductase (RfbD) in complex with NADP+ from B. anthracis, which catalyzes the final reaction of the pathway where it reduces dTDP-4-dehydro-->L-rhamnose to dTDP-->L-rhamnose. Although the protein was crystallized in the presence of Mg2+, it did not bind in the structure. This is likely due to the lack of key conserved glutamic acid residues that classically coordinate Mg2+ to dimerize the homologous RfbD enzyme in Gram-negative bacteria. A structural comparison of RfbD homologs from both Gram-positive and Gram-negative bacteria is also presented, which will be useful for further investigation of the biosynthetic pathway.

Entry Number: 54 GL
3D STRUCTURE OF THE BACILLUS ANTHRACIS DTDP-L-RHAMNOSE BIOSYNTHETIC ENZYME: GLUCOSE-1-PHOSPHATE THYMIDYLYLTRANSFERASE
By: Jackson Baumgartner and Jesi Lee
Biochemistry
Faculty Advisor: Dr. Misty L. Kuhn
Abstract: The bacterial cell wall composition plays a critical role in bacterial survival by maintaining the cell shape, preventing lysis under changes in osmotic pressure, and protection from the surrounding environment. L-rhamnose is a ubiquitous and vital component of bacterial cell wall polysaccharides. Its precursor dTDP-L-rhamnose biosynthetic pathway is not present in humans, and therefore makes the enzymes of the pathway potential drug targets to combat important human pathogens. In this study we determined the 3D structure of the first protein of this pathway, glucose-1-phosphate thymidylyltransferase (RfbA) from Bacillus anthracis, which is the etiological agent of the deadly disease Anthrax. RfbA was co-crystalized with the products of the enzymatic reaction, dTDP-alpha-D-glucose and pyrophosphate, at 2.3 Å resolution. This is the first reported thymidylyltransferase structure from a Gram-positive bacterium, RfbA is best described as a dimer of dimers that forms a tetramer and is similar to other reported Gram-negative thymidylyltransferase crystal structures. However, our crystal structure of RfbA formed a crystal packing pattern that significantly differed from previously reported thymidylyltransferases, whereby a less dense hexagonal honeycomb-like structure was observed. The RfbA from B. anthracis is approximately 50 amino acids shorter than Gram-negative homologs; the lack of these residues corresponds to the absence of three alpha helices at the C-terminus that are involved in the arrangement of the allosteric site. Consequently, this unique structure of RfbA provides insight into the structural distinctions between Gram-positive and Gram-negative bacteria and will aid future studies of the L-rhamnose biosynthetic pathway in other organisms.

Entry Number: 55 GL
3D STRUCTURES OF THE BACILLUS ANTHRACIS DTDP-L-RHAMNOSE BIOSYNTHETIC ENZYMES. DTDP-4-DEHYDRORHAMNOSE 3,5-EPIMERASE, RFBC
By: Jennifer Macias, Ha Bich Tran, and Alex Shornikov
Biochemistry

Faculty Advisor: Dr. Misty L. Kuhn
Abstract: The content of the exosporium layer of Bacillus anthracis spores is rich in L-rhamnose, a deoxysugar that is a common bacterial cell wall component, which often contributes to the virulence of pathogens by increasing their adherence and immune evasion. dTDP-6-deoxy-D-xylo-4-hexulose 3,5-epimerase (RfbC) is the third enzyme of the dTDP-L-rhamnose biosynthetic pathway with homologs in bacteria and archaea, but none in mammals; thus, it represents an attractive drug target. Despite numerous crystallization trials of the B. anthracis RfbC protein alone, we found that co-purifying and screening RfbC in the presence of the other B. anthracis proteins of the biosynthetic pathway (RfbA, RfbB, and RfbD) yielded crystals suitable for data collection. The RfbC protein crystallized as a dimer and its structure was determined at 1.63 Å resolution. Two different ligands were bound in the protein structure: pyrophosphate in the active site of one monomer and dTDP bound in the other monomer. Compared to other known structures of RfbC homologs, this asymmetry in ligand binding is atypical. A comparison with RfbC homologs showed the key active site residues are conserved, indicating that the catalyzed reaction proceeds via a mechanism that has been previously suggested for this family of enzymes.

Entry Number: 56 GL
CHEMICAL INVESTIGATION OF THE MARINE SEDIMENT-DERIVED ACTINOMADURA SP CP26-28
By: Yoko Toriyabe
Biochemistry
Faculty Advisor: Dr. Taro Amagata
Abstract: Marine actinobacteria have been recently recognized as a prolific source for bioactive secondary metabolites with unique structural motifs. Due to increase of resistance to existing antibiotics and variety of diseases, it is an urgent and important objective to discover new drug candidates for infectious disease as well as cancer. As part of our program to discover new anticancer lead compounds, we investigated the secondary metabolites of the rare actinomycete, Actinomadura sp. CP26-28, separated from San Francisco Bay sediment,This strain was selected based on the screening results obtained by and against HeLa cell-based cytological profiling (CP).The detailed analysis of the secondary metabolites produced by the strain CP26-28 led to isolation of two new compounds. The structures of the new compounds have been elucidated based on analysis of the HRESIMS and the comprehensive 1D and 2D NMR data. In the poster, isolation and structure elucidation of these compounds will be presented.

Entry Number: 57 GL
THE FRUCTOSE-SPECIFIC TRANSPORTER GLUT5 USES A LONG-RANGE CHANNEL CHECKPOINT TO CONTROL SUBSTRATE PASSAGE INTO THE CELL
By: Trevor Gokey
Biochemistry
Faculty Advisor: Dr. Anton Guliaev
Abstract: GLUT5 is a member of the GLUT sugar transporter family and is unique in that it passes fructose but not glucose into cells. Breast cancer cells, but not normal breast cells, highly upregulate GLUT5 in order to sustain their high metabolic demands, making GLUT5 a potential target for anti-tumor therapeutics. Other GLUT transporters are known to switch between two states during glucose passage, however recent crystallographic data suggests GLUT5 utilizes four states during fructose passage. The mechanisms which account for fructose specificity and drive GLUT5 between the four conformational states are unclear. To address this, we utilized non-equilibrium molecular dynamics techniques to model fructose permeation through GLUT5. The methods shown here revealed distinct energy barriers that exist in the GLUT5 channel. In addition we revealed that fructose, but not glucose, was able to form key interactions with GLUT5 which permitted transition between conformational states. This data suggests that GLUT5 selectivity can be controlled by key residues in the channel.

Entry Number: 58 GL DISPLAY ONLY
3D STRUCTURES OF THE BACILLUS ANTHRACIS DTDP-L-RHAMNOSE BIOSYNTHETIC PATHWAY ENZYMES: DTDP-D-GLUCOSE 4,6-DEHYDRATASE
By: Trevor Gokey
Biochemistry
Faculty Advisor: Dr. Misty L. Kuhn
Abstract: Controlling infectious agents is a major issue for public health and safety. One particular example is the Gram-positive pathogenic bacterium Bacillus anthracis, which causes the disease Anthrax. Throughout history this disease has resulted in the death of significant numbers of livestock around the world, but is largely seen as a disease of the past for humans except as a bioterrorist agent. Many bacteria, including B. anthracis, require L-rhamnose as a key structural component in cell wall polysaccharides, and absence can significantly impair its viability. The biosynthetic pathway that produces dTDP-L-rhamnose is not found in eukaryotes, and therefore makes the four enzymes in the dTDP-L-rhamnose pathway potential antibacterial targets. In this work we determined and described the 3D structure of dTDP-α-D-glucose 4,6-dehydratase (RfbB), the second enzyme in the dTDP-L-rhamnose pathway from B.anthracis str. Ames at 3.0 Angstrom resolution. RfbB is a lyase that catalyzes the oxidation of the C4 hydroxyl group on dTDP-α-D-glucose, followed by dehydration at C6 to form dTDP-4-keto-6- deoxyglucose. We were only able to obtain crystals of RfbB in the presence of the third enzyme of the pathway (RfbC from B. anthracis), but RfbC was not observed in the crystal. RfbB has a conserved Rossmann fold paired with a flexible nucleotide binding domain that undergoes a conformational change upon binding the dTDP-α-D-glucose substrate. The structure of this protein contained a disordered region in the nucleotide binding domain due to the absence of substrate. Compared to other similar structures with a bound dTDP-hexose substrate, the disordered region becomes an ordered helix and forms a hydrogen bond with the α-phosphate of the sugar substrate. The specific interactions with the substrate and conformational changes we observed in RfbB can be used to further develop our understanding of how the enzyme functions.

Entry Number: 59 GP
TITANIUM METAL NANOWIRES VIA ELECTROSPUN POLYMER NANOCOMPOSITE
By: Heather-Rose E. Lacy
Chemistry
Faculty Advisor: Dr. Andrew S. Ichimura and Dr. Kwok-Siong Teh
Abstract: A new method to prepare titanium nanowires based on electrospun polymer/metal nanocomposites is under development. Titanium nanowires may find biomedical applications such as ligament prosthetics due to their anticipated biocompatibility and mechanical properties. Electrospinning provides a relatively inexpensive and efficient method to produce long and narrow nanofibers compared to other methods such as solution phase synthesis and chemical vapor deposition. To date, only titanium oxide nanowires have been produced by electrospinning not titanium metal nanowires as we are attempting. Our strategy employs a solution of polyvinylpyrrolidone and titanium-nanoparticles that is electrospun onto a conducting substrate. The result is a mesh of nanofibers ~200-400 nm in diameter. This polymer-titanium nanocomposite is subjected to heat treatment to remove the organic polymer. The titanium nanowires are formed during the heat treatment by sintering the titanium nanoparticles under a reducing atmosphere. This procedure minimizes oxidation. Scanning electron microscopy (SEM) reveals that our new method results in a titanium nanowire mesh that is composed of long strands of sintered nanoparticles. The composition of the material was determined by energy dispersive x-ray spectroscopy (EDS) and shows the resulting nanowire mesh is oxidized titanium metal. The results of SEM and EDS will be presented elucidating the morphology and relative oxygen content of the titanium nanowires produced at each stage of the preparation.

Entry Number: 60 GP
FIRST-PRINCIPLES MOLECULAR DYNAMICS ON MIXED LITHIUM INDIUM HALIDES AS SOLID ELECTROLYTES FOR BATTERIES
By: Alysia Zevgolis and Thomaz Alves
Chemistry

Faculty Advisor: Dr. Nicole Adelstein
Abstract: The low ionic conductivity across solid-solid interfaces and through the solid electrolyte is a limiting factor for commercial implementation of all solid state batteries. Through the understanding of Li^+ ion diffusion by using first-principles molecular dynamics, significant insights in developing new battery materials can be achieved. Previous research has determined the lithium ion conduction pathway in Li_3InBr_6 and noted its non-Arrhenius behavior at high temperatures. Our current research builds off our previous by studying the effects of halide substitution, lattice volume, and temperature on the diffusion coefficients in $Li_3InBr_{6-x}Cl_x$.

Entry Number: 61 GP
INTEGRATING <001> ORIENTED TIO2 THIN FILMS INTO PEROVSKITE SOLAR CELLS FOR ENHANCED CARRIER SEPARATION
By: Megan Mayer, Yen Tran, Alex Yore, and Hasti Dehnashi
Chemistry
Faculty Advisor: Dr. Andrew S. Ichimura
Abstract: Since 2009, much progress has been made in perovskite solar cells. The perovskite light absorber, methylammonium lead iodide (MAPbI3), can be made from inexpensive precursors, effectively separates charge carriers, and leads to devices with power-conversion efficiencies greater than 16%. In this work, we focus on the integration of <001> oriented anatase TiO_2 films into the solar cell heterostructure. Titanium dioxide is a key component of the solar cell that serves as blocking and electron transport layers (ETL). The typical ETL is composed of amorphous or randomly oriented nanocrystalline TiO_2. However, oriented thin films should improve charge carrier separation and collection. To construct our solar cells we spin-coat MAPbI3 onto <001> oriented anatase TiO_2 thin films. The hole transport layer (HTL), spiro-OMeTAD, is deposited onto the MAPbI3 layer. We have studied the effectiveness of charge transport to TiO_2 and the HTM by photoluminescence (PL) spectroscopy. It was observed that PL intensity of perovskite's TiO_2 heterojunction decreases by 54% when TiO_2 is annealed under H2 compared to MAPbI3 without an ETL. The PL intensity is further decreased in the presence of the HTM. The Bragg diffraction pattern of the perovskite thin film suggests that the MAPbI3 exhibits preferred orientation in the presence of <001> textured TiO_2 which may improve carrier separation and overall device efficiency. Since grain size and orientation of CH3NH3PbI3 play an important role in the effectiveness of a solar cell, future work will involve fine tuning the crystallization of perovskite on <001> oriented TiO_2.

Entry Number: 62 GP
ENHANCING THE EFFICACY OF PROTEASE DRUGS THROUGH SITE-DIRECTED MUTAGENESIS
By: Angela Amorello
Chemistry
Faculty Advisor: Dr. Teaster Baird, Jr.
Abstract: A modern approach to drug development draws from nature to treat disease. Proteases, historically targeted for the development of inhibitors, show therapeutic potential. Development of protease therapeutics is complicated by the presence of endogenous inhibitors, which result in reduced serum half-lives of these agents. Determining which residues influence inhibitor binding can inform the design of efficacious protease therapeutics that have less favorable interactions with inhibitors through mutagenesis. Trypsin-fold serine proteases account for the majority of commercially available protease therapeutics. Consequently, substitutions that confer inhibitor resistance without compromising activity in trypsin may be applied to prospective serine protease drugs. Examination of crystal structures of trypsin and its macromolecular inhibitors have shown a conserved hydrogen bond interaction between Tyr 39, Lys 60 and inhibitor. Using PCR mutagenesis, three trypsin variants (Y39E, Y39S, and Y39L) were produced with amino acid substitutions at position 39 (Y39E, Y39S, and Y39L). We have demonstrated that certain Tyr 39 substitutions confer weaker enzyme-inhibitor interactions. Y39A trypsin had a lower association rate (4.1×10^{-3} M^{-1} s^{-1}) and higher dissociation rate (3.3×10^{-3} s^{-1}) compared to wild type (5.5×10^{-3} $M^{-1}s^{-1}$ and 2.5×10^{-3} s^{-1}) respectively with bovine pancreatic trypsin inhibitor and also demonstrated catalytic activity similar to that of wild type. Substitutions at position 39 in trypsin show promise to retain catalysis and reduce inhibition.

Entry Number: 63 GP

MEET-THE-NEED, A SHARING COURIER SERVICE

By: Abhilash Shrivastava
Computer Science
Faculty Advisor: Dr. Bill Hsu

Abstract: Parcel delivery or courier services are widely used today but can be costly. Meet-the-Need is an application that provides courier services based on the sharing economy. Meet-the-Need does not require any infrastructure to provide courier services, unlike other courier services such as UPS, USPS, FedEx etc. A parcel sender, who needs a parcel to be delivered, can post a parcel request, offering a proposed fee for the delivery service. Our application will provide a list of commuters already traveling towards the parcel destination, with a capacity to accommodate the proposed parcel. The parcel sender can choose the best option for the parcel delivery based on price and time. Using our Meet-the-Need application, commuters or frequent travelers can also earn income by providing parcel delivery services.

Entry Number: 64 GP

LABYRINTH

By: Brian Parra
Computer Science
Faculty Advisor: Dr. Ilmi Yoon

Abstract:The Labyrinth project is a collaboration with the UCSF Neuroscape Lab. Labyrinth procedurally generates Virtual Reality environments that will be used to test and train participants' spatial memory skills. The hypothesis is that improved spatial memory will lead to improved object recognition for ageing adults.

Entry Number: 65 GP
SEARCHBOARD: COMBINING THE OKAPI BM25 ALGORITHM AND SENTIMENT ANALYSIS FOR BOARD GAME Recommendations
By: Brook Thomas
Computer Science
Faculty Advisor: Dr. Anagha Kulkarni
Abstract: SearchBoard is a board game recommendation engine driven by user reviews and sentiment analysis. By blending the ranking algorithm BM25 with sentiment scores using Microsoft Cognitive Services Sentiment Analyzer, SearchBoard enables users to explore board games by topic, keyword, and mechanism using free text queries and view the most relevant, positive results.

Entry Number: 66 GP
AUTOMATED QUESTION ANSWERING SYSTEM
By: Chanin Pithyaachariyakul
Computer Science
Faculty Advisor: Dr. Anagha Kulkarni
Abstract: The goal of the project is to develop algorithms to answer the questions posted by users, using the Web-as-Data. Our approach applies tools and techniques from natural language processing, data mining, information retrieval, and machine learning for the various subtasks, such as, question-to-query transformation, document retrieval, candidate answer extraction, and final answer selection. We plan to participate in an evaluation forum, TREC LiveQA Track, where the participant systems have to answer the user questions submitted to Yahoo! Answers in real time.

Entry Number: 67 GP
MINING SOCIAL MEDIA TO UNDERSTAND DISEASE EPIDEMIOLOGY
By: Deeptanshu Jha
Computer Science
Faculty Advisor: Dr. Rahul Singh
Abstract: Sexually transmitted infections (STIs) and infections from injection drug use(IVIs) are liable for a significant amount of morbidity and mortality. HIV and HCV are the two diseases most commonly transmitted because of injection drug use or unsafe sexual practices, and unfortunately, United States is in the midst of an unprecedented opioid epidemic. Hitherto, studies tracing the propagation of STIs and IVIs in an infected population make use of simulated data, patient records, surveys and contact tracing. These methods fail to cover a large population and are not real time. The development of novel methods to identify and curb the spread of such diseases is of utmost importance. In our research, we try to determine communities who are at risk for HIV/HCV infections using real world contact networks obtained from social media. The proposed method will allow us to interpret the epidemiological dynamics of HIV/HCV-like diseases based on the contextual information and social relationships of the individuals in real time for a much larger population. Identification of such communities will enable us to model disease transmission patterns in high-risk populations in a more reasonable manner than what has been possible until now.

Entry Number: 68 GP
PHENOTYPE INDEXING FOR "BIG DATA" DRUG DISCOVERY
By: Jakob Dohrmann
Computer Science
Faculty Advisor: Dr. Rahul Singh
Abstract: Querying data by content is a powerful search paradigm in domains where the semantics of the data is circumscribed yet difficult to precisely express through manually specified attributes. A number of applications ranging from high-content and phenotypic drug screening to medical diagnostics are regularly generating such data today. The challenge of querying data by content in these contexts is exacerbated by large size of the repositories, high-dimensionality of the data, as well as the need for the search strategy to be exploratory. The design of indexing techniques that meet the aforementioned criteria is one of the fundamental requirements for

building real-world systems for managing content-rich information. Our approach combines a hierarchical partitioning of the data with subspace clustering to construct the index. We obtain and employ lower bounds on a number of commonly used similarity measures. These bounds prevent false negatives when the index is employed. The proposed index can support multiple similarity measures simultaneously, allowing a user to flexibly query and explore the data. The method is sufficiently rapid, robust and accurate to be used for indexing large repositories of biological images, as well as biomedical and statistical data.

Entry Number: 69 GP
EPUB-READER ANDROID APP
By: Mahesh Singh Sawant
Computer Science
Faculty Advisor: Dr. Ilmi Yoon
Abstract: Epub-Reader is an android app intended to provide users with the ability to read e-books available in ePub format, anywhere and at any time. Along with the ability to read any kind of ePub, the app intends to provide the users with a rich, interactive learning experience with the help of word definition lookups, annotations, and word games. The app provides the users with the ability to listen to text in the book being read out as well as voice recognition features such as turning the page when the user says next. The app allows users to view a statistical analysis of time spent reading each page and frequency of words searched to determine the difficulty of the book.

Entry Number: 70 GP
AN ASSISTANT FOR GENE SUMMARIZATION
By: Meghana Dayananda
Computer Science
Faculty Advisor: Dr. Anagha Kulkarni
Abstract: Summary Assist is a multi-document summarization approach developed specifically for generating Gene summaries in the context of pharmacogenomics. Currently, pharmGKB summaries are written by human curators for which substantial amount of literature needs to be reviewed. These summaries provide an in-depth information (structural, drug-interactions, associated-diseases) about the genes, and thus differ from other online resources, but generating these summaries is highly time-consuming. Summary Assist employs tools and techniques from natural language processing, data mining, and machine learning, to automate the summary generation task wherever possible, and to assist the human curators by reducing the information overload.

Entry Number: 71 GP
MIND AND MACHINE: DEVELOPING BRAIN-COMPUTER INTERFACES WITH BCIKIT, A SIMPLIFIED OPEN SOURCE RESEARCH PLATFORM
By: Octavian Drulea
Computer Science
Faculty Advisor: Dr. Kazunori Okada, Dr, Anagha Kulkarni, and Dr. Xiaorong Zhang
Abstract: A brain-computer interface (BCI) takes signals from a human brain as input to a computer system. The goal of BCI systems is to allow a human operator to control a computer application by mental activity alone. Research in this field has advanced considerably in recent years, with the advent of powerful new machine learning technologies. However, many obstacles currently inhibit BCI research, including cost, access to equipment, and domain-specific expertise challenges at the intersection of neuroscience and computer science. This project implements a simplified software toolkit called bcikit which puts research within reach for many new investigators. With an organized, modular design, the software provides a platform for signal acquisition, signal processing, machine learning, visualization, and offline analysis that just works, and yet is transparently flexible for researchers. bcikit is written with python, with widely used scientific computing tools such as numpy, pandas, scipy, and scikit-learn. The project includes not only software, but also open-source EEG hardware for human brain signal acquisition, complete with a demonstration project of a fully operational BCI project using motor imagery as the control paradigm. The software and hardware will continue to be used for further BCI development by the BIDAL group at SFSU.

Entry Number: 72 GP
GENEDIVE: GENE-GENE RELATIONSHIP SEARCH AND DISCOVERY
By: Paul Previde and Brook Thomas
Computer Science
Faculty Advisor: Dr. Anagha Kulkarni, Dr. Dragutin Petkovic, and Mike Wong
Abstract: We present GeneDive, an information retrieval and filtering tool to visually explore DeepDive-identified gene-gene interactions. This work is the collaborative effort between Stanford University, and San Francisco State University. Stanford Researchers used DeepDive, a rules-based machine learning system, to extract gene-gene interactions from over 100,000 full-text PLOS articles [1]. GeneDive is designed to assist curators to prioritize probable relationships, compile supporting literature evidence, and discover biopathways to direct new curation investigations and potentially new discoveries.

Entry Number: 73 GP
PF-WORDS: LITERATURE POWERED PROTEIN FUNCTION SEARCH
By: Rajat Arora
Computer Science
Faculty Advisor: Dr. Anagha Kulkarni
Abstract: Proteins are the biomolecules that are the workforce in a living cell. PF-Words is a search engine that identifies relevant Protein Functions to the free-text user query. To accomplish this PF-Words uses textual data compiled from multiple biomedical databases (Prosite, PDB, UniProt/Swiss-Prot, PubMed). Through the use of this enriched corpus PF-Words seeks to overcome data scarcity challenges, and to reduce the noise in the search space.

Entry Number: 74 GP
YOUDESCRIBE IOS APP - AN AUDIO ANNOTATION AND PLAYBACK TOOL TO MAKE ONLINE VIDEOS ACCESSIBLE
By: Rupal Khilari
Computer Science
Faculty Advisor: Dr. Ilmi Yoon
Abstract: ‘YouDescribe’ is a project founded by the Smith-Kettlewell Eye Research Institute’s (SKERI) Video Description Research and Development Center (VDRDC) with an aim to enable sighted volunteers to record audio descriptions for online videos for the benefit of the blind and those with low visual perception. It helps such users understand and experience visual content in online videos through audio descriptions played back along with the video. VDRDC’s current platform includes a server, a database and a web interface to facilitate this. Due to the increasing availability of online content through smartphones and the convenience it offers, there was a strong need to make YouDescribe available on mobile phones as well. Also, as YouDescribe requires complex interaction with audio functions, its web version was not available on mobile browsers. Stemming from these needs, the main objective of this project is to develop a native iOS application for YouDescribe that provides an accessible, mobile application for playing back and recording audio descriptions for online videos (particularly YouTube). The YouDescribe iOS app presented here recreates the web experiences for video and audio playback, recording, searching, sharing and requesting for audio descriptions on social media with full support for low-vision accessibility. The key technical outcomes from this effort are the native iOS app for multiple devices, design approaches for building accessible components in Swift 3.0, and potential future extensions. We believe that the YouDescribe iOS app will not only enable visually challenged users to enjoy videos on their iPhones, but also encourage volunteers to make video content more accessible to everyone.

Entry Number: 75 GP
VISUALIZING THE PHARMACEUTICALLY RELEVANT MOLECULAR SPACE
By: Thomas Olson
Computer Science

Faculty Advisor: Dr. Rahul Singh
Abstract: The exploration the chemical space has been a consistent research topic for those looking to improve the efficacy of drug discovery, as even a marginal improvement of drug lead identification could result in significant improvements in terms of results and research costs. In this project we introduce CSPACE, a public web based application that can be used as a tool for visualization and analysis of the chemical structure space. The chemical structures space is the representation of drug like compounds which captures their similarity.What is unique about CSPACE, is that it uses a structural comparison of the compounds and creates an embedding using multidimensional scaling a 3D space that is easy to visualize and interact with. Users can freely explore this space using just their browser to search for relationships between drugs that is not readily apparent. Additionally, users can upload their own structures of interest into CSPACE, which integrates them into the chemical structure space.

Entry Number: 76 GP
ANDROID UNDER THE HOOD
By: Pooja Kanchan, Syed Omer Khureshi, Sai Krishna Undurthi, and Anshul Vyas
Computer Science
Faculty Advisor: Dr. Arno Puder and Dr. Bill Hsu
Abstract: The Android codebase has been changing dramatically over the last few years to support a wide range of mobile devices and attractive features. Although it is an open source project, due to its dynamic nature and continuous growth, there is an ever-increasing need for a tool that facilitates developers to instrument the code at the platform level and aids them in the analysis of the source code by providing handles into the platform. The objective of this project is to develop a tool that provides the developers with the ability to instrument the Android platform using Aspect-Oriented Programming. The tool weaves handles into the source code to trigger custom actions. With the help of this tool it becomes possible to add sophisticated conditions for spotting security violations, battery optimizations, and best practices into the Android platform. Effective visualization of the logs generated by the tool is provided to help analyze large execution traces.

Entry Number: 77 GP
Influence of Competition on Growth at a High Sierra Treeline Environment
By: Lan Ma
Geosciences
Faculty Advisor: Dr. Alexander Stine
Abstract: Growth of trees at treeline often forms the basis for reconstructing past temperature variabilities. However, the strong covariance between temperature and light availability permit ambiguity in attribution. We investigate the influence of tree-level environmental factors on growth in a treeline environment near Sonora Pass, CA (38.32N, 119.64W; elev. 3130m). We cored and mapped position and size of the trees across an 80m x 70m study plot. Inter-annual variabilities of the averaged ring width chronology show significant positive correlation with May-Jun temperature ($r = 0.36$, $p < 0.001$). We show that differences in growth rate between trees are predicted by an index of competition ($r = -0.46$, $p < 0.001$). Further, inter-tree competition exerts greater influences on growth in the directions of incident solar radiation, suggesting trees in this treeline environment are competing for light.

Entry Number: 78 GP
STATIC DESIGN OF SPIN TRANSFER TORQUES MAGNETIC LOOK UP TABLES
By: Ali Attaran
Embedded Electrical & Computer Systems
Faculty Advisor: Dr. Hamid Mahmoodi
Abstract: In this work, we propose a static approach to the design of Spin Transfer Torque Look Up Tables (STT-LUT) and investigate the sensing reliability in the proposed design in detail. The proposed design style utilizes STT-Latches that their sensing reliability is key in determining the overall reliability of the proposed

static STT-LUT. The simulation results in a 10nm FinFET CMOS technology shows that the proposed static STT-LUT design exhibits around 37% read delay reduction compared to the best dynamic STT-LUT design, and more than 400X reduction in sensing failure rate.

Entry Number: 79 GP
DYNAMIC SINGLE AND DUAL RAIL SPIN TRANSFER TORQUE LOOK UP TABLES WITH ENHANCED ROBUSTNESS UNDER CMOS AND MTJ PROCESS VARIATIONS
By: Ali Attaran and Praveen Kumar
Embedded Electrical & Computer Systems
Faculty Advisor: Dr. Hamid Mahmoodi
Abstract: Abstractâ€”Spin Transfer Torque Magnetic Memory (STT-MRAM) is a promising technology for non-volatile storage in which the information is stored in the form of magnetic orientation of a Magnetic Tunnel Junction (MTJ) rather than electric charge. Besides memory applications, this technology is promising for CMOS compatible non-volatile reconfigurable logic design. Given the relatively high power and long delay associated with changing the magnetic state of an MTJ, the most efficient method of designing reconfigurable logic using MTJs is the Look-Up-Table (LUT) based approach. In such STT-LUTs, the write to MTJs occurs only during the configuration phase, while for the normal mode of the operation, the MTJs are only read from. The major design challenge in STT-LUTs is the reliable reading of the state of the MTJs in power and performance efficient manner. The read operation involves sensing the magnetic state of an MTJ (high and low resistance states) and converting it into high and low voltages for interface to next stage circuits. In this paper, we investigate the limitation of existing STT-LUT designs and propose two new circuit styles of designing STT-LUTs that offer higher performance and robustness compared to the conventional STT-LUT design. The proposed styles include a Dynamic Single Rail (DSR) and a Dynamic Dual Rail (DDR) STT-LUT. The simulation results in a 16nm bulk CMOS technology shows that the proposed designs exhibits up to 3.3X read delay reduction, 2.4X active power reduction, and 441X sensing failure rate reduction compared to the best conventional STT-LUT design. The proposed DDR scheme offers the best overall performance even when considering the state of the art Separated Precharge Sensing Amplifier and Separated Decoding schemes.

Entry Number: 80 GP
FANO RESONANCE EFFECTS IN OPTICAL ANTENNAS FORMED BY REGULAR CLUSTERS OF NANO-SPHERES
By: Ali Attaran and Fahima Mahzabin Chowdhury
Embedded Electrical & Computer Systems
Faculty Advisor: Dr. Zhigang Chen
Abstract: Unique optical properties of Fano resonance on plasmonic nanoparticle materials has generated tremendous interest, due to its potential applications in sensing, lasing, switching, nonlinear devices and slow-light devices. Fano resonance phenomena results from coherent interference of super-radiant and sub-radiant hybridized plasmon modes. Superradiant mode possesses finite dipole moments, and it is also efficiently excited by incident light on the subradiant mode, possessing zero dipole moments, without being efficiently coupled to light. Focus of this research is to investigate the physical dimension of nano-clusters on fano resonance to optimize the ano-antenna bandwidth and directivity properties in optical domain.

Entry Number: 81 GP
IOT USING NODE-RED AND AMAZON WEB SERVICES (AWS)
By: Anoja Rajalakshmi
Embedded Electrical & Computer Systems
Faculty Advisor: Dr. Hamid Shahnasser
Abstract: The Internet of Things (IoT) is learning and interacting with millions of things including services, sensors, actuators, and many other objects on Internet. The best outcome of it is when we use the data available in most effective way. IoT brings various platforms combined, cross-linking various software platforms, protocols and products. This project emphasis on how far can IoT devices get connected in a cross platform which will effortlessly help human in various fields like Home Automation, networking, data monitoring etc. It also provides the elasticity to change or convert the response methods after the data processing. This project also focus on bringing up a new user interface(UI) which is likely to be the UI of next generation - the Voice.

Entry Number: 82 GP
ALGORITHM FOR "SCOOP" MOTION DETECTION USING MEMS ACCELEROMETER
By: Hariharan Venkatramanan
Embedded Electrical & Computer Systems
Faculty Advisor: Dr. Hamid Shahnasser
Abstract: Accelerometers are used widely in mobile phones, wearable & IoT devices, these days, for implementing low-cost & low-power motion or gesture recognition methods. In this paper, a new scooping motion detection based on a 3-axis accelerometer is discussed. An algorithm for effective scoop motion detection has been developed with error rejection techniques considering numerous scenarios to suit both right handed and left handed people. A custom BLE enabled System-on-Chip is designed with an accelerometer and is placed in a physical food scoop, where it will detect and record the gesture. A mobile application is also developed that pairs with the food scoop via Bluetooth to configure the device and to gather the collected data. This proposed system aims to be useful when there is a necessity for counting the number of times a food scoop is utilized.

Entry Number: 83 GP
SIMPLE SPACE-DOMAIN FEATURES FOR LOW-RESOLUTION SEMG PATTERN RECOGNITION
By: Ian Donovan and Juris Puchin
Embedded Electrical & Computer Systems
Faculty Advisor: Dr. Xiaorong Zhang and Dr. Kazunori Okada
Abstract: In recent years, low-cost, low-power myoelectric control systems such as the Myo armband from Thalmic Labs have become available and unlocked tremendous possibilities for myoelectric controlled applications. However, due to the embedded system constraints, such sEMG control devices typically samples sEMG signals at a lower frequency. It is in doubt whether existing sEMG feature extraction methods are still valid on such low-resolution sEMG data. In addition, the feature extraction algorithms implemented on embedded devices must have low computational complexity in order to meet the real-time requirement. This paper aims to investigate effective features for low-resolution EMG pattern recognition. In particular, a set of novel computational efficient space-domain (SD) features (referred to as simple SD (SSD) features) have been developed to exploit the spatial relationships of sEMG signals recorded from the sensor array on the Myo armband. The proposed SSD feature set was evaluated with a linear discriminant analysis (LDA)-based classifier on a 9-gesture dataset. The experimental results indicate that using the SSD features increased the classification accuracy by 5% compared to using Hudgins' time-domain features.

Entry Number: 84 GP
A GESTURE CONTROLLED VIRTUAL REALITY GAME.
By: Kartik Bholla and Ian Donovan
Embedded Electrical & Computer Systems
Faculty Advisor: Dr. Xiaorong Zhang
Abstract: The project aimed to develop an intelligent electromyography (EMG)-based gesture control interface (GCI) which deciphers EMG signals collected from forearm muscles to identify users intended hand and arm movements. The GCI has great potential to provide natural human-machine interaction in a variety of

applications, from assistive devices through rehabilitation therapy to virtual reality (VR) application such as treatment of post-traumatic stress disorders (PTSD) and gaming. The developed interface provides easy connection with a commercial EMG-based armband Myo and a modular software engine for customizable gesture recognition as well as a special pipeline for converting recognition decisions into control commands for external applications. In conjunction, a first-person shooter (FPS) VR video game was developed as an application of the GCI. The game uses the information from the GCI as a means of control within the virtual environment. To conclude, The VR game was used as a usability assessment platform to test the feasibility of using gesture classifications and inertial measurement unit (IMU) data from the GCI to control the game as opposed to a standard keyboard/mouse setup.

Entry Number: 85 GP
SMART INDOOR FARMING USING INTEL EDISON AND AWS IOT
By: Pavan Kumar Konda
Embedded Electrical & Computer Systems
Faculty Advisor: Dr. Hamid Shahnasser and Dr. Hamid Mahmoodi
Abstract: Indoor Farming is a booming Industry and it requires precise measurements. This paper discusses about a system which collects analyzes helps to monitor and control the essential elements like moisture, light, temperature, and humidity by uploading data from sensors to Amazon Web Services IoT (AWS) cloud, AWS has a rules engine and device gateway which processes the data and gives secured access to users, who can then connect to the cloud from a browser and make the decisions.

Entry Number: 86 GP
MOBILE APPLICATION BASED EKG MONITORING SYSTEM
By: Poornima Eshwara
Embedded Electrical & Computer Systems
Faculty Advisor: Dr. Hamid Shahnasser and Dr. Xiaorong Zhang
Abstract: Abstract Electrocardiography (ECG or EKG) is the process of recording the electrical activity of the heart over a period of time using electrodes placed on the skin. These electrodes detect the tiny electrical changes on the skin that arise from the heart muscle's activity during each heartbeat. It is a very commonly performed cardiology test that provides information about various factors in human body like heart’s electrical activity, cause of any pain/pressure. This project proposes a way to capture and transmit the ECG of a subject to the Doctor through an android app based on Shimmer sensing device using latest features of Cloud platform as data storage and processing unit.

Entry Number: 87 GP
IMPLEMENTATION OF SPIKING NEURAL NETWORK CLASSIFIER IN HARDWARE
By: Sergey Dusheyko
Embedded Electrical & Computer Systems
Faculty Advisor: Dr. Xiaorong Zhang
Abstract: One major challenge of human machine interfacing has been the reduction of latency, power requirements, and size of the biological signal processing system. Hardware implementations of learning algorithms have helped resolve these challenges but have been limited by lack of ideal hardware synaptic connections. The recently discovered memristor has taken the lead as the ideal component of choice for synapse in hardware implementations of artificial neural networks. In this study, system parameters of hardware implementation of spiking neural network based on memristor crossbar array have been studied in simulation. The goal of this study is to inform future hardware implementations of spiking neural networks for biological signal classification in human machine interfaces.

Entry Number: 88 GP
RELIABLE DESIGN OF SPIN TRANSFER TORQUE LATCH
By: Solmaz Hashemzadeh
Embedded Electrical & Computer Systems
Faculty Advisor: Dr. Hamid Mahmoodi

Abstract: Spin Transfer Torque RAM (STT-RAM) promises low power, great miniaturization prospective and easy integration with CMOS process. It has become a strong non-volatile memory candidate for both embedded and standalone applications. However, the increase in process variation and decrease in the supply voltage results in the degradation of the reliability. This research targets official design solutions to improve the reliability of STT- based latches. The research investigates different sources of variability and aging in CMOS and magnetic Tunnel Junction (MTJ) devices used in the STT-RAM process. Different STT-latch design styles are also investigated and their robustness against process variations is analyzed.

Entry Number: 89 GP
REAL TIME AIR QUALITY MONITORING
By: Sumanth Reddy Enigala
Embedded Electrical & Computer Systems
Faculty Advisor: Dr. Hamid Shahnasser
Abstract: In this paper, a real-time crowd sensing based air quality monitoring system is presented. Raw sensor data collected from the gas sensors is sent to the cloud using an android application. In cloud, the data is processed and analyzed using apache spark/Hadoop framework. The processed data is visualized in real time using an open-source geospatial data visualization framework such as Leaflet using R programming. This paper also proposes a methodology to compare the past data with the present data using R base plotting.

Entry Number: 90 GP
REMOTE CONTROLLED CAR MONITORED USING AN ANDROID APPLICATION
By: Mayur Dhikle
Electrical Engineering
Faculty Advisor: Dr. Hamid Shahnasser and Dr. Mojtaba Azadi
Abstract: The wireless technology involves the transfer of information between two or more locations that are not connected by a physical medium. It is one of the fastest growing technologies in modern times. The Internet of Things (IoT) is a network of physical things embedded with electronics, software, sensors and connectivity, which enables these objects to collect and exchange data [2][3]. This project aims at integrating Wireless Technology with Embedded Systems. The main goal is to be able to transmit and receive audio and video signals from a Remote Controlled (RC) Car controlled by an android application. By using the Internet, the range of the RC car increases significantly. An Arduino Uno board is used to transmit and receive data over the The Internet to and from the mobile to the RC Car with the help of a Wi-Fi shield and a Wi-Fi module. All the components are integrated together and a working model of the proposed project has been obtained. A key factor motivating to build this device is that not much work has been done to integrate an RC Car with IoT. This project gives an insight on whether integrating IoT with embedded systems in the field of RC Car for monitoring remote areas is feasible and to what degree. Another important area where this technology proves to be useful is in the military. This car can be used as a Spybot to monitor and track information of areas inaccessible to soldiers. This technology can also be used commercially. The car can be used to conduct surveys in remote locations such as forests or deserts. Monitoring and collecting samples in inaccessible and remote terrains and locations becomes 10 very convenient and easy with the help of this device. Farmers/Landowners can use the car to survey their lands. Large areas on lands can be monitored with the help of this device. If there was a stray animal or poacher on the land the RC car can easily monitor the disturbances and send real-time data back to the landowner. All the data monitored can be controlled on the fingertips, which makes activities involving such tasks a lot easier. The various applications and uses of building of such a design were the main inspiration to choose this project.

Entry Number: 91 GP
COMPREHENSIVE ANALYSIS OF CONVENTIONAL SWITCHED RELUCTANCE MACHINES AND MUTUALLY COUPLED SWITCHED Reluctance Machines
By: Wei Chung Yu and Forest Hensley
Electrical Engineering
Faculty Advisor: Dr. Jin Ye
Abstract: This paper presents a comparative analysis of conventional switched reluctance machines (SRMs) and mutually coupled switched reluctance machines (MCSRMs) in terms of inductance profiles, torque profiles, the average torque, and the maximum torque. Four 3-phase, 12/8 SRMs including the conventional SRM, the short-pitched MCSRM, the fractionally-pitched MCSRM, and the fully-pitched MCSRM are evaluated. Compared to the conventional SRM, the MCSRMs can be driven by the three-phase standard voltage source converter and work in bipolar, two-phase excitation mode. In the bipolar, two-phase excitation mode, the fully-pitched MCSRM has the highest maximum and average torque production compared to the short-pitched MCSRM and the fractionally-pitched MCSRM.

Entry Number: 92 GP DISPLAY ONLY
DESIGN EFFICIENT AND SUSTAINABLE STRUCTURES USING TOPOLOGY OPTIMIZATION
By: Wen Li Tang
Civil Engineering
Faculty Advisor: Dr. Zhaoshuo Jiang
Abstract: Topology optimization provides a unique optimal solution for a given design parameter, applied load, and boundary condition. The optimal shape will create a structure that minimize the use of material and increase the efficiency and rigidity of the structure compared to the conventional method that is used in high-rise building today.

Entry Number: 93 GP
UNCERTAINTY QUANTIFICATION FOR A LARGE-SCALE MAGNETO-RHEOLOGICAL DAMPER FOR SEISMIC HAZARD MITIGATION
By: Jun Jian Liang
Structural & Earthquake Engineering
Faculty Advisor: Dr. Cheng Chen
Abstract: Magneto-Rheological (MR) dampers have been widely studied by researchers. The rheological properties of the MR fluid change when a magnetic field is applied so as to achieve smart energy dissipation result. Realistic modeling of MR damper is critical for seismic hazard mitigation. Model parameters derived from experiments have inherent uncertainties due to optimization and the seismic response prediction could deviate from actual structural performance due to these uncertainties. In this study, the algebraic model with 6 parameters for a large-scale 200 kN MR damper is utilized to evaluate the effect of uncertainties of its numerical model. Sensitivity analysis is also conducted to determine the impact of model parameters. The analysis shows that the uncertainties of MR damper should be accounted for in structural design.

Entry Number: 94 GP
USING SMART WEARABLE DEVICES FOR SEISMIC MEASUREMENT
By: Jackie Lok and Panfilo Armas
Structural & Earthquake Engineering
Faculty Advisor: Dr. Zhaoshuo Jiang
Abstract: Our existing method for seismic data retrieval consists of using stationary seismic stations to detect earthquakes. The stations house seismographs that records data and sends it back to a central data base. This project proposes an alternative to seismic stations in utilizing smart wearable devices such as phones, tablets to detect and record seismic data.

Entry Number: 95 GP DISPLAY ONLY
STABILITY EVALUATION OF STRUCTURAL PROPERTY-DEPENDENT INTEGRATION ALGORITHMS FOR REAL TIME HYBRID SIMULATION
By: Maryam Khan
Structural & Earthquake Engineering
Faculty Advisor: Dr. Cheng Chen
Abstract: Real-time hybrid simulation divides a structure into experimental and analytical substructures. The experimental substructures are physically tested in laboratories while the analytical substructures are computationally modelled using finite element programming. Integration algorithms are used to solve the equation of motions for the structural response based on the excitations applied to the substructures. Explicit integration algorithms are preferred over implicit algorithms since they don't involve iterations. Structural property dependent methods such as CR and KR-Î± algorithms have been widely applied in real-time hybrid simulations for structural laboratories around the world. However, accurate estimation of structural properties is required to determine the integration parameters. This project explores the effect of parameter estimation on the stability and accuracy of structural property dependent integration algorithms, thus providing a guideline for general application of these algorithms in structural testing involving rate-dependent devices.

Entry Number: 00 GP DISPLAY ONLY

DETECTING MONTANE MEADOWS IN THE TAHOE NATIONAL FOREST USING LIDAR AND ASTER IMAGERY

By: Austen Lorenz
Geographic Information Science
Faculty Advisor: Dr. Leonhard Blesius and Dr. Jerry Davis

Abstract: In the Sierra Nevada mountains, meadows provide numerous hydraulic and ecosystem functions such as flood attenuation, groundwater storage, and wildlife habitat. However, many meadows have been degraded from historical land use such as water diversion, grazing, and logging. Land managers have altered management strategies for restoration purposes, but there is a lack of comprehensive data on meadow locations. Previous attempts to inventory Sierra Nevada meadows have included several remote sensing techniques including heads up digitizing and pixel based image analysis, but this has been challenging due to geographic variability, seasonal changes, and meadow health. I present a remote sensing method using multiple return LiDAR (Light Detection and Ranging) and ASTER imagery to detect montane meadows in a subset of the Tahoe National Forest. The project used LiDAR data to create a digital terrain model and digital surface model. From these models, I derived canopy height, surface slope, and watercourse for the entire study area. Literature queries returned known values for canopy height and surface slope characteristic of montane meadows. These values were used to select for possible meadows within the study area. To filter out noise, only contiguous areas greater than one acre that satisfied the queries were used. Finally, 15-meter ASTER imagery was used to de-select for areas such as dirt patches or gravel bars that might have satisfied the previous queries and meadow criteria. When using high resolution aerial imagery to assess model accuracy, preliminary results show user accuracy of greater than 80%. Further validation is still needed to improve the accuracy of modeled meadow delineation. This method allows for meadows to be inventoried without discriminating based on geographic variability, seasonal changes, or meadow health.

Entry Number: 97 GP
THE "GREENING" OF GENTRIFICATION: A CASE STUDY OF THE EAST BAY GREENWAY
By: Erika Poveda
Geography
Faculty Advisor: Dr. Tendai Chitewere and Dr. Jennifer Blecha
Abstract: The San Francisco Bay Area has a close and contentious relationship with gentrification, displacement, and environmental justice. However, more research is needed within the region on the growing phenomenon of environmental gentrification. Through a case study of the proposed East Bay Greenway in Alameda County, California, this research explores whether communities can prevent gentrification before it happens. Data for this study was gathered from an online questionnaire and semi-structured interviews with non-profit staff, municipal staff, and community residents, and included a textual analysis of planning documents and local journal articles. Rather than measuring gentrification after development, this study is uniquely situated to offer a before and after analysis of the impact of greening in cities. Through providing a valuable snapshot of an area prior to the completion of a countywide sustainable development project, the research offers a more complete understanding of the complex relationship between environmental gentrification, environmental justice, and sustainable development than has thus far been done. Insights from this case study will benefit community residents, activists, and urban planners.

Entry Number: 98 GP DISPLAY ONLY
THE IMPACT OF WASTE MANAGEMENT POLICY ON MARINE DEBRIS: A CASE STUDY IN SAN MATEO COUNTY
By: Heather Co
Geography
Faculty Advisor: Dr. Tendai Chitewere and Dr. Jen Blecha
Abstract: On a global scale, marine debris threatens the health and well-being of coastal environments. Over the last few decades, researchers around the world have discovered plastic to be the most common type of debris found in waterways and along coastlines. The transition in consumption from recyclable and reusable materials, like glass to synthetic materials like plastics, has led to its proliferation of debris. Plastic litter is a major land-based source of marine debris and municipalities in San Mateo County, California have recognized that single-use plastic bags and polystyrene (Styrofoam) food service ware make up a large percentage of marine debris. As a result, these municipalities have adopted plastic bag and polystyrene bans. This research focuses on understanding how these policies in San Mateo County have reduced banned plastics from entering receiving waterways and becoming marine debris. This project analyzes debris data from San Mateo County Coastal Cleanup events and on-land visual trash assessments, as well as semi-structured interviews with staff from government agencies, waste haulers, environmental organizations, and plastic bag and polystyrene ban opponents. This research contributes to improving marine debris mitigation programs and policies by examining the effectiveness of current bans and proposing policy suggestions.

Entry Number: 99 GP DISPLAY ONLY
IMPACTS OF ILLEGAL DUMPING IN EAST PALO ALTO: AN ENVIRONMENTAL JUSTICE ANALYSIS
By: Misty McKinney
Geography
Faculty Advisor: Dr. Tendai Chitewere and Dr. Jennifer Blecha
Abstract: Illegal dumping causes significant impacts on land, water and air, but it can also contribute to poor health in the community. Because illegal dumping is often concentrated in low-income communities and communities of color, it can be considered an environmental injustice. Research on environmental justice and illegal dumping of solid waste has been widely studied, however, there are limited studies linking the two. To answer the question of whether low-income communities and communities of color are disproportionately burdened with illegal dumping, this project uses semi-structured interviews with government agencies, non-profits, and community members involved in community engagement, clean-ups, and environmental policies. Content from transcribed interviews were analyzed for common themes. Textual analysis of government reports, plans public comments and newspapers was conducted. This research contributes to our understanding of the impacts of illegal dumping in the City of East Palo Alto, California, a community predominantly with

people of color. The findings will provide a better understand why low-income communities and communities of color are disproportionately burdened with higher rates of illegal dumping and how municipalities can react to mitigate the burden on the impacted population.

Entry Number: 100 GP
AN EXAMINATION OF WATER QUALITY IN THE SOUTH BAY SALT POND RESTORATION PROJECT
By: Samuel Stein
Geography
Faculty Advisor: Dr. Leora Nanus and Dr. Nancy Wilkinson
Abstract: The South Bay Salt Pond Restoration Project (SBSPRP) was established in 2003 from 15,100 acres of former Cargill salt harvesting ponds in the San Francisco Bay Area. Since then, the SBSPRP has utilized an adaptive management framework to restore the ponds with the goal of habitat restoration, public access, and flood protection as its guiding principles. The SBSPRP is the largest wetland restoration project on the West Coast and the complexity of the project is compounded by nearby land use, including wastewater treatment plants (WWTPs) and urban development. The majority of previous water quality studies in the area have primarily focused on legacy pollutants, such as methylated mercury. In the SBSPRP and the South SF Bay as a whole, eutrophication and hypoxia are issues of ongoing concern. During the summer of 2016, a selection of Alviso ponds with diverse management histories were sampled for water quality parameters including dissolved oxygen (DO), nitrate (NO_3^-), and ammonium (NH_4^+) during spring and neap tides. Nutrient concentrations were positively correlated with DO values; distance to WWTPs was negatively correlated with DO. When examining change in DO from pond inlet to outlet, volume was negatively correlated. Pond management regime and tidal action also influenced the change in DO, suggesting that residence time may be a control on DO levels in the SBSPRP. These results suggest that greater considerations for DO and other water quality parameters may be of use in future adaptive management strategies in the SBSPRP, both in making new management decisions and anticipating effects of selected actions.

Entry Number: 101 GP
PHASE AND CONJUGATE PHASE RETRIEVAL
By: Andrew Luke Evans
Mathematics
Faculty Advisor: Dr. Chun-Kit Lai
Abstract: Phase retrieval is the recovery of unknown signals from measurements with noisy or lost phase. Recovery from loss of phase occurs in applications such as x-ray crystallography, speech processing and quantum information theory. In a finite-dimensional vector space, the measurements are inner products with a given spanning set of measurement vectors. One can consider the minimal number of measurement vectors required for phaseless reconstruction of a signal as well as any necessary and sufficient conditions on the measurement vectors for successful reconstruction. We introduce the concept of conjugate phase retrieval in complex vector spaces and provide examples of vectors which allow conjugate phase retrieval but not phase retrieval. In Paley-Wiener spaces, we exhibit a connection between phase retrievability of Riesz bases with one element removed to integrability of Lagrange-type interpolating series.

Entry Number: 102 GP
A DECOMPOSITION OF BIVARIATE ORDER POLYNOMIALS
By: Gina Karunaratne
Mathematics
Faculty Advisor: Dr. Matthias Beck
Abstract: Posets can be used to describe real world scheduling problems. Order polynomials help us count the number of ways we can re-order the poset, or the scheduling according to certain constraints. There is a strong tie between weak and strict univariate order polynomials. A decomposition of strict bivariate order polynomials is known. We show a similar decomposition of weak bivariate order polynomials and look for a connection between the two.

Entry Number: 103 GP
LITTLEWOOD'S CONJECTURE GEOMETRICALLY IN THE DUAL SPACE
By: Gregory Reese
Mathematics
Faculty Advisor: Dr. Yitwah Cheung
Abstract: Geometrically, any two real numbers, a and b, and an integer, n, can define a sequence of points in three dimensional real space, (na,nb,n) . The Littlewood Conjecture implies that as n goes to infinity, a sub-sequence of integer lattice points in three dimensional real space can be chosen such that for some value of n, (na,nb,n) is arbitrarily close to some lattice point. This paper investigates the behavior of the duals of vectors representing a sub-sequence of such lattice points. We explore some restrictions on the dual vectors and hope this will lead to a limitation on rational approximation of a pair of real numbers.

Entry Number: 104 GP
GRADUATE TEACHING ASSISTANTS' ENACTMENT OF PEDAGOGICAL PRACTICES IN DEVELOPMENTAL MATH COLLEGE COURSES
By: Javier Haro
Mathematics
Faculty Advisor: Dr. Kimberly Seashore
Abstract: Is one semester of instructional development enough to be an effective mathematics instructor? That semester course, Math 700, may be the only time that math graduate teaching assistants (GTAs) are exposed to formal training. At San Francisco State University, Math 60/70 courses are structured to promote the use of reform-oriented teaching practices that promote student-centered learning. However, GTAs may derail from these methods and fall back on traditional methods because of a lack of models and experience in using them. As a result, there is a growing need for research of how GTA training affects their pedagogical learning outcomes. We study these outcomes through classroom observations of classroom lesson segments. We conclude that most GTAs are using some of the pedagogical practices from Math 700 in their classes but there is a possible hesitation in adopting the provided reform materials.

Entry Number: 105 GP
THE CONFIGURATION SPACES OF THE ROBOTIC ARM IN A TUNNEL AND DYCK PATHS
By: John Guo
Mathematics
Faculty Advisor: Dr. Federico Ardila
Abstract: A reconfigurable system produces a natural graph called the state complex. When a state complex is CAT(0), there is a unique shortest path between its vertices. We can assess this CAT(0) quality of the state complex by determining if the state complex has a corresponding smaller graph, the poset with inconsistent pairs (PIP). We determine that the state complex of the robotic arm inside a tunnel and the state complex of Dyck paths are CAT(0). We present our implementation that demonstrates the capability to optimally move from one state of the robotic arm to another efficiently.

Entry Number: 106 GP
SOS DECOMPOSITION FOR SYMMETRIC POLYNOMIAL INEQUALITIES
By: Logan Coe
Mathematics
Faculty Advisor: Dr. Serkan Hosten
Abstract: We study the majorization of several term-normalized symmetric functions. By reorganizing desired inequalities between these symmetric functions we can use a sum of squares (SOS) decomposition to verify the inequality. Using semidefinite programming, we determine whether a given symmetric function has an SOS decomposition. By designing an invariant semidefinite program we reduce our problem size using the natural symmetries in SOS semidefinite programs. Using these methods we validate known majorizations corresponding to elementary and power sum symmetric functions. We also expand on similar results that have been found for Schur and complete homogeneous cases showing that all four symmetric functions are given a partial order using our semidefinite programming method.

Entry Number: 107 GP
WINNING A RECTANGLE GAME AND THE LITTLEWOOD CONJECTURE
By: Miguel Cardoso
Mathematics
Faculty Advisor: Dr. Yitwah Cheung
Abstract: The Littlewood Conjecture has been an open problem in number theory since the 1930s. We wish to give a background on one attempt to resolve this problem. The focus is to prove that there is a winning strategy to a game involving nested rectangles. To do this, we use the domain of approximation of a rational pair. We use the corners of the domains of approximation to pick our rectangles. From here, we look for any conditions that would help us guarantee a winning strategy for the game. A guaranteed winning strategy implies that the Littlewood Conjecture is false.

Entry Number: 108 GP
ESTIMATION OF TIME SERIES COMPLEXITY WITH AN APPLICATION TO SEIZURE PREDICTION
By: Nathanael Aff
Mathematics
Faculty Advisor: Dr. Alexandra Piryatinska
Abstract: The epsilon-complexity coefficients were introduced by Darkhovsky and Piryatinska as a method of quantifying the complexity of a time series. We extended the set of approximation methods used to compute epsilon-complexity. Three approximation methods were compared in a classification task using a suite of simulated functions. Cubic spline interpolation was found to perform as well or better than other interpolation methods. We then used epsilon-complexity coefficients along with frequency, variance, and other features to predict seizures in epileptic mice using electroencephalograms (EEG). A seizure response to a stimulus was predicted 89% of the time while the absence of response was predicted with an 87% accuracy.

Entry Number: 109 GP DISPLAY ONLY
MEASURING POLYTOPES WITH SYMMETRY: THE EQUIVARIANT EHRHART THEORY OF THE PERMUTAHEDRON
By: Anna Maria Schindler
Mathematics
Faculty Advisor: Dr. Federico Ardila
Abstract: Equivariant Ehrhart theory is an extension of Ehrhart theory that considers a lattice polytope under group actions. We study the permutahedron under the action of the symmetric group, computing the equivariant Ehrhart polynomials and quasi-polynomials for the subsets of the permutahedron fixed by various permutations. Furthermore, we find that these subsets have properties analogous to those of the permutahedron.

Entry Number: 110 GP
THE EQUIVARIANT EHRHART THEORY OF THE PERMUTAHEDRON
By: Anna Maria Schindler and Andres R. Vindas Melendez
Mathematics
Faculty Advisor: Dr. Federico Ardila
Abstract: Ehrhart theory is a well-established field that studies lattice points in dilations of polytopes. Polytopes are geometric objects with flat sides that exist in all dimensions. Much of the structure connecting the volume of a dilated polytope to the number of lattice points it contains is encoded in its Ehrhart polynomial. In 2010, Alan Stapledon described an equivariant analogue to Ehrhart theory as an extension of the theory with group actions.This work attempts to describe the equivariant Ehrhart theory of the permutahedron, which is the convex hull of all points formed by permuting the coordinates of the vector $(1, 2, ..., d)$. The results in this poster include information on the dimension of the fixed polytopes, combinatorial equivalence, and the relationship to zonotopes.

Entry Number: 111 GP
EFFECTIVE WEDDERBURN AND APPLICATIONS
By: Justin Fong
Mathematics
Faculty Advisor: Dr. Joseph Gubeladze
Abstract: We propose a new algorithmic proof of the classical Wedderburn's theorem in the representation theory of finite abelian groups. Namely, the algebra isomorphisms, known to exist from the classical theory, are explicitly found. Employing ideas from algebraic geometry, the global variety of all representations of fixed dimension for a finite group is introduced and its geometric properties are explored. The last step involves an extensive computer assisted analysis of the resulting high dimensional polynomial ideals.

Entry Number: 112 GP
PHOTORESPONSE OF NATURAL VAN DER WAALS HETEROSTRUCTURES
By: Sauraj Jha
Physics
Faculty Advisor: Dr. Akm Newaz
Abstract: Van der Waals (vdW) heterostructures consisting of two- dimensional materials offer a platform to obtain material by design and are very attractive owing to novel electronic states. Research on 2D van der Waals heterostructures (vdWH) has so far been focused on fabricating individually stacked atomically thin unary or binary crystals. Such systems include graphene (Gr), hexagonal boron nitride (h-BN) and members of the transition metal dichalcogenides family. Here we present our experimental study of the optoelectronic properties of a naturally occurring vdWH, known as Franckeite, which is a complex layered crystal composed of lead, tin, antimony, iron and sulfur. We present here that thin film franckeite (60 nm < d < 100 nm) behave as narrow band gap semiconductor demonstrating a wide band photoresponse. We have observed the band-edge transition at ~ 1500 nm (~830 meV) and high external quantum efficiency (EQE~3%) at room temperature. Laser power resolved and temperature resolved photocurrent measurements reveal that the photo-carrier generation and recombination are dominated by continuously distributed trap states within the band gap.

To understand wavelength resolved photocurrent, we also calculated the optical absorption properties via density functional theory. Finally, we have shown that the device has fast photoresponse with rise-time as fast as ~ 1 ms. Our study provides a fundamental understanding of the optoelectronic behavior in a complex naturally occurring vdWH and can open up the possibilities of producing new types of nanoscale optoelectronic devices with tailored properties.

Entry Number: 113 GP DISPLAY ONLY
DESIGNER PHOTONICS! WAVEGUIDES AND FILTERS USING HYPERUNIFORM DISORDERED MEDIA
By: Shervin Sahba
Physics
Faculty Advisor: Dr. Weining Man
Abstract: My research focuses on photonic media: geometric arrangements of dielectric that can manipulate the flow of light. My work uses FDTD simulations to design waveguides and filters that can be used to create photonic circuitry - which may one day supplant electronic information technologies.

Entry Number: 114 UL DISPLAY ONLY
HOW DOES CHILDHOOD FAMILY ADVERSITY GET UNDER THE SKIN AND AFFECT AGGRESSIVE BEHAVIOR?
By: Cynthia Perez
Cell & Molecular Biology
Faculty Advisor: Dr. Leticia Marquez-Magana, Dr. Melissa J Hagan, and Dr. Rebecca Mendez
Abstract: Individuals raised in an adverse family environment are more likely to develop aggressive behaviors that can lead to poorer health outcomes and health disparities. Recent studies propose that this may be due to a heightened biological stress response that puts individuals at risk of interpersonal aggression impacting health. For example, individuals raised in an adverse family environment are at greater risk of drug and alcohol use and abuse, self-harm, suicide or violence, and heart disease. The purpose of this study is to examine the role of the biological stress response in the development of aggressive behavior in young adult female students who have or have not had a history of childhood family adversity. We hypothesize that young adult females with a history of childhood family adversity will express higher levels of the stress hormone, cortisol, and greater levels of aggression when confronted with a challenging task than females lacking this history. To test this hypothesis participants completed questionnaires about their childhood experiences and we are in the process of measuring cortisol levels from saliva samples collected before, during, and after participation in an ecologically valid conflict task that measures direct (i.e., physical) and indirect (i.e., relational) aggression. Taken together, our data is expected to shed light on how a history of childhood family adversity can get under the skin to disrupt the biological stress response and trigger aggressive behavior in young adult females. This knowledge will contribute to creation of an intervention that addresses the biological impact of childhood family adversity on health disparities that arise from increased interpersonal aggression to promote health equity and healthier communities.

Entry Number: 115 UL
The LAC-ttuce You Been LAC-in
By: Jacky Lo
Biology
Faculty Advisor: Dr. Lily Chen
Abstract: In the recent years, leafy greens including lettuce, spinach, and sprout have been implicated in many multistate foodborne illness outbreaks linked to pathogenic E. coli. Conventional sanitization methods such as commercial triple washing steps to reduce the spread of contamination remain ineffective in reducing the risk of internalized pathogens in the edible tissue. The mechanisms of how the pathogen is introduced into the leafy greens are not fully understood. However, speculation of contaminated soil with cattle feces, or the water used in irrigation and roots injuries sustained from soil, are the primary catalysts. This study initiated a biocontrol approach of evaluating the inhibitory capacity of internalized probiotic bacteria (LAB) Lactobacillus casei and Lactobacillus acidophilus against E. coli invading lettuce plant through the roots. A testing procedure on lettuce seedling model was developed to examine cellular uptake and bacterial interactions. Fluorescence microscopy and flow cytometry are used to image and perform a time-course study of E. coli tagged with GFP and Lactobacillus-containing RFP. The study is currently examining internality and inhibitory capacity of LAB against non-pathogenic E. coli, once methodology is fully developed, future study will examine other enteropathogens including pathogenic E. coli, Salmonella and Shigella spp.

Entry Number: 116 UL
SMALL MOLECULE SCREEN USING GRP/CHK1 DROSOPHILA MUTANT USING SYNTHETIC LETHALITY
By: Jacqueline Leiva, Alonso Castro, and Victor Talamante
Biology
Faculty Advisor: Dr. Blake Riggs
Abstract: Currently there are 3 main treatments for cancer, which are surgery, radiation and chemotherapy; however, radiation alone is not enough to eliminate all cancerous cells.
In this study, the concept of synthetic lethality is used to test the effects of small molecule drugs from the National Cancer Institute with Drosophila melanogaster as the model organism. Using the small molecule with the mutated Chk1 will induce a synthetic lethality effect, decreasing eclosion counts in grp mutants. By screening the small molecule drug library and coupling with radiation, it may be possible to find a small molecule drug that shows promising signs of cancer treatment for the future. We predict that the small molecule will have promising results as a treatment by maintaining survivability of wildtype and reducing survivability of the grp mutants, despite the synthetic lethality or damage caused by irradiation

Entry Number: 117 UL
INVESTIGATING ALTERNATIVE SPLICING EVOLUTION
By: Jamie Moon
Biology
Faculty Advisor: Dr. Rori Rohlfs and Dr. Scott Roy
Abstract: Alternative splicing (AS) is the process by which fragments of genes, known as exons, are rearranged in different ways to form many protein variants from the same gene. It is important as it expands the functional repertoire of transcriptomes with protein variants, or isoforms. AS provides a convenient means for rapid evolution as including or excluding a single exon can have profound impacts on the function of a protein. Until recently, research in AS evolution has been stalled by the lack of quality RNA-Sequencing data that accurately quantified AS. Now, we have the opportunity to accurately estimate how AS plays an important role in expression adaptation, by methods of comparative and inter-species analysis. In this study, we apply the phylogenetic ANOVA model known as EVE, Expression Variance and Evolution, to three datasets, comparing variation in exon inclusion proportions between and within tissues of Human, Chimpanzee, Macaque, and Mouse. We identify patterns in exon inclusion proportion variance, within individuals and between species that reflect conservation or expression adaptations.

Entry Number: 118 UL
FUNCTIONAL ANALYSIS OF HUMAN GLUTAMIC-OXALOACETIC TRANSAMINASE 1 IN VITAMIN B6 HOMEOSTASIS SIGNALING
By: Cinthya Ibarra
Botany
Faculty Advisor: Dr. Zheng-Hui He
Abstract: Vitamin B6 plays a crucial role functioning as a cofactor for more than 140 enzymes. Pyridoxal 5-Phosphate (PLP) is the bioactive form of vitamin B6 that is essential for many metabolic reactions. The human aspartate aminotransferase (commonly known as GOT1 for glutamate-oxaloacetate transaminase 1) requires PLP as its cofactor and plays a key role in nitrogen metabolism. GOT1 has been used as a clinic marker for liver functions. Our studies have shown that the Arabidopsis ortholog of HsGOT1, ASP2 (aspartate aminotransferase 2), plays key roles in both nitrogen metabolism and vitamin B6 homeostasis signaling. Specific mutations in ASP2 partially rescue the phenotype of a mutant called rus1 (root UV-B sensitive 1) that has defects in vitamin B6 homeostasis signaling. Our data suggests that specific mutations in ASP2 may affect its PLP conjugation property, allowing the vitamin B6 homeostasis signals to be partially restored. Our genetic studies suggest that the highly conserved HsGOT1 may also have dual functions just like ASP2. This project aims to test if HsGOT1 holds the same protein binding and PLP association properties as ASP2. Site-directed mutagenesis

was carried to create HsGOT1 mutations that mimic the known ASP2 alleles. HsGOT1 mutant proteins are tested for their protein-protein interactions by yeast two-hybrid assays. Interaction constructs (GAL4 AD and GAL4 BD) required for yeast two-hybrid assays have been generated and confirmed by DNA sequencing. Our experiments have shown that HsGOT1 interacts with itself indicating it forms homodimers as expected. HsRUS also interacts with HsGOT1. Interestingly, the mutant HsGOT1 proteins showed stronger interactions when compared with wild type HsGOT1 and ASP2. Our tests suggest that specific mutations in HsGOT1 may change its binding capacities with PLP and other proteins and these changes may play a role in vitamin B6 homeostasis signaling.

Entry Number: 119 UL
CHARACTERIZING THERMODYNAMIC STABILITY OF THE H2A/H2B DIMER AND VARIANTS FROM C. ELEGANS USING CIRCULAR DICHROISM
By: Austin Murchison and Troy Lowe
Cell & Molecular Biology
Faculty Advisor: Dr. Raymond Esquerra
Abstract: Histones are DNA binding proteins that pack and arrange DNA into an ordered structure called chromatin. Nucleosome core particles (NCP) are protein complexes comprised of DNA spooled around a histone octamer. The core histones that make up the NCP are two H2A/H2B dimers, and one H3/H4 tetramer. H2A has many evolutionary variations in the amino acid (AA) sequence which alters the functionality of the NCP. Two of these H2A variants are HTAS-1 which contain 145 AA and has a 51% sequence identity to H2A, and HTZ-1 which contains 140 AA and has 54% identity. We will examine the thermodynamic stability of H2A variants, HTZ-1 and HTAS-1, and how they compare to the canonical H2A in the H2A/H2B dimer structure. The physical stabilities of HTAS-1/H2B and HTZ-1/H2B will be characterized using circular dichroism and compared to the canonical H2A/H2B to further understand how monomer sequence affects the NCP. It is hypothesized that the dimer variants have a lower stability and reflect greater DNA accessibility in these NCP variations. Histones were expressed in E. coli and purified using size exclusion and ion exchange chromatography. Dimers were further purified through size exclusion chromatography. We use thermal studies to characterize the thermodynamic stability of the H2A/H2B dimer. We will use far-UV circular dichroism to monitor the dissociation of the histone heterodimers and the unfolding of histone secondary structure to denatured conformation. The stability of nucleosome core particle is important when considering how DNA is expressed and repressed, these studies will contribute to our understanding of DNA accessibility.

Entry Number: 120 UL
IDENTIFYING BARRIERS TO ACCESSING HEALTHCARE AMONG FEMALE SEX WORKERS IN ZAMBIA
By: Chinomnso Okorie
Cell & Molecular Biology
Faculty Advisor: Dr. Catherine E. Oldenburg and Dr. Leticia Marquez-Magana
Abstract: Introduction: In Sub-Saharan Africa, female sex workers (FSWs) need more accessibility to primary and reproductive health services, which are currently limited by structural, cultural and social-economic factors. FSWs have elevated rates of HIV infection compared to the general population and reduced access to healthcare services. Here, we investigated the general barriers FSWs face towards access to healthcare in Zambia under three intersections of women's health: family planning, primary care, and HIV testing.
Methods: A cross-sectional questionnaire was administered to 965 FSWs in the transit towns of Chirundu, Kapiri, and Livingstone in Zambia. All women self-reported their HIV status as negative or unknown. Eligible participants were 18 years or older and reported exchanging any form of sex for money or goods at least once in the past month at a transit town in Zambia. The barriers FSWs face towards access to healthcare were identified using the intersects of women's health. Participants were asked if they were currently using family planning, and if not, the reasons. Participants were also asked if they had ever tested for HIV, and if not, why not, and if so, when their most recent test was (in months). Finally, they were asked if there was a time they needed healthcare, but were unable to access it, and what made it difficult. Descriptive and bivariate statistics were used to describe the barriers FSWs face to accessing care.

Results: Out of the 965 participants enrolled in the study, the median age was 25 years (interquartile range 21-30 years), and 806 (84.9%) reported a monthly income of <1000 Zambian kwacha (~USD $100). Literacy was at 75.3% (N=722) with approximately half (N=450) having Primary/Junior Education. 232 (24.1%) FSWs reported they were not currently using family planning; women who reported not using family planning were more likely to be older in age (P=0.009). There were 142 (60.9%) women who were not using family planning identified fear of side effects as the root cause. Also, 196 (20.66%) FSWs reported never being tested for HIV, with 88 (45.8%) being afraid of results and 40 (20.8%) reporting lack of time as the primary reason for not testing for HIV. The most recent HIV test was an average of 12 months previously (SD 18.3). More than 354 (36.8 %) were unable to access healthcare in the past 12 months, most commonly because of transportation, money for services, or feeling uncomfortable to receive care.
Conclusion: This study of almost 1000 female sex workers in Zambia suggests that there are significant barriers to accessing care. The most novel finding was the prominent barrier fear; fear from side effects, fear of results and fear of feeling uncomfortable. This is contrary to previous studies, where interventions have emphasized reducing lack of awareness and lack of knowledge as barriers. Future directions should focus on expanding research which incorporates interventions that addresses fear-related barriers to improve access to care at multiple levels. One example would be to work with peer educators, who can help reduce fear amongst FSWs. They can be used to administer public information campaigns and incorporated into primary care services to create more personable connections and reduce desensitization of health workers.

Entry Number: 121 UL
SQUID SHOW STABLE LONG-TERM MEMORY UNDER TWO DIFFERENT REINFORCEMENT SCHEDULES.
By: Emily Zepeda and Rob Veline
Cell & Molecular Biology
Faculty Advisor: Dr. Robyn Crook
Abstract: Learning and memory in cephalopod molluscs have received intensive study due to cephalopods' complex behavioral repertoire and relatively accessible nervous systems. While most of this research has been conducted using octopus and cuttlefish species, there has been relatively little work on squid. Euprymna scolopes, a sepiolid squid, is a promising model for further exploration of cephalopod cognition. These small squid have been studied extensively for their symbiotic relationship with bioluminescent bacteria, and their short generation time and successful captive breeding through multiple generations makes them appealing models for neurobiological research. However, little is known about their behavior or cognitive ability. Using the well-established prawn in the tube assay of learning and memory, we show that within a single 10 minute trial, Euprymna scolopes learns to inhibit its predatory behavior, and after three trials can retain this memory for at least 12 days. Rapid learning and very long-term retention were apparent under two different training schedules. This study is the first demonstration of learning and memory in this species, and to our knowledge, is the first demonstration of associative learning in any squid.

Entry Number: 122 UL
DEVELOPING A MODEL SYSTEM TO INVESTIGATE AN ENDOPLASMIC RETICULUM SURVEILLANCE CHECKPOINT IN MULTICELLULAR ORGANISMS
By: Iris Avellano
Cell & Molecular Biology
Faculty Advisor: Dr. Blake Riggs
Abstract: Developing a model system to investigate an endoplasmic reticulum surveillance checkpoint in multicellular organisms
The endoplasmic reticulum is a cellular organelle with essential roles in the biosynthesis of lipids, and processing of newly synthesized proteins. Like the nucleus, the ER cannot be synthesized de novo and must be passed down to daughter cells during mitosis. Therefore, it is essential that the ER is partitioned as the cell divides, in a highly regulated and controlled way. However, this mechanism hasnâ€™t been well-studied. The ER Stress Surveillance Pathway (ERSU) has been identified in S. cerevisiae where ER stress causes a delay in ER inheritance and cytokinesis, and it has yet to be determined whether a similar organelle cell cycle checkpoint exists in multicellular organisms. This study aims to develop an animal cell model, using Drosophila Schneider 2 (S2) cell culture to identify analogous ERSU in metazoans. S2 cells, transfected with RASv12 to raise their mitotic index, are exposed to ER-stressor drugs, and then screened for cytokinesis defects, using fluorescent microscopy and flow cytometry. The fundamental mechanisms of cytokinesis differ between uni- and multicellular organisms, so the details of their respective ER inheritance may also differ. The failure to properly regulate ER functional capacity in cells is known to contribute to the pathophysiology of a number of human diseases such as diabetes and certain cancers. Identifying key regulation checkpoints in ER partitioning will eventually lead to development of previously unrecognized strategies for therapeutic intervention of these diseases.

Entry Number: 123 UL
DETERMINING TARGET GENES REGULATED BY MICRORNA-206 DURING EARLY SKELETAL MUSCLE DEVELOPMENT
By: Jason Garcia
Cell & Molecular Biology
Faculty Advisor: Dr. Carmen Domingo and Dr. Julio Ramirez
Abstract: MicroRNA's (miRNAs) are small non-coding RNAs that regulate genes post-transcriptionally. miRNAs regulate various aspects of development including growth, differentiation and cell maintenance. In particular, we study miR-206 because it is a vertebrate and skeletal muscle-specific miRNA. Although miR-206

has 100s of potential targets, many have not been confirmed. We are optimizing a green fluorescent protein (GFP) reporter system that will allow us to characterize putative miR-206 targets using Xenopus laevis as our model system. Our approach consists of co-injecting mRNA coded for GFP that includes a putative miR-206 binding domain upstream of GFP. We express this reporter along with a control constitutively active red fluorescent protein (RFP) reporter in the fertilized egg. We can then use relative GFP/RFP levels to identify potential miR-206 targets. We tested the specificity of our reporter system by determining the ability of miR-206 and a closely related myomir, miR-1, to downregulated GFP-pax7 3 UTR, a key protein expressed in muscle satellite cells and a known target of miR-206. Our results indicate that both miR-206 and miR-1 down regulate GFP-pax7 3-UTR signal compared to a control miRNA precursor. Interestingly, miR-1 appeared to more significantly decrease the GFP-pax7 3-UTR signal in comparison to miR-206. These results suggest that Pax7 mRNA may be differentially regulated by these two muscle specific miRNAs. Given our results, we are now poised to use our GFP reporter assay to identify new miRNA targets that are important in regulating early skeletal muscle formation.

Entry Number: 124 UL
THE RELATIONSHIP BETWEEN EXTERNAL PH AND VACUOLAR PH/ VACUOLAR MORPHOLOGY
By: Jean Luke Campos and Robert Carlos Segura
Cell & Molecular Biology
Faculty Advisor: Dr. Yee-Hung M. Chan
Abstract: The yeast vacuole is important for degradation, protein transport and pH regulation. The regulation of pH is important because of its role in a wide variety of processes such as receptor down regulation and mitochondrial health. However, the relationship between pH regulation and vacuole morphology is still unexplored. Insights towards this problem would enable cell optimization in industry and a better understanding of the mammalian lysosome. To answer these questions, the behavior of the vacuole has to be characterized in a controlled manner. To begin, we decided to observe the change in morphology and vacuolar pH as the growth media is changed. To observe morphology, we use the dye fm464, which localizes to the membrane of the vacuole. To observe pH regulation, a pH sensitive dye is localized to the vacuole and measured using confocal microscopy and fluorimetry. Previously, the dye we have used was carboxyfluorescein diacetate (CFDA), but the dye was degraded easily leading to inconsistent results. In order to improve data collection, various dyes were tested and 2-,7-bis(carboxyethyl)-5(6)-carboxyfluorescein (BCECF AM) would be used due to its' stability and improved fluorescence. Using this dye, we will now be able to accurately measure pH of the vacuole in the wildtype yeast, BY4741 to see if pH is regulated through different media changes.

Entry Number: 125 UL
A SMALL MOLECULE ANTI-CANCER DRUG SCREEN IN DROSOPHILA MELANOGASTER LARVAE
By: Maiya Akhmetzhanova, Elizabeth Sandovsky, Jose Ortega, and Frank Wu
Cell & Molecular Biology
Faculty Advisor: Dr. Blake Riggs
Abstract: Cancer is a class of diseases that causes cells to lose their ability to control their proliferation. Current cancer therapeutics target cancer cells, but they also target healthy cells. The molecular mechanisms of cancer cells are well understood, but the biological community does not have the information on therapeutics that target exclusively cancer cells. Using Drosophila melanogaster as a cancer model, we tested many small molecules that may have anti-cancer properties to stop or slow down cell cycle progression. We irradiated mutant flies that have an aberrant Checkpoint kinase 1 (Chk1) protein and administered anti-cancer molecules to them. We then scored for lethality and determined if the anti-cancer molecule slowed down or stopped Drosophila development. Preliminary data has shown that irradiated larvae treated with the small molecules have lower eclosion percentages, compared to larvae that were not administered the anti-cancer molecule. The results from this experiment will give insight on how future cancer therapeutics can specifically target cancer cells and either slow down or stop cancer cell division.

Entry Number: 126 UL
EMBRYONIC MYOSIN HEAVY CHAIN IS TRIPHASICALLY EXPRESSED AND NOTABLY DELAYED IN COMPARISON TO BIPHASIC EXPRESSED TITIN IN MYOTOMES OF DEVELOPING CHICKEN EMBRYOS
By: Muhammad Siraj, Devan Shah, Adrian Martin, and Omar Mendoza
Cell & Molecular Biology
Faculty Advisor: Dr. Wilfred Denetclaw
Abstract: Nitric oxide (NO), is a pleiotropic, short-lived, signaling gas molecule, that we show is produced in the ectoderm layer and has regulatory control over subjacent somites for embryonic skeletal muscle (myotome) formation in chicken embryos. Although previous work from our lab investigated titin expression, an early made muscle protein, to investigate the time myotome formation began in somites of chicken embryos, our results showed notable significant short delays or activation of myotome formation from control rates under NO signaling. However, it is unknown if muscle differentiation rates in myotomes might be under greater regulation by NO signaling. We hypothesize that myotome will show greater responses in differentiation through earlier or later expression of embryonic fast myosin heavy chain (eMHC), a muscle protein that following titin expression by several hours, under NO signal regulation. To investigate, we first established timing of eMHC expression by MF20 immunofluorescence labeling in whole chicken embryos and muscle formation assessment by fluorescence microscopy. We report the eMHC expression rates in myotome [n=24, HH12-HH18], of chicken embryos as triphasic, like desmin, but unlike titin, both early expressed muscle proteins. We conclude that eMHC expression is stable and dynamic in the development of somites in chicken embryos and allows differences in myotome formation rates and muscle differentiation rates to be measured in assessment of NO signaling in the chicken embryo. Supported by DBI-1548297; IRA Awards to MBS and DS

Entry Number: 127 UL
FINDING THE RELATIONSHIP BETWEEN VACUOLE SIZE AND RECEPTOR DOWN-REGULATION IN SACCHAROMYCES CEREVISIAE
By: Presley Jackson
Cell & Molecular Biology
Faculty Advisor: Dr. Mark Chan
Abstract: Yeast cells are a powerful model organism that have been used widely in the investigation of endo- and exocytosis. Using this model organism can help us understand a number of biological processes such as receptor down-regulation and how important organelles play a role in the regulation of such processes. Previous studies have shown that organelle size such as the vacuole in Saccharomyces Cerevisiae has an effect on the function of certain biological processes within the cell. However, little is known about how this organelle directly effects receptor down-regulation. In this study, we aim to understand if there is a relationship between the size of the vacuole and the rate at which receptor down-regulation occurs. Current studies are aimed at first understanding if glucose starvation has an effect on the localization of these receptors within the yeast cells. To test this, yeast cells were transformed with Ste2-GFP and Mup1-GFP, separately. Cells were grown in nutrient rich media, YPAD, and grown overnight. Cells were imaged from the overnight culture and some were grown to log phase (0.6 OD). We found that glucose starvation does in fact have an effect on the localization of the proteins.

Entry Number: 128 UL
JOINT ROLE OF A PROTEASE AND LIPOPROTEIN IN SYMBIOSIS BETWEEN RHIZOBIA AND LEGUME PLANTS
By: Rebecca Moore and Joseph Sapienza-Martinez
Cell & Molecular Biology
Faculty Advisor: Dr. Joseph C. Chen
Abstract: Nitrogen is a fundamental element of life, but current agricultural practices quickly deplete its bioavailability from soil. While anthropogenic fertilizers can supply the nutrient rapidly, leguminous plants, such as alfalfa, offer a more environmentally sustainable alternative. These plants form a symbiotic relationship with rhizobial microorganisms which convert atmospheric nitrogen into ammonium, capable of being metabolized by the plant. *Sinhorhizobium meliloti* serves as a model bacterium for studying the cascade of molecular signals leading to this symbiosis. Exopolysaccharides produced by *S. meliloti*, in particular

succinoglycan (or EPS-I), have been shown to be critical for successful infection of the plant root hairs. Two previously uncharacterized proteins, LppA (a lipoprotein) and JspA (a zinc-dependent protease), appear to regulate jointly EPS-I production, in turn affecting the efficiency of symbiosis. Microarray analysis identified over 100 *S. meliloti* genes whose expression changed when JspA was overexpressed. Based on such transcriptional changes, we hypothesize that LppA and JspA modulate the activity of a conserved signaling pathway integral to bacterial infection. Transcriptional fusions of the reporter enzyme beta-glucoronidase (GUS) to candidate downstream targets were constructed to validate the microarray results. Measurements of GUS activity under different conditions indicate that JspA and LppA indeed influence expression of genes that belong to the regulon of the conserved ExoR-ExoS-ChvI signaling pathway. Further investigation of the activities of LppA and JspA will help clarify the molecular events that allow *S. meliloti* to colonize its host plant effectively. Increased understanding of factors that contribute to rhizobia-legume symbiosis can help improve agricultural practices: finding methods to enhance symbiosis and nitrogen fixation may lessen reliance on fertilizers, thus reducing the ecological impact of human activities while improving crop yields.

Entry Number: 129 UL
IDENTIFYING CHEMOTHERAPEUTIC SMALL MOLECULES BY SYNTHETIC LETHALITY IN D. MELANOGASTER CHK1 MUTANTS
By: Sam Weick and Addison Yu
Cell & Molecular Biology
Faculty Advisor: Dr. Blake Riggs
Abstract: Cancer is a complex disease which requires an equally complex treatment program. Small molecule treatment plans have largely proved ineffective in producing remission in cancer patients due to their inability to preferentially eliminate malignant cells. Identifying new compounds to introduce into combination therapies is essential to achieve progress in chemotherapy treatments. We developed a whole organism screening protocol which utilizes Drosophila oncogenic mutants to test small molecules for chemotherapeutic activity indicated through synthetic lethality. This was accomplished through comparative analysis of controls and Drosophila Chk1 homologue post radiation eclosion counts with or without compound addition. Any compounds identified to selectively target checkpoint 1 mutants over wild type will be highlighted as candidates for future trials.

Entry Number: 130 UL
MOLECULAR AND BIOCHEMICAL ANALYSIS OF HUMAN ASPARTATE AMINOTRANSFERASE
By: Stacey Phan
Cell & Molecular Biology
Faculty Advisor: Dr. Zheng-Hui He
Abstract: Vitamin B6 (vitB6) functions as a crucial coenzyme for over 140 enzymes. VitB6 homeostasis is critical for cellular functions for all organisms, but how vitB6 homeostasis is regulated and maintained is unknown. Genetic and molecular studies have shown that ASP2, an Arabidopsis aspartate aminotransferase protein, plays a role in vitB6 homeostasis signaling. The human ASP2 ortholog, HsGOT1, a critical indicator utilized ubiquitously to detect abnormalities in human liver health, was shown to genetically complement ASP2 in Arabidopsis. We hypothesize that the highly conserved HsGOT1 may genetically and biochemically function like ASP2 in vitB6 homeostasis signaling. To test this hypothesis we investigated the protein-protein interactions of Hsgot1-S1-1 (P300L) that mimics the amino acid residue replacement in the genetically identified ASP2 allele (P292L) that show specific vitB6 related phenotypes. Various constructs with HsGOT1 alleles were made in yeast-two hybrid assay vectors. Plasmid DNA of these constructs were purified and sequenced to confirm that the intended amino acid substitution is present before transformed into yeast competent cells. GAL4-AD and GAL4-BD constructs that carry HsGOT1 (WT) was successfully engineered. Our yeast two-hybrid assays show that HsGOT1 interacts with itself confirming that HsGOT1 forms homodimers. Our analysis also show that HsGOT1 interacts with Hsgot-S1-1 (P300L). The Arabidopsis ASP2 is known to interact with RUS1. Our assays suggested that HsGOT1 physically interacts with HsRUS. The compiled preliminary data suggests that a vitB6 homeostasis signaling pathway involving both aspartate aminotransferase and RUS1 may be conserved between human and Arabidopsis.

Entry Number: 131 UL
RESOLVING HEME REACTION INTERMEDIATES IN NITRIC OXIDE SYNTHASE WITH CRYOGENIC MAGNETIC CIRCULAR DICHROISM (MCD)
By: Steven Sun
Cell & Molecular Biology
Faculty Advisor: Dr. Raymond Esquerra
Abstract: Nitric oxide (NO) is an important signaling molecule involved in many physiological processes such as smooth muscle relaxation and neuronal growth. NO is produced by the heme protein nitric oxide synthase (NOS) from L- arginine via two separate mono-oxygenation reactions. Both involve the binding of oxygen to the heme moiety to form activated oxygen complexes. However, to date the identity of these heme reaction intermediates has yet to be resolved. We developed a new technique to characterize catalytic intermediates that combines a caged-oxygen phototrigger, (mu-peroxo)(mu-hydroxo)bis[bis(bipyridyl)cobalt(III)]nitrate (HPBC), to initiate a reaction and low-temperature magnetic circular dichroism (MCD) to characterize cryogenically trapped intermediates. This method enables us to generate molecular oxygen for NOS in situ and initiate NO

synthesis in a controlled fashion. After oxygen production, the MCD spectra of cryogenically trapped intermediates can be measured. By combining HPBC photolysis and cryogenic MCD, this study aims to generate spectral fingerprints of the NOS heme reaction intermediates during NO synthesis. This method can help answer fundamental questions about the mechanism of heme protein catalysis, provide insight into how the active site environment controls this chemistry, and be a valuable resource in characterizing the mechanism of any oxygen dependent heme protein.

Entry Number: 132 UL
CELL PLASTICITY DURING XENOPUS LAEVIS EMBRYOGENESIS
By: Talia Hart
Cell & Molecular Biology
Faculty Advisor: Dr. Carmen Domingo
Abstract: The fertilized egg undergoes divisions to give rise to an adult organism comprised of specialized cell types. Our lab is interested in understanding the in-vivo dynamics that determine cell fates. My research examined four factors: range of plasticity, age of the host embryo, host environment, and timing of commitment to specific cell types. We examined this process by challenging prospective neural cells to change their fate and become muscle cells. Our results show that cells from the prospective anterior neural region lose their ability to change their fate by the end of gastrulation. In contrast, cells from the posterior neural ectoderm remain plastic until mid-neurulation. By varying the age of the host embryo, we show that prospective neural cells are most responsive to muscle-inducing signals present at the end of gastrulation. In addition, by grafting prospective neural cells to different embryonic regions, we show that the lateral dorsal blastopore lip region is the most conducive for inducing a muscle fate. Finally, we transplanted prospective neural and muscle cells to the same muscle inducing location to compared the timing of cell differentiation and cell behaviors among these two different cell populations. We concluded that prospective posterior neural ectoderm cells form muscle cells at the same spatial and temporal rate as prospective muscle cells. However, cells from the anterior neural ectoderm region showed a delay in forming muscle. These results suggest that the posterior prospective neural ectoderm retains more plasticity in comparison to the anterior prospective neural ectoderm during embryogenesis.

Entry Number: 133 UL
MICROTUBULES ARE NECESSARY FOR ER REORGANIZATION DURING MITOSIS AND INDEPENDENT OF THE MINUS END MOTOR DYNEIN
By: Ulises Diaz
Cell & Molecular Biology
Faculty Advisor: Dr. Blake Riggs
Abstract: The Endoplasmic Reticulum (ER), a network of tubules with dynamic three way junctions that expands most of the cytoplasm, is responsible for folding proteins, synthesizing lipids, and regulating cytoplasmic Ca2+ levels. During mitosis, the ER displays dramatic structural remodeling by condensing around the peri-spindle and spindle pole regions; however, the mechanism involved in these dramatic mitotic changes is unknown. Because microtubule impairment using Taxol and Colchicine prevents ER remodeling during mitosis, we hypothesize that minus end motors are responsible for remodeling the ER during mitosis. While the cytoplasmic dynein is responsible for most minus-end directed microtubule transport, our results show that dynein plays a minimal roll in remodeling the ER during mitosis. Ultimately, our goal is to discover how microtubules are utilized and regulated to remodel the ER during mitosis.

Entry Number: 134 UL
MICROBES THE NEXT QUARTERBACKS [QUANTIFYING MICROBES PRE- AND POST-SUPER BOWL 50 ON BAY AREA RAPID TRANSIT SYSTEM]
By: Crystal Khuu and Margaret Adrianzen
Microbiology
Faculty Advisor: Dr. Lily Chen
Abstract: Being the most convenient, efficient and reliable public transport system, BART (Bay Area Rapid Transit) is a major use of transportation and also plays a vital role in the Bay Area's economy. More than 3 billion riders used BART in

2016, and major events such as Super Bowl may attract more people to use BART which leads to a congested environment of overcrowding people within the trains. This study focuses on the Super Bowl 50 event occurred on February 7, 2016 in Levi's Stadium, San Jose, CA. Frozen samples collected in Amies transport media from hand strap and chair handle of several transit lines (before- and after- the Super Bowl) were revived, inoculated and characterized. The study results showed bacteria present in the samples were viable after a year of freezing in -80 C. Through quantification experimental and data analysis, the CFU (colony forming unit) counts were greater on the hand strap as opposed to seat handle. The amount of CFU counts from collected BART samples overall were greater after the Super Bowl event. This study supports a testing procedure for monitoring microbe riders on the BART system.

Entry Number: 135 UL
UNDERSTANDING THE GENE CONFLICT THAT LEADS TO RETROPOSED ALTERNATIVE SPLICING FACTORS.
By: Gerardo Aguilar
Microbiology
Faculty Advisor: Dr. Blake Riggs
Abstract: Proteins are the basis for all phenotypic expression; easily deciphered to their very own molecular sequences. But not easily understood is the evolution of Alternative splicing networks that orchestrate a vast diversity of proteins from a single gene. In Drosophila, the splicing factor Large Subunit 2 (LS2) regulates a tissue-specific alternative splicing network distinct from its progenitor, U2AF50. Using a poly-pyrimidine tract, U2AF50 regulates the constitutive splicing of genes within its own splicing network across the eukaryote kingdom, ubiquitously. Conversely, LS2 expression is restricted to the testes of most Drosophila, and uses a guanine-rich motif to repress the splicing of specific exons within its splicing network. While it is understood how LS2 evolved as a protein, how its regulatory splicing network formed is still not understood. To this end, I am reconstructing the evolutionary history of the LS2 regulatory splicing network to further our understanding in the gene conflict that led to the architecture in evolution of LS2 and its splicing network. To interpret conservation characteristics of the retroposed LS2 gene, we have measured the expression of LS2 orthologs in Drosophila species using Bowtie, an alignment software that showed multifarious and in some cases absent expression in testes. Currently, transfection of a younger Scaptodrosophila LS2 containing vector into Drosophila embryonic S2 cells will test preservation of protein. By analyzing this preservation, the evolution of its own regulatory network can tell us more about the evolution of differentiated splicing networks. A question that if understood could further our understanding of how proteins take on new roles that lead to disease in Humans.

Entry Number: 136 UL
MODIFICATION OF AN ION TRAP MASS SPECTROMETER FOR THE ANALYSIS OF GAS-PHASE ION-MOLECULE REACTIONS
By: Sara Monica Francisco
Microbiology
Faculty Advisor: Dr. Krista Vikse
Abstract: Gas-phase Ion-Molecule Reactions (IMRs) are utilized to investigate the reactivity of ionic species that are detected by mass spectrometry. This investigation allows researchers to alter the original function of the mass spectrometer to observe reactions in the gas-phase. After its modification, ions of interest are isolated in the ion trap and a known pressure of a gaseous mixture of helium and a neutral reagent is injected. Any ions formed due to the reaction between the ions and the neutral reagent are then analyzed and detected. Prior research into IMRs has cultivated advances in understanding of solution-phase reactivity, oxidative addition reactions and the synthesis of reactive organometallic complexes. This project focuses on understanding organometallic systems and deriving information about the ionic products that are isolated. By adding a series of modifications, the ion trap within the mass spectrometer will act as a stage on which we will observe and further analyze the resulting ionic reactants and products.

Entry Number: 137 UL
ALL MIXED UP ISOLATION AND IDENTIFICATION OF MICROBES IN COMMERCIAL SCONE MIX
By: Yesenia G. Lopez, and Tracy O. Torres
Microbiology
Faculty Advisor: Dr. Lily Chen
Abstract: In the fall of 2016, the Centers for Disease Control and Prevention (CDC) reported an infectious multi-state outbreak caused by Shiga toxin producing *E. coli* (STEC), a pathogenic pathogen, found in commercial flour products. While the outbreak produced no fatalities, sixty-three people were infected with STEC and seventeen people were hospitalized. The investigation successfully isolated and contained the pathogen, and sparked our own investigation of a separate commercial flour product of our own. During the Fall 2016 semester at San Francisco State University (SFSU), we were introduced to a chocolate chip scone mix that had been purchased in the spring of 2016. Our focus on the flour mix emerged from the suspicious, lumpy appearance of the box, which did not show evidence of damage or tampering. The scone mix was a heterogeneous mixture that provided a variety of nutrients for bacteria to feed on. It was stored in a dark area with its ingredients contained within a box and a plastic bag so anaerobic, possibly pathogenic bacteria was suspected.

Entry Number: 138 UL
THE EFFECT OF A Y39A SUBSTITUTION IN TRYPSIN AND ITS INTERACTION WITH MACROMOLECULES - IMPLICATIONS FOR THE DEVELOPMENT OF PROTEASE THERAPEUTICS
By: Andrea Adame, Peishan Huang, and Anna Batt
Physiology
Faculty Advisor: Dr. Teaster Baird, Jr.
Abstract: The majority of serine proteases that are used as therapeutic agents, such as tissue and urinary plasminogen activators, share the structural scaffold of trypsin. Trypsin is one of the most well-studied proteases and is quintessential as a model for examining serine protease interactions with substrates. Previous work has shown that positions 39 and 60 play an important role in inhibitors binding to trypsin where an amino acid change results in a decreased affinity due to disrupted prime-side, backbone binding. A single amino acid substitution of alanine for tyrosine at position 39 (Y39A-Tn) was found to be less sensitive to inhibitors and has the potential to improve the protease half-life. In Y39A-Tn, hydrogen bonding with lysine 60 (K60) on trypsin and with the inhibitor residue at the P4 position is prevented. Position Y39 of trypsin is conserved among trypsin-fold serine proteases and its resistance to inhibitors could suggest the same effect for interactions with a macromolecular substrate. To examine the overall catalytic activity toward such a macromolecule, sodium dodecyl sulfate-polyacrylamide gel electrophoresis (SDS-PAGE) and gel imaging were used to analyze digestion product band intensities. Preliminary data suggests that the Y39 variant has similar proteolytic activity towards macro-substrates as wild-type trypsin. Due to increased inhibitor resistance, Y39A variant can serve as a good model for other proteases in the therapeutics field.

Entry Number: 139 UL
MAPPING ALZHEIMER'S DISEASE: A VISUAL GUIDE TO THE ANATOMY OF NEURODENGERATION
By: Christopher Van Winkle and Sutikan Parkeenvincha
Physiology
Faculty Advisor: Gloria Nusse and Charles Barbieri
Abstract: An estimated 5.1 million Americans are living with Alzheimer's Disease (AD). Alzheimer's Disease is a progressive neurodegenerative disorder that causes physical changes in the brain and cognitive decline. Alzheimer's Disease is the most common form of dementia and has increased in prevalence over the years, mirroring the ever aging population[1]. The purpose of this study was to observe the neuroanatomy of two brains, one with Alzheimer's Disease and one without Alzheimer's Disease. The observed anatomical differences were then associated with known detrimental effects on cognition. Two cadavers were used for this study, their anatomical differences were shown by comparing 6 transverse sections of approximately 9 mm thickness. Atrophy was observed in the hippocampi and in the lobes of the cerebrum. Enlargement was

observed in the lateral ventricles. Scientific literature was used to associate the observed neuroanatomical changes with their potential effects on memory and cognition.

Entry Number: 140 UL
THE BIRTH OF MESENTERIC SCIENCE: A RECLASSIFICATION OF THE MESENTERY THROUGH STRUCTURE AND FUNCTION
By: Felipe Valentine Macias
Physiology
Faculty Advisor: Gloria Nusse and Charles Barbieri
Abstract: The field of mesenteric science is derived from the reclassification of the mesentery, the double-folded layer of the peritoneum, from connective tissue to its own independent organ. While British Surgeon Sir Frederick Treves first described mesentery in 1885, illustrations of the organ date back to the writings of Leonardo da Vinci. Since its conception, anatomical literature has described and taught the mesentery as a fragmented structure, present only along the lower two-thirds of the small intestine and mesocolon. Recently, new research from the University of Limerick has challenged this notion and suggested that the mesentery is one continuous structure and should be considered an individual organ. The mesentery is a peritoneal structure that connects the small intestine and the transverse and sigmoid colons to the abdominal wall. The new findings suggest that this is not comprised of coincidentally fragmented tissue, but instead has one continuous and well-defined structure. The mesentery's functional role is to provide the route of innervation and vascularization to the GI tract, and suspend several organs within the abdominal cavity. As such, the mesentery deserves the recognition of an organ to better explore its unique structure, function, and importance within the human body. As structure and function are closely related, my study project aims to analyze whether the mesentery is in fact one continuous structure through hands-on cadaver dissection. Furthermore, I will attempt to isolate a blood vessel that passes through the mesentery into the small intestine to present its function. By illustrating both the structural continuity claims from the University of Limerick, and my own cadaver dissection and presentation of a vessel, my goal is to present a comprehensive study of the most current research on the mesentery to better understand the significance of this new organ. The new field of mesenteric science has implications in scientific, anatomical, and medical research. As scientists expand what is known of the mesentery's structure and function, we can build mesenteric science to create more efficient methods of understanding and diagnosing systemic and organ complications. By establishing what constitutes a normal versus abnormal mesentery, scientists can then look at the relationship between existing diseases to test whether they are correlated. Thus, the field of mesenteric science will lead to earlier disease detection, new pathological understandings, and ultimately, better patient treatment outcomes.

Entry Number: 141 UL
IS THERE A CORRELATION BETWEEN LUNG CANCER AND CONGESTIVE HEART FAILURE?
By: Jessica Chan
Physiology
Faculty Advisor: Gloria Nusse and Charles Barbieri
Abstract: Lung cancer is the leading cause of cancer death for both men and women worldwide. According to the American Cancer Society, it is estimated that more than 200,000 people will contract this cancer with more than 150,000 deaths occurring annually. In the early history of lung cancer, it was considered a rare disease. After the increase in tobacco consumption in the 1900s, however, it has been proven that long term smoking is the cause of the rapid increase in lung cancer occurrences. Although some may believe that lung cancer mostly affects the function of the lungs, many do not know that lung cancer is also associated with congestive heart failure (CHF) which is characterized by fluid buildup in the heart. Because congestive heart failure impedes the heart’s ability to be able pump efficiently, it thus causes the heart to increase in size. The goal of this independent study was to look at the effects of lung cancer in relation to CHF. In order to understand the correlation between the two diseases and how they affect the cardiorespiratory function, samples were taken from the right lung of a female cadaver afflicted with cancerous tumors and CHF. These lung samples were processed and ran through an old fashioned rotary microtome to create slides which were used to examine the tissue at a cellular level. The heart was also examined for any size differences and other abnormalities that are common with CHF. This poster displays my approach with the process of creating the

slides through the microtome and the data that I have collected. It also displays my research on the correlation between the two diseases and the effects the two have on the body.

Entry Number: 142 UL
TICK BURDENS ON SMALL MAMMALS IN A LYME DISEASE ENDEMIC AREA
By: Jordan Raquel Romero Salomon
Physiology
Faculty Advisor: Dr. Andrea Swei
Abstract: In the western U.S. the black legged tick, Ixodes pacificus is the main vector for Borrelia burgdorferi, the cause of Lyme disease. Juvenile stages I. pacificus feed on reservoir hosts such as deer mice (Peromyscus spp.) and dusky-footed woodrats (Neotoma fuscipes), which maintain B. burgdorferi. We investigated the relationship between small mammal richness, small mammal abundance and tick burden across multiple host species. We hypothesized that with lower abundance and diversity of small mammals would lead to higher average tick burdens. Small mammals were live trapped at oak woodland field sites that ranged in size from 11 to 2775 hectares. Attached ticks were removed, identified to species, and quantified. A total of 201 small mammals were captured primarily of the species *N. fuscipes* and *Peromyscus spp.* mice and 325 *I. pacificus* tick were collected off these hosts. Contrary to our hypothesis, the average larval I. pacificus burden on *N. fuscipes* shows a trend of increasing burden with increasing *N. fuscipes* abundance and small mammal richness. For *Peromyscus spp.* there was a decreasing trend of *I. pacificus* larval burden as *Peromyscus spp.* abundance increased. Also, as small mammal species richness increased there was an increasing trend in the *I. pacificus* larval burden on *Peromyscus spp.*. This study illustrates how habitat patch size can mediate host diversity and abundance and impact the distribution of pathogen vectors. These results have important implications for predicting Lyme disease prevalence and dynamics and ultimately human health.

Entry Number: 143 UL
QUANTIFYING THE ROLE OF LIPID CONCENTRATIONS IN PRIMATE BRAIN ADAPTATION
By: Mariamagdalena Ortiz
Physiology
Faculty Advisor: Dr. Rori Rohlfs
Abstract: Lipids are known to be prominent components that serve a key role in a diverse number of environments within the body, namely membrane development. Recent studies have shown that lipids are also responsible for aspects within our nervous system, particularly acting as chemical messengers in order to initiate communication signals within cells. It is understood that lipid compounds are key in human survival, however, could they be considered significant in brain evolution? There has been much work done on how changes in gene expression levels impact brain evolution . Many scientist perform comparative primate brain expression studies . With those thoughts in mind, they hypothesize that the evolution of genes responsible for complexity is a driving factor in brain adaptation. On the other hand, lipid levels are high in neural tissue and could also be considered a factor in brain adaptation, however, it isn't commonly studied due to the complexity of identifying lipids and the lack of technology. Fortunately, due to recent studies, that isn't the case anymore. Therefore, this project examines the divergence of lipid complexity using a lipidome concentration data set originally analyzed by Dr. Bozek et al.. In that study, 5,713 lipid compounds were detected in five types of tissues that include kidney, muscle, visual cortex, prefrontal cortex, and cerebellum taken from several individuals in each of human, chimpanzee, rhesus macaque, and mouse. Initially, when Bozek et al. investigated lipids, it was determined that the complexity of lipids differed from the neural tissue compared to the non-neural tissue in all species. However, when considering Bozek's analysis, phylogenetic information on the various species was absent. This is important in that historical relationships of lineages are crucial when attempting to answer evolutionary hypotheses as well as drawing new insights on diverging lipid complexity in those four species. In addition, without taking into account phylogeny, they have reduced power to detect signatures for lipid adaptation and a higher false positive rate to mistake neutral variation for adaptation. In order to address this gap in knowledge, the Expression Variance and Evolution model (EVE) will be utilized to perform divergence and diversity tests between and within species in order to establish candidate lipids for brain adaptation. Most importantly, EVE takes into account phylogenetic information when running lineage-specific shift test on the

data set to identify divergence of lipid expression indicating lipid adaptation. Understanding the role that lipids play on the brain will help us gain a better perception of primate brain adaptation and functionality.

Entry Number: 144 UL
CHARACTERIZING REACTION INTERMEDIATES IN NEURONAL NITRIC OXIDE SYNTHASE CATALYSIS USING MAGNETIC CIRCULAR DICHROISM AT CRYOGENIC TEMPERATURES
By: Marick Buenafe
Physiology
Faculty Advisor: Dr. Raymond Esquerra
Abstract: This project seeks to characterize the reaction intermediates of neuronal nitric oxide synthase(NOS) by initiating catalysis using a caged-dioxygen complex (μ-peroxo)(μ-hydroxo)bis[bis(bipyridyl)cobalt(III)] nitrate (HPBC) at cryogenic temperatures. Reaction intermediates will be cryogenically trapped and characterized using magnetic circular dichroism. The identities of the heme intermediates are unresolved. We hypothesize a ferryl radical cation intermediate in the first step of the reaction and a ferric-hydro peroxide state during the second stage of the reaction based on the similarities with cytochrome P-450. Understanding the reaction mechanism of NOS aids our understanding of catalytic mechanisms and advances our knowledge of NOS biochemistry.

Entry Number: 145 UL
UNDERREPRESENTED MINORITIES TEACHING AT POSTSECONDARY INSTITUTIONS
By: Marissa Harris
Physiology
Faculty Advisor: Dr. Rori Rohlfs
Abstract: For a long time, there has been a little diversity in the STEM workforce, with many ethnic groups left largely underrepresented or not represented at all. Many programs and methods have been implemented to address this issue and increase diversity at a student level as well as on a professional level. I am part of a larger project looking to analyze hiring practices of underrepresented minorities in the biological sciences. The focus of our project was to identify faculty hiring practices at our academic institution that supported hiring of underrepresented minorities; and compare the outcomes of those hiring practices against the larger workforce in the country. My primary goal was to analyze nationwide trends of underrepresented minorities currently employed in higher education, and compare longitudinal data on San Francisco State University biology (SFSUB) faculty to the nationwide trends of biology faculty. At this point in our project, our tentative results show SFSUB faculty to have a higher percentage of underrepresented minorities on staff than the nationwide averages. Furthermore, our biology department (the focus of our study) has shown an increase in employment of underrepresented minorities over time, surpassing the average number of underrepresented minorities employed in the biological sciences nationwide. My work was consistent with the hypothesis that the faculty hiring practices implemented by SFSUB were effective at diversifying the biology faculty. The factors observed and researched in our project can help play a larger role in diversifying the field.

Entry Number: 146 UL
LOCATING AND TRACING THE INFERIOR ALVEOLAR NERVE AND ITS BRANCHES
By: Michelle Merino
Physiology
Faculty Advisor: Gloria Nusse
Abstract: The purpose of this study was to locate and trace the inferior alveolar neurovascular bundle containing the inferior alveolar nerve, a branch of the mandibular nerve. Understanding the location of the inferior alveolar neurovascular bundle is crucial in dental procedures because many procedures require a block to this bundle. The bundle innervates each individual tooth in the mandible and is known to occasionally pass the midline, innervating the opposite side of the mandible. Thus understanding the location and branches of the IA nerve are helpful in practicing dentistry because it can reduce discomfort and pain in patients during dental procedures. To locate the bundle, the the tissues and bone of the mandible were removed. The bundle was then stained with hematoxylin and traced using Saran Wrap. The nerves were mapped using Photoshop and the innervations into the alveoli of the mandible were noted. It was observed that the IA nerve appeared to cross innervate past the midline near the mental protuberance in 2 of the 3 cadavers. In one of the cadavers, fewer branches off of the IA nerve were observed due to lack of teeth and loss of bone.

Entry Number: 147 UL
ANATOMICAL NEUROLOGICAL EFFECTS OF PARKINSON'S DISEASE
By: Natasha Nand, Crystal Perez, Mayra Portillo, Vanessa Hernandez, and Brianna Cuadra
Physiology
Faculty Advisor: Dr. Gloria Nusse and Charles Barbieri
Abstract: Parkinson's disease is a chronic degenerative disease that affects the central nervous system. The exact causes of this disease are still unclear but research to date shows that genetic and environmental factors are involved. Although Parkinson's is a neurological disease, it is most known for its motor symptoms of bradykinesia and resting tremors. Nerve cells which are located in structures deep in the brain such as the basal ganglia and the substantia nigra begin to die. The nerve cells that are located in the substantia nigra are responsible for the production of dopamine. Dopamine is accountable for inhibiting excessive and unwanted body movements. When 80 percent of the dopamine production is halted, the motor symptoms become visible. There isn't a known cure for this diseases but there is a drug therapy known as L-dopa that replenishes the brain's supply of dopamine, which inhibits tremors.

The purpose of this experiment is to compare and contrast anatomical differences in the white and gray matter of a healthy brain and a brain affected with Parkinson's disease. This experiment was achieved by dissecting the healthy brain as well as the affected brain and by making transverse dissections of the lower half of the brain to expose important anatomical structures such as the substantia nigra and the cerebellum. We hypothesize that there will be a visible change specifically in the cerebellum because this structure receives information from the spinal cord and other areas from the brain that regulate movement.

Entry Number: 148 UL
IMAGINAL DISC TRANSPLANTS IN MANDUCA SEXTA
By: Phillip Kanarsh and Manuel Rosero
Physiology
Faculty Advisor: Dr. Megumi Fuse
Abstract: Holometabolous insects undergo radical body changes from larvae, to pupae to adults. Many of the adult structures arise from imaginal discs, highly proliferating stem cell-like primordial tissues. Adult moths rely on their newly formed structures for motility, reproduction, sensing their environment, and feeding. These tissues include the wings, proboscis (feeding structures), legs, eyes, mandible, and other structures. When these discs are damaged, larval and pupal development may be extended, putatively to provide time for these important organs to regenerate. X-ray radiation has been shown to cause disc damage but it is unknown whether the delays in development are a result of this damage or undocumented damage to other tissues. We hypothesized that the damage to imaginal disc tissues was the main factor contributing to the developmental delays. We set out to develop a transplant method to compare the effects of transplanting irradiated (damaged) discs into healthy larvae as a means of assessing the role of damaged discs in developmental timing. We transplanted irradiated and non-irradiated discs into healthy larvae after removing their original dics, and monitored developmental timing to wander, to pupate and to become adults. We compared these results to (i) healthy larvae receiving irradiated or non-irradiated cuticle, (ii) sham-operated healthy larvae, and (iii) healthy vs. irradiated animals. We found that all surgical procedures slightly delayed wandering time, but by pupation, only transplanted larvae - regardless of damage status - showed delays to pupation that were close to irradiated controls. The delays were longest to the adult stage in transplanted animals – even longer than irradiated controls. These data indicate that normal animals are sufficient controls, but that the mechanical action of removing a recipient's discs and inserting discs from a donor, whether or not the donor was irradiated, caused developmental delays. Thus we will further refine the procedure by transplanting discs without removing the original discs.

Entry Number: 149 UL
FACIAL SYMMETRY AND FACE PERCEPTION IN HUMANS
By: Salvador Alvarado and Ofeoritse Ekwejunor Etchie
Physiology
Faculty Advisor: Gloria Nusse
Abstract: Most of our everyday activities revolve around meeting and interacting with other people, and the basis for this simple interaction is the innate ability of humans to recognize and distinguish others based on their facial features. This adaptation in humans has been vital to our success as a species, so much so that several regions of the brain have evolved to play a role in face perception. This Study will explore the relationship between facial bone structure and facial symmetry as it relates to face perception in humans. Standardization of various skulls will be carried out by placing them in Frankfort horizontal, which will accentuate the symmetrical differences in the various paired bones of the face. The final aim of this study is to explore how facial asymmetry makes each individual unique and therefore more easily recognizable by those around them.

Entry Number: 150 UL
JAGUNAL INTERACTORS AND CELL FATE DETERMINATION IN DROSOPHILA
By: Sydney Alvarado and Khayla Shabazz
Physiology
Faculty Advisor: Dr. Blake Riggs

Abstract: The organelle of interest in the Riggs lab is the endoplasmic reticulum. Though a lot is known about its structure and function, not much is known about how it partitions during mitosis. Preliminary experiments in the lab have proven that the ER divides asymmetrically in the drosophila embryo during cell division. A conserved ER transmembrane protein called Jagunal, was determined to aid in ER clustering and is responsible for this asymmetric division. We hypothesize that the daughter cell that obtains a higher concentration of ER develops into a neuroblast and determines cell fate. Essentially, we are trying to find out what molecular players are interacting with Jagunal to facilitate with ER asymmetry. This led Dr. Riggs to conduct a deficiency screen of the third chromosome. We crossed flies with Jagunal RNAi with flies with eyeless-GAL4-UAS so that the knockdown of Jagunal will only be expressed in the eye. A change in eye size phenotype was observed, 80% of the flies displayed the wild type rough eye phenotype and the other 20% exhibited the mutation. This data served as our control group. Currently, we are taking those flies with both Jagunal RNAi and GAL4 on the same chromosomes and crossing them with flies with deficiencies, or missing chunks of DNA, and then observing their rough eye phenotype. We can infer that anything that deviates from this 20:80 baseline is somehow interacting with Jagunal and facilitating in ER asymmetry.

Entry Number: 151 UL DISPLAY ONLY
ONTOGENIC SHIFTS IN DEFENSIVE BEHAVIOR AND HABITUATIVE LEARNING IN THE SQUID, EUPRYMNA SCOLOPES
By: Samantha Brophy, Kia Seehafer, and Sara Tom
Physiology
Faculty Advisor: Dr. Robyn Crook
Abstract: To help develop Euprymna scolopes (Hawaiian Bobtail Squid) as a model organism for cephalopod neurophysiology research, we examined its capacity for non-associative learning (habituation) during different life stages, while simultaneously surveying its most common defensive behaviors. Preliminary analysis of three cohorts of different ages suggests that E. scolopes can habituate to a threatening stimulus and remain habituated for at least five days. All cohorts showed a decrease in both the frequency and intensity of responses to the stimulus, both over repeated presentations within trials, and across successive days. This study is the first demonstration of learning and memory in E. scolopes, and the first formal characterization of its defensive behavior.

Entry Number: 152 UL
DISRUPTING A DISTAL HYDROGEN POCKET IN SERINE PROTEASES
By: Rodolfo Villa, Commodore St. Germain, and Anna Batt
Biochemistry
Faculty Advisor: Dr. Teaster Baird, Jr.
Abstract: Engineered serine proteases as therapeutic agents constitute a new class of drugs for potential clinical applications. One complication faced when using serine proteases as therapeutic agents is their relatively short half-life due to the abundance of tight binding inhibitors that target serine proteases to regulate proteolytic activity and rapidly remove them from circulation. Therefore, if a protease is to be effective as a therapeutic agent, it needs to display resistance towards inhibition. Given that the majority of protease therapeutics currently used are of the trypsin-fold, trypsin itself serves as an ideal structure-function relationship model to address this issue. Previous studies, using small synthetic peptides, bovine pancreatic trypsin inhibitor (BPTI) and an ecotin variant (M84R ecotin) with engineered trypsin variants have shown that prime side interactions can affect association with macromolecular inhibitors through interaction with residues at positions 39 and 60. For example, K60A trypsin variant (K60A-Tn) was more inhibited by BPTI, but less inhibited by M84R ecotin. Molecular modeling suggests that increased mobility of Y39 caused by the K60A substitution impacts P4 interactions and P2 hydrogen bonding, resulting in altered trypsin-inhibitor affinities. However, given that BPTI and ecotin are also proteins, their interaction with trypsin likely reflects the interaction that serine proteases will have with natural protein substrates. Therefore, a desired weakened interaction between the engineered trypsin and the inhibitor may also suggest a similar weakened interaction between the engineered trypsin and protein substrates which cannot be observed with the small peptide substrates that were used previously. Our focus in this study is to use a protein as a substrate to gain insight on the enzyme-substrate interaction by measuring catalytic activity of K60A-Tn compared to wild-type trypsin. Without the K60 and Y39 charged hydrogen bond interaction, we predict to see weakened substrate affinities, causing lowered catalytic efficiency.

Entry Number: 153 UL
STRUCTURAL MODELLING OF THE FAD-EXCHANGE STATE OF STYRENE MONOOXYGENASE
By: Samy Ibrahim, Victoria Reyes, Patrick Chen, Philip Valdiva, and Jacob Varela
Biochemistry
Faculty Advisor: Dr. George Gassner
Abstract: *Pseudomonas* bacteria are equipped with catabolic enzymes which allow them to use a diverse array of hydrocarbons as sources of carbon and energy. In the present work we examine the flavin-transport mechanism of the flavoprotein styrene monooxygenase (SMO), which consists of two soluble, homodimeric proteins; styrene monooxygenase reductase (SMOB) and styrene monooxygenase epoxidase (SMOA). SMO transfers an oxygen atom from molecular oxygen to the vinyl group of styrene to yield pure (S)-7,8 styrene oxide in the first step of the styrene catabolic and detoxification pathway of *Pseudomonas putida* (S12). At rest, SMOA and SMOB do not strongly interact, but join in catalysis to form an efficient FAD-exchange complex. The homologous structure of 4-hydroxybenzoate monooxygenase (PHBH) provides insight on possible alternate subunit organization in which the FAD-binding pockets are exposed. Reorganization of the subunits of SMOA from the crystallographically observed resting-state into the active site exposed state would allow for direct engagement of SMOA and SMOB in catalysis. A patch of four lysine side chains sequestered in the dimer interface of the resting state of SMOA are solvent exposed in the exchange state, thus providing a possible means of experimentally distinguishing the two states based on the unique labeling of the proteins with lysine-specific molecular probes. Results of initial experimental studies directed toward testing this structural hypothesis of alternate subunit interaction are presented in the associated poster (156 UL).

Entry Number: 154 UL
HOW THE LOSS OF A SINGLE HYDROXYL GROUP AFFECTS THE PROTEOLYTIC ACTIVITY OF THE MODEL SERINE PROTEASE, TRYPSIN
By: Sandra Munoz, Jennifer Huang, and Anna Batt
Biochemistry
Faculty Advisor: Dr. Teaster Baird, Jr.
Abstract: Trypsin is used as a model for the study of serine proteases, for its fold is commonly observed in this family of enzymes. The overall aim of this study is to discern whether the Y39F trypsin variant will act on a macromolecular substrate similar to the way it interacts with macromolecular inhibitors, specifically focusing on the S prime (S) side. In wild-type trypsin, the hydroxyl group in tyrosine at position 39 serves to stabilize the interaction with macromolecular inhibitors via the formation of hydrogen bonds at the P prime (P) Â subsites. A Y39F substitution was made to reduce the affinity between the enzyme variant and inhibitor. A phenylalanine was used in place of the tyrosine because the two amino acid residues are chemically similar with the exception of the hydroxyl functional group missing from the phenylalanine. The absence of the hydroxyl functional group serves to prevent the formation of hydrogen bonds between macromolecular substrates that interact with the S site of the enzyme, presumably weakening of the enzyme-inhibitor interaction. However, previous research from our group demonstrated that the Y39F trypsin variant was more sensitive to inhibition from both bovine pancreatic trypsin inhibitor (BPTI) and ecotin compared to wild-type trypsin. Molecular modeling suggests that the tighter binding is a consequence of the formation of a hydrogen bond between the P2 site and the histidine side chain at position 40 not seen in wild type trypsin. The presence of the newly formed hydrogen bond in the Y39F trypsin variant helps stabilize the enzyme- inhibitor complex. Still, Y39F trypsin retained similar catalytic activity against N-α-benzyloxycarbonyl-glycylprolylarginine p-nitroanilide (Z-GPR-pNA). However, Z-GPR-pNA physically cannot interact with the modified S subsites as the macromolecular inhibitors, and likely macromolecular substrates, do. Therefore, the activity observed with Z-GPR-pNA may not accurately reflect the activity of the Y39F variant towards macromolecular substrates. In this study, we used sodium dodecyl sulfate polyacrylamide gel electrophoresis (SDS-PAGE) and gel imaging to monitor and compare the progression of macromolecular substrate hydrolysis of Y39F and wild-type trypsin. Based on the observations made with BPTI and ecotin, we would expect that the Y39F variant would bind more tightly to a macromolecular substrate as well, likely increasing the efficiency of cleavage relative to wild-type.

Entry Number: 155 UL
PASITO: TESTING THE EFFECT OF GUM ON CORTISOL CONCENTRATION
By: Josephine Turner
Biochemistry
Faculty Advisor: Dr. Teaster Baird, Jr.
Abstract: This project stems from the PASITO project. My research investigates the question: is gum a good salivary stimulant to facilitate saliva collection? In addition, to test the effect of gum on cortisol concentration, ELISA's were conducted on collected saliva with gum and without.

Entry Number: 156 UL
TRAPPING STYRENE MONOOXYGENASE IN AN FAD-EXCHANGE COMPLEX
By: Patrick Chen, Samy Ibrahim, Philip Valdivia, Victoria Christine Reyes, and Jacob Varela
Biochemistry
Faculty Advisor: Dr. George Gassner
Abstract: Styrene monooxygenase (SMO) is a protein complex found in *Pseudomonas* bacteria that catalyzes the enantioselective epoxidation of styrene into styrene oxide. SMO is a two-component flavoprotein composed of an NADH-specific flavin-reductase (SMOB) and a FAD-specific styrene epoxidase (SMOA). Although the mechanism of styrene catalysis by SMO has been established by previous research, the structure of the catalytic complex formed by SMOA and SMOB in the FAD-exchange reaction has not been resolved. Reduced flavin (FADred) has a 8000-fold higher affinity to SMOA than oxidized flavin (FADox) and the associated binding energy is thought to be linked to a decrease in activation energy for subunit reorganization in the FAD-exchange reaction. Structural modeling analysis of SMOA presented in the associated poster (154 UL) suggest a possible mechanism in which alternate subunit interfaces of the SMOA dimer engage in resting (SMOArest) and FAD-exchange (SMOAex) state of this enzyme. Unique sets of lysine residues are sequestered at the dimer interfaces of the model resting and exchange states of SMOA. These lysines were targeted for labeling with fluorescent probes dansyl-Cl (5-(DimethylAmino)Naphthalene-1-SulfonYL chloride), FITC (Fluorescein isothiocyanate), and RITC (Rhodamine isothiocyanate). The labeling stoichiometry and FAD-binding properties of the labeled SMOA were evaluated by using absorbance and fluorescence spectroscopies. The protein was successfully labeled by all three fluorophores and we were able to trap SMOA in a configuration related to the FAD-exchange state by chemically reducing the enzyme in the presence in 50% glycerol followed by labeling with dansyl-Cl. The preparation and properties of this intermediate-state of SMO will be presented.

Entry Number: 157 UL
PURIFICATION AND KINETIC CHARACTERIZATION OF NEURONAL NITRIC OXIDE SYNTHASE
By: Amy Wong
Biochemistry
Faculty Advisor: Dr. Raymond Esquerra
Abstract: Nitric oxide (NO) is an important signaling molecule acting on many tissues and regulating a diverse array of physiological processes. NO has been found to play a role in a seemingly limitless range of functions, spanning from learning and memory to programmed cell death to blood vessel formation. In living organisms, the production of nitric oxide is regulated by a group of enzymes called nitric oxide synthases (NOS). These enzymes convert L-arginine into citrulline, producing NO in the process. The reaction includes two steps with NG-hydroxyl-L-Arg as the intermediate. Like P450 enzymes NOS has a thiolate ligated heme for its active site. It is a homodimer and requires Calmodulin (CaM), heme, tetrahydrobiopterin (BH4), FAD, FMN, and NADPH for activity. We expressed mammalian neuronal nitric oxide synthase (nNOS) in E. coli and purified each using a combination of anion exchange and affinity chromatography. We observed the purified protein for a Ferrous-CO complex (440 nm) from Ferric state (400 nm) under UV spectrophotometer. The difference between the 440nm and 490nm absorbance values are taken to obtain a more accurate protein concentration from the Beers Law. We examined the kinetics of the NOS enzyme using the hemoglobin capture assay. This kinetic assay determines the activity by measuring the production of NO by observing the conversion of HbO-2 to met-

Hb.The goal of this project is to use the purified protein for further observance of nNos under Magnetic Circular Dichroism to determine the exact mechanism of nNos as it has yet to be determined.

Entry Number: 158 UL
ENGINEERING A POLYAMINE ACETYLTRANSFERASE SPEG PROTEIN TO INVESTIGATE THE IMPORTANCE OF BETA-HAIRPIN RESIDUES ON ITS ALLOSTERIC BEHAVIOR
By: Darwin Gawat and Allan Solis
Biochemistry
Faculty Advisor: Dr. Misty L. Kuhn
Abstract: In Vibrio cholerae the polyamines norspermindine and spermidine are present in high concentrations in the cell. A signaling cascade involving NspS and MbaA proteins is regulated by these polyamines, which trigger biofilm formation and dispersal in a reciprocal manner. This is critical for V. cholerae pathogenesis. Polyamine levels within the cell are controlled by acetylation via the SpeG enzyme. This enzyme has both an allosteric and active site that bind polyamines, which is unusual. We want to understand how the allosteric site of SpeG behaves when residues that form a beta-hairpin near its C-terminus are replaced with amino acids from a comparable enzyme that is not allosteric. A phenylalanine residue from this beta-hairpin forms a stacking interaction with a second phenylalanine residue of the allosteric site. To investigate the importance of these residues on activity, we created a chimeric construct between the two proteins and a single point mutant of the phenylalanine on the beta-hairpin. We performed heterologous expression of the new proteins in Escherichia coli and purified them using a Ni-NTA affinity column. These proteins were very soluble and were purified to near homogeneity as assessed by SDS-PAGE. In the future, we will kinetically characterize our new constructs to determine the kinetic parameters of these proteins compared to the wild-type SpeG enzyme. These data will allow us to evaluate the importance of the beta-hairpin residues on the allosteric behavior of the enzyme.

Entry Number: 159 UL
MOBILE LOOPS ON ALLOSTERIC PROTEINS: CONSTRUCTING CHIMERIC PROTEINS OF A VIBRIO CHOLERAE ENZYME TO INVESTIGATE THEIR IMPORTANCE ON SPEG'S ACTIVITY
By: Paloma Boeck, and Rossellini Renolo
Biochemistry
Faculty Advisor: Dr. Misty L. Kuhn
Abstract: Vibrio cholerae is responsible for causing the devastating disease Cholera, which disproportionately affects populations without access to clean drinking water. Its ability to form and disperse biofilms is important to its pathogenesis. A biofilm is a protective matrix of DNA, polysaccharides, and proteins, which is indirectly regulated by polyamine concentrations in the cell. Polyamine concentrations are regulated by the polyamine N-acetyltransferase SpeG. This enzyme is a member of the Gcn5-related N-acetyltransferase (GNAT) superfamily and adopts an unusual dodecameric oligomeric state. It catalyzes the acetylation of polyamines, such as spermidine and spermine, by transferring an acetyl group from acetyl coenzyme A to the polyamine. SpeG is also unique due to the presence of an allosteric site in each monomer of the dodecamer, which is not seen in other GNATs. In the presence of polyamines, a conformational change of a loop at the allosteric site occurs. To determine whether the observed allosteric effects are dependent upon the amino acid composition of this loop, we exchanged its residues in a comparable region with those of a known non-allosteric polyamine acetyltransferase. Specifically, we constructed two chimeric proteins between SpeG and the human spermine/spermidine N-acetyltransferase (hSSAT). We focused on residues 24-38 of SpeG and residues 22-37 of hSSAT. Ultimately, we tested the soluble expression of these constructs and purified the enzymes to near homogeneity. By manipulating this region of the protein, our aim is to further understand the allosteric nature of SpeG, which is important for responding to environmental signals to regulate polyamine concentrations and biofilms.

Entry Number: 160 UL

CONSTRUCTION AND INVESTIGATION OF TWO C-TERMINAL TRUNCATIONS AND CHIMERIC *VIBRIO CHOLERAE* SPEG PROTEINS

By: Van Thi Bich Le and Ee Qing Lim
Biochemistry
Faculty Advisor: Dr. Misty L. Kuhn

Abstract: Spermidine *N*-acetyltransferase from *Vibrio cholerae* (VcSpeG) is an allosteric dodecameric enzyme that belongs to the general control non-repressible 5 (Gcn5) - related *N*-acetyltransferase (GNAT) superfamily of enzymes. The polyamines spermine (spm) and spermidine (spd) bind to all twelve allosteric and active sites of the protein. These polyamines are important polycationic molecules for many life processes, including cell growth, protein synthesis, and metabolic regulation. Spd is also known to regulate biofilms in V. *cholerae*. Under stressful conditions VcSpeG acetylates these polyamines; however, the importance of the allosteric site on its activity is still unknown. VcSpeG is the first identified polyamine acetyltransferase that has an allosteric site. In humans, the homologous enzyme (hSSAT) exists as a dimer and does not contain a comparable allosteric site. Since this site is not present in humans, we performed a structural alignment between the two proteins to identify regions that differed. To study the allosteric behavior of VcSpeG, we constructed different truncations and chimeric proteins between it and hSSAT. To examine the importance of the last 13 residues of the VcSpeG protein, which are not present in hSSAT, we created a truncated VcSpeG protein. Additionally, we exchanged the last 33 residues of VcSpeG with the protein sequence of hSSAT in this region. We confirmed the sequences of the constructed proteins and performed a heterologous test expression and purification of the two newly engineered enzymes. The proteins were very soluble and were successfully purified to near homogeneity. In the future we plan to investigate the kinetic activities of these new constructs compared to the wild-type VcSpeG enzyme to assess the importance of these regions on the allosteric behavior of the enzyme. This will provide new insight into the regulation of intra- and extracellular polyamine levels in pathogenic V. *cholerae*.

Entry Number: 161 UL
INVESTIGATION ON OXIDATIVE ADDITION MECHANISM OF THE MODIFIED ULLMANN-TYPE COUPLING BY ELECTROSPRAY IONIZATION MASS SPECTROMETRY
By: Vy Cao
Biochemistry
Faculty Advisor: Dr. Krista Vikse
Abstract: Metal-catalyzed reactions have been used conveniently and effectively for a long time to synthesize organic molecules that can be made into drugs, pesticides, and industrial chemicals. Palladium-catalyzed methods have had tremendous development throughout history. Cu-catalysed arylation reactions devoted to the formation of C-C and C-heteroatom bonds (Ullmann-type couplings) are complementary to Pd-catalyzed systems and have also acquired great importance in the last decade. Copper catalysis is cheaper, and the Ullmann arylations have a wider range of suitable nucleophiles and require simpler, less expensive ligands. The 'modified Ullmann' reaction, which uses milder reaction conditions, is a more recent version of this reaction. However, its mechanism is not fully understood. Researchers agree that in this reaction, the nucleophile is activated first forming the $L_nCu(I)$-Nu before the activation step of the aryl halide which still has 5 proposed mechanisms. This project will focus on studying the oxidative addition/reductive elimination mechanism involving an aryl-Cu(III) species as a key intermediate proposed in the mid-70s by Cohen. The reaction will be carried out using 2-pyrrolidinone as the nucleophile, Copper(I) chloride as the copper source, dmeda as the ligand, and 1-iodo-4-nitrobenzene as the aryl halide. The Finnigan LCQ Deca Ion Trap Mass Spectrometer will be used to study the identities and reactivity of the produced intermediates.

Entry Number: 162 UL
DETERMINATION OF NEW MOLECULAR MARKERS TO CLASSIFY DISTINCT MICROGLIA PHENOTYPES IN ALZHEIMER'S DISEASE
By: Brianna Rivera
Biochemistry
Faculty Advisor: Dr. Carlo Condello
Abstract: Alzheimer's disease (AD) is a slowly progressive dementia and the most common neurodegenerative condition worldwide. AD cannot be prevented, cured, or slowed which makes finding a targetable pathway in AD progression for therapeutics critical. The neuropathological hallmarks of AD are the cerebral deposition of extracellular plaques made of Aβ peptides and intracellular neurofibrillary tangles made of Tau protein. The gradual accumulation of these pathogenic deposits is associated with neurotoxicity and cognitive decline. Another feature of AD is neuroinflammation resulting from the activation of glial cells like microglia and astrocytes. Microglia are the resident immune cells in the brain that protect against various pathogens. In AD, activated microglia are primarily known as phagocytic cells, similar to peripheral tissue macrophages, and are observed ingesting small, diffusible Aβ aggregates in the brain. In addition, microglia cluster and polarize their processes around large insoluble plaques, but the function of this phenomena has been poorly understood. However, recent reports have suggested that the envelopment of Aβ plaques by microglia establishes a cellular barrier that increases Aβ compaction leading to a decrease in plaque growth and plaque-associated neuronal damage. Emerging evidence indicates that the microglia barrier function is mediated by the microglia-specific protein, Triggering Receptor Expressed on Myeloid 2 (TREM2), which can be found enriched in microglia processes wrapping around plaques. Interestingly, recent genome-wide association studies in humans have identified that loss-of-function mutations in TREM2 are a significant risk factor for AD. Thus, improving our understanding of the microglia barrier function, and other neuroprotective microglia phenotypes, as well as the molecular signaling pathways that regulate them are of great interest. In the current study, we examined several classes of immune-related proteins known to be selectively expressed by microglia in AD. We first determined if any of these proteins were enriched in plaque-associated microglia processes. Using fluorescent immunohistochemistry and high-resolution confocal microscopy in brain slices derived from transgenic mouse models of AD, we screened a library of antibodies targeting various immune cell related proteins. Of all the proteins, we identified three novel markers for the microglia barrier process contacting Aβ plaques. Overall,

our findings highlight new signaling molecules that may contribute to the formation of microglia barrier processes. Although further research is needed to validate these findings, identifying other molecular pathways regulating neuroprotective functions like the microglia barrier may provide novel targets for diagnostic probes and therapeutic agents in AD.

Entry Number: 163 UL
UNDERSTANDING HOW MOLECULAR ARCHITECTURE CONTROLS FUNDAMENTAL CHEMISTRY BETWEEN HYDROGEN SULFIDE AND THE HEME MOIETY
By: Sita Chandrasekaran
Biochemistry
Faculty Advisor: Dr. Raymond Esquerra
Abstract: Previously assumed to be a highly toxic compound in any concentration, Hydrogen sulfide was recently shown to be a gasotransmitter, like carbon monoxide and nitric oxide. Hydrogen sulfide is involved in many important processes in the mammalian body, including cardiovascular and neuronal signaling. Hydrogen sulfide is also known to pathologically react with some heme proteins yet heme proteins are the target of many biochemical signaling pathways. This project seeks to understand how the protein matrix modulates different chemical interactions with hydrogen sulfide and the iron in the heme complex. Thus far, we have found that ferric myoglobin (MbIII) binds to hydrogen sulfide in its oxidized state, SH- (thiol), and forms a (Fe3+ - SH-) complex. We found that distal pocket environment in ferric myoglobin affects the chemistry between heme proteins and hydrogen sulfide, where a smaller distal pocket results in a lower Kd and therefore a more stable (Fe3+ - SH-) moiety. Now, the goal of the project is to elucidate how the distal pocket environment affects the reaction between ferrous myoglobin and hydrogen sulfide. This work will add to the current understanding of the molecular factors that affect the chemistry between heme proteins and hydrogen sulfide.

Entry Number: 164 UL
SYNTHESIS OF ALDA-1 AND RELATED ALDEHYDE DEHYDROGENASE AGONISTS BY A CARBODIIMIDE-BASED COUPLING REACTION
By: Coby Varela and Sandra Munoz
Biochemistry
Faculty Advisor: Dr. George Gassner and Dr. Marc Anderson
Abstract: Aldehydes are biochemical alkylating agents that accumulate under conditions of oxidative stress. They form adducts with proteins and DNA bases that can lead to cancer and other serious conditions including ischemia, heart failure, and Parkinson’s disease. Aldehyde dehydrogenases protect against these conditions by catalyzing the oxidation of aldehydes to less toxic organic acids. The correlation of depressed aldehyde dehydrogenase activity with human health risk has sparked interest in the development of drugs that can increase or restore the activity of these enzymes. It was recently demonstrated that human mitochondrial aldehyde dehydrogenase ALDH is activated by the small molecule agonist Alda-1. The reported mechanism of action is a decrease in Km for NAD+ that leads to a two-fold activation of the enzyme (1). In the present work Alda-1 was prepared by an amide-bond synthesis pairing piperonylamine ((1,3-Benzodioxole-5-methylamine, 3,4-(Methylenedioxy)benzylamine) with 2,6-dichlorobenzoic acid. The reaction was carried out by the coupling agent EDCI (1-Ethyl-3-(3 dimethylaminopropyl)carbodiimide) in dichlormethane and methanol. Two other non Alda-1 related starting materials, phenylacetic acid and 4-nitrobenzylamine, were paired and cross-paired using the same methods to make 3 other Alda-1 analogues. The reactions were monitored by TLC and 1H-NMR spectroscopy and found to be significantly pure. The activity of the Alda-1 was tested on phenylacetaldehyde dehydrogenase (NPADH), a bacterial enzyme that is structurally and mechanistically similar to ALDH, but no significant activation of PADH nor observable change in Km for aldehyde or NAD+ was observed. Hydrogen bonding interactions observed in the crystallographically resolved Alda-1 binding site of the human enzyme are absent in the putative Alda-1 binding-site of NPADH. This provides a structural basis for difference in Alda-1 specificity of human and bacterial aldehyde dehydrogenases.

Entry Number: 165 UI
ADOLESCENTS' OCCUPATIONAL EXPECTATIONS AND SUBSTANCE USE: "I WANT TO BE THE FIRST DUDE TO SMOKE WEED IN SPACE."
By: Daishea Poole and Laura Alcaraz
Psychology
Faculty Advisor: Dr. Zena Mello
Abstract: Career development is an important task for adolescence. Occupational expectations have been associated with indicators of well-being, including academic achievement and risk-taking. However, research has not yet examined the relationship between occupational expectations and substance use in adolescents. This study included 790 adolescents (Mage = 15.81, SDage = 1.23; 51% female). Data were collected with anonymous self-reported surveys. Occupational expectations were assessed with an open-ended question. Responses were coded into six categories (e.g., laborer to major professional) by independent raters. Substance use included several drugs (i.e., tobacco, marijuana, & cocaine/heroine). The Chi-Square statistic indicated associations among occupational expectations and substance use. Specifically, adolescents with higher occupational expectation used fewer substances.

Entry Number: 166 UI
SO...YOU BOUGHT IT? UNDERSTANDING VALUE-ACTION GAP TOWARDS EXPERIENTIAL PURCHASES
By: David Alexander Chang
Psychology
Faculty Advisor: Dr. Ryan Howell and Dr. Kenneth Paap
Abstract: Numerous published journals have reported on life experiences purchases affecting well-being and overall happiness positively. Despite evidence of an "experiential advantage" people have not shifted towards spending for life experiences. This divide in thought intentions and behavior is dubbed the value-action gap. The concept of value-action gap is seen in other fields of study particularly in environmental studies and health studies. Such examples include Kollmuss & Agyeman (2010) who studied the reasons why people act environmentally and what are the barriers to pro-environmental behavior; this article tries to find the different variables to understand what makes this gap. This study focuses on understanding the value-action gap on spending habits and what variables to even consider. Grimer et al. (2015) focused on a model looking into eight moderators between the relationship between intention and ethical purchase behavior. This study adapted the model of Grimer et al. (2015) in order to see if application of said model can apply to the construct of experiential spending. Surveying from Amazon Mechanical Turk at two different time points, participants answered questions regarding planned and actioned purchases. The data collected as of now points to intention being the strongest moderator towards making a purchase.

Entry Number: 167 UI
AUTOMATIC COUNTING AND INVOLUNTARY POLYMODAL IMAGERY (INVOLVING OLFACTION, AUDITION, TOUCH, TASTE, AND VISION)
By: Jamie Renna, Wei Dou, and Sabrina Bhangal
Psychology
Faculty Advisor: Dr. Ezequiel Morsella and Dr. Mark Geisler
Abstract: The Reflexive Imagery Task (RIT) reveals that high-level conscious thoughts and mental imagery can be activated involuntarily through the mere activation of action sets (Allen et al., 2013). In the original version of the RIT, participants are presented with visual objects and instructed to not think of the names of the objects. Involuntary subvocalizations arise on the majority of the trials. We extended this paradigm to investigate involuntary counting (Study 1) and unintentional imagery (Study 2). In Study 1, participants (n = 30) were presented with an array of nonsense shapes after receiving the instruction to not count the shapes. Some arrays had object counts below the subitizing range (2-5 shapes, the range for automatic counting); other arrays had counts exceeding this range (6-10 shapes). Involuntary counting was more likely for the former condition than the latter condition, $t(29) = 29.42$, $p < .001$. Does the likelihood of an RIT effect vary as a function of the type of sensory modality? To address this question, in Study 2, participants (n = 33) were presented with food items

as orthographic stimuli (e.g., BANANA) or as line drawings. For each stimulus, participants were instructed to not experience a certain type of imagery (e.g., visual, olfactory, haptic, or auditory). Across the 216 trials, the rate of the RIT effect (involuntary imagery) varied as a function of modality, $F(3, 96) = 47.10$, $p < .001$. Because these RIT variants involve imagery and minimal overt behavior, they are well suited for exploration with neuroimaging technologies.

Entry Number: 168 UI
EXTERNAL CONTROL OF THE STREAM OF CONSCIOUSNESS: AN EEG STUDY
By: Jessica Yankulova, Wei Dou, Sabrina Bhangal, and Zaviera Reyes
Faculty Advisor: Dr. Mark W. Geisler and Dr. Ezequiel Morsella
Abstract: The Reflexive Imagery Task (RIT) reveals that involuntary cognitions can be systematically elicited by the presentation of external stimuli (Allen et al., 2013). In the basic version of the task, participants are presented with visual objects and instructed to not think of the names of the objects. Involuntary subvocalizations arise on roughly 80% of the trials. In previous RITs, objects were presented only one at a time, thereby not resembling the nature of everyday stimulus scenes. With this in mind, we developed an RIT variant in which two objects are presented simultaneously (6 s), with one object on the left of the screen and one object on the right of the screen. Participants ($n = 44$) were instructed to not think of any of the names of the objects. Participants indicated that they happened to think of the name of any of the objects on a high proportion of trials ($M = .78$, $SE = .03$). In addition, the RIT effect arose for both objects on a considerable proportion of the 38 trials ($M = .34$, $SE = .05$), demonstrating the external control of multiple thoughts in the stream of consciousness. In a follow-up study, we investigated the neural correlates of the RIT effect and of the attentional processes associated with this effect. Electroencephalography was recorded from eleven electrode sites (Fz, Cz, Pz, F3, F4, C3, C4, T3, T4, P3, and P4). We focused on the alpha (8-13 Hz), beta (13-30 Hz), gamma (30-150 Hz), and theta (4-8 Hz) frequencies.

Entry Number: 169 UI
TIME ORIENTATION ACROSS THE LIFESPAN: EXAMINING TIME PERSPECTIVE FROM ADOLESCENCE TO OLDER ADULTHOOD.
By: Julie Chandler
Psychology
Faculty Advisor: Dr. Zena Mello
Abstract: In this study, we sought to examine the relationship between time-orientation and self-esteem. Time orientation is defined as the emphasis toward the past, present, and future. Participants included samples of adolescents, younger adults, middle adults, and older adults from a Western region of the United States, with ages ranging from 12 to 85. To assess participants' orientations toward a particular time period, the Adolescent and Adult Time Inventory-Time Orientation Scale was used. The Scale included circles of varying size, indicating one's emphasis toward the past, the present, and/or the future. Across age groups, adolescents and middle adults were less likely to emphasize all time periods equally compared to younger and older adults. Furthermore, more middle adults were present-oriented than adolescents and young adults. Regarding self-esteem, for both adolescents and young adults, those who were present-future oriented also reported the highest self-esteem; whereas an association was not observed for middle and older adults.

Entry Number: 170 UI
"WE ARE JUST AS GOOD:" ADOLESCENTS REFLECT ON HOW LIVING IN A LOW-INCOME COMMUNITY CONTRIBUTES TO THEIR FUTURE.
By: Liceth Solis and Celeste Lopez
Psychology
Faculty Advisor: Dr. Zena Mello
Abstract: We examined qualitative data on adolescents' thoughts about how their community contributed to their future. Data were collected with anonymous self-report surveys administered through a public high school in a low-income community in a Western state. The sample included 383 adolescents. Participants were asked to respond to an open-ended question regarding how they perceived their community to contribute toward their future. Data were entered and checked for accuracy. Independent raters employed content analyses and

observed eight emergent themes:positive affect, self, school, work, family, community, programs, and peers. Participants especially reported how the community contributed to their future, indicating links to community, self, and positive affect. Direction for further research focus on the relationship between these themes and indicators of well-being, including self-esteem and academic achievement.

Entry Number: 171 UI
PSYCHOLOGICAL INERTIA AND AGING
By: Megan Thomas and Jordan Seliger
Psychology
Faculty Advisor: Dr. Sarah Barber and Dr. Gaurav Suri
Abstract: People sometimes fail to take actions that are best for them. For example, they do not always take their medications or make easy lifestyle changes that would improve their health. This lack of behavior is called psychological inertia. To study psychological inertia, Suri and Gross developed a laboratory paradigm in which participants were shown images. During each trial, participants could push a button to switch the image being displayed, to one higher in valence (e.g., switching from a negative image to a neutral image). Despite having a preference for viewing the higher-valenced image, participants showed psychological inertia by continuing to view the low-valenced images. In the current study, we tested whether younger and older adults differ in their tendency to exhibit psychological inertia. Although it occurred for both age groups, we found that older adults demonstrated greater psychological inertia than younger adults.

Entry Number: 172 UI
THE FEMALE APPEARANCE PREDICAMENT: ON THE OBJECTIFICATION AND DEHUMANIZATION OF SOCIALLY ATTRACTIVE AND UNATTRACTIVE WOMEN RESPECTIVELY
By: Yrian Derreumaux and Lyndsey Wallace
Psychology
Faculty Advisor: Dr. Avi Ben-Zeev
Abstract: We found evidence for backlash against women who are either socially attractive or unattractive. Attractive female faces elicited slower reaction times at a subordinate/individuating level as well as higher objectification ratings. Socially unattractive women were attributed lower moral status, and are less likely to experience emotions such as pain and fear.

Entry Number: 173 UI
EMOTION REGULATION CHOICE: DIFFERENCES IN U.S. AND INDIAN POPULATIONS
By: Ashish Mehta, Gerald Young, and Alyssa Wicker
Psychology
Faculty Advisor: Dr. Gaurav Suri and Dr. Sarah Barber
Abstract: In the past two decades, researchers have conclusively demonstrated that various emotion regulation (ER) strategies give rise to differing consequences. Such findings have prompted an examination of the internal and external factors that contribute to emotion regulation choice. Previous empirical studies modeling ER choice have been limited to Western samples. Based on knowledge of the role of culture in other choice behavior, we sought to test whether culture was a driver of ER choice. For the present studies, we compared ER choices of participants from India, to ER choices of participants from the U.S.A. Research demonstrating a correlation between religiosity and effective use of cognitive reappraisal lead us to anticipate the more religious India showing higher rates of cognitive reappraisal. Based on the incorporation of acceptance themes in Indian philosophy, as well as higher rates of fatalistic outlooks in India, we also expected to see Indian participants more frequently using an acceptance ER strategy. We further expected that difference in choice strategies would be moderated by emotional intensity of the stimuli. To test these hypotheses, we presented high and low-intensity emotion-eliciting images to both samples and recorded ER choice selections. We discovered that as hypothesized, the Indian sample was significantly more likely to use cognitive reappraisal than the U.S. sample, specifically for high intensity images. Contrary to our hypothesis, the choice rate for acceptance was indistinguishable in the Indian and U.S. samples. This research indicates that culture bears considerably on which strategies people choose to employ when regulating emotion in response to negative stimuli.

Entry Number: 174 UI
EXTERNAL CONTROL OF HIGH-LEVEL PROCESSING: INVOLUNTARY COUNTING, VERBAL IMAGERY, AND ATTENTIONAL SHIFTS

By: Erica Walker
Psychology
Faculty Advisor: Dr. Mark W. Geisler and Dr. Ezequiel Morsella
Abstract: It is a fact of everyday experience that percepts and urges can (and often do) enter one's consciousness involuntarily: The eyes open and a visual world is perceived instantaneously; then, all of the sudden, one experiences, say, thirst. To the thinker, subconscious content just happens involuntarily and, most often, insuppressibly. Theorizing (Morsella et al., 2016) and experimental paradigms reveal that high-level thoughts, too, can arise in consciousness involuntarily and insuppressibly. In the Reflexive Imagery Task (RIT; see review in Bhangal et al., 2016), high-level conscious thoughts are triggered by external control. In the most basic version of the task (Allen et al., 2013), subjects are presented with visual objects (e.g., a triangle) and asked to not think of the name of the objects. On a high proportion of trials (~ 80%), subjects cannot suppress the subvocalizations of the object names, even though such subvocalizations require the sophisticated and multi-stage process of object naming. Complex variants of the task reveal that subjects also cannot suppress the counting of objects (Merrick et al., 2015) and even sophisticated symbol manipulations (e.g., those of Pig Latin; Cho et al., 2016).
In Study 1, we developed an RIT variant to investigate whether high-level attentional processes, too, can be activated in an involuntary and externally-controlled manner. This variant was inspired in part by the proposal that shifts in attention, including those from top-down control, are best construed as an effect [of unconscious processes] rather than as a cause of enhanced perceptual processing (Krauzlis et al., 2014). In this variant, a fixation cross is surrounded by a circle of twelve words, resembling a clock made of words instead of numbers. Subjects are instructed to not think of the number of letters at a certain position of the clock. Involuntary letter counting of the designated word serves as evidence of an involuntary shift of set-related attention. Study 2 was inspired by the observation that perceptual load can influence whether a percept enters consciousness (Dux et al., 2010). It was a replication of the basic version of the RIT, except that the visual object was presented briefly (80 ms) and flanked by many distractors. Do these conditions diminish or enhance the RIT effect? In Study 3, we investigated the learning-based determinants of the RIT effect. Subjects (n = 11) were trained to make associations between nonsense shapes and nonsense words. Critically, each shape was paired with two such words. One of the words presented with the shape appeared sixty times, creating a strong association, while the other word was presented only ten times, creating a weak association. After 420 training trials, subjects were presented with the shapes and instructed to not think of the name of the object. On a substantive proportion of the trials (M = .59, SD = .28), which was significantly different from zero, t(10) = 6.97, p < .0001, the first RIT effect was associated with the strong association. Together, these studies reveal the potential boundary conditions and learning-based sources of the RIT effect.

Entry Number: 175 UI
COMPUTATIONAL EXPERIMENTS ON DRIVERS OF LI+ DIFFUSION IN LITHIUM-OXYHALIDE ANTI-PEROVSKITES
By: Zerina Mehmedovic and Andrew Grieder
Chemistry
Faculty Advisor: Dr. Nicole Adelstein
Abstract: Introduction: This research addresses the long-standing dilemma in the design of solid-state batteries, the low ionic conductivity across solid-solid interfaces and through the solid electrolyte. Understanding the mechanism behind lithium ion diffusion in solid electrolytes can provide significant insights in developing new battery materials. This study focuses on the lithium-oxyhalide anti-perovskites due to their usual non-monotonic conductivity upon increasing the ratio of bromine to chlorine. To explain the variation in conductivity, we simulated Li3OCl1-xBrx with x=0, 0.22, 0.30, and 1. The hypothesis that the Li-Br compared to the Li-Cl bond significantly affects conductivity is tested.
Methods: First principles DFT-MD was performed on a 3x3x3 Li3OClxBrx supercell using ultrasoft (Vanderbilt) pseudo-potentials as implemented in the Quantum ESPRESSO PWscf package. The size of the supercell (135 atoms) allows for a higher percentage Br substituted doping, comprising of 22% and 30% Br:Cl. The simulations each ran for 10 ps with 1 or 2 Li+ vacancies, as the conduction mechanism requires vacancies. An additional study was performed to determine how temperature (700-900K) effects Li+ ion diffusion in Li3OClxBrx. Maximally Localized Wannier Functions (MLWF) are used to quantify the covalent character of the Li-Cl/Br/O bonds, in particular their dynamic behavior. The diffusion coefficient for each compound was

determined using the mean squared displacement. The activation energy was calculated using the diffusion coefficients at 1000, 1500, and 2000K.
Results: We identified how the number of Cl and Br bonds and changes in covalency during Li+ jumping affects the diffusion pathway. The bonding characters that were determined from the MLWF analysis show that the bromine has more covalent bonds with Li+ than the chlorine. This strong bond affects the diffusion pathway and diffusivity, in addition to the larger size of the bromine atom. Simulations with two Li+ vacancies revealed correlated motion.
Similar to previous studies, the diffusion coefficients were much lower than experiment. In order to simulate significant diffusivity, very high temperatures are required. The change did not correlate with superionic conductance. Thus there is still more that is required to understand the diffusion mechanism in these oxy-halides, especially examining correlated motion using MD simulations with additional defects, including more Li+ vacancies.

Entry Number: 176 UI
USING ESI MASS SPECTROMETRY TO ANALYZE EARLY-STAGE GOLD NANOPARTICLES
By: Justin Nahavandi
Chemistry
Faculty Advisor: Dr. Krista Vikse
Abstract: In the recent years, gold nanoparticles (AuNPs) have proven to be useful in various fields such as biomedical imaging, pharmaceuticals, and catalysis just to name a few. Due to their unique characteristics, such as size, shape, and fluorescence, these particles have grown in popularity in the scientific community. There are many methods by which gold nanoparticles can be synthesized. One classical synthesis method is to combine a gold precursor like tetrachloroauric acid and a stabilizer like trisodium citrate with heating and mixing. However, the mechanism behind the birth of these and other nanoparticles is still relatively unknown. Previous experiments have attempted to analyze the beginning formation of nanoparticles using a number of different methods such as small-angle X-ray scattering (SAXS) and X-ray absorption near-edge spectroscopy (XANES). Although yielding promising results, these methods still were not as precise and sensitive as required to measure the beginning stages of nanoparticle formation. Here, electrospray mass spectrometry will be used to analyze the very beginning formation of gold nanoparticles in real time. Mass spectrometry (MS) will be able to give results that are more informative because MS will be able to detect the formation of gold nanoparticles at smaller scale than previous methods that have been tested.

Entry Number: 177 UI
ASSESSING THE FUNCTIONALITY OF ACTIVE SITE THREONINE SUBSTITUTED TRYPSIN WITH DISULFIDE RESIDUE SERINE VARIANTS
By: Ben Caswell
Chemistry
Faculty Advisor: Dr. Teaster Baird, Jr.
Abstract: The catalytic triad of the serine proteases has been studied extensively, but we seek to understand why the chemically and structurally similar amino acid threonine is rarely observed in a similar context. Research has shown that the hydroxyl group of serine at position 195 is necessary for proper functionality of the protease. However, the substitution of threonine at position 195 made in conjunction with substitutions of alanine residues at positions 42 and 58 in the canonical serine protease trypsin (C42A/C58A/S195T-Tn) modestly increased the activity relative to the S195T single variant by promoting backbone flexibility that accommodates rotation of Thr-195 residue. In wild-type trypsin, the side chains of C42 and C58 from a conserved disulfide bond that restricts conformational mobility in the prime side binding region of the enzyme. Here, we compare the activity and stability of the C42S/C58S/S195T and C42S/C58S variants to that of wild-type and previously studied variants to determine how isosteric substitutions at positions 42 and 58 affect the enzyme in the absence of the disulfide bridge. Preliminary results suggest that the C42S/C58S double variant has similar activity to that of wild-type while the C42S/C58S/S195T variant seems similar to the S195T single variant. Together,

these results suggest that the covalent interaction between C42 and C58 may not be required to facilitate activity in the S195 background or inhibit activity in the T195 background.

Entry Number: 178 UI DISPLAY ONLY
COOKERY
By: Hung Do, Sang Saephan, Ed Young, and Robert Mitchell
Computer Science
Faculty Advisor: Dr. Bill Hsu
Abstract: Cookery allows you to choose your own ingredients and place them in a cart. You can use the cart functionality to search up recipes based on your ingredients.

Entry Number: 179 UI DISPLAY ONLY
GPU High Performance Computing on Android Devices using Renderscript
By: Jason Cromer
Computer Science
Faculty Advisor: Dr. William Hsu
Abstract: Evaluating the performance of using Renderscript for parallel computing on Android devices versus the conventional Java implementation. Observing the performance and result of algorithms, and a Gray Scott Diffusion Reaction implemented in Renderscript.

Entry Number: 180 Dropped

Entry Number: 181 UI
GATORSELL: SFSU BUY/SELL WEBSITE (CLASS PROJECT)
By: Amanda Robinson, Jason Bockover, Kanakapriya Krishnakumar, Rainier Hui, Ronald Rieger, and Tony Filippo
Computer Science & Linguistics
Faculty Advisor: Dr. Dragutin Petkovic and Dr. Anthony Souza
Abstract: GatorSell, a website exclusively produced for the advantages of SFSU students, has user perks of selling and buying items. Compared to other competitive sites, GatorSell is a reliable source that is focused on faster transactions and is tailored more towards students' needs. The website is customized to be more affordable and reasonable for SFSU students. GatorSell will be acted upon as the mediator for students to sell/buy used or new items and ensure the safety of the students by handling transactions through a Safe Meeting. Our team focuses on building a website that is easy to be worked with, and makes our users happy.

Entry Number: 182 UI
ISWITCH: WIRELESS SWITCH
By: Di Mao
Computer Science
Faculty Advisor: Dr. Hao Yue
Abstract: Wireless Switch is a project/device that can turn on/off electronic appliances wirelessly using iOS or Android APP from anywhere in the world. Also Amazon Alexa service is added into the system which mean you can control electronic appliance using voice command.

Entry Number: 183 UI
A GOODNIGHT SPACE
By: Evan Terry, Lindsey Hogg, Andrew Lesondak, and Brook Thomas
Computer Science
Faculty Advisor: Dr. Bill Hsu
Abstract: A web app for centralizing homeless shelter communications and resource allocation.

Entry Number: 184 UI
SFSU CONGRE-GATOR'S MARKET

By: Ihsan Taha, Kevin Chu, Prateek Gupta, Mark Tompong, Shane Cota, and Darel Ogbanna
Computer Science
Faculty Advisor: Dr. Dragutin Petkovic, Anthony Souza
Abstract: SFSU Congre-Gator's Market is a buy/sell web application exclusively for SFSU students that is beneficial, convenient, and of great value to the SFSU community. Users can create item listings on the website to sell various types of items including books, electronics, furniture, and more that are of interest to students. The application consists of two general types of users: non-registered and registered. Both of these users can browse the website for compelling items, and the latter can purchase items posted by other registered users or sell items of their own. Registered users shall be able to contact each other through messaging provided by our web application while transactions take place outside of the application after an agreement. Moreover, the website shall have at least one admin whose job shall be to monitor postings and messages to ensure a safe and legitimate environment. Finally, our website provides a convenient set of locations for students to meet on campus for a safe and swift transaction. Sellers choose a meet-up location prior to posting a new item, but buyers can request a different location at the consent of the seller, and both members must agree to a common area.

Entry Number: 185 UI
SWAY: SONIFICATION OF URBAN ARCHITECTURE
By: Jeremy Erickson
Computer Science
Faculty Advisor: Dr. Bill Hsu
Abstract: Sway is an interactive proof-of-concept app that uses geological and architectural data to create an urban audioscape comprising the natural resonating tones emitted by buildings as mapped onto a human-audible gamut.

Entry Number: 186 UI
SafeZone
By: Kevin Lay, Matthew Serna, Alex Aichinger, and Farbod Zolghadri
Computer Science
Faculty Advisor: Dr. Bill Hsu
Abstract: Safety zone app that allows students to have a panic button that will on click, call the the University Police Department. The app will also in the background, ping the location of the victim to the University Police. There will also be an option on the app to take users to the closest hospital, depending on where they are on campus The shell of the project is here https://techcrunch.com/2016/09/11/safezone-guides-you-to-safe-spaces-in-crises/

Entry Number: 187 UI
SEEGET
By: Rodolfo Anguiano, Javier Baltazar, Preyansh Kotecha, Ashley Conanan, and Pujan Paudel
Computer Science
Faculty Advisor: Dr. Bill Hsu
Abstract: SeeGet is a platform for online retailers to deliver a new way of shopping. We use Augmented Reality and haptics to deliver a better shopping experience. With Augmented reality, you are able to see the product and with haptics, you are able to feel the texture. SeeGet makes shopping smarter with machine learning, fun with augmented reality, and much faster with image recognition.

Entry Number: 188 UI
ROOMY
By: Rodrigo Bell, Ryan Liszewski, Dustyn Buchanan August, and Poojan Dave
Computer Science
Faculty Advisor: Dr. Bill Hsu
Abstract:Roomy is an app that creates a smart home for roommates, building an mobile ecosystem allowing everyone in a home to become more productive, social, and intelligent, together. Living in a city like San

Francisco is impossible without roommates. But living with roommates can be impossible. To ease the pain, we created an ecosystem to coordinate with your roommates. An app that lets you know whether or not your roommates are at home. Communicate with your roommates through the built-in group chat. Create a to-do list to keep up with the chores, the bills, and any other tasks. Includes a button to provide quick directions back home. Future growth for the app includes a built-in method to pay rent, a calendar for events, and a grocery and supplies shopping center.

Entry Number: 189 UI
INVESTICKATIONS: A CITIZEN SCIENCE ANDROID AND WEB APPLICATION FOR RECORDING AND TRACKING REAL-TIME TICK OBSERVATIONS AND DATA
By: Sophia Amin
Computer Science
Faculty Advisor: Dr. Andrea Swei and Dr. Dragutin Petkovic
Abstract: InvesTICKations is a Citizen Science project that aims to track when and where people come into contact with ticks that transmit human diseases. This tool allows users to capture real time data for ticks during usual human activities. After careful analysis of the data it will be presented to scientists, who can utilize it to further their research in related fields responsible for Lyme disease. The primary goal for developing the InvesTICKations project is to collect a variety of information about ticks. This data will help perform analysis about ticks and their existence. Currently, there are no tools to monitor tick related information in real time. Therefore, this application is crucial to trace, analyze, and share data about ticks. The launch of InvesTICKations will be a tool to accumulate data that will ultimately lead to a valuable resource for advancing Lyme disease research.

Entry Number: 190 UI
NEIGHBORHOODS MATTER: HEALTH AND RESILIENCE IN OAKLAND, CALIFORNIA.
By: Maggie Chen
Geography
Faculty Advisor: Dr. Tendai Chitewere
Abstract: Anthropology has a long history of studying neighborhoods and health in North America. Increasingly, scholars across the discipline recognize that for social and environmental health and well-being, neighborhoods matter. At the same time, the economic gap between the rich and poor has put political and ecological strains on what increasingly feels like a fragile democracy. Oakland, California is uniquely placed historically, and culturally well situated, to examine the question of how neighborhoods impact health and well-being, especially in a tremulous time. Using the lens of political ecology, we present our research on the multiple ways residents confront and address environmental degradation in their city through creating gardens and public green spaces. Concurrently, residents focus on the social health of their community, contributing human energy in the form of working and volunteering to build resiliency. These efforts are not new in Oakland; the 50th anniversary of the Black Panther Party presents an opportunity to reflect on the history of Oakland's commitment to self-determination in caring for the community and the natural environment. In this paper we present the analysis of over 130 organizations through archival data, Zeemaps, and interviews with local residents. We draw connections between how neighborhoods today continue to echo the spirit and resilience of the Black Panther Party, including the party's survival programs for disenfranchised communities in Oakland and across the United States. The Black Panther Party's Ten-Point Program continues to matter in the everyday lives of Oakland residents and the quest for a social and environmentally just society.

Entry Number: 191 UI
MODELING THE EVOLUTION OF ALTERNATIVE SPLICING
By: Ksenia Arzumanova
Applied Mathematics
Faculty Advisor: Dr. Rori Rohlfs

Abstract: During post-transcription of a gene, a biological process called alternative splicing occurs, wherein exons are either included or excluded, resulting in different protein isoforms being translated from a single gene. Alternative splicing diversifies and increases the capacity of gene functionality, and provides opportunity for gene regulation. The scope of this process, and its presence across species over evolutionary time, still has yet to be investigated. The purpose of this research is to better understand the evolution of alternative splicing and how changes in alternative splicing support adaptation. We aimed to investigate how alternative splicing evolves by observing and analyzing exon expression levels across several species. In order to measure the evolution of alternative splicing, we use the Expression Variance and Evolution (EVE) model program, a phylogenetic Analysis of Variance (ANOVA) traditionally used on gene expression levels, to determine exon expression divergence between, and diversity within, species over evolutionary time. Through these analyses, we identify exons with high inclusion divergence as candidates for adaptation, and exons with high inclusion diversity as candidates for plasticity. The EVE model was used on three datasets representing different sets of tissues for Human, Chimp, Macaque, and Mouse. We expect our results to show that alternative splicing can be modeled by the Ornstein-Uhlenbeck model, a stochastic process which describes the random movement of an object over time, but approaches a stable long-term mean. This model would suggest that alternative splicing is subject to stabilizing selection. Using EVE is a new and robust way of analyzing expression data, and with this project we have expanded its capabilities to alternative splicing.

Entry Number: 192 UE

INCREASE STUDENT SUCCESS THROUGH NOVEL MOBILE LABORATORY AND FLIPPED LABORATORY LEARNING MODULE

By: Alec Maxwell
Civil Engineering
Faculty Advisor: Dr. Zhaoshuo Jiang

Abstract: Learning style changes from generation to generation. With the advancement of technologies, the current and incoming tech-savvy learners grow up with the digital world. Such technology advancement makes learning more accessible. As one of the examples, mobile learning has become a commonly accepted and embraced concept among the younger generations. Effective learning occurs when the teaching styles align well with the learning styles. To better serve the need of the next-generation learners in a more accessible way, a standalone mobile learning module was developed for an undergraduate upper division class, Mechanical and Structural Vibration, at San Francisco State University (SFSU). The developed mobile learning module consisted of three interconnected components, namely Analysis, Simulation and Experiment, representing the three important elements in a good engineering learning environment - theory, practical example and physical experimentation. Besides delivering the theoretical knowledge and important concepts, the learning module also allows students further examine the gained knowledge through animated simulations in the interactive Apps. In addition, the module includes a mobile remote shake table laboratory (RSTLab) which provides students the opportunity to remotely participate and conduct physical shake table experiments in real-time through smart mobile devices (e.g. smartphones and tablets). Through these physical experiments, students may easily use scaled physical models to test theories and implement their own innovations to observe how structures behave under different ground excitations. A telepresence robot is innovatively adopted and integrated with the mobile RSTLab to actively engage students and provide them a real sense of in-person participation without the need of being physically present in the laboratory.
The learning module was implemented in Fall 2016 at SFSU as a flipped laboratory. Pre- and post- surveys were conducted to evaluate the effectiveness of the mobile learning module to fulfil course learning outcomes. Survey results demonstrated the readiness of the mobile learning and improvement in participants' knowledge competence after using the module. The obtained information will be utilized to guide the future refinement of the learning module and understand what strategies could be used to better fit the need of the new generation learners.

Entry Number: 193 UE
SEISMIC GROUP 2: TMD TOWER
By: Alicia Estrada, Seerit Brar, Jose Vasquez, Samson Gan, Early Cobb, Brianna Bright, Laura Marji, and Yuanhong Chen
Civil Engineering
Faculty Advisor: Dr. Timothy D'Orazio
Abstract: We designed and constructed two identical balsa wood towers that we designed to be flexible. We also designed a tuned mass damper to limit the motion in one of the towers

Entry Number: 194 UE
ASCE STEEL BRIDGE
By: Bryan Vrba, Jon Machado, Alex Yerena, Reynaldo Gaglio, Harry Parr, Vince Encinas, Jonathan Guzman, and Chiem Saechao
Civil Engineering
Faculty Advisor: Dr. Timothy D'Orazio, AND Dr. Jenna Wong
Abstract: Our goal was to design an economical Steel Bridge that would be easy to mass fabricate, easy to transport and have ease of constructibility for a timed construction as per the 2017 ASCE MIDPAC competition held at CSU Chico.

Entry Number: 195 UE
TIMBER BRIDGE 2017
By: Dylan Watters, Alex Cuevas, Tony Huang, Evelyn Moran, William Li, Carl Seldura, Marcos Morales, Allan Trejo, Thomas Kyabega, and Anthony Wong
Civil engineering
Faculty Advisor: Dr. Timothy D'Orazio
Abstract: The 2017 SFSU ASCE student chapter entry to the national timber bridge competition coordinated by Southwest Mississippi Resource Conservation and Development (RC&D), Inc.

Entry Number: 196 UE
AMERICAN SOCIETY OF CIVIL ENGINEERS CONCRETE CANOE
By: Jacob Shaw, Ryan Rost, Merhawit Tesfai, Marquez Monroe, Johana Quandt, Grant Groshans, Maryanne Caras, Edward Chung, and Tristan Nilumol
Civil Engineering
Faculty Advisor: Dr. Timothy D'Orazio
Abstract: Our group is competing in the 2017 American Society of Civil Engineers Mid - Pacific Concrete Canoe regional competition for our civil engineering senior design project. We are to construct a 20ft long canoe made of concrete and compete it against other local universities. For our senior design class, we are required to enroll in the project showcase and create a poster informing peers on the process of creating our concrete canoe.

Entry Number: 197 UE
2017 SEISMIC DESIGN TEAM (EERI)
By: William Solano, Gerald Macaspac, Selena Gray, Josias Galan, Amy Chun, Mark Manalo, Tyler Fallon, and Bashir Habboub
Civil Engineering
Faculty Advisor: Dr. Timothy D'Orazio
Abstract: Portland, Oregon, located in the Pacific Northwest of the United States, is well known for its unique culture, large open parks, and contributions to the fields of science and technology. Unlike California, the seismic risk in the Pacific Northwest has only been recognized recently, and therefore has not been extensively studied. The lack of recent seismicity is the primary reason for the lack of characterization for the area. It is known, however, that the downtown Portland area is situated between three shallow crustal faults: Oatfield, Portland Hills, and East Bank. In addition, the city faces a potential M 9.0 earthquake from the Cascadia Subduction Zone, which extends from Northern California to Vancouver Island. As a part of the 2017 Seismic Design Competition, our team was tasked with responding to a Request for Proposal (RFP) for a new building

to be constructed in the Pearl District in downtown Portland. The client wanted this new building to be an iconic structure. Recognizing the opportunities posed by this new construction, the client also wanted to incorporate two green building design requirements into this new structure. The first design requirement was the inclusion of a green roof on the uppermost floor to create a green-space, reduce cooling costs, and minimize rainwater runoff into the Willamette River. This posed a unique challenge to us, since the mass of the green roof would impact the building response during seismic events. The second design requirement was to maximize the presence of natural light on the first, second and third floors. To achieve this, the client requested for a continuous open atrium space that is unobstructed by structural and nonstructural elements. This posed another unique challenge to us because the open layout of the first, second, and third floors would affect the lateral resistance of the structure. Our Proposed structure, The Malany Tower, implemented an outrigger-braced structural system that improved the building's resistance to overturning as well as increased the overall rigidity of the structure. The goal was to designate a load path to transfer dead and lateral loads between the core and exterior of the building. The core was designed as a stiff truss system with strategically placed outriggers at specific floors providing a connection between the core and exterior of the structure. By using the concept of structural topology optimization, we implemented an orthogonal cross-brace system that used a two-thirds height ratio for the cross braces' intersection point. To serve as support, perimeter columns were constructed to span vertically throughout the entire height of the building. The truss system redistributed the lateral load evenly instead of imposing too much on the outrigger system. Collectively, these systems worked together to support the three-story atrium space which though is a beautiful feature, behaved as a weak point in the building.

Entry Number: 198 UE
SEISMIC RESPONSE PREDICTION USING POLYNOMIAL CHAOS EXPANSION FOR BUILDING PERFORMANCE EVALUATION
By: Yifeng Xu
Civil Engineering
Faculty Advisor: Dr. Cheng Chen
Abstract: Numerical simulation plays an important role in system-level structural performance evaluation under earthquakes and its seismic risk assessment. It, however, involves significant computational burden, especially for applications involving highly nonlinear models. In this study, the surrogate modeling using the polynomial chaos expansion (PCE) technique is explored for seismic response prediction of a steel moment-resisting frame under stochastic ground motions. PCE is a non-sampling-based method to determine evolution of uncertainty in a dynamic system. Effects of various PCE parameters such as sample number, PCE degree, integration time step are evaluated on the accuracy of the surrogate model. It is demonstrated that, with properly selected parameters, the surrogate modeling using PCE provides an effective and efficient technique for seismic response prediction.

Entry Number: 199 UE
PROJECT COLPLAN
By: Anxin Yang and Man Ki Tsang
Computer Engineering
Faculty Advisor: Dr. Thomas Holton
Abstract:

This project creates a website that can be used as an alternative of current DPR as a ”roadmap to graduation.” This project visualizes requirements of the selected major on a single screen. Also, it has a convenience interface that allows advisors and students to obtain and edit information that they needed.

Entry Number: 200 UE

SINGLE CROSSBAR-PER-LAYER SOLUTION FOR HARDWARE-ACCELERATED MULTILAYER PERCEPTRONS

By: Felix A. Portillo
Computer Engineering
Faculty Advisor: Dr. Hao Jiang

Abstract: Memristor Crossbar Arrays can be used to perform hardware-accelerated dot product computations. This has a useful application in speeding up computing time for artificial neural network algorithms. An issue with using memristor crossbar systems is the need for two separate crossbars per network layer in order to handle representations of both positive and negative values through the conductance of each memristor. By only allowing positive values to have an influence in the final output and setting all negative values to zero during neural network training, it is feasible to have just one memristor crossbar array per network layer. This was tested using a multilayer perceptron neural network classifying handwritten digits using the MNIST Data set.

Entry Number: 201 UE
IMEDMANAGER - AN AUTOMATIC MEDICATION NOTIFICATION AND DISPENSER SYSTEM
By: John Emery and Gerardo Garcia
Computer Engineering
Faculty Advisor: Dr. Thomas Holton
Abstract: Missing medication doses can have life threatening consequences leading to emergency room visits, doctor's visits, and inpatient hospitalizations. We prototyped a medication dispensing system that notifies a person via email , SMS text, audio, and LEDs to take their medications. It is configured using a touchscreen interface and connects to the internet via WiFi.

Entry Number: 202 UE
iFound MOBILE APPLICATION (ENGR 697)
By: Joseph Prasad, Olasheni Olora, and Weizai Zeng
Computer Engineering
Faculty Advisor: Dr. Hao Jiang
Abstract: Designed an app that will notify the user if your pet or child is out of range of parameters. Building an alarm system within the app using ringtones. It will be designed to play an alarm if the two items are not in sync anymore via Bluetooth. We will use the phone as a base station, which will sync with a Bluetooth device (arduino) and will notify us if the child, or pet is out of range of the parameters and will send a sound notification on the app to notify the owner. Easy to use.

Entry Number: 203 UE
D'SOX
By: Miklesh Naicker, Alvin Kwok, and Steven Bao
Computer Engineering
Faculty Advisor: Dr. Thomas Holton
Abstract: Most "beginners" struggle when learning how to dance and have difficulty finding the beat or realizing in which direction they should point their feet. D'Sox is a wireless system which utilizes actuators to guide the user through basic dance routines, according to the flow of the song, by incorporating a transmitter and two receiver modules communicating via Bluetooth. Through repetition, users adapt to dance commands issued by D'Sox and are able to make use of the device to learn different dance routines.

Entry Number: 204 UE
ALTERNATING DIGITAL STREET SIGN DISPLAYS
By: Abdulrahman Althobaiti, Omar Ahmad, Jagroop Singh, and Haitham Alzerma
Electrical Engineering
Faculty Advisor: Dr. Hao Jiang
Abstract: The project is named alternating street sign display. The goal of the project is to provide an alternative technique to display street signs for incoming traffic. The idea is to replace conventional street signs with digital displays that could be remotely controlled to change the output on the street sign based on the requirement. Applications of this alternating digital street sign would improve traffic flows in high traffic areas. It aims to remove confusion resulting from excess information, caused by displaying multiple ordinances on a single street sign. Furthermore, it can be changed remotely in case of emergency to display important information as well as controlling traffic flow.

Entry Number: 205 UE
WATER AUTOMATION SYSTEM FOR PLANTS (WASP)
By: Alexander Yore, Nick Ng, and Trevor Taylor
Electrical Engineering
Faculty Advisor: Dr. Thomas Holton

Abstract: The Water Automation System for Plants (WASP) eases the burden of the gardener by constantly monitoring the soil moisture level, and watering the plant when necessary. It comprises two sensors placed 4" deep in the soil, tracking the soil's volumetric water content by measuring the dielectric constant of the soil. The moisture information is sent to a microcontroller, which compares the current level to a user-defined threshold. WASP waters the plant if the current soil moisture level is below the threshold at both sensors. A touch screen creates a simple and intuitive interface for the user.

Entry Number: 206 UE
FORMULA SAE - BATTERY MANAGEMENT SYSTEM
By: Dennis Chhun, Roberto Ceballos, and Nathanael Wong
Electrical Engineering
Faculty Advisor: Dr. Thomas Holton and Dr. Jin Ye
Abstract: Formula Society of Automotive Engineers (FSAE) is an international student design competition in which each team must design, construct, and test their custom built high performance Formula One-style race car. Teams are responsible for structuring their organization's business model and raising their own of funds. The Gator Racing Battery Management System (BMS) team will be designing and building a BMS PCB to monitor the voltage and temperature levels of Lithium Ion Cells for San Francisco State University's FSAE Vehicle.

Entry Number: 207 UE
SILENT PC WORKSTATION - FANLESS ITX CHASSIS PROTOTYPE WITH WATER COOLING
By: Farnam Adelkhani
Electrical Engineering
Faculty Advisor: Dr. Hao Jiang
Abstract: Personal and commercial computing has reached a crossroads. For years, CPU manufacturers have been working tirelessly to meet the demand for high-power processors capable of handling a heavy workload. However, we are now in a new age, CPU manufacturers are moving towards developing processors capable of delivering the same amount of performance that is currently available to users, while consuming much less power. As this shift in demand occurs, personal computing workstations with large/noisy fans will become relics. Apple computers, along with a select few companies in the bay area, are trying to design cases that are quieter and more aesthetically pleasing, but to this point they have fallen short of delivering something game changing. My project, and company, seeks to create bold and beautiful computer cases that run at 0 dB while delivering unparalleled reliability and maximum ascetic benefactor. This design and the ideas behind it have the potential to develop into a corporation.

Entry Number: 208 UE
TORQUE RIPPLE AND COPPER LOSS MINIMIZATION FOR A FAMILY OF MUTUALLY COUPLED SWITCHED RELUCTANCE MACHINES
By: Forest Hensley and Wei Chung Yu
Electrical Engineering
Faculty Advisor: Dr. Jin Ye
Abstract: In this paper, an optimal torque sharing function (TSF) for a family of mutually coupled switched reluctances machines (MCSRMs) is proposed to minimize the torque ripples and copper losses over the wide speed range. Winding distributions and torque production mechanism of a family of mutually coupled switched reluctance machines including short pitched, full-pitched, and fractionally- pitched MCSRMs are discussed. Then an optimal TSF for the MCSRM is obtained by solving the optimization problem. The objective of the optimal TSF combines the squares of three-phase currents (copper loss); the torque equation for the MCSRM in the linear magnetic region is expressed in terms of both self-inductance and mutual inductance, which is used as the equality constraint of the optimal TSF; the limits of the rate of change of current references serve as the first inequality constraints, while three-phase current limits serve as the second inequality constraints. Simulation results show that in the linear magnetic region, the torque ripples of the MCSRM using the proposed optimal

TSF are only one half and one fourth of those produced by conventional sinusoidal and square current excitations over the wide speed range while keeping the power losses minimum.

Entry Number: 209 UE
BLU-LOCK
By: Joseph Ly, Edwin Betancourt, and Edwin Cho
Electrical Engineering
Faculty Advisor: Dr. Thomas Holton
Abstract: Blu-Lock was created as part of the two-term senior design course for Engineering majors at San Francisco State University in Fall/Spring 2016-2017. The premise of our project was that people are still being locked out of their homes without their keys, but are almost never without their cellphones. Our team's mission is to allow the user to wirelessly unlock their front door, using their smartphone. This is not a fully automated wireless lock door, but a secondary option for unlocking the door if someone forgets their keys. We have created an android application that communicates through bluetooth, with a microcontroller that controllers a DC motor that allows the doors deadbolt to be locked or unlocked by the user.

Entry Number: 210 UE DISPLAY ONLY
PROSTHETIC HAPTIC FEEDBACK SYSTEM
By: Justin Clark
Electrical Engineering
Faculty Advisor: Dr. Thomas Holton
Abstract: A haptic feedback system has been developed to provide sensory information to people using prosthetics and exoskeletons. Conductive rubber cords were used as stretch sensors to provide control information to the exo-gripper CPU. Force-sensitive resistors mounted on the end of the exo-gripper are used to collect the tactile information. This tactile information collected by the force-sensitive resistors is sent back to the exo-controller gauntlet CPU, processed, and is felt by the user by the vibration of the feedback motor. The feedback vibration frequency is proportional to the strength of the tactile information. Using this method we can simply and effectively provide sensory feedback for prosthetics and exoskeletons.

Entry Number: 211 UE
CONTROLLED CELLPHONE CHARGER
By: Kit Cheang
Electrical Engineering
Faculty Advisor: Dr. Hao Jiang
Abstract: Most of our portable devices are powered Lithium-ion battery cells. While many people does not know that keeping their devices plugged into a charger after charging is done can be harmful to the battery, many people chose to charge their devices overnight because manually unplugging it in the middle of the night can be troublesome and inconvenient. This project is aimed to provide a solution to this problem by implementing a microcontroller into the charge to control the charging process. This charger will stop the charging once the battery cell is fully charged and users will not have to worry about damaging their devices or have to go through the trouble to unplug devices at a certain time.

Entry Number: 212 UE
THE HUMAN POTENTIAL ENERGY HARVESTER
By: Martin Gray, Robin Trinh, and Ken D.C. Chen
Electrical Engineering
Faculty Advisor: Dr. Thomas Holton
Abstract: Mobile computing technology has been skyrocketing in the last decade, yet battery performance is lagging behind in comparison to the increased power demand. Instead of waiting for the breakthrough of new battery technology to reach consumer hands, a faster alternative solution to the problem is needed. Enter The Human Potential Energy Harvester, a wearable mechatronic device that harvests the dissipated energy in the human walking cycle to charge a battery.

Entry Number: 213 UE
CONTACTLESS SENSING FOR TRANSPLANT REJECTION
By: Monique Avila, Georgia Haddad, and Shawn Bray
Electrical Engineering
Faculty Advisor: Dr. Hao Jiang
Abstract: Our project focuses on changing the way doctors and surgeons monitor possible tissue rejection on a transplanted organ. We intend on creating a Bluetooth capable device that will observe the impedance measurements of the organ to check if there are any deviations in tissue development. This will be the first time that anyone has ever attempted to wirelessly detect problems after surgery, and this innovation can potentially save the lives of organ recipients. The success of this device can lead the way for further advancements in internal body detection, and this means that engineers can continue to create products that can help patients in need.

Entry Number: 214 UE
THE DRAIN DRAGON, A STEP FORWARD IN REALIZING MORE EFFECTIVE DRAINAGE SOLUTIONS
By: Richard Devera, Henry Mattoon, and John Sze
Electrical Engineering
Faculty Advisor: Dr. Hao Jiang
Abstract: The Drain Dragon was created to effectively traverse a drainage pipe. The device could then be used for a variety of tasks such as inspecting the inside of the pipe or removing any blockage, granted it is mounted with the correct tools. In order to work, the Drain Dragon would need to be able to move through a 3 inch in diameter pipe. To tackle the movement problem, the Drain Dragon was designed to implement screwing motion to get through the pipe. After testing out different designs, the Drain Dragon was able to successfully move through a straight pipe, both climbing against gravity and descending with it. Currently the Drain Dragon is the step in the right direction to creating a device that can easily traverse a drainage pipe, but there are still improvements that need to be made.

Entry Number: 215 UE
Vehicle Impact Alert System (VIAS)
By: Roberto Cuyate, Matthew Deleon-Randolph, and Eric Carter
Electrical Engineering
Faculty Advisor: Dr. Thomas Holton
Abstract: Vehicle Impact Alert System ,VIAS, was created to provide a higher level vehicle alarm system. By integrating emerging technology, VIAS allows users to take comfort knowing that their vehicle is under watch. VIAS utilizes a small microcontroller which enables the device to delivers digestible edited security footage 24 hours of the day. Also if network connectivity is available, VIAS also provides real-time updates if an incident is to occur. The resulting video can be used by the user to support their damage claims. VIAS aims to create peace of mind when stepping away from one's car.

Entry Number: 216 UE
IDETECT
By: Tina Nguyen and Jose Sierra
Electrical Engineering
Faculty Advisor: Dr. Thomas Holton
Abstract: iDetect is a device that will convey a message to the driver when their child/pet are still inside the car. We are hoping that this design will help decrease the fatality rates in children and pets. Also, it will help adults become more aware of leaving their child/pet unattended. The device will detect for any movement or pressure on the seat. If one of the two are detected, the device will send out a message to two registered numbers. With two numbers, the second person can contact the driver to make sure he/she know that there is movement inside the vehicle. Once the driver verifies that he/she has checked the inside of their vehicle, they can turn off the alert system.

Entry Number: 217 UE
DESIGN AND RELIABILITY OPTIMIZATION OF A MODULAR NON-VOLATILE LATCH USING SPIN TRANSFER TORQUE
By: Tyler Sheaves
Electrical Engineering
Faculty Advisor: Dr. Hamid Mahmoodi and Dr. Thomas Holton
Abstract: In order to maintain the demands of technological development, the world of computing is in desperate need of alternative computing methods to integrate volatile and nonvolatile memory, preserve IP, and allow for software based hardware reconfiguration. Spintronics, and in particular spin-transfer-torque (STT) based devices are among the most promising alternatives. Until now, a completely modular design (one that can be dropped into nearly any CMOS compatible circuit with ease) has been missing. In my project we will construct a modular unit memory cell with read and write capabilities, optimize the cell for reliability and, through use of logic gates, implement a simplistic user interface which integrated circuit designers could easily drop into their designs.

Entry Number: 218 UE
WIRELESS POWER TRANSFER FOR BIOMEDICAL IMPLANTS USING SWITCH-CONTROLLED BOOST CONVERTER
By: Zizhe Ren and Ayush Narula
Electrical Engineering
Faculty Advisor: Dr. Hao Jiang
Abstract: Wireless power transfer is an essential technology in biomedical field. The biomedical implants are powered by batteries which need to be replaced through surgery after a period of time. Therefore, wireless charging or power transfer provides a more convenient method to power the implants. Based on above concerns, we proposed a wireless power transfer system, which is composed of a pair of inductive-coupling coils, a switching control unit and a rectifier unit.The core of this system is the control unit that converts high frequency low AC voltage to relatively high DC voltage by using a transistor switch to control the receiving coil altering between storing energy and charging the load. Our theoretical approach is to use a two stage RC delay circuit and XOR gate to generate the switching control signal.Our goal is to be able to convert a low AC voltage of 100-300 kHz frequency to a 3-5 V steady DC voltage. This project provides the potential for future applications in biomedical implants powering, not only to enrich the implants' functionalities but also to enhance their durability.

Entry Number: 219 UE
UNDERSTANDING IONIC Li DIFFUSION IN CRYSTALLINE Li3PS4 AND Li10GeP2S12 SOLID ELECTROLYTES, VIA QUANTUM MECHANICAL SIMULATIONS
By: Nima Leclerc and Alexander Hall
Mechanical Engineering
Faculty Advisor: Dr. Nicole Adelstein
Abstract: Using ab-initio Density Functional Theory (DFT) simulations of both the crystalline and amorphous phases of Li3PS4, the cause of high conductivity of Li+ ions in the amorphous phase is explored. Li3PS4 and other lithium thiosulfates are promising electrolytes for all solid-state batteries, especially in amorphous phases, like 75%L2S-25%P2S5. However, the high conductivity in the amorphous phases is not fully understood. This research aims to understand and compare diffusion mechanisms in both the amorphous and crystalline phases of - Li3PS4. We will analyze the effect of disorder on the diffusion, both short range and long range.
METHODOLOGY
The crystalline and amorphous simulation cells are optimized and initialized with DFT using the Quantum ESPRESSO package. First, a crystalline phase of Li3PS4 is generated, by obtaining its minimum energy structure.

In the next stage, the amorphous phase of Li3PS4 is created using simulation cells with 128 atoms using the 'melt-quench' approach. Here, the structure is melted at 1,500 K, employing the Nose-Hoover Thermostat, and then cooled to 700 K, over multiple steps at a cooling rate of 40-60 K/ps. Diffusion behavior in the crystalline and amorphous 2x2x2 supercells, are compared over three cell volumes, corresponding to lattice vectors of 23.41, 24.17 and 25.29 Bohr. Diffusion mechanisms and bonding in both materials systems are then analyzed. RESULTS AND DISCUSSION: Comparison of local structure and diffusion pathways in the amorphous and crystalline phases, in particular the effect of covalent bonding and correlated Li+ motion, provide insight into the anomalous diffusion behavior in amorphous lithium thiophosphates. The diffusion is analyzed by calculating the diffusion coeffcients, the activation energy barriers, jump statistics, and Li+ density plots. Additionally, the disorder and its contribution to diffusion mechanisms is quantifi ed through looking at correlated motion of Li+ and the effect of isolated S2- atoms in the amorphous material. Maximally Localized Wannier Functions (MLWFs) are used to provide insight into the ionic/covalent interactions between the Li+ and sulfur atoms.
The results presented will include the following: Li+ Mean Square Displacement (MSD) and diffusion coeffcients, analysis of bonds using MLWFs, and a comparison of diffusion mechanisms, especially the effect of defects, between the crystalline and amorphous phases. These results and analyses illustrate how amorphous Li3PS4 has high Li+ diffusion, despite its disordered structure. The MLWFs centers provide insight into how the electronic structure affects correlated motion.

Entry Number: 220 UE
IHANGAR SOLAR CAR PROJECT: BODY AND FRAME DESIGN AND CONSTRUCTION
By: Michael Villanueva
Mechanical Engineering
Faculty Advisor: Dr. Thomas Holton, Dr. David Caditz (Stanford), and Dr. Kwok Siong Teh
Abstract: The Innovation Hangar Solar Car Project is a community-collaborative project made up of engineering students at SFSU as well as outside volunteers. Our goal is to design and build a functional solar-electric vehicle to race in the 2017 Formula Sun Grand Prix in Austin, Texas this July. As the team's Body Fabrication Lead, I am responsible for overseeing the construction of the car's body at every stage- from the plug, to the mold, and to the final composite body. Aside from this role, I also assisted in the design and impact analysis of the frame and rollcage over several prototypes and models.

Entry Number: 221 UE
LINEAR CHARGER
By: Kevin Li, Van Williams, and Jordan Chan
Mechanical Engineering
Faculty Advisor: Dr. Kwok Siong Teh
Abstract: Mechanical component designed for electric or hybrid vehicles which use the linear motion of that vehicle's suspension system to harvest kinetic energy. This energy is stored, then put back into the electric system. This would improve the range and efficiency of current electric and hybrid vehicles.

Entry Number: 222 UE
WATER WAVE ENERGY GENERATION
By: Bashar Alaoudi, Jungrock Lee, Mukhiya Gurung, and Carlos Colina
Mechanical Engineering
Faculty Advisor: Dr. Kwok-Siong Teh
Abstract: To optimize and harness the stored energy in water waves and turn it into usable electricity through mechanical and electrical systems. The kinetic energy of the ocean waves can be converted into usable power. The electricity generated from the wave energy is clean and available in abundance. The incoming energy is a function both of the available seashore length and of the energy density per meter of wave crest in a given region.

Entry Number: 223 UE
ROBOTIC TOOLBOX
By: Chris Lim, Eduardo Ramirez and Mohammed Owais I Saiyed
Mechanical Engineering
Faculty Advisor: Dr. Kwok Siong Teh
Abstract: Proof of concept of an autonomous robotic toolbox that can assist the user with tool retrieval and return via a voice commanded robotic arm. The toolbox is mounted atop an autonomous cart that navigates to the user's desired location with the aid of onboard sensors and control system.

Entry Number: 224 UE
MODULAR ELECTRIC SCOOTER
By: Jose Garcia, Elliot Marx, and Noah Sato
Mechanical Engineering
Faculty Advisor: Dr. Kwok-Siong Teh
Abstract: Prototype for modular electric scooter for commuters. Parts can be added, removed or replaced by user to suit their needs.

Entry Number: 225 UE
FSAE GATOR RACING GR1 SUSPENSION
By: Alexander Foster, Khalid Al-Tailji, and Amir Abadi
Mechanical Engineering
Faculty Advisor: Dr. Kwok-Siong Teh
Abstract: Senior project team in charge of design and fabrication of a suspension for SFSU's premier FSAE competition vehicle 'Gator Racing GR1'. We at San Francisco state deserve to compete at FSAE with all the other top schools as opposed to being left out every year. We hope our project will spark genuine interest in our fellow students and help make SFSU a yearly competitor at FSAE.

Entry Number: 226 UE DISPLAY ONLY
Refrigeration Truck Energy Recovery
By: Essa Alkandari, Almuhannad Binsaied, and Ebdulrahman Althobeany
Mechanical Engineering
Faculty Advisor: Dr. Kwok Siong Teh
Abstract: Large refrigeration box trucks that travel for long distances (8 hours +) consume more fuel than any other equivalent standard truck. There are a couple of reasons for this. The first thing is that large refrigeration trucks use their diesel engine to power the refrigeration compartment in the back of the truck. In addition, large trucks' aerodynamics have a great impact on fuel consumption as well. As a result, more energy is produced from the engine, and more fuel will be consumed. After doing lots of research, calculations, and brainstorming, we have come up with a solution to recover the energy the engine consumes to overcome drag force, and to power the rear refrigerator. Our design consists of an aerodynamic wind deflector box that contains two wind turbines that are going to directly power the rear refrigeration compartment instead of using the engine to power it. The system will be installed above the truck head (meaning right on the top of the roof of the driver and passenger side). The reduced drag force on the truck due to the aerodynamic wind deflector box, and the energy produced by the two turbines to power the refrigerator will result in a significant fuel consumption reduction.

Entry Number: 227 UE
MEDULLA OBLONGATA
By: Clayton Lopez, Tommy Mark, and Rachel Yee
Mechanical Engineering
Faculty Advisor: Dr. Kwok Siong Teh
Abstract: Our BattleBot is equipped with a chainsaw designed to cut the wheels out from opponents while its steel armor withstands all attacks.

Entry Number: 228 UE
ACFD (AUTOMATIC CAT FOOD DISPENSER)
By: Francisco Gularte and Dave Labree
Mechanical Engineering
Faculty Advisor: Dr. Kwok-Siong Teh
Abstract: ACFD (Automatic Cat Food Dispenser) aims to solve the endless battle between pet owner and pet. Rather then being woken up at odd hours of the night by a "Meow" or finding a petsitter so you can go on that vacation to hawaii, the ACFD aims to save you time and money by dispensing the food for you at the desired time you set. The product utilizes a internal DS132 clock, LCD button display and Arduino microcontroller to do the relenting chore of waking up early to feed your Cat.

Entry Number: 229 UE
ARIES LANDER
By: Jake Cleaveland, Michael Hong, and Michael Kamel
Mechanical Engineering
Faculty Advisor: Dr. Kwok Siong Teh

Abstract: Many traditional rockets and spacecraft use Vernier thrusters to correct their roll, yaw, and pitch. Our project, the Aries Lander, uses a control system which substitutes combustion Vernier thrusters with propellers to stabilize a small rocket when dropped from a height. An on-board inertial measurement unit (IMU) senses the mini-rocket's orientation and acceleration, and sends this data in real time to the on-board microcontroller which uses a combination of proportional-derivative-integral (PID) control and Kalman filtering to output the precise speed to the motors to land the mini-rocket upright and safely.

Entry Number: 230 UE
AUTOMATED BIOMASS GASIFIER
By: Daniel Putney, Emmanuel Veloz, and Dave Beard
Mechanical Engineering
Faculty Advisor: Dr. Kwok Siong Teh and Dr. Ed Cheng
Abstract: Whether you look at universities, small businesses, or homes, biodegradable products are always readily available and often wasted. Biomass gasifiers break down the chemical components of biodegradables and convert it into a bio-hydrogen that can be synergistically used in engines. Backyard gasifiers have long been used to create biogas, but often times are very inefficient, dirty, labor intensive, and unsafe. Our goal is to design and build an automated biogas reactor modeled after those that have come before. The goal of this is to create a user friendly, self reliant energy conversion system so that just about anyone can operate the device effortlessly and as safe as possible.

Entry Number: 231 UE
SURVPAK
By: Jonathan Wong, Cesar Canales, and Ryan Gutierrez
Mechanical Engineering
Faculty Advisor: Dr. Kwok Siong Teh
Abstract: Even with the advances in technology we see today, disasters, both natural and manmade, are ultimately unavoidable. Such disasters cause major damages which continue to affect the lives of its victims long after the occurrence has passed. This report explains the design process of an emergency kit that can be used in case of a disaster occurrence. After extensive research on the items required during disaster relief, a team of three San Francisco State University mechanical engineering students constructed the following design of an emergency kit. Current emergency kits are sold as individual components, and water required to sustain a typical household often is stored in large barrels that take up a significant amount of space. This paper details a design that integrates a water filter, battery that powers the active filter, and hand crank to charge the battery; all into a convenient and practical package. The goal of this report is to further expand on current relief services being provided today. In order to achieve this, the authors have proposed to create and test the application of a self-powered water filter for use during emergencies.

Entry Number: 232 UE
THE MOBILE CHILLER
By: Nicholas Hinson, Aaron Schnittger, and Colin O'Connor
Mechanical Engineering
Faculty Advisor: Dr. Ed Cheng, Dr. Kwok Siong Teh
Abstract: San Francisco State University was donated some components for an Air-Conditioning unit some years ago. This project was supposedly a senior design project that was abandoned and has been left in pieces in the fluid dynamics laboratory. Professor Ed Cheng approached Aaron to see if he would be interested in putting together a group that would be interested in finishing this long forgotten project. Aaron has an extensive background in the HVACR industry and he would be an excellent candidate for finishing this project that would then be donated to the to the fluids lab, to be used for the Engineering lab experiments.
Starting with the equipment that is already in the Fluids Lab, we will build a working Air Conditioning system, integrating in a data acquisition system. This finished project can then be used as a lab experiment to create a hands on opportunity for young engineering students to giving them more experience with the technical side of HVAC systems. The system makes hot and cold air, with an adjustable flow rate. The data acquisition system

monitors; air temperature and humidity in four locations, the flow rate of air, and the power consumption of the three major components. With the various data and variability of this system students can easily design their own experiment for their 463 project. The professors will have an opportunity to add a HVAC laboratory experiment to the curriculum if so desired.

Entry Number: 232 UE
SELF-SUFFICIENT PLANT ROBOT
By: Pyi Khin, Rachel Stoerkel, and Yuki Takahashi
Mechanical Engineering
Faculty Advisor: Dr. Kwok-Siong Teh
Abstract: Our Plant Bot represents a significant bond between nature and technology. The goal of designing this plant bot is to bring users one step closer to a chore-free lifestyle. Users will be able to gain access to fresh food with the help of an energy efficient robotic device using natural sunlight. Our bot will save users time and in the long run, it will even save them money.