

Entry Number 79 UL  
THE ROLE OF STROMAL DERIVED FACTOR -1 $\alpha$   
IN VERTEBRATE SOMITOGENESIS  
By: Marisa Leal  
Cell and Molecular Biology  
Faculty Advisor: Dr. Carmen Domingo

Abstract: Stromal derived factor-1 $\alpha$  (Sdf-1 $\alpha$ ), a chemoattractant chemokine, along with its exclusive receptor CXCR4, plays a major role in tumor growth, angiogenesis, metastasis and in development. Recently, the Sdf-1 $\alpha$  signaling pathway was shown to be important for zebrafish somitogenesis (Holloway, et al 2007). Somitogenesis is an important embryological process as it establishes the segmented nature of the vertebrate body plan as well as giving rise to the adult skeletal and musculature system. During zebrafish somitogenesis, cells within the somite undergo rotation prior to myogenesis. This rotation behavior requires Sdf-1 $\alpha$  signaling. Interestingly, somite cell rotation also occurs in the frog, *Xenopus laevis*, however the molecular mechanism underlying this process remains unknown. Therefore, we examined whether Sdf-1 $\alpha$  signaling is also required for somite rotation in *Xenopus laevis*. Our approach was to inject morpholino antisense oligomers into one of two blastomeres at the two-cell stage to knock down the expression of Sdf-1 $\alpha$  and its receptor, CXCR4 during somitogenesis. Injected embryos were then fixed and stained with the myotome-specific antibody, 12/101. The embryos were then imaged with a confocal microscope. We found that a knock down of Sdf-1 $\alpha$  caused a range of phenotypes from a complete block of somite formation to the misalignment of myotome fibers. These results suggest that Sdf-1 $\alpha$  signaling is important in directing the cell movements during somite formation in *Xenopus*, and that this pathway is well conserved between fish and frogs.

Entry Number 80 UL  
SIBO: SOCIAL INSECT BEHAVIOR ONTOLOGY  
By: Ilma Abbas  
Cell and Molecular Biology  
Faculty Advisor: Dr. Christopher D. Smith

Abstract: Invasive social insects, including the red imported fire ant, Africanized honeybee, and Argentine ant, exhibit unusually cooperative and aggressive behavior in their non-native ranges and result in billions of dollars of agricultural and ecological damage. Since pesticides are ineffective at controlling these pests, a better understanding of the genes involved in social behavior may provide insight into new ways to control these species. One challenge to this approach is that behaviors are often incompletely or qualitatively described and often presented in textbooks or scientific articles that are poorly accessible. Behavior ontologies are useful tools to organize the data in the scientific literature into a form suitable for advanced data mining. Ontologies can be used both to standardize behavior nomenclature and to map the relationships between behaviors and associated genes or chemicals so that they are more amenable to computer-aided analyses. While, the Gene Ontology (GO) has eased interspecies comparison of the 'molecular functions' in many annotated genomes, there are currently only 14 terms for 'social behavior' (GO:0035176). Therefore, we started development of SIBO, the social insect behavior ontology. SIBO contains terms for complex social behaviors exhibited by different ant and bee species, the semiochemicals involved in group communication, and the anatomical parts where these chemicals are synthesized, stored, or sensed. We have already developed a map of ant anatomical parts and their interrelationships as well as a catalog of semiochemicals used for communication. Currently, we are curating scientific literature to create ontologies for social behaviors in honeybees and the Red Harvester Ant, *Pogonomyrmex barbatus*, including 'colony defense', 'foraging', and 'patrolling.' We propose to integrate SIBO with existing gene function and chemical ontologies to better understand the gene networks that underlie social behavior and to identify potential new targets for biological control.

Entry Number 81 UL  
THE SENSITIZATION OF DEFENSIVE BEHAVIOR OF THE LARVAL TOBACCO HORNWORM,  
*MANDUCA SEXTA*

By: Kenichi Iwasaki  
Cell and Molecular Biology  
Faculty Advisor: Dr. Megumi Fuse

Abstract: Nociceptive sensitization, an enhanced defensive behavior following noxious stimuli, has been extensively investigated in some invertebrates, notably sea hare *Aplysia californica* (Kandel, 2001). The defensive behavior of the larval tobacco hornworm, *Manduca sexta*, has also been shown to undergo sensitization in response to repeated mechanical stimulation of the abdominal prolegs (Walters et al., 2001). However, little other research has been done to investigate the mechanisms of nociceptive sensitization in insects, one of the most species-rich groups of arthropods. The goal of the current project is to replicate the findings of nociceptive sensitization in larval *Manduca sexta*. In this experiment, neutral stimuli (i.e. pokes applied by soft nylon filament) are applied to the eight abdominal prolegs of the larval *Manduca sexta* before and after the application of noxious stimulation of a strong pinch to one of the prolegs. The degree of sensitization is assessed based on the change in the frequency of one type of defensive response, a strike, a rapid bending of the head toward the site of stimulation, after the application of the noxious stimuli. The tested larvae exhibited a greater number of strikes in response to neutral stimuli after experiencing a noxious stimulus of strong pinch. The tested larvae also showed a greater number of thrashing responses, another type of defensive behavior following noxious stimulation. These results combine to support the occurrence of sensitization of defensive responses in *Manduca sexta*. Moreover, the sensitization response is generalized since the application of noxious stimuli causes the same level of sensitization regardless of the sites of stimulation.

Entry Number 82 UL  
WAKL4 Cis-ACTING ELEMENTS IN RESPONSE TO  
ENVIRONMENTAL MINERALS

By: Janelle Johnson  
Cell and Molecular Biology  
Faculty Advisor: Dr. Zheng-Hui He

Abstract: The cell wall-associated receptor kinase (WAK) and WAK-like (WAKL) gene family members are good candidates for signaling molecules that physically link and communicate between the cell wall and the cytoplasmic compartment. Genetic and molecular studies have shown that WAK/WAKL members play important roles in a wide range of functions, including cell elongation, plant development, bacterial pathogenesis, and abiotic mineral and heavy metal responses. WAKL4, a member of the WAK/WAKL family, was shown to play a functional role in mineral responses. Previous studies have shown that WAKL4 promoter impairment resulted in hypersensitivity to  $K^+$ ,  $Na^+$ ,  $Cu^{2+}$  and  $Zn^{2+}$ , and WAKL4 was required for the up-regulations of zinc transporter genes during zinc deficiency. Transgenic studies have located regions in the WAKL4 promoter with putative mineral-responsive cis-elements. Transgenic lines carrying constructs of serially deleted WAKL4 promoters fused to beta-glucuronidase reporter gene have been generated. Reporter gene assays in different tissues under different mineral conditions were performed. Our goal is to fully characterize the mineral-responsive cis-acting elements in the WAKL4 promoter and to eventually elucidate WAKL4-mediated mineral signaling pathways.

Entry Number 83 UL  
MBC SKELETAL MUSCLE CULTURES TREATED WITH ACETYLCHOLINE SHOW INHIBITION OF  
INTRACELLULAR Ca<sup>2+</sup> RESPONSE

By: Dianna Baldwin  
Zoology  
Faculty Advisor: Dr. Wilfred Denetclaw

Abstract: Skeletal muscle cells in culture undergo regular stages in their differentiation that include change in gene expression and myoblast fusion for myotube formation. One physiological change parameter that can be observed is a myoblast-to-myotube change in sensitivity to acetylcholine (Ach) reflecting an expression of acetylcholine receptor in the cell plasma membrane and development of a membrane potential for activation of voltage gated calcium channels. We have previously reported that MBC treatment and membrane raft disruption in muscle cultures, blocked myoblast differentiation and myotube formation. However, it is not known if physiological effect for differentiation are also halted by MBC. To investigate, primary skeletal muscle cultures from 11 day-old chicken embryos were tested over 24 to 72 hours in differentiation conditions for their ability to respond Ach (200 mM) with a rise in intracellular free calcium (Ca<sup>2+</sup><sub>i</sub>) as shown by fura-2 and calcium ratio imaging. Our results show that 24 hour muscle cultures responded with a rise in Ca<sup>2+</sup><sub>i</sub> following Ach addition and that the rise was stronger over increasing days in differentiation. In contrast, MBC treated cultures showed no response to Ach treatment up to 72 hours. Furthermore, when MBC muscle cultures were allowed to recover in normal differentiation medium, Ach did not cause calcium to increase by 2 hours, but later caused Ca<sup>2+</sup><sub>i</sub> to rise after 24 hours. Cholera toxin B labeling of muscle cultures showed that MBC treatment produce a loss of membrane rafts, but did not affect the ability of cells to proliferate. In conclusion, disruption of membrane rafts in primary skeletal muscle culture causes physiological changes in intracellular free calcium signalling.

Entry Number 84 UL  
INVESTIGATING SALINE SENSITIVITY OF THE  
SINORHIZOBIUM MELILOTI SMC02230 DELETION MUTANT  
By: Charlene Navarrete, Darlene Franklin, and Dr. Joseph C. Chen  
Microbiology  
Faculty Advisor: Dr. Joseph C. Chen

Abstract: Pathogenic  $\alpha$ -proteobacteria such as *Rickettsia spp.* and *Bartonella spp.* depend on surface adhesion via the pili or flagella to the host cells to initiate infection. In the model  $\alpha$ -proteobacterium *Caulobacter crescentus*, PodJ, PleC, and DivJ were identified as key factors involved in pili formation and flagella function. We wanted to study the role of these key factors in another model  $\alpha$ -proteobacterium, *Sinorhizobium meliloti*. SMC02230, one of the homologs to the *podJ* gene from *Caulobacter*, was the focus of this investigation. A mutant strain of *S. meliloti* with a deletion in this gene was constructed. We found that the mutant grew on Luria Bertani (LB) rich medium but did not grow on LB with lower salt concentration, unlike the wild type strain. In liquid media, we observed that the  $\Delta$ SMC02230 strain grows in LB broth at a decreased rate as compared to the wild type. It also shows a branched, "T-shaped" morphology. Based on these results, our future directions are to observe the mutant using both light microscopy and electron microscopy and to study the role that saline concentration plays in cell organelle biogenesis.

Entry Number 85 UL  
EXPRESSION OF LAC GENE IN *CAULOBACTER CRESCENTUS*  
By: Janet Manzano and Benjamin Arellano  
Microbiology  
Faculty Advisor: Dr. Joseph C. Chen

Abstract: Gram-negative, obligate aerobic *Caulobacter crescentus* is shown to have a key enzyme, encoded by the CC\_1643 gene, that is required for lactose metabolism. Beta-galactosidase assay (using ONPG as a chromogenic substrate) is widely used for quantifying lac gene expression in fermenting organisms such as *Escherichia coli*. We have adapted the assay to assess the activity of the CC\_1634 gene product in *C. crescentus*. CC\_1634 appears to have higher expression when induced with lactose in wild-type strains. We also observed that membrane integrity may be required for enzyme activity. Quantitative analysis is important in determining gene regulation upstream of CC\_1634 for future research.

Entry Number 86 UL  
GROWTH RATES OF INVASIVE COLONIAL ASCIDIANS *BOTRYLLOIDES* AND  
*BOTRYLLUS* SPP. IN THE SAN FRANCISCO BAY  
By: Jessica Donald  
Marine Biology  
Faculty Advisor: Dr. Sarah Cohen

Abstract: Colonial sea squirts of the protochordate family Botryllidae are invasive species found worldwide, including in San Francisco Bay. *Botryllus* and *Botrylloides* spp. May be found on a variety of submerged surfaces including boat hulls, dock pilings, ropes, mussels and eel grass. Once attached, they grow as flat irregularly shaped colonies composed of genetically identical zooid systems. These colonies have the ability to coat entire organisms that serve as substrate and also compete for substrate within the community. At three locales around San Francisco Bay (including one outer coast site and 2 sites with varying salinity within the bay), larval recruitment on PVC panels and unobstructed growth rates of adult individuals were measured over 3-4 weeks in October and November. Fouling panels were groomed to remove any organisms that could compete directly for space and food with the experimental subjects. Preliminary analysis of data compares larval recruitment and growth patterns of colonies between these three separate survey sites. Continued work will show differences between the growth rates of the colonies observed in the wild versus growth rates of colonies in the laboratory using food as the limiting factor. Identification of growth limiting factors other than space availability in *Botryllus* and *Botrylloides* spp. will help to further characterize the dynamic of colonial tunicates as successful invasive competitors.

Entry Number 87 UL  
GENETIC DIVERSITY IN A RECOVERING POPULATION OF EELGRASS (*ZOSTERA MARINA*) IN  
THE SAN FRANCISCO BAY

By: Summer Morrisson and Dr. Brian Ort  
Botany  
Faculty Advisor: Dr. Sarah Cohen

Abstract: Eelgrass provides an important habitat for fish, invertebrates and waterfowl; it is also beneficial for substrate stabilization. Genetic diversity in a recovering bed may help to determine how resilient eelgrass is to disturbance, whether natural or man-made. In 2005, a population of eelgrass at Point Molate was chosen as a donor site for a restoration project in the San Francisco Bay. Tissue samples were collected for future genetic analysis. In the summer of 2006, the bed was found to be decimated, with fewer than ten plants located and an oily slick on the sediment. The bed began to recover in 2007, when I made a collection of forty samples, composed of 38 seedlings and two large plants that apparently had survived the die-off of 2006. The recovery of Pt. Molate continues in 2008. There are already over one hundred seedlings, as well as hundreds of larger plants from 2007. After sampling the population this year, I will be able to compare the genetic diversity before the die-off to one and two years after. I am using eight microsatellite markers as a means of testing for genetic differences in the population before and after the die-off, and to attempt to identify the source populations for the re-colonization. Is genotypic composition different after re-colonization?

Entry Number 88 UL  
IDENTIFYING NOVEL PROTEIN STABILIZERS BY  
CO-IMMUNOPRECIPITATION IN PORCELAIN CRABS, GENUS *Petrolisthes*

By: Andrea Cayenne  
Physiology and Behavior Biology  
Faculty Advisor: Dr. Jonathon Stillman

Abstract: Biochemical adaptation of enzymes, specifically those involving sequence variation among orthologous homologues, allows organisms to conserve metabolic kinetic properties in a wide range of environmental conditions. However, the role(s) of protein-protein interactions in enzyme adaptation are less well understood. Previous examination of the glycolytic enzyme lactate dehydrogenase (LDH) in porcelain crabs showed that interspecific differences in thermal stability were related to both intrinsic and extrinsic protein stabilizers. Here, we attempted to identify the extrinsic stabilizing proteins in porcelain crab muscle tissue using co-immunoprecipitation. To do this, we homogenized muscle tissue from *Petrolisthes cinctipes* in RIPA buffer and incubated the homogenate supernatant with purified rabbit polyclonal IgG anti-*Petrolisthes cinctipes* LDH. To separate LDH and its associates proteins, we used protein-A sepharose beads and low speed centrifugation. The samples were then run on a 12% SDS-PAGE and Coomassie Blue stained. We found bands with molecular weights of 190, 90, 85, 80, and 45 kDa that were not present in either the purified LDH, IgG, or Protein-A beads. To identify these unknown proteins, we are in the process of extracting the protein from the gel and preparing the sample for peptide mass fingerprinting (MS/MS) using MALDI-TOF/TOF mass spectrometry. Additional species will be examined using the same methods including *Petrolisthes cinctipes*. Funded by: NIH MBRS-SCORE to JHS, and NIH-RISE to APC

Entry Number 89 UL  
MICROARRAY ANALYSIS OF HEPATOPANCREAS HEAT STRESS RESPONSES IN THERMALLY  
ACCLIMATED PORCELAIN CRABS, *PETROLISTHES CINCTIPES*

By: Claudia Tomas Miranda and Eric Galassi  
Physiology and Behavior Biology  
Faculty Advisor: Dr. Jonathon Stillman

Abstract: Intertidal zone organisms experience thermal stress during periods of low tide, and much work has shown that induction of heat shock proteins occurs in response to this stress. Here, we investigated the plasticity of gene expression responses to heat shock in porcelain crabs that were acclimated to 8°, 14°, and 22° C. We used cDNA microarrays containing a library of *Petrolisthes cinctipes* ESTs representing 6,400 unique consensus sequences to identify genes that are differentially expressed during recovery in heat stressed crabs relative to crabs held at their acclimation temperature. Crabs from each acclimation temperature were given a heat stress or held at their acclimation temperature for 4h, and then were placed back into their acclimation aquarium for recovery. Individuals were sampled at various recovery timepoints. Sampling consisted of dissecting tissues into liquid nitrogen. Here, RNA was extracted from the hepatopancreas tissue using TRIZOL, 10µg were reverse transcribed into amino allyl cDNA, labeled with Cy3 and Cy5 dyes, and hybridized to cDNA microarrays. Each hybridization contained a heat stress sample and a control sample from the same acclimation temperature. Due to limited samples at the 1h recovery timepoint we used pooled RNAs for comparisons of heat stress responses across acclimation temperatures. We also compared using individual vs. pooled samples at one acclimation temperature to see how pooling affected identification of differentially expressed genes. Statistical identification of differentially expressed genes were determined with R/MAANOVA, and the results of these analyses presented here. This work was funded by NSF 0533920 to JHS.

Entry Number 90 UL  
THE INFLUENCE OF ION TRANSPORT PEPTIDE ON  
GLUCOSE REGULATION IN THE DIFFERENT  
DEVELOPMENTAL STAGES OF *MANDUCA SEXTA*

By: Allison Dias  
Physiology and Behavior Biology  
Faculty Advisor: Dr. Megumi Fuse

Abstract: I began my research project with the development of an appropriate sugar assay to measure blood sugar levels in the hornworm, *M. sexta*. Measurements of blood sugar levels were collected by using a diabetes monitor with test strips. That project established a method to study the relationship between hormones and sugar regulation in *M. sexta*. For this experiment, I will investigate the role of Ion Transport Peptide (ITP) in regulating glucose levels in the blood with materials and methods utilized in my initial experiment, previously described. Tissue homogenates putatively containing ITP were injected into animals and changes in blood sugar levels were measured. The role of ITP will be substantiated in future experiments by verifying the presence of this peptide in the tissue homogenates, using tools such as Mass Spectrometry.

Entry Number 91 UL

VARIATIONS BETWEEN VISUAL AND MULTIMODAL LEARNERS IN VIEWING AUTOSTEREOGRAMS AS MEASURED BY PROCESSING TIME, PROCESSING ABILITY AND ELECTROOCULOGRAPHY (EOG)

By: Lindsay Kuntz , Amy Ngo, and George Miranda

Physiology and Behavior Biology

Faculty Advisor: Anne Thilges

**BACKGROUND AND PURPOSE:** Current research on the correlation of eye movement and therapy of psychological disorders has presented results suggesting that some treatments, such as Eye Movement Desensitization and Reprocessing (EMDR), may reduce the distress associated with Posttraumatic Stress Disorder (PTSD). In accordance, this experiment aims to study the relationship between measurable variables of the eyes when viewing autostereograms with the subjects' learning preferences. If a correlation is found, this may provide evidence of the influence that eye movement may have on thought patterns and learning orientations.

**HYPOTHESIS:** It is hypothesized that visual learners will have more eye movement and shorter processing times when processing autostereograms than those of multimodal learners because they are generally more excited to visual stimuli and prefer using their visual capabilities to process information. Due to the limited knowledge that is currently available about the relationship between eye movement and processing times with visual learners, an alternate hypothesis also exists. Because visual learners are more apt to using their visual capabilities in processing information, it could also be hypothesized that there would be less eye movement for visual learners due to their mastery in processing visual stimuli. The hypothesis for processing times is the same for both possible hypotheses. The number of slides that is processed is expected to be higher for visual learners, because of their mastery of processing visual information.

**METHODS:** Ninety-seven free-living college students were used as test subjects. A learning style questionnaire was administered to each subject and scored. After determining that a subject would be able to process autostereograms into 3-D images with a preliminary assessment, seventy-five of the subjects were able to complete the test by viewing a slideshow of ten autostereograms in which processing time, processing ability and eye movement were measured. Subjects were connected to a BIOPAC MP35/50 unit in order to obtain EOG readings. Subjects were given verbal instruction on how to view the autostereograms and how to indicate that they were processing the images. Time was measured in seconds and vertical and horizontal eye movement was measured in difference in millivolts (mV). Subjects who completed the entire test were divided into three categories for the purposes of this experiment based on learning style; multimodal learners, visual learners and other learners. Statistical analysis was used to exclude outliers from the data.

**RESULTS:** The visual learners (N=10) had a mean processing time of  $11.87 \pm 4.30$  seconds, while the multimodal learners (N=27) had a mean processing time of  $9.93 \pm 4.44$  seconds. Mean eye movement for the two groups was the same at  $0.17 \pm 0.09$  mV. The visual learners processed a mean of  $8.30 \pm 2.45$  autostereograms and the multimodal learners processed a mean of  $8.96 \pm 1.16$  autostereograms. The correlation between mean eye movement and mean processing time for the visual learners was 0.273. The linear regression line for this data was  $y = 0.0056x + 0.1034$ . The correlation between mean eye movement and mean processing time for the multimodal learners was 0.183. The linear regression line for this data was  $y = 0.0037x + 0.1381$ . The correlation between mean processing time and mean number of slides processed for the visual learners was -0.827. The linear regression line for this data was  $y = -0.471x + 13.89$ . The correlation between mean processing time and mean number of slides processed for the multimodal learners was -0.528. The linear regression line for this data was  $y = -0.1379x + 10.333$ . The correlation between mean eye movement and mean number of slides processed for the visual group was -0.129. The linear regression line for this data was  $y = -3.5683x + 8.9066$ . The correlation between mean eye movement and mean number of slides processed for the multimodal learners was -0.088. The linear regression line for this data was  $y = -1.1543x + 9.1644$ .

**CONCLUSIONS:** The amount of eye movement did not vary between the visual learners and the multimodal learners and did not have a strong correlation between processing ability or processing time during autostereogram viewing. However, the visual learners did process the autostereograms much slower on average than did the multimodal group, a difference of almost 2 seconds. In addition, the autostereogram processing ability of the visual learners was less than that of the multimodal learners. Because the amount of eye movement was nearly identical between the two groups, the differences in autostereogram processing time and ability could be due to another variable and should be investigated further.

Entry Number 92 UL  
ZOSTERA MARINA (EELGRASS) POPULATION CONNECTIVITY IN THE SAN FRANCISCO BAY  
IMPLICATIONS FOR RECOVERY AFTER THE COSCO-BUSAN OIL SPILL

By: Gwen Santos Conahan  
Ecology and Systematic Biology  
Faculty Advisor: Dr. Katharyn E. Boyers

Abstract: Seagrasses are important primary producers distributed worldwide with a variety of critical functions. They provide food sources, nursery habitats for many commercially important fish and invertebrates, they cycle nutrients in the water column and sediment, and they are the foundation of one of the world's most productive ecosystems (Lewis et al. 2007). In November 2007, a container ship crashed into the Bay Bridge ripping a hole in the fuel tank and releasing approximately 58,000 gallons of Bunker Fuel into the bay. In conjunction with a team of scientists from the National Oceanic and Atmospheric Administration (NOAA), Dr. Kathy Boyer's restoration ecology lab set out to study the impacts of the oil spill on the eelgrass populations throughout the bay in areas thought to be contaminated by the oil spill.

I set out to examine the impacts of the oil spill directly on eelgrass by conducting field germination studies. These germination studies would indicate the extent of damage and what it meant for recovery of potentially contaminated populations. My project consisted of setting out seed packets across six eelgrass beds and leaving them over winter, and retrieving them when the natural populations began germinating. The packets were checked once for signs of germination and for signs of germination in the surrounding field populations. When conditions were prime, the packets were retrieved and analyzed back at the lab. Packets were analyzed for total remaining seeds, number germinated, and number appearing viable. Of those seeds appearing viable, up to ten seeds were randomly chosen and tested using the tetrazolium viability method.

Entry Number 93 UL  
COMPARATIVE qPCR REPRODUCIBILITY  
By: Inara Iskenderova, Shui Lam (Yvonne) Mak, and Dan Kelliher  
Biochemistry  
Faculty Advisor: Dr. Elizabeth Runquist

Abstract: Quantitative polymerase chain reaction (qPCR) is an analytical method used to determine the relative level of gene expression in a sample. When qPCR relies on the comparison between two genes for normalizing the expression of one gene relative to another, it is known as comparative qPCR. Although qPCR has been widely utilized, few studies have examined its reproducibility. This study has examined if reproducibility was dependent on three variables: the amount of template at which the experiment was carried out, the method of analysis chosen to evaluate the result, and the choice of amplicons for the assay. To do so, a series of assays were performed on four different amplicons: Hypoxanthine Guanine Phosphoribosyl Transferase (HPRT), Mouse Cyclophilin, Malonyl CoA Decarboxylase (MlyCD), and Polymerase two Subunit A (Pol 2A) at different amounts of template generated from mouse liver mRNA. At each amount of template within one assay the ratio of one amplicon to another, and the error associated with the ratio was generated twice, first by manual threshold analysis and then with analysis by the newly developed software Qual Anal. The ratios of Cyclophilin to HPRT and MlyCD to Pol 2A at each amount of template were compared to corresponding ratios generated on different days. The overall variability between the ratios at each individual amount of template provides an estimate of the overall reproducibility of comparative qPCR. Using varying amounts of template, and observing the consistency of same expression ratios between different days, allowed us to study if the reproducibility was dependent on the amount of template used. Two methods of data analysis of the reproducibility were compared. The results of these assays will provide an insight into the role of template concentrations and analysis methods in the reproducibility of comparative qPCR.

Entry Number 94 UL  
TO EXAMINE THE INFLUENCE OF THE DYNAMIC RANGE IN COMPARATIVE q-PCR

By: Shui Lam (Yvonne) Mak  
Biochemistry

Faculty Advisor: Dr. Elizabeth Runquist

Abstract: Comparative quantitative polymerase chain reaction technology (q-PCR) is widely used to measure mRNA expression ratios between target and reference genes. However, the viability of this technology for accurately quantifying mRNA expression ratios has not been well examined. The aim of this study was to analyze expression ratio accuracy. The linear response between template cycle time (Ct) and template concentration, i.e. the dynamic range, was determined. Next, using this defined range, the expression ratios between two known amounts of pure mRNA transcripts, Rubisco Activase and Carboxylase, were examined. This assay system then allowed us to determine expression ratios accuracy. Preliminary results indicated that there was a linear response between Ct and template concentration over a wide concentration range for both transcripts. However, when the accuracy of the ratio between the two transcripts was examined, in which the ratios were either 1 to 1 or 1 to 10, the accuracy varied, and it was depended on the ratio between the transcripts and template concentration. These preliminary results suggest that when the ratio difference was small, a higher concentration of template is required for accurate comparative ratio whereas a lower concentration of template is needed when the ratio difference was large.

Entry Number 95 UL  
STEADY STATE KINETIC MECHANISM OF  
PHENYLACETYLALDEHYDE

By: Baljit Singh  
Biochemistry

Faculty Advisor: Dr. George Gassner

Abstract: The metabolic pathway for styrene metabolism involves three enzymes; which oxidatively transform styrene to phenylacetic acid. The terminal enzyme in thi pathway, phenylacetylaldehyde dehydrogenase is an enzyme encoded by the styD gene, which converts phenylacetylaldehyde and NAD<sup>+</sup> to phenylacetic acid and NADH. This enzyme is a close mechanistic and structural relative of human mitochondrial aldehyde dehydrogenase, which transforms aldehyde to acetic acid. It is important to understand how phenylacetylaldehyde dehydrogenase functions in order to understand the overall metabolism of styrene by prokaryotes and eukaryotes. The PADH mechanism was evaluated under steady-state conditions by using stopped-flow instruments configured with Xenon lamp and diode array or photomultiplier-based detection. The absorbance change was measured as function of time and converted to rate of NADH production based on the 1 cm pathlength and known molar extinction coefficient of NADH. A series of experiments were done by varying NAD<sup>+</sup> concentration while keeping PADH and phenylacetylaldehyde concentrations constant. The apparent Km and the apparent Vmax are 302 mM and 22.70.3 mM/min at 1 mM PADH, 50 mM phenylacetylaldehyde, and different NAD<sup>+</sup> concentrations ranging from 0 to 2 mM. In an alternate study designed to evaluate the substrate inhibition effect the phenylacetylaldehyde concentration was varied while NAD<sup>+</sup> and PADH concentrations were held constant. The substrate inhibition constant (Ki) for phenylacetylaldehyde is 3458 mM. The apparent Kcat for the reaction is 22.70.3 min<sup>-1</sup>. This data can be used to design experiments to study pre-steady state of PADH.

Entry Number 96 UL

STUDIES OF NADH BINDING EQUILIBRIUM OF PHENYLACETALDEHYDE DEHYDROGENASE

By: Levenlou Vender

Biochemistry

Faculty Advisor: Dr. George Gassner

Abstract: The phenylacetaldehyde dependent dehydrogenase (PADH) has been characterized from the styrene catabolic pathway that transforms styrene to phenylacetic acid. PADH belongs to the general class of enzymes known as pyridine nucleotide-dependent aldehyde dehydrogenases. These enzymes catalyze the transformation of aldehydes to carboxylic acids in oxidative metabolism. This represents a two-electron oxidation of the aldehyde with the pyridine nucleotide serving as the electron acceptor. The overall equation for this process is: Aldehyde + NAD<sup>+</sup> → Carboxylic Acid + NADH + H<sup>+</sup>. The thermodynamic mechanism of Nicotinamide Adenine Dinucleotide (NADH)-binding has been investigated by using the plate-reader based Fluorescence Spectroscopy and Isothermal Titration Calorimetry. Fluorescence assay is used to evaluate the NADH binding equilibrium by monitoring the increase in fluorescence that occurs as a function of PADH-NADH complex formation. This interaction is relatively weak and due to instrumental limitations it was possible to obtain only a partial saturation curve. The Isothermal Titration Calorimetry assay suggests that the dilution of NADH is endothermic contributing about 150cal/mole injected. NADH binding to PADH is exothermic about -50620cal/mole. NADH binding occurs with a large negative entropy change about -153cal/mole K. Energetically the entropy change nearly compensates the enthalpy change and because of this the K<sub>d</sub> is relatively large (171uM). Overall the fluorescence and ITC results are in reasonable agreement indicating that NADH bind PADH weakly under the conditions evaluated in this study. Preliminary data suggest that magnesium may have a significant role in modulating the NADH binding affinity.

Entry Number 97 UL

SYNTHESIZING DIARYLUREAS AS POTENTIAL INHIBITORS OF IGF-1R

By: Jason Cook

Biochemistry

Faculty Advisor: Dr. Marc O. Anderson

Abstract: Insulin-like growth factor I (IGF-1R) is a receptor tyrosine kinase implicated in the development and progression of breast and other cancers. This receptor plays an important role in promoting oncogenesis and is thus a key target for anti-cancer treatment. The goal of this project is to synthesize a novel library of diaryl urea compounds, which have been shown to be promising inhibitors of IGF-1R, and submit them for biological screening. This project investigates large hydrophobic groups (silyl ethers), which have been found to improve potency. A library of five uniquely substituted aryl amines was synthesized by reacting commercially available amino-phenols with TBDMS-Cl, using column chromatography for purification. The subsequent phase of this project is to react each of the five synthesized aryl-amines with 4-aminoquinoline in the presence of carbonyldiimidazole (CDI), to yield the desired library. These products are to be biologically screened in collaboration with Dr. Jack Youngren at the Comprehensive Cancer Center at UCSF.

Entry Number 98 UL  
RADICICOL INSPIRED INHIBITORS OF Hsp90 AS ANTI-MALARIA AGENTS

By: Judy Szeto and Chris R. Cornell  
Biochemistry

Faculty Advisor: Dr. Marc O. Anderson

Abstract: Current anti-malarial drugs such as quinine, mefloquine, primaquine, and especially chloroquine are becoming less effective because *Plasmodium* strains have developed resistance to them. Thus, novel small molecule anti-malarial compounds are needed. The overall goal of this project is to optimize a linear synthetic route to a library of radicicol analogs that has inhibitory potency against the *P. falciparum* heat shock protein (PfHsp90). The design of the anti-malarial agents targeted in this project is based on a natural compound, radicicol, which has anti-malarial activity. Radicicol has been shown to both inhibit ATPase activity of PfHsp90 and prevent the growth of the parasite. The library of radicicol analogs is designed to (a) explore the size and shape of the macrocycle, (b) determine functional group requirements within the molecule, and (c) introduce additional aromatic and heterocyclic rings into the molecule. Our synthetic approach to constructing the macrocycle involves ring-closing metathesis of two chains added to a substituted benzoic acid. The size and shape of the macrocycle is being investigated by varying the lengths of alkyl chains in hopes of obtaining a better fit within the active site. Additional interactions within the active site will be investigated by introducing alkyl chains that contain aromatic or heterocyclic rings and various functional groups. Altogether, both chains are being designed to generate a library of inhibitors with improved potency and specificity toward PfHsp90.

Entry Number 99 UL  
CLONING THE P450 3A4 ISOTYPE (CYP 3A4) GENE FROM HUMANS

By: Dayani Nualles  
Biochemistry

Faculty Advisor: Dr. Nancy Gerber

Entry Number 100 UL  
HEME-BASED NITRITE REDUCTASE ACTIVITY OF HEMOGLOBIN:  
LINKAGE BETWEEN GLYCATION AND INCREASED CARDIOVASCULAR DYSFUNCTIONS IN  
DIABETICS

By: Kay Saw and Damon Robles  
Biochemistry

Faculty Advisor: Dr. Raymond Esquerra

Abstract: Roughly 21 million Americans were diagnosed with diabetes in 2005, making diabetes the sixth leading cause of death in the United States. Levels of glycated hemoglobin (HbA1c) are elevated to as high as 25% in diabetics compared to about 5% in non-diabetics. Diabetes is associated with much mortality and morbidity; in particular diabetics face elevated risk of cardiovascular dysfunction. Diabetic adults are 2 to 4 times more likely to die from heart disease and stroke than adults without diabetes. However, the relationship between elevated blood sugar levels and increased cardiovascular complications is unresolved. Recent evidence shows that physiologically, hemoglobin acts as a nitrite reductase, reducing nitrite to nitric oxide (NO) and contributing to vasodilation under low oxygen conditions. Our hypothesis is that glycation of hemoglobin alters its nitrite reductase activity, thereby disrupting normal NO homeostasis. We compare the nitrite reductase activity of normal and glycated hemoglobin to determine the effect of glycation on this aspect of hemoglobin function. Understanding how glycation alters normal nitric oxide physiology is fundamental toward designing therapies that target increase cardiovascular dysfunction in diabetics.

Entry Number 101 UL  
EFFECT OF NONENZYMATIC GLYCATION ON THE AUTO-OXIDATION KINETICS OF  
ADULT HUMAN HEMOGLOBIN

By: Richelle Raagas, Damon Robles, and Arthur de los Reyes

Biochemistry

Faculty Advisor: Dr. Raymond Esquerra

Abstract: Diabetics have elevated levels of glycated hemoglobin (hemoglobin with a covalently linked sugar). Understanding how glycation affects the function and stability of hemoglobin may help elucidate the course of diabetic complications. To investigate if glycation has an effect on the oxygen-transporting abilities of hemoglobin, we examined how glycation affects the rate at which hemoglobin auto-oxidizes to methemoglobin. We used absorption spectroscopy to compare the auto-oxidation kinetics of purified HbA0 (non-glycated hemoglobin) and HbA1c (glycated hemoglobin) under different allosteric conditions to see if the rate of auto-oxidation was affected by glycation and if glycation affected the rate by allostery. Results show that oxyHb in the auto-oxidation of HbA1c has a half-life of 42 +/- 2 hrs., oxyHb in the auto-oxidation of HbA0 has a half-life of 31 +/- 1 hr., and the difference in rate was not an effect of allostery.

Entry Number 102 UL  
INTRODUCING NOVEL SUBSTRATE SELECTIVITY INTO TRYPSIN THROUGH REDESIGN

By: Sayeeda Najibi

Biochemistry

Faculty Advisor: Dr. Teaster Baird, Jr.

Abstract: The serine protease trypsin cleaves C-terminal to arginine and lysine residues in peptides and proteins. The overall objective of this research is to understand the molecular determinants of substrate selectivity by this class of enzymes. A threonine protease variant of trypsin with modified selectivity has been previously described. This investigation presents the expression, purification, and initial characterization of the triple variant, C42S/C58V/S195T-Tn (SVT-Tn) to evaluate the effect of having a residue with hydrogen bond capability at position 42 on substrate selectivity in the threonine protease variant of trypsin. Kinetic assays were used to determine the specificity of the SVT-Tn variant on substrate Z-Gly-Pro-Arg-paranitroanilide (Z-GPR-pNA) and compared to a second variant C42A/C58V/S195T-Tn (AVT-Tn), which does not have hydrogen bond capability. It was determined that SVT-Tn is ~ 10 fold more selective for Z-GPR-pNA ( $k_{cat}/K_M$  of 1.23 ( $\pm 0.15$ )  $\times 10^3 M^{-1} sec^{-1}$ ) than AVT-Tn ( $k_{cat}/K_M = 1.50(\pm 0.07) \times 10^2 M^{-1} sec^{-1}$ ). The reason for increased selectivity may be due to the hydroxyl group of serine hydrogen bonding to nitrite moiety (-NO<sub>2</sub>) in Z-GPR-pNA. The  $\Delta\Delta G$  of binding for comparison of SVT-Tn to AVT-Tn is -1.245 kcal/mol, which is not inconsistent with the increase in specificity due to the additional hydrogen bonding capability of serine at position 42.

Entry Number 103 UL  
CHROMIUM(VI) REDUCTION AND ADSORPTION BY IRON(II)-TREATED ZEOLITES

By: Diem Huynh

Chemistry

Faculty Advisor: Dr. Bruce A. Manning

Abstract: Zeolites are natural rocks which have ability to clean water of toxic compounds. Chromium(VI) is a toxic pollutant in groundwater and waste water from industries such as electronics and electroplating. This experiment used two different kinds of zeolites (faujasite and chabazite) to test chromium(VI) adsorption. Zeolite was pre-treated with Fe(II) followed by treatment with various concentrations of Cr(VI). The equilibrium solutions were analyzed by flame atomic absorption spectrometry (FAAS). The results showed that the amount of Cr(VI) uptake by faujasite was 6.20 mg Cr/g zeolite in 15.60 ppm Cr(VI) solution. The amount of Cr(VI) uptake by chabazite was 1.248 mg Cr/g zeolite in the same concentration of Cr(VI) solution (15.60 ppm). However, in the high concentration of Cr(VI) (124.80 ppm), faujasites adsorption was 45.12 mg Cr/g zeolite and chabazites was 31.59 mg Cr/g zeolite. Although faujasite and chabazite had a large difference about the absorptions ability, they both absorb a large amount of Cr(IV) in the water. Therefore, these zeolite rocks are very high-quality natural filters for today's water filtration.

Entry Number 104 UL  
THE USE OF HANDHELD XRF FOR DETERMINATION OF  
ARSENIC AND MERCURY IN A MUSEUM COLLECTION

By: Kara Cross

Chemistry

Faculty Advisor: Dr. Peter Palmer

Abstract: This presentation will describe the determination of arsenic and mercury in over 240 samples from the Oakland Museum. The samples included a subset of a basket collection along with a few bird specimens. The museum curators were concerned that these artifacts may have been preserved with arsenic and/or mercury-based pesticide agents, and hence required definitive analytical data to take appropriate precautions in displaying, handling, and storing these artifacts. X-Ray Fluorescence spectrometry (XRF) is an ideal technology for this application due to its simplicity, speed, multi-element and nondestructive analysis capabilities. Of particular concern in this work was providing reliable detection and quantitation of arsenic and mercury in the samples. The spectral overlaps of the analytes (the K $\alpha$  line for arsenic at 11.73 keV overlaps the L $\alpha$  line for mercury at 11.82 keV) and some of the matrix species (i.e., lead and bromine) presented complications in positively identifying the element. Quantitation was based on the use of a series of custom-made standards in an organic matrix, Compton Normalization to correct for varying sample densities, and external standard-based calibration. Limits of detection were on the order of 5 ppm for arsenic and mercury and calibration curves were linear over the 10 to 1000 ppm range. The highest concentrations in the samples were found to be 10,000 ppm arsenic (>1%) in a bird specimen and 6000 ppm mercury in a basket coated with vermilion (mercury-based) pigment. Overall, approximately 20% of the baskets were found to contain detectable levels of arsenic and/or mercury.

Entry Number 105 UL

CONVENIENT OXIDATION OF BENZYLIC AND ALLYLIC HALIDES TO ALDEHYDES AND KETONES

By: David X. chen

Chemistry

Faculty Advisor: Dr. Weiming Wu

Abstract: Benzylic and allylic halides were conveniently oxidized to aldehydes and ketones by pyridine N-oxide in the presence of silver oxide under mild conditions.

Entry Number 106 UP

IMPLEMENTING A BASIC TRACKER ON  
MAC OS X WITH COCOA AND CoreAudio

By: Chris O'Neill

Computer Science

Faculty Advisor: Dr. William Hsu

Abstract: A tracker is a program which allows the user to take a list of instrument samples and compose a song by arranging them on a grid and changing their pitch. In this grid, each row corresponds to one beat in the song, and the user can change the speed of their song by setting the BPM (beats per minute).

I have written a basic tracker using Apple's CoreAudio API for the sound manipulation and Cocoa for the GUI (graphical user interface). This tracker allows the user to import instrument samples from many different file formats (wav, mp3, etc), arrange them on a grid, and adjust their pitch and volume. They can then play the resulting tune, export it to a wav file or save the grid / list of samples in a custom file format for later work.

Entry Number 107 UP  
REAL-TIME PITCH DETECTOR FOR MUSIC APPLICATIONS  
By: Peter Gulezian  
Computer Science  
Faculty Advisor: Dr. William Hsu

Entry Number 108 UP  
INTERACTIVE MODULAR SYNTHESIZER FOR AUDIO GENERATION  
By: Trevor Blackstone  
Computer Science  
Faculty Advisor: Dr. William Hsu

Abstract: Audio synthesis software is traditionally very technical in nature, and functional usage is limited by the experience of the technician. While complex audio soundscapes can be created using commercial applications, these applications fall short in allowing the average user to create acoustically appealing sounds. In addition, the amount of time it takes to create sounds, whether they are single tones or a performance piece, can be overwhelming. Here I describe an interactive modular synthesizer (IMS) application that I developed which allows the user to create diverse sounds dynamically using a simple, intuitive GUI.

Entry Number 109 UP  
GUITAR TUNER WITH AUDIO AMPLIFIER (GTAM)  
By: Adurape Owolabi, Rommel Matundan, and Adrian Magana  
Electrical Engineering  
Faculty Advisor: Dr. Tom Holton

Abstract: A digitally controlled electrical guitar tuner using an ATMEL microcontroller with a National Semiconductor audio amplifier.

Entry Number 110 UP  
MICROCONTROLLER AT LARGE  
By: Ja Song Koo and William Yu  
Computer Engineering  
Faculty Advisor: Dr. Hamid Shahnasser

Abstract: description of the project: We implemented and integrate a few essential computer subsystems, including a single step through circuit and a clock and reset circuit. In order to make the system usable, we add memory and hex displays to the base computer system, so we can see the contented of memory and location of address being used by CPU.

Entry Number 111 UP  
WIRELESS DATA ACQUISITION SYSTEM  
By: Matt Willman  
Computer Engineering  
Faculty Advisor: Dr. Hamid Shahnasser

Abstract: The goal of this project is to create a set of small wireless data collection nodes that can be controlled from one central computer. These nodes will be able to connect to a variety of different sensors and collect, route, and transmit data wirelessly to a central computer for processing. This system give users the ability to create wireless data collection networks that will allow for a much greater dispersion of data collection nodes with half the effort of older wired data collection networks.

Entry Number 112 UP  
BEAU GESTE: A WEARABLE HUMAN-COMPUTER  
INTERFACE DEVICE  
By: Michael Carychao  
Computer Engineering

Faculty Advisor: Dr. Hamid Shahnesser

Abstract: This device is worn on the wrist and uses two sensors, a 3-axis accelerometer and a 2-axis gyro, to detect the user's arm motions. Data from these gestures is sent via a microcontroller to a computer where it is translated "real-time" into interface commands using C++ and OpenGL.

Entry Number 113 UP  
DIGITAL DOOR LOCK  
By: Issac Siavashani  
Electrical Engineering

Faculty Advisor: Dr. Tom Holton

Abstract: This Digital Door Lock can be open via entering combination and wireless key

Entry Number 114 UP  
WEB BASED POWER MONITORING UNIT  
By: Nash Weber and Roberto Ramirez  
Electrical Engineering

Faculty Advisor: Dr. Tom Holton

Abstract: To design and implement a web based power production/consumption monitoring unit. Our design can measure either your homes power consumption or the power produced by a homes solar unit. The data will be sent via Wi-Fi to a web server where the user can log on and watch his homes consumption and or production from anywhere with internet access. Our design requires minimal to no modification of their existing home setup.

Entry Number 115 UP  
LINEAR-ACTUATED INVERTED PENDULUM  
By: Nick Langhoff and Jackie (Thuya) Maw  
Electrical Engineering  
Faculty Advisor: Dr. V.V. Krishnan

Entry Number 116 UP  
GPS ACTIVATED AUDIO TRANSMITTER  
By: Brandon Wong and Jackson Taylor  
Electrical Engineering

Faculty Advisor: Dr. Tom Holton

Abstract: When a blind person is walking around campus, he/she may need to be told when they are coming up on stairs, at a certain building, or any other important points that would give the blind person enough information so that their loss of sight would not be as much of a handicap. The goal is to make a device that will send an audio message to the person when they reach a certain location. The best and most accurate method of detecting the location of the person was found to be global positioning system (GPS). With the use of the Atmel AtMega16 microcontroller, the information from the GPS will be interpreted and the corresponding audio message will be played in the person's ear via an ear phone. This device can also be used in other applications besides an aide for the blind, such as a way to provide specific location information for outdoor tours, hikers, and campers.

Entry Number 117 UP  
ULTRASONIC WIND SENSOR  
By: Eugene Tom, Wai Yu Lam, and Nay Min Soe  
Electrical Engineering  
Faculty Advisor: Dr. Tom Holton

Abstract: The Ultrasonic Wind Sensor utilizes transducers that emit ultrasonic waves. Since sound waves are essentially vibrations of the molecules in air, winds that act upon ultrasonic waves can alter the speed of these waves. Using distance and speed measurements, we can calculate the velocity (magnitude and direction) of a given sample of wind based on how much it alters the speed of an ultrasonic pulse. Our sensor consists of two pairs of ultrasonic transmitters and receivers that are oriented in the North, South, East, and West directions. Each transmitter will emit a pulse and the time it takes for that pulse to reach its receiver will be recorded. The measured time will be used to calculate the overall wind speed and direction. Once the calculations are completed, the results are output to an LCD and the process repeats itself over a desired interval.

Ultrasonic wind sensors are preferred over the traditional propeller method of capturing wind speed because they do not have any moving parts, they are theoretically much more accurate, and they are usually weatherproof.

The main purpose of our project is to provide a "proof of concept" that the ultrasonic wind sensor system is realizable and can function properly. The secondary goal of our project is to familiarize ourselves with one of the most popular microcontrollers in the market today, the Atmel AVR.

Entry Number 118 UP  
CANE PROJECT  
By: Gai (Brian) Chan Lu and Christopher John Osian  
Electrical Engineering  
Faculty Advisor: Dr. Tom Holton

Abstract: A cane that vibrate when it sweeps across a piece of metal wire.

Entry Number 119 UP  
LINE FOLLOWER  
By: John-Charles Bautista and Tim Wang  
Electrical Engineering  
Faculty Advisor: Dr. Tom Holton

Abstract: A robot with a microcontroller that is designed to follow a black or white line

Entry Number 120 UP  
LINE FOLLOWER CAR  
By: Me Me Thin  
Electrical Engineering  
Faculty Advisor: Dr. Tom Holton

Entry Number 121 UP  
ROTARY INVERTED PENDULUM  
By: Kirk Fitzpatrick and Hezekiel Randolph  
Electrical Engineering

Faculty Advisors: Dr. George Anwar and Dr. Tom Holton

Abstract: The project consists of an array of interconnected components which comprise a hybrid of controls, electrical engineering and mechanical engineering. The basis for this project is to solve a classic control theory problem: the inverted pendulum. Our design consists of many constraints which have been met in order to preserve the integrity of the pendulum's operation as well as aesthetic appeal. Using MCUs (microcontrollers) we will implement a control law to drive a DC motor (actuator) with a pendulum attached to the end of a shaft. The shaft is free floating and will provide feedback to the controller for a closed loop feedback system. The end result is a control system which torques the shaft appropriately to maintain balance of the pendulum in a naturally unstable condition.

Entry Number 122 UP  
CNC MILLING MACHINE  
By: Issac Siavashani and Sean Mccommens  
Electrical Engineering  
Faculty Advisor: Dr. George Anwar

Abstract: CNC milling is a computer interface based drill and engrave machine.

Entry Number 123 UP  
WATER CONSERVATION IN HOT WATER PIPING SYSTEMS  
By: Dustin Holley, Jeremy Romano,  
Shadow Moyer, and Steven Gong  
Mechanical Engineering

Faculty Advisors: Dr. A. S. Ed Cheng and Michael Strange

Abstract: Our project is based on the issue of conserving usable water. We designed a system that minimized the loss of tap water while a user waits for hot water to arrive from their hot-water heater. When a user draws from their hot water lines they only wish to use heated water, and will simply waste the water that has cooled in their hot water lines, due to inactivity, waiting for hot water to arrive. On average a gallon of water is wasted during the time it takes for water, from the hot-water heater, to arrive at the point of use, after the hot water lines that have cooled. Our design is equipped with a heating element, activated by temperature and flow sensors, to rapidly heat water in the hot water lines that have cooled. This system has the potential to conserve approximately a gallon of water each time hot water is drawn from water supply lines that have cooled. We accomplished this by restricting the flowrate out the faucet while the pre-heated water, in the hot-water heater, is brought to the point of use and quickly reheating the water that has cooled in the hot water lines for immediate use.

Entry Number 124 UP  
SOLAR WATER HEATER

By: Kristine Low, Mark Ritchie, Matt Suidan, and Nathan Alloro  
Mechanical Engineering

Faculty Advisors: Dr. A. S. Ed Cheng and Michael Strange

Abstract: Our goal is to create a solar water pre-heater that is efficient and low in cost. This solar water heater would be hooked up in line with your residential electric or natural gas water heater and would act to pre-heat the feed water to the existing water heater. We are designing this heater in module form allowing additional units to be attached depending on residence water usage and varying climates. Overall, this unit will reduce the amount of natural gas or electricity required by the in-house conventional water heater and subsequently reduce utility costs and emissions.

Entry Number 125 UP  
WONDERBASS!

By: Ansgar Lorenz  
Mechanical Engineering

Faculty Advisor: Dr. Dipendra Sinha

Abstract: This project is one to do with stringed musical instruments and the construction thereof. I have devised a new way of building stringed musical instruments; a fantastic new method which is easy, economical, beautiful and sounds wonderful.

Entry Number 126 UP  
CROSSBOW

By: William Haugse and Jon Rubick  
Mechanical Engineering  
Faculty Advisor: Dr. Dipendra Sinha

Entry Number 127 UP  
ASME ELECTRIC MOTORCYCLE CONVERSION PROJECT

By: Oliver Burke, George Bainbridge, Nick Certo, David Shirling, Laura Cioffi,  
John McMaster, and Andrew Cole  
Mechanical Engineering

Faculty Advisor: Dr. Dipendra Sinha and Dr. Kwok Teh

Abstract: The Electric Motorcycle Project is an ASME at SFSU related project. The project's purpose is to explore the engineering challenges and benefits involved in converting a vehicle from spark-ignition gasoline power to electric motor power. The final product is designed to be an even more efficient vehicle than the original. Engineering challenges were calculations involved with electric components, energy storage and charging, force/stress calculations for the drivetrain, wind tunnel testing, and project funding and management.

Specifications are 70 mph top speed and 70 mile range. It is designed for a driver and a passenger. It also allows for recharging of batteries from a conventional 120 V outlet.

Entry Number 128 UP  
HUMAN POWERED VEHICLE  
By: Matthew Jaeger, Carlo Sola, and David Kang  
Mechanical Engineering  
Faculty Advisor: Peter Verdone

Abstract: A two wheeled recumbent bicycle that is steered from the back wheel instead of the front wheel.

Entry Number 129 UP  
SFMTA CABLE CAR GRIP EVALUATION SYSTEM  
By: John Becker, Ansgar Lorenz, and Sean McCommons  
Mechanical Engineering  
Faculty Advisor: Michael Strange

Abstract: The SFMTA Cable Car System uses a gripping mechanism "the grip" to transmit momentum from a cable that runs beneath the street to a cable car. The part of the grip, the gripping dies, that comes in contact with the cable are subject to high rates of wear. SFMTA sees great variation in die wear over time. The dies often last only 2 days in service, sometimes they last as little as 6 hours, when they are expected to last a week.

We are seeking to explain how the dies wear in the cable car system. To do this we have designed an instrumentation system and a test bench to model the stress/strain the grip mechanism will experience under different loading conditions. With the data we will generate, we can model the operation of the cable cars, and explain how the SFMTA might reduce costs by improving the cable car system.

Entry Number 130 UP  
DESKTOP 3-AXIS CNC MILL  
By: Quang Pham  
Mechanical Engineering  
Faculty Advisor: Dr. Dipendra Sinha

Abstract: The milling machine is very useful tool used for shaping and cutting solid materials. A simple mill consists of a rotating cutter or endmill that rotates about the spindle axis. The cutter can be controlled to move up or down on the z-axis. The work piece is affix to a table which is movable back and forth and left and right across the x and y axis. Milling machines can be found both manually operated or with computer numeric control (CNC). In this project I will design a 3-axis mill that will be controlled using a computer. The lathe will be able to cut in 3 different axis. The 3 dimensional cutting shapes will be pre-drawn on the computer and then cutting will be done.

Entry Number 131 UP  
FIXED DOCK TOWER LIFTER  
By: Quang Pham, Curtis Hartdegen, Nikko Kusuma, and Cyrus Lam  
Mechanical Engineering  
Faculty Advisor: Michael Strange

Abstract: The campus grounds director, Phil Evan, at San Francisco State University has asked our group to design a fixed dock waste delivery system. We will design a system that autonomously helps workers dump a heavy tower load into a larger waste bin. The system will allow waste management workers to dump towers from the Creative Arts building dock into the onsite bin. Our system will work to provide safety and reduce strain on the workers, and increase the waste disposal system efficiency.

Entry Number 132 UP  
TL1 (TOTTER LIFTER 1)  
By: Patrick Ng, Dan Luo, and Jose A. Guardado  
Mechanical Engineering  
Faculty Advisor: Michael Strange

Abstract: At the request of the Grounds department at SFSU we have designed a stationary totter lifting device (LT1). This device is capable of accommodating a max load of 500 lbs. LT1 also offers horizontal motion that allows it to be used in multiple bins. This device was designed for the purpose of minimizing lifting related injuries, and offers futures comparable with similar devices and more. LT1 was designed for an specific site, but with the flexibility to be adapted to different sites with minimal adjustments. LT1 uses an hydraulic rotary actuator powered by an AC hydraulic pump. Controls have been designed to minimize risk of injury and ease of operation. Materials and parts have been specified to offer durability and reliability.

Entry Number 133 UP  
TOTTER TIPPER  
By: William Haugse, Jon Rubick, Laura Freiburg,  
and Jackie (Thuya) Maw  
Mechanical Engineering  
Faculty Advisor: Michael Strange

Abstract: It is a machine we are building to assist school grounds workers to empty the Totter brand trash cans in to dumpsters placed at the lower level of the loading docks around campus, mainly behind the Thornton Hall building.

Entry Number 134 UP  
TRIPLE I-BRIDGE  
By: Dong Wen Liang, Man Wai Chan, Wan R. Chen,  
Sokari Frank, and Quynh Cao  
Civil Engineering  
Faculty Advisor: Dr. Norman Owen

Abstract: For our senior project, we choose to enter The National Timber Bridge Competition. We need to design, construct, and test our model within certain period of time. The main purpose of our project is to demonstrate and apply what we have learned in school to an actual project. Our purpose of this project is to provide a safe and strong timber foot bridge that can hold about 20-KN an hour with minimum deflection as possible.

Entry Number 135 UP  
AERONAUTICAL MUSEUM  
By: Henry Diep, Michael Dubrovsky, Raman Fiaskou,  
Lauren E. Kirk, Nancy Lee, and Ezekiel Robles  
Civil Engineering  
Faculty Advisor: Dr. Norman Owen

Abstract: The goal of this project is to design an educational structure with unique configurations. The team set out to challenge their abilities and creativity. With this in mind, the team envisioned an airplane museum focused on displaying achievements in modern aviation. Our building is rectangular, made of steel and glass building, with an arched roof. Its dimensions are 400 feet long, 300 feet deep, and 100 feet at the tallest point. We will be analyzing its structural integrity against gravity, wind, and seismic loads.

Entry Number 136 UP  
GEOTECHNICAL FOUNDATION AND WALL DESIGN OF  
AN AIRPORT TERMINAL BUILDING AND HOTEL

By: Andrew Tangsombatvisit, Mary Bokova, Terence Huey, and Norma Silva  
Civil Engineering  
Faculty Advisor: Dr. Timothy D'Orazio

Abstract: Design the foundation and wall options of an airport terminal building and hotel located in San Francisco based on soil properties, economics and feasibility.

Entry Number 137 UP  
STEEL BRIDGE

By: Helen Yu-Lee, Robert Gomez, Queena Liang, Richard Chircop, Gerard Joseph,  
Katie Himmelberger, and Marta Minkwitz  
Civil Engineering  
Faculty Advisor: Dr. Wenshen Pong

Abstract: For this project we will be analyzing, designing and constructing a steel bridge to replace a Century-old Bridge that spans a river. Construction must be completed quickly to provide transportation means to the rural region's residences, farms, and agricultural processing industries that are the economic base of the region.

This bridge must be built in accordance to the rules and regulations explained in the Student Steel Bridge Competition 2008 Rulebook. Some of the design criteria that must be implemented include: providing minimal clearance for flood waters to pass, meeting and maintaining minimal sway and deflection limits in accordance to the load patterns on the deck of the bridge, weight of the entire structure, and finally the construction materials used.

Each company competing for the final bid will submit a 1:10 scale model that will be constructed later in a regional competition and judged by a panel of Department of Transportation personnel. The small-scale model will be designed based on the following governing factors: display, constructability, economy, usability, stiffness, construction speed, durability and efficiency. The contract will then be awarded to the company whose design and model best meet the needs and requirements provided by the DOT and 2008 Student Steel Bridge Competition Rulebook.

Entry Number 138 UP  
CABLE STAYED TIMBER BRIDGE

By: Veronica Crothers, Robert Curcio, Candace Cable, Hai Pham, and LeiLei Hsieh  
Civil Engineering

Faculty Advisor: Dr. Norman Owen

Abstract: Although most cable-stayed bridges are not made of structural wood, the design concepts are equally suitable for small structures, like the ones being designed for the 2008 Timber Bridge Competition. Our group collectively believed it would be advantageous in today's advancing civil engineering field to begin exploring the principles of design and construction of a cable-stayed bridge. Thus the motivation for designing one of the first ever cable-stayed wood bridges for the Timber Bridge Competition was born. Our objective was to build a wood bridge that is non-traditional, aesthetically pleasing, and structurally sound. Our bridge is composed of four 6X6 pressure treated select structural Douglas Fir columns supporting a bridge deck of five Douglas Fir 2X4 stringers, forty-five 2X4 decking pieces and two 2X4 curbs. There are three transverse stringers comprised of two 2X6 members bolted together with 4X6 blocking at the ends. 2X4 bracing is provided as well as eight diameter steel cables in a harp pattern tying into the deck from the four columns. Under the deck are four cables tying in horizontally to the columns to resist kicking out moments. This innovative design is the first of its kind in the competition.

Entry Number 139 UP

EFFECT OF GRAIN-SIZE MIXTURE ON THE FORMATION OF COARSE FRONTS IN DEBRIS FLOWS

By: Jo Ann Huerto

Geosciences

Faculty Advisor: Dr. Leonard Sklar

Abstract: I tested various grain-sizes and how they effect the formation of a coarse front. I have done several experiments to show how coarse fronts form and explain why they are so significant to us.