Quartz Crystal Microbalance Quantitative Analysis: Photodegradation of Secondary Organic Aerosols
Joshua Klobas & Carmen Seetho
*Mentor: Sergey Nizkorodov*

Upon exposure to solar radiation, atmospheric particular matter often undergoes significant photodegradation, which affects chemical, physical, and biological properties of particles. This project characterizes the volatility and photostability of secondary organic aerosols (SOA), a class of particulate matter produced by atmospheric oxidation of terpenes and other volatile organic compounds. This measurement relies on a quartz crystal microbalance (QCM), which can sensitively detect small changes in the mass of SOA deposited on the QCM crystal during its exposure to simulated solar radiation. A micro-orifice uniform-deposit cascade impactor (MOUDI) was used to deposit limonene/O_3 and myrcene/O_3 SOA onto gold-plated QCM crystals. The mass of SOA was monitored under dry conditions and ambient temperature during periods of irradiation from a 50 Watt high-pressure xenon arc lamp. This presentation will discuss the following results: preparation of SOA samples under controlled laboratory conditions; calibration of the QCM apparatus; spontaneous volatilization of SOA material from the QCM surface; photodegradation of the SOA material; and future work.

Utility of Additional Radiographs Ordered by Surgical Consultants for Emergency Department Patients with Extremity Injuries
Rex Chang & Allison Leung
*Mentors: Shahram Lotfipour, Michael Mirhadi & Jeffrey Suchard*

Patients with injuries to their extremities are commonly evaluated in the Emergency Department (ED). The emergency physician typically orders x-rays of the injured area(s) and, in some cases, additional x-rays above and below the site of injury are ordered by a surgical consultant. Although previous research suggests that these additional x-rays may be unnecessary, the incidence of significant injury or change in clinical management when these x-rays were ordered by surgical consultants is unknown. To determine this incidence, we reviewed the charts of patients who received extremity x-rays in the UCI Medical Center ED during the past six months and recorded information from patients who had positive findings on the initial x-ray and who received additional x-rays. The recorded information included the mechanism of injury, the site and the specific injury/finding of the initial x-ray with a positive finding, whether or not a surgical specialist was consulted, whether the ED physician or the surgical consultant ordered additional x-rays, whether the additional x-rays had positive findings and, if so, whether additional procedures not indicated by the initial injury were performed. We found that very few patients had positive x-ray findings from the additional x-rays ordered by surgical consultants. Thus, the incidence of significant injury or change in clinical management when these x-rays were ordered by surgical consultants was low. This study suggests that altering the current clinical practice by not obtaining these additional x-rays may be safe. We hope to prevent the additional costs and time involved in obtaining these additional x-rays in the future.

Causes and Consequences of the Erosion of Emergency Department On-Call Panels and the Effect on Higher-Level-of-Care Inter-Hospital Transfers
Thuy-Chung Nguyen & Jimmy Tran
*Mentors: Omar Amr, Shahram Lotfipour & Michael Menchine*

There is a growing trend of deficiency in on-call specialist availability and increasing need for higher level of care (HLOC) transfers for emergency department (ED) patients. The goal of this retrospective study is to assess the financial implications to a university trauma center that frequently accepts transfers for HLOC, as well as the consequences to patients in regards to mortality. We conducted a chart review of all patients transferred to the University of California, Irvine Medical Center (UCIMC) from an outside ED for HLOC between January 1, 2007 and March 31, 2008. Charts identified were reviewed to determine the HLOC service needed, patient characteristics such as age and sex, and the source of expected funding. Costs and reimbursements for their medical care were obtained from the hospital finance department. The net financial impact to the institution was calculated by subtracting the marginal cost of treatment from the total reimbursement. Overall, 563 patients identified had complete billing information. There was a net gain of $2,525,540 during the study period. About 3.02% of patients who were accepted died. At UCIMC, HLOC transfers resulted in a net financial gain. However, reimbursement varied drastically depending to the type of insurance, suggesting that a hospital that receives HLOC transfer with a greater proportion of uninsured, Medicaid, or MSI patients could suffer financial harm. Base on this result, there were no definitive correlations between mortality and the distance and time required to transfer patients for HLOC.
**Effects of Heat Treatment on the Creep Behavior of Electrodeposited Nanocrystalline Nickel**

Frank Jimenez & Courtney McConnell  
*Mentor:* Farghalli Mohamed

Nanocrystalline (nc) materials are polycrystalline materials with grain sizes in the range of 1–100 nm. Nc-materials possess attractive mechanical properties that give them high potential in engineering applications. Primary among these properties is creep resistance. In this investigation, the creep behavior of nc-Nickel with an average grain size of 20 nm has been studied. Nc-Ni was subjected to creep tests following heat treatments at a temperature of 443 K for various annealing times. Nc-Ni has served as a model material in studies involving deformation and correlation between properties and microstructure. Nc-Nickel was produced via an electrodeposition (ED) process to ensure dense and highly pure (ED) nc-Ni. The double shear creep testing technique was used to avoid any geometric instability with the onset of necking commonly seen in tensile tests. Furthermore, the microstructure of nc-Ni was examined via Transmission Electron Microscopy (TEM) to gain insight into the effect of heat treatment on the grain size and microstructure, and the details of the deformation process.

**The Impact of Stigma Eliciting Labels on Preference for Social Distance**

Sarah Mattison & Kara Scartaccini  
*Mentor:* Roxane Silver

Individuals with a history of mental illness, prior criminal arrests, or chronic illnesses are often ostracized from others and may lack adequate social support. This study examined the extent to which college students sought to distance themselves from others with potentially stigmatizing conditions that might negatively affect social relationships. An online survey was administered to 745 undergraduate students at the University of California, Irvine, in which subjects were asked the extent to which they would be willing to interact with individuals with a number of potentially stigmatizing conditions (e.g., physical illness, mental illness, criminal history). The primary dependent variable used to conceptualize stigmatization was a composite measure of social distance. Blameworthiness, demographics, and prior life experiences were examined as potential moderators and mediators of this outcome variable. Results indicated that participants wanted social distance from criminally deviant individuals and those labeled as mentally ill. Specifically, individuals most sought to distance themselves from others labeled as Schizophrenics, AIDS patients, and murderers.

**Anti-Leukemic Efficacy of Inhibiting PI3K/AKT/mTOR Simultaneously**

Melissa Chavez & Raymond John Lim  
*Mentor:* David Fruman

An aggressive subtype of acute lymphoblastic leukemia (ALL) develops through a genetic abnormality, known as the Philadelphia (Ph) chromosome, which encodes the BCR-ABL fusion tyrosine kinase. Current therapy for Ph+ ALL patients involves inhibiting BCR-ABL with a small molecule inhibitor of ABL kinasea, imatinib, combined with conventional chemotherapy. In early stages of ALL, imatinib therapy works effectively to decrease or limit the progression of the diseases. However, in later stages, patients often develop some form of resistance to imatinib, causing them to relapse. Therefore, to help treat the disease, it is important to target other signaling pathways downstream of BCR-ABL that are deregulated or overexpressed in leukemia. Such pathways include the PI3K/mTOR pathways, which regulate cell proliferation and growth of lymphocytes. Our approach is to use inhibitors that target one or multiple nodes of these pathways downstream of BCR-ABL in efforts to increase the efficacy of treatment. Therefore, by using a variety of specific novel inhibitors, this study aims to see which inhibitors provide the most effective killing of leukemia cells *in vitro*.  

p190 BCR-ABL+ cells were treated with indicated concentrations of downstream inhibitors, and their viability was assessed using a high throughput MTS assay. In addition, after p190 BCR-ABL+ cells were treated with various inhibitors, immunofluorescence was used to assay Akt activity through the visualization of the location of its substrate, FOXO1. Studies are underway to determine the synergistic effects of these compounds.

**Determining TP53 Gene Mutation Status in Tumor Stem Cells’ Subpopulation of Malignant Gliomas**

Mariam Abdelmelek & Nirvi Shah  
*Mentor:* Yi-Hong Zhou

A malignant glioma brain tumor is considered to be one of the deadliest brain tumors. A subpopulation of tumor cells expressing Tumor Stem Cell (TSC) markers has intact chromosome 10. TSCs are the most resistant cell population in tumors, and their presence is believed to cause the tumor recurrence. The *TP53* gene within chromosome 17p13.1 suppresses the cell by either G1 arrest or apoptosis, or both of them. To study the mutation status of *TP53*, we carried out a nested PCR. We used a primer set that amplifies exons four to nine. The second PCR product was purified with 1% agarose gel using QIAquick gel purification kit. The purified sample was then sequenced and analyzed for mutations. Our preliminary results show that eight primary culture samples from a GBM showed that this is a tumor with at least three tumor cell lineages: 1) the tumor mass cells with a hemizygous deletion of...
chromosome 10 that predominates in initial adherent cell culture conditions, 2) the NSCL cells with intact chromosome 10 that was enriched in SF non-adherent culture conditions, and 3) a subset of tumor cells with a homozygous deletion of chromosome 10 that predominates in initial SF non-adherent culture conditions. This data further supports analysis on various grades of human malignant astrocytomas to determine if there is TP53 mutation that may cause an unstable genome resulting in chromosome 10 deletions. The study is still in progress with various other cDNA samples in determining specific mutations of TP53.

The Digital Tourniquet-Evaluation of a New Device
Kevin Liu & Eemit Yazdanmehr
Mentors: John Christian Fox & Shahram Lotfipour
The goals of this research project are to generate a database of finger sizes in a general population, then to mathematically determine the amount of force applied over an area of finger to produce a pressure that would prevent arterial blood flow in order to create a bloodless field for physicians to treat finger lacerations. Measurements were taken of the circumference of the base of the thumb, middle finger and pinkie from 200 males and 200 females using a ruler. The subjects measured were patients, family members, staff, or other adult volunteers encountered in the Emergency Department. The sizes of the different fingers were averaged for males and females. The average size of the male pinkie, middle finger and thumb were 60.3, 70.4, and 72.2 mm, respectively. The average size of the female pinkie, middle finger and thumb were 52.2, 60.8, and 62.7 mm, respectively. From the average finger size taken from the database, we found that 166.9 mm Hg was enough pressure to prevent arterial blood flow. This study indicates that the digital tourniquet will be able to prevent arterial blood flow in finger lacerations at a significantly lower pressure than presently used tourniquets, thus minimizing the chance of damage from excess pressure.

Green Fluorescent Protein (GFP) Expression in Response to Vascular Endothelial Growth Factor (VEGF) In Vivo Activity following Laser-Induced Injury
Hannah Schreibeis-Baum & Kathleen Teves
Mentor: Bernard Choi
Angiogenesis, the growth of new blood vessels from existing vessels, is due largely to the repair mechanisms promoted by the vascular endothelial growth factor (VEGF). By providing needed nutrients to new microvasculature sprouting from affected areas, this growth factor plays a prominent role in the proliferation of tumors in diseases such as cancer. Using green fluorescent proteins (GFP) that fluoresce in and around injured sites, we were able to mark and identify growth patterns in the microvasculature of VEGF-GFP transgenic mice. Following the insertion of a window chamber on the dorsal skinfold of the animal, we irradiated specific blood vessels and monitored the regeneration process through fluorescence imaging with the multiphoton microscope, as well as through laser speckle imaging and multispectral imaging. Although previous studies have denoted the presence of GFP in wounded areas within two to three weeks subsequent to injury induction, it is uncertain whether novel vessels are already forming a few days following laser-induced injury. It was, therefore, our goal to determine the time period at which there is maximal VEGF response. Our recent experimental imaging data have indicated fluorescence in non-irradiated sites; moreover, they have shown that injured areas reveal little or no GFP within the first week of injury. Thus far, we expect that there is a specific time period of three to five days during which maximum VEGF activity can be isolated and investigated, but more experimentation with the imaging systems is necessary to determine accurate results.

Determining the Possible Relationship of Time of Day and the Predictability of SIB Behavior
Julie Chen & Vy Han
Mentor: Curt Sandman
Maladaptive behaviors are prevalent, costly, and difficult to treat in individuals with developmental disabilities. Examples of such behaviors include aggression towards peers or staff, self-injurious behaviors (SIB), and property damage. Previous studies report an association between frequency of SIB and dysfunctional regulation of the hypothalamic-pituitary-adrenal (HPA) axis involved in the “fight-or-flight” reflex. Increases in hormonal production associated with episodes of SIB persist despite the normal circadian or “time of day” cycles that regulate hormonal fluctuations. Our purpose was to determine if there are any differences in SIB between AM and PM periods, and if there are differences, whether they are related to changes in Cortisol. To accomplish this, we collected behavioral data for 21 days on an 11 year-old boy with autism and severe self-injurious behaviors. Daily Cortisol samples (salivary) were also collected to determine Cortisol awakening response and subsequent diurnal decay. It was determined that the subject injured himself at a significantly higher rate during afternoons compared to the morning periods. Higher levels of Cortisol at 4 PM were significantly correlated with rates of SIB in the afternoon periods. Higher Rates of SIB were positively correlated with a lower percent change of Cortisol values at 4 PM relative to baseline values. Additionally, Cortisol levels at 7:30 AM were negatively correlated with rates of stereotypy. These findings suggest that a diminished circadian variation in Cortisol may predict higher frequencies of SIB.
Relationship Between hsp26 Expression and Longevity in Drosophila melanogaster
Matt Erro & Jonathan Oishi
Mentor: Michael Rose
In the fruit fly Drosophila melanogaster, the gene that encodes the small heat-shock protein 26 (hsp26), is differentially expressed in extant populations selected for different life-history traits such as longevity, development time, and stress-resistance. Specifically, it has been shown that the expression of this gene is correlated with both increased longevity and accelerated development. We aim to further characterize the effects of hsp26 expression on life-history traits by monitoring phenotypes and hsp26 genotypes over a period of sustained laboratory evolution. Beginning with a set of five-fold replicated populations with a 70-day generation time, we created four new sets of replicated populations reverse-selected for slightly different accelerated development regimes. We hypothesize that populations selected for shorter development times should have decreased lifespan, compared to the ancestral populations. Furthermore, longer-living populations should express hsp26 at a greater rate than populations that develop more quickly. We monitored this reverse-selection for about 50 generations. During this time, hsp26 expression decreased in all populations. This decrease was not significant in populations selected for extremely accelerated development, but was significant in populations selected for moderately accelerated development. We found that longevity was significantly decreased in all reverse-selected lines, and that a population’s generation time was negatively correlated with its average lifespan. We therefore find correlated results with respect to phenotype and genotype. We find that selection in the laboratory for accelerated development results in decreased longevity in less than 50 generations. We also find that this selection results in decreased hsp26 expression, but not in populations selected for extremely accelerated development. These results support previous studies that suggest that the expression of hsp26 is beneficial for a fly’s abilities to live longer and develop quickly.

A “Real” UCI Dining Experience: A Food Systems Assessment for the University of California, Irvine toward a Just and Sustainable Food Plan
Kelsey Meagher & Hai Vo
Mentor: Joseph DiMento
In recent years, several universities have completed campus food assessments in order to understand their impact on the environment and the community. These assessments provide a broad overview of campus food systems, looking into such factors as food miles, energy conservation, waste reduction, and student education; however, very few of these assessments examine procurement data. In our study, we sought to provide a more holistic approach to assessing our food system by evaluating the top food purchases at the University of California, Irvine on the basis of four categories: ecological soundness, proximity to campus, humane treatment of animals, and fair treatment of labor. For the three largest campus dining facilities, we used existing third party certifications to assess the top 25 food purchases in each of eight food categories during the months of October 2007 and October 2008. Each food item that met the criteria for one of the four categories was considered “real,” and our goal was to establish the percentage of total purchasing that was directed toward “real” food. Our early results indicate that less than 5% of total purchasing was directed toward “real” food. These results support the national estimate that American universities spend, on average, only 2% of their total food budget on “real” food. Additionally, our results establish a baseline measure from which the university can measure its progress toward the goals of the UC Sustainability Policies.

Inducing Truth in Maltreated Children’s Reports of a Transgression
Vreni Barrios & Ryan Healy
Mentor: Jodi Quas
Young children often lie to conceal a transgression, and a growing body of research has examined how to motivate children to tell the truth. For example, Lyon and Dorado found that specific reassurances that the children will not get in trouble for their transgression increased truth telling. However, such reassurances also increased errors. Researchers have not examined in detail how more general reassurances that do not specifically mention the transgression affect children’s reports. Nor have studies adequately examined other techniques (e.g., practicing narratives) effectiveness at eliciting true disclosures. This study examined the effects of narrative practice and general reassurance on maltreated children’s disclosure of a transgression. We predicted that the narrative practice and reassurance would increase children’s disclosures. Maltreated 4-to-9-year olds (N=125) interacted with a confederate during which time the child broke some toys. Before leaving, the confederate warned the children not to tell that they played with some of the toys. Next, children were interviewed about what happened with the confederate. Children were randomly assigned to rapport (narrative practice v. none) and reassurance condition (v. control). As hypothesized, children in both the narrative practice and reassurance conditions said more, including about the broken toys. Results can inform legal practitioners about effective methods of eliciting the truth from children during forensic interviews.
Emergency Physician Patient Satisfaction Intervention Survey (EPPSIS)
Ladan Khoddam & Roula Saleem
Mentors: Shahram Lotfipour, Michael Menchine & Lynduh Soldavini

Patients often leave the Emergency Department (ED) unsatisfied due to unanswered questions or poor practice among providers, ultimately resulting in dissatisfaction with the level of care received. This study aims to evaluate the impact of an intervention tool employed to improve communication on unvoiced patient concerns. This two portion study was carried out at the UCI Medical Center ED over a five month period. During the first portion of the study, the control phase, patients were contacted 4–8 days after their ED visit and given a phone survey about their level of satisfaction with their ED visits. During the second portion of the study, the intervention phase, patients were given a communication sheet to complete prior to being seen by the treating nurse or physician. The participant was then given a phone survey to determine their level of satisfaction with the visit and the satisfaction with the communication sheet. Two hundred four patients were enrolled in the study overall, 104 in the first portion and 100 in the second portion. Overall, 91.4% of the patients were satisfied with the level of care received, 94% of patients were satisfied during the control phase and 89% of patients were satisfied during the intervention phase. There was no clear difference in overall communication scores between the groups. Fifty percent of the patients in the intervention phase agreed that the intervention improved the quality of care received while 13% disagreed. Although the majority of patients generally agreed that the communication sheet helped the level of care received, the data suggests that there was no significant difference in the level of patient satisfaction or communication using the communication sheet compared to the control phase.

The Role of Very Important Non-Parental Adults (VIPs): Adolescent and Young Adult Females' Experience of Incarceration
Nathan Hadinata & Brandon Reintjes
Mentor: Elizabeth Cauffman

Very important non-parental adults (VIPs) are highly influential individuals, at least 25 years old, serving a significant compensatory role in adolescents' lives by facilitating resilience and providing social support. However, the literature on VIPs predominantly focuses on community samples, whereas this study investigates the relation between delinquent females and their VIP. Data were obtained via structured one-on-one interviews with an ethnically diverse sample of 94 serious female offenders, ages 15–24, who were incarcerated in a secure juvenile facility in California. As expected, results indicate that having a VIP is related to higher self-esteem, yet there are unexpected increases in aggression. Furthermore, having a male VIP is associated with higher aggression and increased depression. Although the study reaffirms the VIPs’ influence on resilience, it also reveals the VIPs’ influence on females' delinquent behavior. Therefore, the VIPs’ distinct role in incarceration experiences of female adolescents directs attention towards the effects of negative VIPs.

Emergency Department/Psychiatry Agreement on Disposition Study
Stacy Hata & Kelly Wang
Mentors: Shahram Lotfipour & Michael Menchine

To treat psychiatric patients in the emergency department (ED), the physicians must consult a psychiatrist before making a final diagnosis. However this procedure causes a delay in the treatment of the patient and in effect prevents the ED from running at an optimal level of efficiency. There is a lack of research regarding the need for psychiatric consults in the management of emergency psychiatric patients. To address this need, we asked ED physicians to fill out a survey indicating their decision on the disposition of the psychiatric patient and then subsequently, the psychiatrist on whether or not he agreed with the emergency physician’s decision. Two or three days later, the final disposition of the patient was recorded. Overall, by performing this study, we experienced the prolonged wait for the psychiatric consults in the ED and noticed how the environment negatively affected the patients by increasing their anxiety and stress levels. We currently have 240 cases to analyze but are still in the process of collecting more data.

Mammal Monitoring in Laguna Coast Wilderness Park
Gaiane Azatian & Laura Shore
Mentor: Peter Bryant

Roadways can have numerous negative impacts on wildlife, including the destruction of habitat and an increase in the number of roadkill incidences. Due to this, it is important to implement effective mitigation systems that aid in the safe, uninterrupted passage of wildlife through the site of development. The purpose of this project was to monitor animal use of two wildlife corridors—meant to provide safe passage under freeways—and the nearby water guzzlers—drums of standing water intended to lure animals to the corridors—located in Laguna Coast Wilderness Park (LCWP). To determine which species use the corridors and water guzzlers, and to measure the frequency of their use, we collected and examined photos taken by heat-in-sensed cameras, animal foot tracks on gypsum powder, foot tracks left in the mud around the site, and on-site wildlife observations. Our data analysis has revealed a negative relationship between human and animal use of the corridors. It is also necessary to take into account factors such as corridor dimensions and the surrounding vegetation that may influence the use of a corridor by different species.
types of species. Contrary to its purpose, the water guzzler may actually be a threat to wildlife, and has not yet been found to be effective. When implementing mitigation in a similar environment, these matters can be taken into account to most successfully protect wildlife and their habitat.

**U.S. Policies on the Middle East—A Delicate Balance**
Evonne Liew & Sally Mouakkad  
*Mentors*: Lina Kreidie

This paper examines the complicated consequences of the delicate balance the U.S. must attempt to establish between pursuing its interests in the Middle East and propagating its intention to promote democracy and prosperity as an underlying foundation to end extremism stemming from the region. The United States policy of war on terror in the Middle East is marred with inconsistencies and reliance on sectarian and ideological divisions has put American policy makers in a major dilemma of how to contain such divisive policies that rendered the region a stage of struggle between moderates and extremists, Sunni and Shia, as well as between allied states and non-state actors. However, the Bush Administration’s decision to enter Afghanistan and then Iraq as preludes to waging an international, ideological war on terrorism resulted in the opposite of its desired result; instead, the U.S obtained a false sense of security, economic crisis, and decrease in world leadership and reputation. The question that the United States must answer is how to contain such instabilities to preserve its national security, economic prosperity, and reputable world leadership. In this paper, we argue that current and past foreign policies pursued by the U.S. are working against regional stability in the Middle East and harming its own goal of maintaining its status as a world hegemon.

**Solar Powered Stirling Engine System**
Clark Brewster & Brian Oliver  
*Mentors*: John LaRue & Farghalli Mohamed

Stirling engines are of significant importance today because they are driven by an external heat source. This provides an opportunity to harvest extra heat from sources such as radioactive materials, waste steam, cooking heat, and the sun. This project focused on driving an engine with heat from solar energy. Significant mechanical and materials challenges existed in creating this complex system. A cost effective system was designed and built to illustrate an alternative to photovoltaic power sources. The engine must withstand twice the pressure of the atmosphere and temperatures near 500 °F. Critical material decisions were made in the heat exchanging parts of the engine. Mechanical design was paramount to allow use of materials that met strength, weight, temperature, budget, and other constraints. The project has compiled information from many different research projects, and provided relevant information on Stirling engines regarding purpose, design and construction.

**Applications of the Venturi Effect on the Microscale within Lab on a CD Platform**
Christopher Nguyen & William Southard  
*Mentor*: Marc Madou

Microfluidic compact disc (CD) technology has grown rapidly with new approaches and innovative ideas. The basic design for a spin platform microfluidic-CD is unidirectional—radially towards the outside of the disc. The radius of the disc limits the potential operations, hindering advancements by requiring larger products. Our work focuses on using venturi force to create a pumping mechanism, which creates a negative pressure within the system to either draw fluids together or towards the center of the disc. To achieve the former we used a design that resembles a siphon valve, yet has an added condition of requiring a fast-moving fluid to initiate it. Once coupled with the fast-moving fluid, the secondary fluid will prime the channel, then merge with the fast-moving fluid and continue to expel its contents. Through experimental trials, fluid has been successfully moved towards the center of the disc using a venturi-generated vacuum, allowing for fluid movement in multiple steps around the disc. Upon further experimentation, we are attempting to move the fluid back to the center of the disc by creating a funnel system that will draw air in and create a venturi vacuum when spun at low RPM. Our continued work will evaluate the implementation of such a standalone system. This unique principle, when perfected, will greatly expand this already operational system, resulting in many advances in microfluidic CD designs, such as creating preloaded CDs, RPM and fluid dependant valves, repeated processes, and multiple events in a single device.

**Visualization of the Transport of Individual dpp Particles in Drosophila during Embryonic Development by Binding to Quantum Dots**
Joshua Cheng & Michelle Ding  
*Mentor*: Arthur Lander

Morphogens are biochemicals able to direct specific patterns of cell differentiation during early development. Applied along a gradient, any cell in the developing embryo undergoes differentiation appropriate to its position along both the dorsoventral and anteroposterior axes. Decapentaplegic (dpp) in *Drosophila*, as a member of the Transforming Growth Factor β (TGF β) family, is functionally analogous to morphogens Squint, Activin, and BMP-2 in Zebrafish, *Xenopus*, and humans, respectively. While *dpp* activity had been extensively studied, the exact mechanism of its transport to act directly on the embryonic *Drosophila* cells is still unclear. We attempt to track *dpp* movement by using Quantum Dots. The gene for a *dpp* fused with accep-
coexpression will yield secreted biotin ligase were also expressed in S2. Future coexpression will yield in vivo biotinylated dpp, which can then be bound to Quantum Dots and injected into the perivitelline space of Drosophila embryos. This way we can enable visualization of dpp and investigate its positive feedback transport mechanism.

**Improving Process Control of Anaerobic Digestion with Molecular Tools**  
Andrew Davis & Emily Wong  
*Mentor: Betty Olson*

Anaerobic digestion is a series of processes that can be used to treat organic wastes and produce biogas. One important process involves the use of an anaerobic methanogen, Methanosarcinales (MSL), the only anaerobic bacteria that can be used to degrade acetate in the absence of oxygen, to produce methane and carbon dioxide. The breakdown of acetate produces 70% of the methane in the anaerobic digestion. This decomposition reaction was studied in six laboratory anaerobic digesters, which contained three different concentrations of MSL. The Monod model, a model used in predicting cellular growth, was used to predict rates of substrate degradation and methane production. Molecular tools were used to help quantify and further specify kinetic parameters of the Monod model. Andrew Davis used quantitative polymerase chain reaction (qPCR) to determine ribosomal deoxyribonucleic acid (rDNA) concentrations of MSL while Emily Wong used gas chromatography to analyze reactor samples for concentrations of acetate. By injecting acetate into the reactors, the kinetic constants from the Monod model were determined to aid in prediction of rates of acetate degradation and methane production by focusing on determining the concentration of bacteria. In conclusion, more accurate and predictive process models will make anaerobic processes a more attractive option for simultaneously treating waste and generating energy.

**Personality and Study Groups**  
Amair Jaber & Melissa Obregon  
*Mentor: Joanne Frattaroli*

Students are constantly searching for study methods that are the most successful and efficient, which may include choosing an effective study partner. Although previous studies have shown a link between personality and academic outcomes, most studies have not looked specifically at personality in a group context, and those that have appear to lack a degree of ecological validity. Given previous findings that students high in conscientiousness have superior study habits (which is related to better performance), it is likely that conscientious students not only keep themselves organized and on task in studying but keep others organized and on task as well. Drawing from the concepts within the field of personality, this study examined the personality traits of study partners and assessed whether the personality traits of one’s partner is related to one’s own success. One hundred two college students (51 pairs of study partners) participated in this study. Drawing students from more than 32 different academic courses, each individual completed the NEO-FFI Personality Test (a measure of extraversion, conscientiousness, agreeableness, openness, and neuroticism), a demographic survey, and a consent form that allowed the release of course grades. We hypothesize that participants who partner with conscientious others will do better in the course for which they study with that partner compared to those with study group members who are lower in conscientiousness; the relationship between performance and the other four personality traits (extraversion, openness, neuroticism, and agreeableness) is also examined. The implications of these findings for students and educators are discussed.

**Accelerating Propane Clathrate Formation by Varying Ice Particle Sizes**  
Elizabeth Klueger & Joel Rivera  
*Mentor: Kenneth Janda*

Clathrate structures have been considered as a plausible medium for the commercial storage and transportation of combustible gasses and could potentially play a major role in CO$_2$ sequestration. In this work, the formation rate for propane clathrate hydrate was studied as a function of the ice particle size. Using smaller ice grains resulted in higher rates of enclathration, presumably due to a larger effective surface area. The smallest ice grain size, 106 µm, had a maximum uptake rate of 1.4x10^-5 mol/s while the largest ice grain size, 425 µm, had a maximum uptake of 5.5x10^-6 mol/s. These findings are in agreement with the clathrate growth model described by Hwang et al., whose experiments demonstrated a positive correlation between the surface area of exposed ice and the formation rate of clathrate structures. Smaller ice grains increased the exposed surface area of ice and reduced the amount of unexposed ice surrounded in a clathrate crust. Continued formation only occurs with permeation of the clathrate layer by propane molecules. Experiments such as these will help develop a more thorough understanding of clathrate formation kinetics and advance the development of clathrate technologies.
Earth’s gravity disrupts the process of muscle maintenance in its major function of supporting body weight. The efficacy of a gravity independent resistance exercise device that produces forces similar to gravity was examined by comparing six men training on the Space Cycle for two weeks with six men using conventional free weights. Subjects performed squats, which consisted of three sets of ten repetitions. The regulation of IGF-1, skeletal muscle Col1A1 and Col3A1 were determined by reverse transcription-Polymerase Chain Reaction, gel electrophoresis, and were then analyzed using ImageQuant Software. Overall, there was a significant increase in IGF-1 mRNA among both the Space Cycle and free weight subjects. Additionally, there was a significant up regulation of Col3A1 in Space Cycle and free weight subjects over the course of 14 days, while there was not a significant increase in Col1A1 in the either the Space Cycle group or free weight group. The Space Cycle and free weight control group produced similar results of Col1A1 and Col3A1. The results demonstrate that there is initial muscle hypertrophy, as indicated by the up regulation of IGF-1 and collagen genes, and that the Space Cycle can produce results that are comparable to squats that are performed under 1 G_0 environment, and thus, may be a potential countermeasure to microgravity.

Parent and Adolescent Emotional Reactivity to Stressors
Judy Szklaer & Lisa Walias
Mentor: Wendy Goldberg

According to the social learning theory perspective, children will likely respond to stress in a similar fashion as their parents. Previous research has focused primarily on young children, however, the goal of this study is to examine the linkages between parents’ and adolescents’ emotional reactivity to widely used stress tasks (i.e., conflict discussion, Trier-social stress task, and an observed conflict task). This study also measured within-individual changes in emotions in response to the different stressors. Data was collected during home visits with a sample drawn from one site of the NICHD Study of Early Child-Care and Youth Development (n = 40 families). To test our hypotheses, we compared both teen and parent ratings of emotional reactivity using the Positive Affect Negative Affect Scale at baseline and post-stress task time periods. We also calculated and correlated difference scores of emotional rating (post-stress task relative to baseline) for moms, dads and teens. As expected, there were significant within-individual changes in emotions in response to the stressors: teens’ ratings of positive emotions decreased following the stress tasks, while negative and self-conscious emotions increased. For parents, both fathers’ and mothers’ ratings of self-conscious emotions increased, whereas only fathers experienced a significant decrease in positive emotions and a trend-level increase in negative emotions. Results also indicated that mother-father and teen-parent emotional reactivity to various stressors were not significantly correlated. These findings do not support social learning theory perspective in terms of the association between parent-adolescent emotional responses to stress.

Understanding CCTV in Everyday Life
Aurora Bedford & Alexander Bretana
Mentor: Gillian Hayes

Closed-circuit television (CCTV) refers to the use of video cameras to transmit a signal to a limited set of monitors, and is one of the most common forms of surveillance used in the United States and internationally. This increasing prevalence of CCTV systems necessitates research focused on perceptions and feelings of these and other large-scale recording technologies in everyday life. The Day Reconstruction Method (DRM) is an interview technique in which participants are asked to recount the 24 hours of their post day as events on a schedule, and are then asked questions relating to each of those events in order to gain an understanding of the range of participants’ feelings in certain situations. In using this technique we were able to see the prevalence of CCTV related to various activities, and also to understand how participants feel about the presence of cameras, what they believe the cameras’ purpose is, and how they would like to be notified that CCTV systems are present. Twenty-one people participated in these interviews. Our results show that people generally base their conclusions regarding the presence of CCTV on a perceived need (or lack thereof) for that location, based on the type of establishment, the level of affluence of the general surrounding area, or, in private areas, based on their trust in people not to use such a system. People generally feel the most comfortable being captured on CCTV cameras if they believe it is for security purposes, although they often feel behaviorally restrained to seem more demure to those who may be watching. Our findings show that in most cases people want to be notified, by signs or by obvious placement of cameras, prior to entering an area using CCTV.

Graduate School Aspirations of Racial and Ethnic Minority (REM) Transfer Students
Vanessa Almanza & Jessica Chan
Mentor: Jeanett Castellanos

Although the student population of racial and ethnic minorities (REM) continues to grow in U.S. colleges, a significant educational disparity among REM representation continues to exist. Examining the educational pipeline, REM representation is most saturated at the two-year colleges, and a minuscule number of these students pursue a baccalaureate and graduate degree. The emphasis of assessing these students’ experiences has primarily focused on
their adjustment. Limited work has examined their educational aspirations and graduate school pursuits. Given the role of education in relation to social status and opportunities, it is essential to explore the factors that influence transfer students to consider a graduate degree. The purpose of this study is to examine REM graduate school aspirations. This study assesses 150 REM undergraduates using the psychosociocultural (PSC) conceptual framework. Specifically, the study investigates how psychological, social, and cultural independent variables affect graduate school aspirations. Surveys (with eleven standardized measures) will be distributed to measure variables such as college university environment, cultural congruity, college self-efficacy, self-esteem, mentorship, social support, academic/social integration, institutional/goal commitment, and college stress. We hypothesize that mentorship will be the strongest predictor of graduate school aspirations, followed by social support, and college university environment. This study will identify factors that impact academic persistence decisions through the measurement of graduate school aspirations. The implications of the study may lead to the implementation of culturally sensitive application processes that could help facilitate REM student enrollment into graduate programs.

Outcomes of the UCIMC Neurodevelopmental and Behavioral Clinic
Anne Bui & Van Nguyen
*Mentor*: Ira Lott

Many people with developmental disabilities are coupled with significant medication and/or behavioral issues. Furthermore, the individuals within this population tend to be eschewed from physicians and other health professionals from the community due to their dysmorphic appearance, limited cognitive abilities, and severe behavioral issues. The data on each individual consists only of the information gathered at the date of the clinic evaluation, and limited knowledge regarding the outcome of each patient exists. To address the issue of polypharmacy, streamlining psychotropic medications, identifying medication compliance rates and patterns, and to improve future evaluations, a follow-up meeting was held with several patients. During the follow-up conferences, primary caretakers were asked about the recommendations as stated in the patients’ final report during the clinic evaluation and the outcome of following those recommendations, as well as the recommendations that were not followed and their reasons for non-compliance. Also, two instruments used during the clinic evaluation, the Stress Survey Inventory and the Aberrant Behavior Checklist, were re-administered to assess the patients’ current conditions. In most cases, the medication regimen had been significantly reduced and streamlined. The problem of using several psychotropic medications and the severity of side effects had been greatly reduced. The reasons for non-compliance vary, but the majority stem from insurance complications or concerns of physicians. For some cases, more time is needed to see actual or significant changes in compliance with clinical recommendations.

The Association Between Maternal Sensitivity and the Development of Behavioral Inhibition in 24-Month Old Children
Ogen Aslanian & Leya Worcester
*Mentor*: Elysia Davis

Behaviorally inhibited children are more reactive to novel or challenging experiences than children who score low in inhibition or fearfulness. The quality of maternal care experienced by a child may have great influences on his/her ability to regulate responses to these novel situations. In our study, we evaluated the association between maternal sensitivity and the development of fearful temperament. Sixty mother-child pairs were evaluated when each child reached 24 months of age. Maternal sensitivity was evaluated using a seven-point scale on a standardized measure called the Three Boxes Procedure. Child behavior was examined using a standardized behavioral assessment of temperament called the LABTAB. Children were observed in five different situations designed to elicit varying amounts of withdrawal behavior. A four-point scale was used to code fear, escape behaviors, vocal distress and freezing behavior. If a significant correlation is found between maternal sensitivity and a child’s affectsive responses to the LABTAB, this would suggest that the quality of care-giving a child experiences can improve his/her ability to manage challenging situations.

The Prospective Role of Bedside Ultrasound in the Emergency Department in Determining Treatment of Uretal Calculi
Bhakti Patel & George Shahin
*Mentors*: John Christian Fox & Shahram Lotfipour

The gold-standard for diagnosing patients who present to the Emergency Department (ED) with renal colic is computed tomography (CT scan). However, CT imaging is a source of radiation that increases the risk of cancer. A possible alternative is ED ultrasound, which reduces radiation and costs. Patients who presented to the ED with renal colic were identified and a 4-minute ultrasound of the bladder was performed to count the number of urine jets on both the right and left sides of the bladder. The relative jet frequency (RJF) was defined as the number of bladder jets on the symptomatic side divided by the total jet frequency. Specifically, a RJF ≤ 35% of the unaffected side was defined as abnormal and obstructed. The ultrasound imaging was then compared to the CT scan to determine the location and size of the kidney stone. Seventeen patients were enrolled, and five were excluded. Using RJF ≤ 35% to detect the presence of ureteral calculi was 87.5% sensitive and 100% specific. Both patients with a ureteral
stone ≥ 10 mm had an RJF of 0%. Analysis also suggests that kidney stones larger than 4 or 5 mm in diameter obstruct the path of urine from the kidney to the bladder and so result in a greatly reduced urine jet frequency on the side with the kidney stone compared to the contralateral asymptomatic side. Therefore, bedside ultrasound may be a useful diagnostic test for the presence of ureteral calculi in the emergency department.

A Comparative Study on Elemental Composition of *Synechococcus* Strains CC9311 and WH8102
Brian Cheung & Melissa Chow
*Mentor:* Adam Martiny

*Synechococcus* cyanobacteria play a major role in regulating carbon fixation in marine ecosystems via photosynthesis. The purpose of this experiment is to investigate how *Synechococcus* adapts to phosphate limitation. Nutrient availability is an important factor in influencing the molar ratio of *Synechococcus*, and growth can potentially be limited by phosphorus availability in oligotrophic oceans. We subjected two different *Synechococcus* strains, WH8102 (open ocean strain) and CC9311 (coastal strain) to phosphate limited environments and analyzed the phosphate uptake as well as the intracellular carbon (C), nitrogen (N), and phosphorus (P). By adjusting the flow rate, we are able to indirectly manipulate the retention time to control growth rate. The adjustment in retention time in effect manipulated the molar ratio. Although both strains were observed to have a higher C:P and N:P ratio compared to Redfield’s ratio (106C:16N:1P) under phosphate-limited conditions, the open ocean strain (WH8102) had a much higher elemental ratio than the coastal strain (CC9311).

Microbial Cheating Constrains Enzyme Producers and Substrate Degradation
Sara Ritchie & Anh-Minh Ta
*Mentor:* Steven Allison

The main goal of this study is to verify whether or not competition from proteolytic deficient cheaters restricts decomposition driven by extracellular enzyme producers, which are proteolytic proficient. We used two bacterial strains in this experiment to test the hypothesis. One strain was the wild-type *Pseudomonas fluorescens* M114, which was able to produce extracellular protease to degrade organic matter when necessary. The other strain is the mutant strain FA15, lacking the ability to produce extracellular protease. We grew them on a complex medium, and it showed that the wild-type growth rate was higher. In addition, we did competition experiments by growing the strains on complex media in a mixed community. The results showed that cheating from other bacteria can constrain protease production during the decomposition process and eventually affect substrate degradation. This finding represents a new understanding of the metabolic relations that occur when complex organic matter is decomposed in a microbial community.

Phonological and Semantic Effects on Verbal Short Terms Memory of Bilinguals
Maritza Leon & Catherine Sun
*Mentor:* Mary Louise Kean

A substantial amount of research has studied the phonological effect of words on verbal short term memory. However, research on the semantic effect of words on verbal short term memory is limited. The effect of phonological processing is thought of as a bottom-up process in which human thought is mediated from outside input, meaning that humans rely on the outside environment for information. In contrast, semantic processing of words in human thought is understood as using a top-down process because humans have to tap into their pre-existing knowledge of a word to derive meaning of that word. The relationship between phonological and semantic processing for human reasoning serves as a crux in understanding the structures of human thought. Bilinguals are thought to possess different organizations of language communication and comprehension. Three noted theories, word association, concept mediation, and intermediate hypotheses, seek to explain the structure of bilingual lexical access and interpretation of words. Bilingual participants will be shown a list of words, followed by a probe word, and were asked whether or not they recognized the probe word in the list. Both semantic and phonological effects on memory will be tested on participants. Responses towards the stimuli will be recorded for accuracy and response time. Participants are expected to show a significant effect when given a phonological or semantic interference in the word list. Bilingual participants are predicted to score lower due to the difference in language processing.

Prospective Evaluation of Ultrasonographic Measurement of the Optic Nerve Sheath Diameter and Invasive Monitoring of Intracranial Pressure
Jason Morris & Sepehr Shojaei
*Mentors:* John Christian Fox & Shahram Lotfipour

Patients who present to the emergency department (ED) with an elevated intracranial pressure (EICP) can quickly sustain serious complications that could require immediate attention. EICP usually occurs acutely from traumatic head injuries or sudden intracranial hemorrhage, both of which are potentially life-threatening conditions. Evaluating the presence of EICP in the ED demands a diagnostic tool that is accurate, fast and safe. Some physical exams such as the papilledema are subjective and delayed, and therefore are not the best tool to use for diagnosis. The most common tool presently used to detect EICP is a cranial computed tomography (CT). Although the CT is available in most hospitals it does have some limitations. The time to
obtain a CT scan can be highly variable. Also, removing a patient from the ED to complete a scan can have adverse affects as the staff and equipment that can save the patient’s life are far away. Therefore, a noninvasive bedside tool to reliably evaluate the presence of EICP can be a great benefit to healthcare providers in many different settings. The objective of our study is to assess the accuracy of emergency ultrasound measurement of optic nerve sheath diameter to identify the presence of elevated intracranial pressure as verified directly by intracranial pressure catheter. We hypothesize that determination of the ONSD by ultrasound is accurate for detection of EICP and that measurement of ONSD in patients with EICP correlated with values obtained by invasive monitoring.

**Genetic Determinants in Patterns of Variability in Moods: A Twin Study**

**Beatriz Bello & Nicole Shoraka**  
**Mentor: Larry Jamner**

Past twin studies have found non-shared environmental influences to be the main explanation for daily mood fluctuations. However, traditionally, patterns of variability in positive and negative moods are measured using retrospective questionnaires that only indicate individuals’ “typical” moods. The purpose of this study is to evaluate the heritability patterns of mood variability among adolescents, using a naturalistic, Ecological Momentary Assessment approach. Teens were prompted by electronic diary to rate their moods approximately every 30 minutes in up to eight four-day sessions over four years, yielding an average of 800 ratings per person. For this study, data on ten related (five twin, five non-twin) and ten unrelated adolescent pairs matched for age, sex, and other sociodemographic factors were obtained for a secondary analysis of heritability of patterns of fluctuations in happiness, well-being, sadness, and stress. Consistent with McConville and Cooper, patterns of variability were computed by calculating the standard deviation in mood ratings each day for every participant, then summing the total deviation across each four-day session. Degree of concordance in variability between twins, non-twins, and unrelated teens was determined by calculating the correlation between pairs’ variability values for each session. Graphs of daily fluctuations in each mood for each person were also developed. Results indicate greater concordance of variability patterns among sibling pairs compared to unrelated pairs. Implications for the influence of heritability of mood variability on health outcomes will be discussed.

**Characterization of a Single-Cell Platform and its Impact on Malaria Detection**

**Tammy Dinh & Peiran Lu**  
**Mentor: William Tang**

The “lab-on-a-chip” microfluidic device is designed to measure biomechanical properties of individual cells in real time as they exert varying forces onto a substrate coated piezoelectric platform. When cells undergo physiological changes, this highly sensitive film bends to different resonant modes while an electrical signal passes through it. This approach is immunologically significant because the mechanical differences of infected cells relative to normally functioning cells allow rapid detection to occur. The purpose of this research is to characterize the microfluidic platform by seeding *plasmodium falciparum* infected avian red blood cells and bovine aortic epithelial cells directly onto the array of micro chambers. During each seeding process, cells were introduced from the loading channel as fresh CO2-independent culture medium supplied the cells through perfusion channels. Avian malaria cells were incubated at 37 ºC and examined periodically over 48 hours. Typical stages of the *p. falciparum* infection cycle were documented, supporting the assertion that infected avian red blood cells develop similar physiological traits as infected human cells and can be used effectively as a model system in future research. Successfully seeding bovine cells onto the device while observing normal cell function establishes an optimal environment for cell culturing in the micro-chamber. Furthermore, preliminary results from monitoring the infected cells indicate the viability of this device for detecting various stages of parasitic activity and introduce a novel technique for Malaria diagnosis.

**Determining the Effects of Body Content and Demographics on Cardiac Function in Drosophila melanogaster**

**Nicholas Juni & Adela Stroescu**  
**Mentor: Michael Rose**

The intent of this study was to determine the possible effects of body fat content and demographics (generation cycles) on cardiac function in *Drosophila melanogaster*. It was hypothesized that if one factor acted as the major determinant, it would be directly observable in our results (i.e. flies with lower body fat content or shorter generation cycles would exhibit lower heart rates and weaker heart function, and vice versa). The experiment was conducted using one replicate each of four genetically differentiated experimental *D. melanogaster* populations and performing semi-intact heart preparations over a seven week span throughout their adult life. Short movies of individual exposed *D. melanogaster* hearts were filmed and used to obtain a number of quantitative measurements indicative of heart activity. External electrical pacing assays were also performed to assay cardiac function by measuring rates of heart failure and subsequent recovery. Our results demonstrated that based on our quantification, there is not enough evidence to directly support either body fat content or demographics as the major acting determinant in heart function with progression of adult age. Rather, heart function over age is influenced by a combination of both factors. Future assays...
will be performed using other replicates of the four experimental populations to better quantify and re-evaluate our hypotheses. These assays will also provide additional insight into the mechanisms of how differences in body fat content and generation cycle directly influence heart function with age.

Expression and Crystallization of actKR Mutants for Structure-Function Analysis
Justin Nowell & Eunahn Suh
Mentor: Sheryl Tsai
Polyketides, a diverse family of compounds that have a wide range of biological activities are pharmaceutically important, acting as antibiotic, anticancer, cholesterol-lowering, and immunosuppressive agents. Therefore, the elucidation of these structure-function relationships in PKSs will ultimately lead to the design of new polyketide drugs and methods to inhibit the synthesis of harmful polyketides. While there are at least three different types of PKS, our project focuses on the actinorhodin ketoreductase enzyme, which belongs to a type II (aromatic) PKS. Through the work of our graduate student advisor, Pouya Javidpour, several actKR mutants have been identified through in vitro assays that affect the stereochemistry of ketoreduction and potential protein-protein interactions. To solve the actKR mutant structures, the plasmids encoding the actKR mutants were transformed, and the protein cultures were purified and expressed. With more than 800 unique conditions from Hampton and Qiagen crystallization screening, the suitable protein crystallization conditions were identified. After several optimization processes, we have obtained and diffracted crystals for the F189W, Y202F, V151L actKR mutants. The diffraction of the protein crystals and structural analysis will provide insight, not only to the molecular basis of polyketide biosynthesis specificity, but also to designing drugs that specifically target PKS complexes that are responsible for the synthesis of carcinogens and toxins.

The Priming Effects of Emotional Intensity on Memory
Alea Baron & Bret Levine
Mentor: Charles Chubb
Declarative memory is a type of long-term conscious recall of information based on specific facts or data. Emotional memory can at times be so prevalent that it can inhibit processing of new memories, both emotional and unemotional. Traumatic events, those in which emotional arousal is at its highest, are described as being remembered precisely and for a long period of time. Studies have shown that emotional arousal proves to lead to better declarative memory in regards to the emotional event. Priming of three emotions (happy, angry and sad), at different levels of intensities, and a neutral story as the control were used to elicit a particular emotion. A second neutral story was presented to see which emotion created inhibition, and at what intensity. The goal of this study is to establish which particular intensity of different emotions causes the most significant memory inhibition surrounding events over time. Our results show interference from the sad story, at the highest rated intensity, had the most significant effect on inhibiting memories surrounding emotional arousal. Results provide insight to how the intensity of different emotions affect how memories are formed after an emotional event occurs.

Technologies for Autism: Visual Schedules
Sen Hirano & Michael Yeganyan
Mentor: Gillian Hayes
Visual schedules typically use symbols (icons, words, pictures, real world objects) to represent a series of activities or the steps of a specific activity. Visual schedules have been successfully used by caregivers to help children with autism to understand, structure, and predict activities in their daily lives. Our research is aimed at supporting the creation and use of visual schedules that accurately represent fluid classroom and home environments both during activities and in reports. We developed vSked, an interactive and collaborative visual scheduling system designed for elementary school classrooms. It includes three different interfaces: a large touchscreen monitor displayed at the front of a classroom, a monitor to give a teacher administrative control, and a handheld device for each student. Teachers and other caregivers distribute scheduled tasks through vSked. By receiving this information through their own handheld devices, each student gets direct assistance and reinforcement for completing tasks. Meanwhile, every activity is logged in the background, enabling automatic report generation. Finally, these schedules are customizable for any curriculum. This summer we will conduct a study of vSked in one special education classroom. During this study, multiple metrics will be used to evaluate the levels of communication and collaboration among students, teachers and caregivers by both quantitative and qualitative means to determine the outcomes of the vSked project. We hypothesize that use of this system will improve student communication in the classroom and empower teachers in facilitating classroom activities and achieving learning goals.

Correlating Adjusted Lip Proportions and Facial Attractiveness
Leann Mainis & Natalie Popenko
Mentor: Brian Wong
Traditionally, facial beauty is defined and quantitatively measured by correlating discrete anthropometric measurements with subjective facial attractiveness scores, identifying parameters that create the “ideal” facial archetype.
This study pioneers a computer-based approach that progressively modifies facial features along a continuum to determine the effects of changing lip proportion on facial attractiveness. The objectives of this study were to develop a series of synthetic facial images with modified lip proportions; determine the ideal lip geometry based on attractiveness ratings; and determine the impact of lip fullness in determining facial attractiveness. Using facial digital software, lip size in ten female images were scaled up and down in discrete increments of 25% from -100% to +100% of the original. All of the modified and original portraits were posted on a Web-based facial attractiveness site for rating until each face was scored by at least 600 unique evaluators. Results indicated that increasing lip size resulted in improved attractiveness scores up to a point. Facial portraits with the highest and lowest attractiveness scores prior to changing the lip proportions, did not vary their attractiveness scores significantly after changing lip size in either direction. We concluded that increasing lip fullness improves perceived attractiveness of attractive faces. However, there is less impact in unattractive faces as other characteristics and facial features may reduce the impact of the increasing lip size.

Modulation of the Inflammatory Response to Brain Death Using Hypertonic Saline in a Porcine Model

Shahriar Irani & Matin Khoshnevis

Mentor: Darren Malinoski

Transplantation has become the standard treatment for many patients with end-stage organ failure. However, there is a national shortage of organs available for transplantation and thousands of patients die each year while waiting for a transplant. This crisis is compounded by the fact that 80% of transplanted organs come from brain-dead donors, whose organs do not function as well as those of living donors, which often necessitates a repeat transplant. Brain death is associated with an inflammatory response that predisposes organs from brain-dead donors to delayed graft function and decreased long-term survival. Hypertonic saline may prove beneficial in brain-dead organ donors. The use of hypertonic saline has not been studied in brain-dead potential organ donors. Its ability to modulate the immune response and decrease dysfunctional inflammation may prove beneficial in potential organ donors. The ability to modulate dysfunctional inflammation after brain death with hypertonic saline will be determined, which has the potential to lead to future interventions in human organ donors. The goal for this phase of the study is to develop a porcine model of brain death and evaluate an intervention with the inflammatory modulator hypertonic saline. Success of this proposal has the potential to increase the number and quality of cadaveric organs available for transplantation through a better understanding of the inflammatory response to brain death.

Improving Oral Hygiene

Wen-Han Chang, Yu Ong & Henry Truong

Mentor: Zuzana Bice

The correct method of tooth-brushing is essential to oral health since the probability of developing cavities, gingivitis, gum disease, periodontal diseases, and other oral diseases with severe consequences depend greatly on personal hygiene. Previous research had shown that preschoolers who were taught using the correct method of tooth-brushing had positive effects on reducing cavities and improving oral health. This concept was incorporated into a public health manual created by members of the Global Dental Brigades for their Honduras project. The manual includes the correct method for brushing teeth and other additional factors that may have significant impact on oral health (i.e. stress level, nutrition, and physical activity). The manual will also be presented to selected villages in Honduras in the summer of 2009 and measurements oral health improvement will be taken in subsequent visits.

ASCE Steel Bridge

Alexander Chung, Vilong Truong & Jun Yeung

Mentor: Ayman Mosallam

The annual ASCE Student Steel Bridge Competition challenges civil engineering students to design, fabricate and construct the most efficient small-scale, modular steel bridge and present it later for judging. The competition calls for students to build the lightest and strongest 20 foot long steel bridge, and to assemble it in the least amount of time. The rules of the competition make the design, fabrication and assembly of the bridge parallel real-world bridge building challenges. To do well, students have to come up with innovative ideas to produce the most efficient bridge possible. Students get to implement classroom knowledge in a hands-on, team project. The competition is organized in two tiers, with several regional competitions feeding the national competition in May. This year’s team will be competing at the Pacific Southwest regional conference against 18 universities from Southern California, Nevada, Arizona, and Hawaii at University of Hawaii of Manoa on April 2–4, 2009.

Concentrating Photovoltaic Solar Cell

Lucas Barker, Ka Kit Chan & Sahil Gandhi

Mentor: Peter Burke

As worries about energy and its impact on geo-politics, resources, and the environment continue to mount, interest in alternative technologies like solar energy continues to grow at a fervent pace. Current solar cell technologies are either too expensive or too inefficient to compete with traditional fossil fuel energy. One way to improve the output power of a solar cell is to ensure that the cell’s surface is always perpendicular to the direction of sunlight. While this does not change the cell’s efficiency, it increases the
output power simply by increasing the input power. Here, we present a sun-tracking mechanism that can increase the output power of a traditional solar cell. This is accomplished through a photoresistor circuit that tracks the position of the sun in the sky and drives a motor to rotate a 20 lb. multicrystalline silicon solar cell. We also show how our concentrating element, a Fresnel lens, can increase the amount of current generated far above what a simple solar cell would normally output. Our results are indicative of a technique that can dramatically increase the cost per unit power ratio for solar technology. This technique will go a long way in improving the viability of solar energy in satisfying the world’s energy demands.

Seasonal Dynamics of Bacteria and Viruses in Coastal Pacific Ocean and their Impact on Harmful Algal Blooms
Ju Ri Kim, Natalie Nguyen & Selina Singh
Mentor: Sunny Jiang
This research seeks to address the relationship between marine bacteria, viruses, and harmful algal blooms (HABs) in the coastal water. HABs caused by eukaryotic algae, such as dinoflagellates (Alexandrium spp.) and diatoms (Pseudonitzschia spp.), significantly impact marine animals, seabirds, and human health in coastal areas. Although several physical aspects relating to HABs have been studied, little is known about the influence of bacteria and viruses on their dynamics. To address this issue, water samples were taken from Newport Pier, Newport Beach, California, three times a week starting October 2008. Samples were filtered onto 0.2 µm pore-sized filters for the autofluorescent, autotrophic bacteria direct count. Total bacteria and viruses were enumerated using an epifluorescence microscope after staining with SYBR Green dye. The results showed that the concentration of bacteria ranged from 10^6 to 10^7 per ml of seawater, while viruses were generally 10 times more. Autotrophic bacteria ranged from 10^4 to 10^5 per ml. The highest concentrations of bacterial and viral counts were found in the month of February at 35.8 million bacteria and 90.1 million viruses per ml. Replicated samples for bacteria and virus direct counts showed greater than 70% correlation, suggesting reproducibility of the data. The correlation between bacteria and viruses is ~0.2. This data will be incorporated into the large study of HABs ecology in coastal Pacific Ocean. The results of this research will contribute to our understanding of the role of bacteria and viruses in HABs.

Investigating and Developing Alternative Power Supplies for Motes
Kevin Chao, Phillip Haralson & Victor Yeh
Mentor: Peter Burke
By evaluating various power sources for motes, we aim to find a clean, environmentally friendly alternative to battery needs. More specifically, we evaluated sources using ambient RF power, piezoelectric materials, solar power and MEMS based modes of power generation. All of these technologies would replace the traditional AA battery mounted on a mote device. In addition to providing a clean, renewable power source for these new sensor networks, these technologies would also have the added benefit of decreasing maintenance costs by generating power from ambient sources in the environment. After researching various novel power sources, we decided to focus our demonstration on solar power; however, each of the technologies is potentially viable with varying amounts of research and development.

Remote Aircraft Cockpit Design
Frederick Adi, Timofey Ovcharenko & Eric Pham
Mentor: Ian Harris
The goal of our project was to design and build a system with a remote airplane cockpit on a computer that would display real-time data from a model RC airplane, requiring us to integrate and develop the airplane control module and the remote control cockpit to produce the final remote cockpit system. This project’s fundamental focus was to understand the design of a two-way radio frequency communication system, which we did by using 434Mhz and 232Mhz receiver-transmitter pairs that were linked up to an ATMEGA168 (Arduino) chip. Our team not only found a way to implement that hardware, but also designed and wrote the software that allowed two-way communication. Additionally, this project tested the best of our knowledge and our skills, but most of all it taught us how to engineer through catastrophic setbacks of not getting the airplane and working through difficult problems. Most importantly, this project allowed us to experience the entire engineering process firsthand. The experiences and skills learned from this project will become a springboard for future engineering projects that we take on.

Variations Between Psychopathic and Non-Psychopathic Incarcerated Juvenile Offenders
Kaycie Craib, Jacqueline Messerschmidt, Amanda Steiner
Mentor: Elizabeth Cauffman
The construct of psychopathy has recently been extended downward to the juvenile population. This has led to a debate regarding the applicability of the construct to predict future violence and recidivism among this age group. This study examined juvenile offenders (N=355) who were either high or low on the Youth Psychopathic Traits Inventory and compared them on their prior and within facility offenses, the seriousness and frequency of their crimes, and their coping strategies. Those with high psychopathy scores engaged in more offending within the facility, yet the severity of their crimes were comparable to that of
Mechanical Performance of All-Metallic Triangular Corrugated Core Sandwich Panels Under In-Plane Compression

James Guo, Howard Ngo & Philbert Teh
Mentor: Lorenzo Valdevit

A combined analytical, numerical and experimental approach for the mechanical characterization and optimization of corrugated-core sandwich panels subjected to axial compressive loads is presented. Aerospace applications demand structures with increasing stiffness and strength-to-weight ratio. This can be achieved by metallic sandwich panels with topologically optimized core structures. Metal panels are used in this work for easier manufacturing because metals are more amenable to forming complex shapes and have more robust mechanical behavior. For the past decade, extensive studies have been conducted on the mechanical performance and optimal design of all-metallic sandwich structures under bending and transverse shear loads. Varieties of core topologies were investigated, such as pyramidal and tetrahedral trusses, honeycombs, and corrugated plates. Conversely, few results on the axial compression behavior have been published. When loaded in axial compression along the corrugation direction, corrugated-core panels can exhibit four failure modes: global yielding of the structure, global buckling of the structure, local face sheet buckling, and local core buckling. Failure maps are derived and depicted the failure regimes. Then, analytical predictions are verified with Finite Elements simulations and validated with compression experiments. The evolution of the post-buckling behavior in the experimental studies is quantitatively captured with the shadow moiré technique and compared with ABAQUS predictions. Good agreement of analytical, numerical and experimental predictions is shown throughout. Minimum-weight design and optimal materials selection considerations are also discussed. Overall, this study results in a fully verified tool for the optimal design of minimum-weight all-metallic corrugated-core compression structures.

2008–2009 ASCE Concrete Canoe

Erin Cabanero, Amber Greer & Andrew Kim
Mentor: Ayman Mosallam

The American Society of Civil Engineers’ (ASCE) Concrete Canoe Competition is an annual event that brings Civil Engineering students from colleges all over the U.S. to design, build, and race a canoe primarily made out of concrete and reinforcements. The competition is intended to advance the field of concrete construction and help students gain experience in managing a complex and competitive engineering project. The ASCE chapter at UC Irvine participates in the Pacific Southwest Regional Conference, which is an annual conference attended by student ASCE branches from all the largest colleges in Southern California, Arizona, Nevada, and Hawaii. This year’s Canoe, titled “Captain Planet,” implemented new ideas and environmental innovations in its canoe design, like using hollow spheres made out of recycled materials as aggregates for our concrete mix. The advanced technology of finite element analysis programs and 3-D solid modeling allowed this year’s team to provide an analysis of reinforcement placement and required concrete mix compressive strengths. The use of complex technology combined with new ideas and materials such as microspheres and water-reducing admixtures have allowed the creation of a canoe that prospective students can build upon for future concrete canoe competitions.

Exercise Game Controller

Victor Choi, Brian Ly, Kevin Song & Po-Wen Yao
Mentor: Mark Bachman

The Video Game Exercise Machine is a project that aims to solve a real-world problem, the large percentage of overweight adults and children in America. Along with not eating right, Americans are not exercising enough. The Video Game Exercise Machine makes exercising interesting and entertaining by providing a unique exercise environment in which the users can play popular video games with their friends. The product has four main parts that our group has researched and made use of: sensors, microcontrollers, user mapping through software, and telemetry. Sensors are mounted on a typical exercise bike to gather relevant data and to provide input. The microcontroller then takes the inputs and maps the signals based on a software user mapping. Finally, the microcontroller sends the mapped signals as outputs to game controllers. This project uses standard circuits, ADCs, and microcontroller technology to translate inputs to game controls. The primary sensors monitor the speed of rotation for pedals, rotation of a specially made handlebar, and presses of various digital buttons. The finished result is a working product that users can use to control the video game.

Physiology as a Predictor of Death in Drosophila melanogaster

Wilson Chyon, Philip Gacias, Christopher Oh & Poonam Varsani
Mentor: Laurence Mueller

In Drosophila melanogaster, a rapid decline in fecundity 6–15 days prior to death has been observed, and this phenomeno-
non has been termed the death spiral. Previous studies have shown that fecundity declines more rapidly in dying female flies compared to similarly aged females that are not dying. The purpose of our experiment was to explore whether other physiological characteristics measured by time in motion and negative geotaxis assays also decline prior to death in both males and females. The time in motion assay measures a fly’s ability to find food and mates, and the negative geotaxis assay correlates with its escape response from possible dangers. The results indicate that there is a death spiral phase for the time in motion but not for negative geotaxis. The death spiral in *Drosophila* can be seen as synonymous with the period of disability prior to death in humans. With additional death spiral research, we can eventually develop a more complete understanding of physiological traits involved, the timing of these events prior to death, and whether these events can be affected by environmental interventions, e.g. diet or mating status.

**Catalyst**
Anita Issagholyan, Erica Jazayeri, Anette Shirinian & Merry Todd  
*Mentor:* Daniel Martinez

Catalyst, a student operated art gallery, was created three years ago through a collaboration of studio art faculty and undergraduates, with the goal of providing a close approximation of real world gallery experience. Students exclusively operate the gallery with faculty support from Daniel Martinez. The advantages and opportunities to undergraduate students via Catalyst have been vast. Additionally, the structure of interactive responsibilities allows all participants to gain a level of understanding in fields such as marketing, fundraising, curating, writing and review of formal proposals, and physical installation of artwork. Catalyst’s operations provide an insight into professional life in the art world, insights that are not otherwise provided in the curriculum. Most importantly, Catalyst encourages more spontaneous and insightful interactions with faculty, graduate students, and other undergraduates. Our presentation will include a slideshow and discussion about the lessons and experiences gained throughout the year.

**Pacing-Induced Heart Failure Rate Between *Drosophila* Populations**
Tyler Kosaka, Hoang Nguyen, Cindy Park & Neda Rashti  
*Mentor:* Michael Rose

As the human heart ages, there is an increasingly higher chance for one to undergo congestive heart failure or to contract a multitude of cardiac related diseases. However, the exact relationships and mechanisms occurring between aging, cardiac function, and stress resistance remain largely unknown. Two different populations of *Drosophila melanogaster* were used to test these relationships, the baseline (B) population and the old (O) population. The O population was selected for postponed reproduction and has evolved to live more than twice as long as the B population. The B population serves as a control to the effects of delayed aging demonstrated by the O population. The method chosen to test cardiac stress resistance was electrical pacing. Cohorts of both populations were tested on a weekly basis until all flies died. Multiple replicate populations were used to eliminate any results due to random genetic mutations. Flies were subjected to electrical pacing; cardiac function was observed immediately after stimulus, and again after a few minutes to observe any signs of cardiac function recovery. The O populations were shown to have higher survival and recovery rates when compared to the B populations at the same ages. This suggests that cardiological stress resistance and heart function both decline with age in *D. melanogaster*, with significant effects on survival to, and reproduction at, later ages.

**Design of a Dynamic Solar Thermal Power Plant**
Chris Basco, Spencer Dahm, Edward Fernandez & Brian Tarroja  
*Mentors:* Fabian Mueller & Scott Samuelsen

Solar thermal electric generation is an emerging renewable energy technology that can potentially address global climate change and energy security cost effectively. The focus of this project is to design a 50 MW solar thermal power plant that uses solar energy, while integrating thermal storage and additional combustion sources to achieve synergy between the supply of solar energy and energy demands. This includes the design of a novel adaptation of a Fresnel style solar collector that directly uses water as the working fluid, and is separated into common heating phases found in other Rankine based HVAC systems: an economizer, boiler, and superheater. Separating the solar collector into these three sections allows for design optimization of each section, accounting for the conditions experienced by each. This results in the possibility of cutting costs, as well as maximizing the outlet temperature, which is necessary in reaching high thermodynamic efficiencies. The design includes a computer model that demonstrates the ability to effectively follow electricity demand with available solar resources by including analyses of the reflector array dynamics to focus irradiation onto the solar absorber; mass and heat transfer analyses for each of the solar absorber phases; the dynamics of integrating the solar collector into a dynamic system that uses thermal storage to minimize the effects of solar intermittencies, and includes additional fuel based combustion sources to use during extended periods of low irradiation. This project also includes the design and construction of a small working model of a Fresnel solar collector to physically demonstrate and test the efficiency of the collector’s ability to boil water.

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**Undergraduate Research: Enhancing the Human Experience**
Companies have been increasingly affected by diabetes and other chronic diseases due to rising rates of obesity, higher incidence of disease among minority groups, and physical inactivity. Currently, monitoring diabetes consists of multiple daily blood glucose tests and an HbA1c test every 3–6 months. This may not work for many type II diabetics. In recent years a new paradigm for diabetes monitoring and care, based on monthly counseling with a care provider, has shown success in improving health and lowering costs.

The American Diabetes Association’s *Winning at Work: Detecting, Preventing, and Managing Diabetes for a Healthy Workplace*, a corporate wellness program implemented at the Santa Ana Doubletree Hotel, entails monthly health assessments along with monthly diabetes education classes. These activities take place during regular work hours, primarily during lunch. The goal of this program is to see a significant decrease in glucose and other clinical indicators in type II diabetics, while empowering patients to have stronger control over their chronic disease. A group of 40 hotel employees joined *Winning at Work* and were followed over a 5-month period. Participants partook in monthly diabetes education classes and had necessary data collected in order to monitor certain clinical indicators, including blood glucose levels, Alc, cholesterol, weight, body mass index (BMI), body fat percentage, blood pressure, and pulse. Data was collected through onsite point of care tests and was sent to clinical laboratories. Education entailed proper diabetes management and learning self-management skills using American Diabetes Association guidelines and material.

**Physiology of Aging and Late Life in Drosophila Melanogaster**

Keila Benjamin, Ana Garcia, Heena Kapoor & Rebecca Post

*Mentor*: Michael Rose

Before the 1990s, it was widely believed that mortality rates exponentially increased with age until death. However, in several species such as fruit flies, wasps, and medflies, new evidence has shown that mortality rates plateau in a later stage of adulthood known as late life, following a period of physiological deterioration known as aging. Aging and late life have been divided into two distinct phases at an age known as breakday, which evolves according to generation cycles. Previous experiments have shown that there are distinct physiological changes between aging and late life. This project, addressed the question of whether changes in physiological characteristics between aging and late life evolve according to the generation length and lifespan of a population. Two populations of *Drosophila* with an 18-day difference in their last ages of reproduction were used in this study. The populations were evaluated for four physiological characteristics: time in motion, negative geotaxis, starvation resistance, and desiccation resistance. We predicted that the shorter lived population will show an earlier change in physiology between the aging and late life phases. So far, our data seem to support this hypothesis.

**Air Powered Bicycle**

Derek Changsrivong, Thomas Dam, Thai Dinh & Kevin Vu

*Mentor*: James Bobrow

The expanding global economy and environmental awareness created a demand for new sources of clean, sustainable energy. There are currently several different alternative energy sources in study, but compressed air power—which has some key advantages over other sources, such as zero emission operation and ease of manufacture—has generally received less attention. To showcase this alternative energy, we built a compressed air powered bicycle as a practical test platform that allowed us to evaluate overall performance of the bicycle, analyze practicality of the system, and suggest improvements to increase performance and draw conclusions on viability of the system. We found that the commercially available air motors we used are highly inefficient due to their low operating pressures. This is the major element in the system that delivered less than desirable performance. Efficiency could be improved by designing a new air motor that operates on higher pressures and is more specific to this application. Through further research and development, air power may become more efficient and prove to be a viable alternative energy.

**How Can You Change the World?**

Ashley Belmontez, Thomas Nizami, William Overvold, Maria Rubio & Carlos Silva

*Mentors*: Jeannie Liu & Teresa Thompson

The main objective of this project was to research Aerovironment (AV), which is creating technology to help businesses and governments recognize and meet their environmental and energy objectives. The company has advanced into making large, breakthrough commercial ventures. They make products such as Unmanned Aircraft Systems (UAV), Electric vehicle charging systems (EV), and clean power systems. We visited the company at its Monrovia, CA office, which gave us a better understanding of how the company works and manages its products. As a requirement, we had to compare and contrast our knowledge in accounting to what accounting methods and procedures the company follows, based on its manufacturing
processes. We were given an opportunity to tour their research and development plant to see how the products are designed and used. We had to determine if their processes seemed logical and efficient. We had to decide, as a group, if the facility that engineered their products operated in a way we envisioned or expected. AV has established new standards for other companies to meet, and is changing the world by making products for the government, third world countries, and businesses that will help people save energy and the environment, and, most importantly, save lives.

Materials Selection and Analysis of a Solar Absorber Pipe
Chris Basco, Spencer Dahm, Edward Fernandez, Kong Sham & Nonafaye Williams
Mentor: Daniel Mumm

Over the past decade, solar thermal power generation has become an attractive alternative to the use of fossil fuels. With an array of mirrors focusing high intensities of light onto a pipe containing water, the material properties of the solar absorber pipe place significant restrictions on the pressures and temperatures at which the system can operate, ultimately limiting the system’s solar-electric efficiency. This project is meant to compliment the design of a novel adaptation of a Fresnel style solar collector that separates the heating phases of boiling water into an economizer, boiler, and superheating sections. An optimal material can then be selected for each phase to optimize cost. This research tests aluminum 6061-T6 as a possible material for the relatively low temperature economizer section by simulating a year of use—365 cycles of thermal and mechanical load (varying internal pressure) fluctuating over the course of a week. The desired operating temperature and pressure of this portion of the collector are approximately 275 °C and 1000 psi, respectively, and samples were tested over a matrix of temperatures and pressures around these desired conditions. Of these tested samples, evidence of the effects of creep were investigated by measuring the initial and final lengths and diameters of the samples, effects of thermal and mechanical fatigue on the material strength were tested using tensile tests, and microscopy was conducted to look for signs of microstructure changes and signs of failure.

PEM Fuel Cell Design and Research
Frank Jimenez, Daniel Kusnohardjo, Shane McClintock, Daniel Ulloa & Guilherme Porto Vasconcellos
Mentor: Yun Wang

Polymer electrolyte membrane (PEM) fuel cells are a promising alternative energy source that can be used in a variety of applications such as automobiles and small portable devices. With the onset of climate change and damages to the environment due to the harmful byproducts of modern fossil fuels, the research and design of PEM fuel cells thus becomes a necessary field in need of study. PEM fuel cells use the electrochemical reaction of hydrogen and oxygen fuel to produce electricity that can be harnessed to power small portable applications. The major advantage of PEM fuel cells is that they produce power with no byproducts adverse to the environment. This investigation aims to design and fabricate a functioning PEM fuel cell. The primary design considerations were twofold: the Membrane Electrode Assembly (MEA) and bipolar flow plates. The fuel cell in question consists of a 3.2 x 3.2 cm active area, five layered MEA, and aluminum flow plates with a serpentine flow field design. As the cost of PEM fuel cells is often a design limitation, the final size of the MEA was considered the most cost effective. Once the size of the MEA was chosen, SolidWorks was used to design the flow plates, which were then fabricated using Computer Numerical Controlled (CNC) machining. The final assembly of the fuel cell consists of the MEA inserted between the flow plates. The final phase of the investigation includes a performance evaluation, from which the power output of the fuel cell will be determined and assessed.

UCI Wind Energy Project
Noah Henderson, Roger Kwan, Brent Lee, Derek Lee & Francis Raymundo
Mentor: Yun Wang

In this UCI Wind Energy Project, we designed and fabricated a small-scale wind energy turbine and investigated its performance as well as associated costs to compare with other energy sources. A majority of the project work was based on design and fabrication. We are in the final process of fabrication and have built all the components, including the gearbox, tower, and blades. All designs were conducted through Solidworks. We had access to the tools available in the MAE Department and Dr. Wang’s lab to machine the components according to the design. The dimension of the parts, including the blades (radius ~1 m), holder (adjustable height of 1-3 m) and gears (1:100 ratio accomplished by three sub-gear systems in cascade configuration) is designed to meet our target power requirement (~100 W), given the Irvine wind condition (~10 mile/hr). The fabrication cost is just under $1,000. The wind turbine is expected to be able to function within two weeks, and we will be able to measure its performance and efficiency. For future work, the next year’s cycle will be dedicated to further improvement of the wind turbine efficiency through better engineering design.
Evaluation of the Effectiveness of the Visual Rehabilitation in Subjects with Homonymous Hemianopia

Angeline Albiar, Mindy Chen, Kathleen Dang, Demi Tran & Hung Truong

*Mentor: Edward Wong*

Homonymous hemianopia may be due to a cerebrovascular accident (CVA) in the geniculo-calcarine tract that may result in loss of vision in both eyes on the side opposite to the lesion. There have been several proposed treatments for the condition. One treatment involving the computerized Luebeck software has been suggested to partially restore the visual field. In our study, we examined the effectiveness of this computerized visual treatment on a female subject with left homonymous hemianopia. The subject was given a series of tests before and after visual rehabilitation to assess the changes in her visual field. These tests included the Amsler grid, Goldmann perimetry, central threshold tests (30-2 and 10-2) and eye movement studies. In the eye movement study, the Eye-Link eyetracker system was used to determine saccadic eye movements during reading-based and peripheral stimulus-based tasks. After 50 trials of the therapy done at the subject’s home, results from the Amsler grid and central threshold tests revealed a slight increase in the visual field of the left eye in both the vertical and horizontal meridians. To further access the effectiveness of the Luebeck software in restoring vision, more patients undergoing longer treatment durations will be required.

An Extended Dry Eye Animal Model

Angeline Albiar, Mindy Chen, Kathleen Dang, Matthew Ficinski, Demi Tran & Hung Truong

*Mentor: Edward Wong*

Keratoconjunctivitis Sicca, commonly known as dry eye, is an autoimmune disease of the conjunctiva due to decreased tear production resulting in irritation of the cornea. A prolonged animal model for dry eye is necessary to study the chronic effects of the disease. A rat model for dry eye was developed via trigeminal denervation. A radiofrequency probe was inserted ventrally to thermally ablate the V1-V2 junction using stereotaxic surgery. Corneal sensation was tested and tear production was measured in each eye prior to surgery and on days 10, 15, and 20 after surgery. The experimental eye showed significantly less tear production compared with the control eye. Prior to operation, baseline tear production in both eyes was similar (6.3 ± 1.4 mm vs 6.6 ± 1.2 mm, p=.42). However, tear production in the treated left eye was 29% less than the control eye on the tenth postoperative day, 60% on the fifteenth postoperative day, and 36% on the twentieth postoperative day. Postoperative day 10 showed tear production in the treated left eye decreased by 25% prior to operation, by 51% on day 15, and 25% on day 20. Control eye tear production levels did not show any significant difference compared to preoperative production levels. Significant decrease in tear production in the treated eye compared to the control eye (p<0.01) was supported by a sign comparison signed test. In conclusion, our animal model is reliable in displaying the physical signs of dry eye for an extended period of 20 days.

Chainless Challenge

Anthony Brock, Joshua Cohen, Jason Cunanan, Scott Godfrey, Kevin Gubitz & Branden Tarkeshian

*Mentor: James Bobrow*

The purpose of the chainless challenge is to design and build a bicycle that does not have a direct connection between the pedals and the rear wheel. Instead of a chain we are using hydraulic power. This means that instead of turning a chain when pedaling, the rider pumps a piston that sends oil from a reservoir to a motor attached to the rear wheel, causing it to rotate. The oil is then returned to the reservoir for future use. While this is less efficient than using a chain, the use of hydraulic power for the bike allows the bike to use regenerative braking that can help the bike start moving again after it stops. If the hydraulic bike can come close to the efficiencies of a chain bike and it uses regenerative braking, then it may prove a better bicycle for long distance commuter transportation.

What Is Public Health?: A Study on Public Health Literacy and Intervention

Simon Contreras, Tahereh Jaafari, Andrew Johnson, Elyssa Margallo, Anne Nguyen, Vena Sobhawongse & Leya Worcester

*Mentors: Scott Bartell, Zuzana Bic & David Timberlake*

Public health focuses on preventing adverse health effects within populations, rather than in individual patients. The Association of Schools of Public Health (ASPH) cites the need for a diverse public health workforce to mirror the unique needs of several under-represented and/or ethnic minority groups. As such, we designed an “intervention” that could potentially ensure the recruitment of a competent, skilled and diverse workforce. This multi-investigator project targets high school students from a disadvantaged, minority population in Santa Ana, California. The purpose of this study is to increase the students’ knowledge of public health and level of interest in the field. Fifty students from Saddleback High School participated in a nine-week program in which researchers/mentors went to the Santa Ana School District site to discuss and implement activities, covering topics in public health, including but not limited to: environmental health, safety, and nutrition. To assess the effectiveness of the intervention, surveys were issued to the students at the beginning and at end the nine weeks. Each survey uses a Likert scale ranging from 1–5 (“Strongly disagree” to “strongly agree”) where the student can express their level of agreement to a statement con-
cencing their understanding and interest in public health. Since this is an ongoing project, we expect a statistically significant increase in students’ knowledge and interest in public health, whether on a personal or career level. Statistical methods will be employed to compare the results.

**UC Irvine AIAA Design/Build/Fly**

Kristy Bishop, Chad Maynard, Howard Ngo, Calvin Nguyen, Gia Nguyen, Vincent Phong, Rhett Roback, Kamil Samaan, Dennis Tam, Philibert The, Giuseppe Venneri & Nora Wang

*Mentor:* Robert Liebeck

The Design/Build/Fly competition is an international contest to design, fabricate and demonstrate the flight characteristics of a remote controlled airplane to meet strict mission goals. It is a team project that requires knowledge of diverse engineering disciplines and prepares students for jobs in industry. These missions include carrying payloads through a specified flight path. The payloads include four Model Rocket wing stores (1.5 lbs) and a Fuel Tank center-line store (9 lbs full of water). The goal is to create a balanced design possessing good demonstrated flight handling qualities and practical and affordable manufacturing requirements, all while providing a high level of flight performance. This aircraft then competes against those of other institutions, and is rated according to a given score formula. To achieve the best score, the plane needs to focus on a lightweight design and creative/fast loading team that can accomplish the required tasks. A written design report score also affects the overall competition score. The purpose of the project is not only to design the aircraft effectively, but also to provide students with a chance to apply their academic knowledge towards practical applications in a competitive environment.

**UCI/UCSB Dance Exchange**

Rachel Berman, Julian DeGuzman, Steven Diaz, Emiko Gattineau, William Johnston, Alyssa Junios, Shannon Kurashige, Julie Minai, Marissa Osato, Jenna Otter, Amanda Prince-Lubawy, Jessica Rabanzo-Flores, Kari Richardson, Kaityln Shipley, Randall Smith, Ching Ching Wong

*Mentor:* Donald McKayle

The goal of the Dance Exchange is to foster and promote creative, artistic and academic dialogue between emerging and imminent university dancers. In its fifth year, the Dance Exchange will reunite the UCI Etude Ensemble with the UCSB Dance Company for another exciting collaboration in dance. The two-day format (Spring 2009) of the Dance Exchange will allow each company to experience the educational and artistic environment of the other. The Etude Ensemble will host the UCSB dancers during their day-long visit to our campus. Both companies will be able to share a deepening of their craft, both artistically and academically; highlights of the program include technique classes, an evening performance showcasing both companies’ unique repertoires and an open question and answer session for the audience with directors and dancers from both companies. The performance will feature a collaborative work by Professor Donald McKayle and MFA graduate student Caleb Mitchell, titled *Sanctuary* (2009), as well as new works by undergraduate choreographers within the Ensemble. The Etude Ensemble will have an opportunity to experience company life by traveling to UCSB to complete the second leg of the exchange. The Dance Exchange, ultimately, will allow both students and educators a larger perspective on the validity of dance as a worthwhile academic pursuit in a university setting.

**UCI Satellite**

Steven Chung, Filip Dziwulski, Guilherme Fernandes, Lawrence Floresca, Brian Glaser, Kyle Hosford, James Hu, Shibo Hui, Chong Lao, Derek Lee, Yingbin Luo, Richard Mai, Amir Menhaji, Maria Petrosyan, Jerry Poon, Geetika Potdar, David Sasaki, Sheena Shokoohi, Anahita Sidhwa, Hung Jen Tsai, Timothy Van Name & Robert Woo

*Mentor:* Benjamin Villac

UCI Satellite (UCISAT) is the university’s first student engineering team to design, build and launch a small spacecraft (or “CubeSat”) into Low Earth Orbit. A CubeSat must have 10 x 10 x 10 cm cubic dimensions and weigh no more than one kilogram. These physical requirements present significant challenges to the design of a complex spacecraft, including component size and weight constraints, reduced power storage and output, and limitations on attitude correction capabilities. In addition, effects of the space environment, ionosphere, orbital speed, and attitude on the spacecraft’s components and overall mission must also be addressed. After several years of development, the team has created a design that meets these challenges, and is in the process of manufacturing and testing the final spacecraft. The next crucial steps for UCISAT-1 will be the integration of the subsystems into the final structure, assessing the survivability and level of outgassing in a high-vacuum environment, and rigorously testing the autonomous operating system on the spacecraft’s flight computer. This presentation will provide an overview of the mission and research, the ongoing status of each subsystem’s innovative designs, and discussion of the requirements and challenges ahead in securing a launch.