August 13, 2010

Dear STEM Summer Bridge Participants, Faculty Mentors, and Guests:

Engaging the rich and diverse community college student body in faculty-mentored scientific research will further propel their successful transition to a four-year institution and further enrich the workforce in STEM (science, technology engineering and mathematics) fields. With this in mind, the STEM Summer Bridge Program has provided a unique eight-week summer research opportunity for students from Cypress College and Mt. San Antonio College to become fully immersed in cutting-edge STEM research at the University of California, Irvine (UCI).

These 18 program participants had the opportunity to choose from a variety of challenging and original research projects. Under the personal guidance of a UCI mentor, students have gained first-hand experience and training in state-of-the-art research facilities. Seminars and research-related activities have provided opportunities to build knowledge about STEM applications. Such knowledge and skills are necessary for their continued success.

The STEM Summer Bridge Program is a collaborative effort between the community colleges and the UCI Undergraduate Research Opportunities Program (UROP), in the Division of Undergraduate Education. UROP is committed to supporting faculty-mentored undergraduate research and creative activities in all disciplines. UROP’s programs include advising students through the pursuit of on- and off-campus research opportunities, providing funding for project-related expenses, sponsoring the annual UCI Undergraduate Research Symposium, and publishing The UCI Undergraduate Research Journal. UROP also collaborates with various schools and research units to develop specialized research opportunities. Over the last several years, these collaborations have resulted in the IM-SURE (Integrated Micro/Nano Summer Undergraduate Research Experience) program, Inter-Disciplinary Summer Undergraduate Research Experience (ID-SURE), Summer Undergraduate Research Fellowship in Information Technology (SURF-IT), Chemistry Undergraduate Research Fellowship (Chem-SURF), and the Biophotonics Summer Undergraduate Research Program (B-SURP).

Thank you for participating and for showing your support for the STEM Summer Bridge Program participants presenting here today. A special note of appreciation also goes out to the faculty mentors who have devoted much time and effort mentoring these students. We look forward to following up with the continued achievement of these outstanding individuals, and hope that you leave today’s program with a renewed sense of wonder and excitement.

Sincerely,

Said M. Shokair
Director, Undergraduate Research Opportunities Program
Friday, August 13, 2010

Calit2 Auditorium

8:00 a.m. – 8:50 a.m.   Continental Breakfast

9:00 a.m. – 9:15 a.m.   Welcome

9:20 a.m. – 11:00 a.m.  Presentations

11:00 a.m. – 11:20 a.m. Break

11:20 a.m. – 12:20 p.m. Presentations

12:20 p.m. – 1:20 p.m.  Lunch

1:20 p.m. – 2:40 p.m.   Presentations

2:40 p.m. – 3:00 p.m.   Break

3:00 p.m. – 4:20 p.m.   Presentations
## Schedule of Presentations

Each presentation is allotted 15 minutes followed by a 3-minute question and answer period.

**Friday, August 13, 2010**

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<tr>
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<th>Project Title</th>
<th>Faculty Mentor(s)</th>
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<tr>
<td>9:20</td>
<td>Jemmy Poon</td>
<td>In Search of Reproductive Isolation in Laboratory Populations of <em>Drosophila melanogaster</em></td>
<td>Michael Rose (Ecology &amp; Evolutionary Biology)</td>
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<tr>
<td>9:40</td>
<td>Kenneth Kim, Priyanka Patel</td>
<td>Dpp Regulation of Pro-Apoptotic Genes <em>bid</em>, <em>grim</em>, and <em>reaper</em> in <em>Drosophila</em></td>
<td>Kavita Arora (Developmental &amp; Cell Biology)</td>
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<tr>
<td>10:00</td>
<td>Nicole El-Ali</td>
<td>Identification of TGF-β Target Genes in <em>Drosophila</em></td>
<td>Kavita Arora (Developmental &amp; Cell Biology)</td>
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<td>10:40</td>
<td>Prit Desai</td>
<td>Transplantation of hESC-MNPs Improves Muscle Atrophy in SMA Mice</td>
<td>Hans Keirstead (Anatomy &amp; Neurobiology)</td>
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<td>11:00</td>
<td>20-Minute Break</td>
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<td>11:20</td>
<td>Trang Tran</td>
<td>The Effect of Secondary and Tertiary Phases on the Microstructure and Optical Properties of Multiphase Ceramics</td>
<td>Martha Mecartney (Chemical Engineering &amp; Materials Science)</td>
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<td>11:40</td>
<td>Jeong Won Yoon</td>
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<td>Frank LaFerla (Neurobiology &amp; Behavior)</td>
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<td>12:00</td>
<td>Yohannes Assefa</td>
<td>Deafness and Cochlear Implants</td>
<td>Fan Gang Zeng (Otolaryngology)</td>
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<td>12:20</td>
<td>One-Hour Lunch</td>
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<td>Mahtab Jafari, Pharmaceutical Sciences</td>
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<td>1:40</td>
<td>Nabeel Qureshi</td>
<td>Role of the Parabrachial Nucleus in the Pons in Regulation of Cardiac Sympathoexcitatory Reflexes Evoked by Bradykinin</td>
<td>John Longhurst, Medicine</td>
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<td>Michael Dennin, Physics &amp; Astronomy</td>
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<td>Gillian Hayes, Informatics</td>
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<td>Kevin Chen</td>
<td>Design of a Custom Traverse System for Special Wind Tunnel Measurement</td>
<td>John LaRue, Mechanical &amp; Aerospace Engineering</td>
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<td>Masih Tukhi</td>
<td>Practical Measurement Techniques for an Entrained Flow Reactor</td>
<td>Derek Dunn-Rankin, Mechanical &amp; Aerospace Engineering</td>
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<td>Jorge A. Medina</td>
<td>Catalytically Active Gold Nanoparticles: Variations in Electronic Structure with Size</td>
<td>Regina Ragan, Chemical Engineering &amp; Material Science</td>
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Yohannes Assefa

Major: Biology
Community College: Cypress College
Attending Fall 2010: California State University, Fullerton

Project Title: Deafness and Cochlear Implants
Faculty Mentor: Fan Gang Zeng

Abstract:
A cochlear implant (CI) is a surgically implanted electronic device that creates the sensation of sound by stimulating the auditory nerve within the cochlea. Children and adults who are deaf or hearing impaired are now being fitted for cochlear implants. With recent advances in CI technology, many are now considering a second CI in their other ear. While many psychoacoustic experiments have involved normal hearing subjects with two normal hearing ears, more research must be done to study and compare those with CIs in both ears. One of these psychoacoustic experiments tests “Auditory Masking,” which occurs when the perception of one sound is affected by the presence of another sound. The goal of this research project is to compare the result between a normal hearing subject and a subject with two CIs. First, the normal hearing subject was tested using a computer-based program that played different sounds through each side of a pair of headphones. The subject had to identify one sound while another sound was presented in the other ear. The same experiment was done with the CI subject and the results were compared. The results of the subject with two CIs differed from the results from people with two normal hearing ears. The interpretation from the result is that the CIs cannot perfectly simulate or reproduce the sounds of normal hearing. Much more research is needed to improve CI technology so it can more accurately simulate the sounds of normal hearing.
Yuja Chang

Major: Computer Science
Community College: Mt. San Antonio College
Attending Fall 2010: University of California, San Diego

Project Title: FitBaby: A Mobile Device for Supporting the Care of Premature Infants at Home
Faculty Mentor: Gillian Hayes
Abstract:
Studies have shown that diagnosing health issues early can lead to better long-term outcomes, especially, in our population, premature infants. However, it can be hard to detect these problems after the infants go home because parents can have trouble understanding and recognizing them in terms of both identifying problems and introducing false positives. Non-professional caregivers such as parents may provide unclear information to clinicians, which makes it difficult for the health providers to give treatments. FitBaby is a smartphone application that allows caregivers to provide accurate daily information about high-risk premature and low-birth-weight infants. The data is stored in the Microsoft HealthVault server providing access to clinicians. FitBaby is designed to provide caregivers data at a distance, allowing clinicians to support care of these infants. Based on focus groups and interviews with families, providers and other experts, FitBaby has been designed to record data about five issues: weight, diapering, caregiver stress, appointments, and communication between parents and their infants. Some of the categories are collected once a week and others are collected multiple times a day. The survey only contains simple questions that ensure the caregivers’ understanding of the information. This mobile phone system easily allows clinicians and caregivers to monitor infant status, leading to improved feelings of self-efficacy by the parents and improved health outcomes for the infant.

Kevin Chen

Major: Mechanical Engineering
Community College: Mt. San Antonio College
Attending Fall 2020: University of California, Berkeley

Project Title: Design of a Custom Traverse System for Special Wind Tunnel Measurement
Faculty Mentor: John LaRue
Abstract:
The problem investigated is to design and fabricate a test fixture, also known as traverse system, which can be used to determine the length scale of a turbulent structure in the thermal wake region where mixing of passive scalar is taking place. This study simulates the mixing of gaseous fuel and air in a simple gas turbine pre-mixer. The gaseous fuel is treated as a passive scalar. The purpose is to study the effects of varying the size of the large-scale structures, the scalar injector size, and the separation between injectors on the mixing of the passive scalar in a turbulent flow. The goal is to come up with a design for a fixture to hold three cold wire sensors that can vary their position vertically and horizontally and to be able to measure their distance from each other. The design should be optimized to minimize production cost and time by using as many ready-made parts as possible. All design work was done using computer-aided design (CAD) to facilitate the optimization process and production of final drawings for machining. The design uses two ready-made digital calipers with computer readout capability to provide mechanical attachment and distance measurement of the two moving sensors. Two miniature geared motors provide linear motion through an ACME lead screw and matching nuts.
**Prit Desai**

**Major:** Biochemistry  
**Community College:** Cypress College

**Project Title:** Transplantation of hESC-MNPs Improves Muscle Atrophy in SMA Mice  
**Faculty Mentor:** Hans Keirstead

**Abstract:**  
Spinal Muscular Atrophy (SMA) is an autosomal recessive neuromuscular disorder, affecting one in every 6,000 live births. SMA causes selective motor neuron degeneration within the spinal cord and progressive muscle weakness throughout the body, resulting in paralysis and eventually premature death. It is caused by a deletion or mutation in the gene SMN1, which results in an insufficient production of SMN protein. This protein is known to have a very important role in assembling complexes used in pre-mRNA splicing and transcription. No clinical therapies for SMA exist today. Human embryonic stem cell (hESC) transplantation has been very promising in research to develop therapeutic strategies for neurodegenerative diseases such as SMA. These hESCs have the potential to differentiate and regenerate; therefore, they provide an unlimited source of specific cell types that can be used for cellular replacement therapies. In our research, following intraspinal transplantation of hESC-derived motor neuron progenitors (hESC-MNPs) into a mouse model of SMA, we found significance in improving muscle atrophy, weight and righting ability. Our results suggest probable therapeutic value of hESC-MNPs in improving SMA involved in humans.

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**Nicole El-Ali**

**Major:** Biology  
**Community College:** Cypress College

**Project Title:** Identification of TGF-β Target Genes in Drosophila  
**Faculty Mentor:** Kavita Arora

**Abstract:**  
The Transforming Growth Factor beta (TGF-β) signaling pathway plays an important role in both vertebrate and invertebrate development. Disruption of this pathway can lead to many effects in an organism. The function of the *Drosophila* TGF-β ligand Myoglianin is unknown. We observed the growth of *Drosophila* strains that are mutant for the *myoglianin* gene and determined the lethality at all stages from embryo to adult. Four crosses were set up, three *myoglianin* mutant strains and one control, and followed daily. Embryos from each cross were collected and once first instar larvae hatched, homozygous mutant animals were selected based on markers. These animals were transferred daily until they pupated. We observed that *myoglianin* mutants did not eclose to adults, leading to the conclusion that these animals were lethal at the pupal stage. We observed a number of morphological defects in these pharate animals, such as crooked legs and asymmetric pupal case that are also seen in animals lacking ecdysone signaling. Previous studies have shown that TGF-β signaling can control neuronal remodeling by regulating ecdysone receptor expression. The hormone ecdysone plays a crucial role during metamorphosis, and disruption of signaling leads to morphological defects. Our study indicates that Myoglianin is required during metamorphosis and that it may play a role in regulating ecdysone signaling.
Malisa Macarthur

Major: Biology
Community College: Cypress College

Project Title: Quantification of Remyelination in a Spinal Cord Injured Rat: A Comparison of Three Techniques

Faculty Mentor: Hans Keirstead

Abstract:
There are approximately 11,000 new cases of spinal cord injuries (SCI) a year in the United States. There is currently no treatment, yet current research is targeted at replacing the myelin that is lost after the injury. This makes it important to find an efficient way of quantifying remyelination, as well as other pathological hallmarks, such as demyelination and Schwann cells remyelination in SCI models. There are three known methods for quantifying the hallmarks listed above within the fields. These include the Blight line sampling technique, a modified systematic random sampling method (SRS), and complete quantification. The Blight technique determines total counts by averaging the counts from a 15 x 14 μm box placed in one representative area along the central canal and multiplying it by the total area of pathology. The SRS method also multiplies average counts by the total area of pathology, but it uses the average counts from three different 97.8 x 73.3 μm grids placed systematically along the central canal line. Complete quantification involves the tedious and time consuming method of piecing together and counting pictures from the entire area of pathology. We will be determining which of these methods is the most reproducible and efficient way these various pathological features. To date, there is no standard way of quantifying these parameters and only a few labs in the world have the ability to do so. This study will not only identify the best method for quantification but it will also teach others how to quantify remyelination.

Jorge A. Medina

Major: Chemistry
Community College: Cypress College

Project Title: Catalytically Active Gold Nanoparticles: Variations in Electronic Structure with Size

Faculty Mentor: Regina Ragan

Abstract:
The importance of size effects in the catalytic activity of oxide-supported gold nanoparticles is well documented, but the physical mechanisms behind it are still not well understood. A plan is presented for a study that will attempt to establish a link between the known catalytic activity of TiO₂–supported gold nanoparticles, variations in their size and variations in their electronic structure by imaging them using a combination atomic force and Kelvin probe force microscope (AFM/KPFM). Some of the data analysis methods that will be used in this study are demonstrated using a silicon quantum dot sample, which experiences similar size effects.
Project Title: *Rhodiola Rosea* and Carbohydrate Metabolism in *Drosophila melanogaster*

Faculty Mentor: Mahtab Jafari

Abstract:

The root extract of *Rhodiola rosea* has been reported to have numerous health benefits in humans and animals, and has been recently shown to extend the lifespan of the fruit fly *Drosophila melanogaster*. It has also been found to protect flies and human cultured cells against oxidative stress and to decrease the levels of reactive oxygen species (ROS) from isolated fly mitochondria. However, its precise molecular mechanism is currently unknown. Previous findings have suggested an improved energy metabolism, without an apparent effect on mitochondrial respiration, suggesting that the extract may function by modulating carbohydrate metabolism leading to a decreased production of mitochondrial ROS. To address this possibility, the effect of the extract was investigated in three important carbohydrate metabolizing enzymes: glucose-6-phosphate dehydrogenase (G6PD), the first enzyme in the pentose phosphate pathway, and hexokinase (HK) and pyruvate kinase (PK), the first and last enzymes, respectively, in glycolysis. *Rhodiola rosea* extract was found to elevate G6PD and HK activities, and decrease PK activity, in females, but had no effect on the activities of these enzymes in male flies. The finding that *R. rosea* extract extended the lifespan of males without affecting the activities of these enzymes in males argues that the extract does not function by modulating carbohydrate metabolism. Alternatively, the extract may extend lifespan by different mechanisms in males than in females, and the altered activities of these enzymes may be important in females.
Sheryll Nery

Major: Physics
Community College: Cypress College
Attending Fall 2010: University of California, Los Angeles

Project Title: Studying Liquids Through the Physics of 2-D Foams
Faculty Mentor: Michael Dennin

Abstract:
New studies on the physical nature of foams have risen in the past decade. Our specific area of study focuses on the dynamics of the pinch-off process in foams under tension. Initial experiments show that the minimum width ($r_{\text{min}}$) across the bubble raft—bubbles floating on the surface of a solution—decreasing as a function of time approaching pinch-off ($\tau$) follows a power law, but thorough, systematic studies are required. Pinch-off is the process during which the system narrows, or forms a neck, in a contained region until the system breaks in two. In our experiments, we use a control solution with a concentration of 15% glycerol, which we pour into a trough with suspended poly-carbon plates. A motor attached to the plates allows us to control the plates as they are pulled apart, also pulling the bubble raft between them. We find that individual bubbles, or particles, rearrange themselves as they are being pulled apart—occasionally, a boundary will form in the raft, splitting it along a line. When the applied speed is increased sufficiently, fracture occurs in the bubble raft. We will compare the experimental values obtained for the exponent “n” in the power law, $r_{\text{min}} \propto \tau^n$, at a set of controlled speeds between mono-dispersed and poly-dispersed bubble rafts. It is the goal of this experiment to relate the power law to the process of pinch-off in 2-dimensional bubble rafts, using both mono-dispersed and poly-dispersed structures.

Jemmy Poon

Major: Biology
Community College: Mt. San Antonio College

Project Title: In Search of Reproductive Isolation in Laboratory Populations of Drosophila melanogaster
Faculty Mentor: Michael Rose

Abstract:
The Rose Lab has maintained a stock of Drosophila melanogaster since the 1980s, creating hybrids and allowing each population to accumulate mutations. Each population was kept in different environments of maturation length. Using this data, we wanted to determine if incipient speciation was beginning to occur. We hypothesized that in the time that had passed, equivalent to about 15,000 generations, the flies would have accumulated enough mutations to begin to have trouble creating viable hybrids. As a possible method of testing incipient speciation, we chose to test the virility of the males from each population. We then compared the success rates of the hybrid populations to those of the parental populations. We used an ANOVA statistical test to make the comparisons but found ultimately, that no differences were apparent. The hybrid crosses were as or more able than the parental crosses. This result points to the fact that 15,000 generations is probably not enough time for speciation to start. Furthermore, this allows us to reevaluate the use of the virility test to better isolate a viable test for incipient speciation.
**Angie J. Seo**

**Major:** Bioengineering  
**Community College:** Mt. San Antonio College  
**Attending Fall 2010:** University of California, San Diego

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**Project Title:** The Role of Nucleus Tractus Solitarii in Acupuncture-Related Modulation of Cardiopulmonary Reflex  
**Faculty Mentor:** John Longhurst  
**Abstract:**

Electroacupuncture (EA) has been found to regulate blood pressure changes through the stimulation of somatic nerve at the Jianshi - Neiguan (P5-P6) acupoints overlying the median nerve. Many studies have found that EA can reduce blood pressure in hypertensive patients, and studies suggest that it can be used as an alternative treatment for hypotensive patients, but insufficient research has been done to provide convincing evidence. Parasympathetic preganglionic outflow from the nucleus tractus solitarii (NTS) is influenced by baroreceptors and chemoreceptors in the heart and lungs through stimulation via the vagus nerve. Phenylbiguanide (PBG) excites cardiopulmonary chemoreceptors, which send afferent signals through the vagal parasympathetic pathway causing depressor responses. Kainic acid was microinjected into various areas of the NTS to show which region plays the specific role in the Bezold-Jarisch reflex. Through these studies, the role of the NTS in EA modulation of the PBG induced cardioinhibition was examined. Direct stimulation of the cervical vagus nerve and extracellular recordings in the medial NTS were studied to see whether there were electrophysiological changes in evoked responses by EA stimulation of the P5-P6 median nerve. It was found that EA at the P5-P6 acupoints modulate the Bezold-Jarisch reflex by attenuating the depressor responses in heart rate and blood pressure, and that the medial NTS plays an important role in the EA stimulation responses. These studies show that EA has beneficial results in hypotensive conditions and give insight to the physiological pathways.
Trang Tran

**Major:** Chemistry

**Community College:** Mt. San Antonio College

**Attending Fall 2010:** California State Polytechnic University, Pomona

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**Project Title:** The Effect of Secondary and Tertiary Phases on the Microstructure and Optical Properties of Multiphase Ceramics

**Faculty Mentor:** Martha Mecartney

**Abstract:**
Applications for transparent ceramics range from transparent armor to laser lens materials. To date, transparent crystalline ceramics have been made from single phase materials. Transparency can be maximized by eliminating residual porosity. However, the transparent properties of multiphase ceramics have not been investigated, because, in most cases, secondary and tertiary phases scatter light strongly due to the difference in index of refraction between the phases, making the ceramic opaque. This study investigates how transparency if affected when the grain size of a multiphase ceramic is reduced to a size below the wavelength of light. Our hypothesis is that if such a nanocrystalline composite can be made fully dense, even two- and three- phase ceramics will be transparent. Two processing techniques, conventional sintering and sinter forging, were compared and evaluated with respect to the best route to produce a fine grain size and a dense material. Three-phase ceramic composites of Al₂O₃ (alumina), MgAl₂O₄ (spinel) and 3Al₂O₃·2SiO₂ (mullite) were processed at temperatures of 1300–1500 °C, using each sintering technique. The microstructure and density were evaluated in order to correlate sintering methods to the optical transparency of these multiphase ceramics. Hardness measurements, fracture toughness, and impact test were used to determine the mechanical response of these materials.

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Masih Tukhi

**Major:** Mechanical Engineering

**Community College:** Cypress College

**Attending Fall 2010:** University of California, Irvine

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**Project Title:** Practical Measurement Techniques for an Entrained Flow Reactor

**Faculty Mentor:** Derek Dunn-Rankin

**Abstract:**
Currently the United States produces 48% of its electricity through coal combustion which generates a significant amount of coal ash. Coal combustion also presents serious challenges, including minimizing CO₂ emission and emission of heavy metals as well as other pollutants like SOX and NOX. While the last group and particulates are fairly well understood, CO₂ and mercury remain a challenge. This project attempts to understand at a very fundamental level how coal burns and what it leaves behind, in both its gas and solid phases. An Entrained flow reactor is used to burn the coal and find its properties while it is burning and when it has burned completely. The simple geometry with a controlled temperature and oxygen environment make it useful to find the properties of coal when it is burning. This experimental apparatus has been constructed to simulate the time, temperature and oxygen profile experienced by coal in a utility boiler. A radiation shielded thermocouple device is used to measure the temperature inside the Entrained flow reactor. The Opto22 control is also used to monitor the temperature from the thermocouples installed along the length of the furnace. A TSI instrument and GE Oxy track oxygen sensor are used to measure the amount of oxygen inside furnace. The focus of this research is to discover a way to burn coal cleanly and to recycle coal ash obtained from cement industry coal combustion.


**Project Title:** The Effect of β-Amyloid on Sodium-Dependent Vitamin C Transporter (SVCT-1 and SVCT-2)

**Faculty Mentor:** Frank LaFerla

**Abstract:**

Alzheimer’s disease is a progressive neurological disorder characterized by the deterioration of memory and the accumulation of β-amyloid (Aβ) plaques in the brain that may inhibit neuronal cell function. Previous studies showed that Alzheimer’s disease patients had lower plasma and CSF ascorbic acid (AA) levels despite adequate nutritional intake. Given the importance of AA as an antioxidant in the brain, examining AA transport and the effects of Aβ may be significant regarding some pathologies associated with Alzheimer’s disease. Two transporters are known to participate in AA transport in the body: the sodium dependent vitamin C transporters-1 and -2 (SVCT-1 and SVCT-2). We hypothesized that one effect of Aβ on neuronal cells would be to decrease the SVCT levels in the plasma membrane, thereby inhibiting AA transport. Based on previous studies of other neuronal membrane receptors, we also propose that this event is rapid and occurs by SVCT protein internalization rather than turning off genes which synthesize the transporter proteins. To test our hypothesis we performed two experiments. First we compared SVCT RNA and Protein levels in age matched normal human and Alzheimer’s diseased brains. Next, we used an in vitro neuronal cell culture system to examine the effects of Aβ treatment. Human-derived neuronal SH-SY5Y cells were incubated with Aβ-containing buffer for 3 hours. RNA and protein fractions were isolated for analysis and compared to untreated control cells. From the analysis of normal and Alzheimer’s human brain samples, we confirmed a decrease in the expression of SVCT transporter proteins in the Alzheimer’s brain samples. Although Aβ treatment of SH-SY5Y cells and effects on SVCT protein levels are so far inconclusive we did confirm that SVCT mRNA levels didn’t change after the 3 hour Aβ treatment. Further experiments will be necessary to confirm the SVCT internalization hypothesis.
**Group Projects**

**Kenneth Kim**
Major: Biology  
Community College: Cypress College

**Priyanka Patel**
Major: Biology  
Community College: Cypress College

**Project Title:** Dpp Regulation of Pro-Apoptotic Genes *hid*, *grim*, and *reaper* in *Drosophila*

**Faculty Mentor:** Kavita Arora

**Abstract:**
Decapentaplegic (Dpp) is a vital component for development in *Drosophila melanogaster*. It plays many roles, including the patterning and growth of larval tissues such as the imaginal discs and salivary glands. Dpp is a homolog of vertebrate Bone Morphogenetic Proteins (BMPs), which are members of the TGF-β superfamily of secreted ligands. Studying Dpp function in *Drosophila* can pave the way to better understanding the importance of BMPs in vertebrates. In *Drosophila* Dpp negatively regulates its target gene through a 15 bp specific binding site, the Shn-Mad-Medea (SMM) site. This SMM site was also found in the promoters of genes *hid*, *grim*, and *reaper* that are involved in apoptosis. To determine whether the SMM site in these genes mediates Dpp dependent regulation of these genes, we have examined the GFP reporter expression of a wildtype enhancer and a mutant form of the enhancer for each gene. Third instar larvae were dissected to observe and compare the gene expression pattern and levels of reporter genes expression using a GFP scope. Our analysis indicates that the mutant reporter for both genes drives higher level of GFP expression in the salivary glands, suggesting that Dpp negatively regulates *hid*, *grim*, and *reaper* in the larval salivary glands.
Project Title: Role of the Parabrachial Nucleus in the Pons in Regulation of Cardiac Sympathoexcitatory Reflexes Evoked by Bradykinin

Faculty Mentor: John Longhurst

Abstract:
Studies have shown that stimulation of cardiac sympathetic afferent nerve endings leads to sympathoexcitatory reflex responses, including an increase in blood pressure, heart rate and renal nerve activity during myocardial ischemia. There are many integration centers in the brain, such as the Nucleus Tractus Solitarii (NTS), rostral ventrolateral medulla (rVLM), and the Parabrachial Nucleus (PBN), which are responsible for these reflexes. The purpose of this study was to identify the role of the PBN in regulation of sympathoexcitatory reflexes evoked by bradykinin (BK) or myocardial ischemia. In anesthetized cats, 0.1-3 μg/ml of BK was applied to the epicardium of the heart to evoke the reflex responses. Next, 50 nl of non-specific glutamate receptor-antagonist Kynurenic acid (Kyn) was microinjected into the PBN, followed by three repeated BK applications. Arterial pressure, heart rate, and renal nerve activity were monitored and recorded during the experiment. We observed that epicardial BK evoked sympathoexcitatory reflexes. BK-evoked reflex responses were attenuated by 48% in mean blood pressure and 56% in renal nerve activity 25 min after microinjection of Kyn into the PBN. We concluded that the BK-evoked sympathoexcitatory reflexes are regulated by PBN neurons through the glutamate receptor mechanism.