UNIVERSITY OF CALIFORNIA

THE ELEVENTH ANNUAL UNDERGRADUATE SUMMER RESEARCH SYMPOSIUM

FRIDAY, AUGUST 04, 2017

Welcome Kickoff: 8:00 AM in Classroom & Office Building 2 (COB2 130)
Oral Presentations: 9:00 AM - 12:00 PM in Classroom & Office Building 2
Poster Sessions: 1:00 PM - 4:00 PM in Kolligian Library (KL 355)

Sponsored by the Undergraduate Research Opportunity Center

A special thank you to all our partners that contributed to making the 2017 UROC Summer Undergraduate Research Institute possible:

WELCOME TO THE ELEVENTH ANNUAL

UCMERCED

UNDERGRADUATE SUMMER RESEARCH SYMPOSIUM

AUGUST 4, 2017

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Maximizing Access to Research Careers - Undergraduate Student Training in Academic Research (MARC U*STAR)

The following student scholars are part of the Maximizing Access to Research Careers - Undergraduate Student Training in Academic Research (MARC U*STAR) Program at UC Merced. The MARC U*STAR Program is funded by the National Institutes of Health (NIH). The program seeks to increase the number of highly-trained biomedical and behavioral scientists in leadership positions to significantly affect the nation's health-related research needs. MARC U*STAR provides support for undergraduate students who are underrepresented in the biomedical and behavioral sciences to improve their preparation for high-caliber graduate training at the Ph.D. level.

For more information, please visit http://uroc.ucmerced.edu/marc

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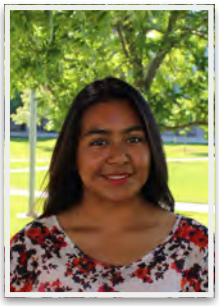


Assessing the Impact of 8 Weeks of Almond Consumption Measurements in College Freshmen

Marilyn Barron[1], Jaapna Dhillon[2], Syed A. Asghar[2], Quintin Kuse[2], Natalie De La Cruz[2], Emily Vu[2], Suzanne S. Sindi[1] and Rudy M. Ortiz, PhD[1]
Applied Mathematics[1] and Molecular and Cellular Biology[2], School of Natural Sciences, University of California, Merced

Biomedical research has provided support for the dietary benefit of almond consumption. However, most of the studies to date have considered only adult populations (age 40+). In this study, we assess the impact of chronic (8-weeks) almond snacking on college freshmen at UC Merced. We observed 73 UC Merced freshmen (mean age: 18.08, mean BMI: 25.44) for eight weeks. 35 consumed a control snack of graham crackers and 38 consumed an isocaloric amount of almonds (2 ounces, 325 kcal) for 8 weeks. Anthropometric and clinical measurements were collected before the study began and at the fourth and the eighth week. With this data, we have outlined a plan to generate multiple models to apply theoretical analyses to robustly assess the effects of chronic almond snacking on anthropometric and clinical outcomes. To date, we have not detected a significant difference in any of the anthropomorphic measurements. We continue to perform many of the biochemical measurements, but of those completed, we observe an increase in plasma HDL in the almond group at week 8 suggesting that chronic almond snacking has the potential to improve the metabolic profile independent of profound changes in anthropomorphic measures such as body mass or adiposity.

The Involvement of Endoplasmic Reticulum Ca^{2+} Leak Via Translocon on $iPLA_2\beta$ Induction in β-cells.

Pablo Juarez[1,2], Xiaoyong Lei, PhD[2], and Sasanka Ramanadham, PhD[2]
University of California-Merced[1], Merced, CA; Department of Cell, Developmental, and Integrative Biology; Comprehensive Diabetes Center University of Alabama-Birmingham[2], Birmingham, AL

Type 1 diabetes is an autoimmune disease that is characterized by the destruction of pancreatic β-cells. Pro-inflammatory cytokines induce ER stress in β-cells, which is associated with an unfolded protein response (UPR) and Ca^{2+} store depletion, that leads to activation of NF-$_k$B and ultimately to β-cell apoptosis. GRP78, master chaperone of the UPR, modulates Ca^{2+}release via translocon opening during UPR response and ER stress. It was reported that the Ca^{2+}-independent phospholipase $A_2\beta$ ($iPLA_2\beta$) participates in ER stress-induced β-cell apoptosis, although the underlying mechanisms by which it does so are not well understood. It might be speculated that the cytokine-mediated induction of ER Ca^{2+} leak via the translocon induces $iPLA_2\beta$. This intriguing possibility led us to investigate the role of the translocon activity on $iPLA_2\beta$ induction in β-cells. INS-1 insulinoma cells were treated with puromycin (2 μM) to activate the translocon in the absence and presence of inhibitors of $iPLA_2\beta$ (S-BEL, 10 μM) or NF-$_k$B (WA) . Assessments included GRP78, pPERK (ER stress factor), CHOP (ER stress apoptotic factor), p65 (activated NF-$_k$B), and $iPLA_2\beta$ protein abundances and incidence of cell death by Western and TUNEL analyses, respectively. We find that, as expected, puromycin induced GRP78, pPERK, and CHOP. Further, puromycin induced NF-$_k$B and $iPLA_2\beta$, WA attenuated $iPLA_2\beta$, and both S-BEL and WA attenuated puromycin-induced INS-1 cell apoptosis. Collectively, these findings suggest that $iPLA_2\beta$ induction in β-cells undergoing ER stress occurs via GRP78-goverened translocon activation, in part through the NF-$_k$B pathway.

Analysis of hematopoiesis in Mice with Altered Bone Homeostasis

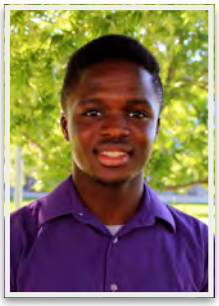
Asmaa Mohamed, Gabriela G. Loots, PhD, and Jennifer O. Manilay, PhD
Molecular and Cellular Biology Unit, School of Natural Sciences, University of California, Merced

Sclerostin (SOST) protein regulates bone homeostasis by regulating the maturation of osteoblast to osteocytes in the bone. Previously, we found that SOST knockout (KO) mice displayed high bone mass, small bone marrow cavities and few hematopoietic cells in the bone marrow. The role of SOST and the molecular mechanisms that mediate the crosstalk between hematopoietic stem cells (HSCs) and the different bone "niche cells" are incompletely understood, and our preliminary data indicate that HSCs in SOST-KO bones may be hyperproliferative. Our goal is to understand the mechanisms that regulate HSC proliferation in SOST-KO mice. To test the hypothesis that specific bone niche cells control HSC proliferation, we established a bone digestion protocol to analyze endothelial cells, osteoblasts, and mesenchymal stem cells by flow cytometry, and are currently optimizing the protocol to purify these cells by flow cytometry for gene expression analysis. We have determined that bone digestion for greater than one hour likely degrades the cells' RNA, and we are currently assessing different strategies to increase cell yields and RNA integrity after flow cytometric sorting. Optimization of this protocol will allow us to perform real-time PCR using purified bone niche cells from control and SOST-KO mice, as well as perform functional HSC-niche cell coculture assays We also successfully performed bone analyses of bone niche cells from other gene knockout mice strains, demonstrating the utility of our technical protocol. Our studies could identify specific bone niche cells that control HSC fate, which could have applications for hematological diseases and immunity.

UC Leadership Excellence Through Advanced Degrees (UC LEADS)

The following student scholars are part of the University of California Leadership Excellence through Advanced Degrees (UC LEADS) Program. The goal of the UC LEADS research and graduate preparation program is to educate California's future leaders by preparing promising students for advanced education in science, technology, engineering and math (STEM) fields. The program is designed to identify upper-division undergraduate students with the potential to succeed in these disciplines, but who have experienced situations or conditions that have adversely affected advancement in their fields of study.

For more information, please visit http://uroc.merced.edu/uc-leads



Oil Droplets, Surfactants and the Effect of the Ratio of Adsorption and Desorption Rate on Rise Velocity

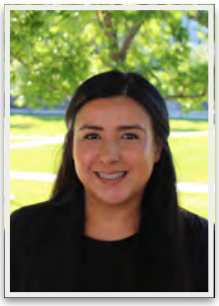
Tamunotubo George, Francois Blanchette, PhD, and David Martin, PhD
School of Engineering, University of California, Merced

In the case of oil spillage, it is important to know how fast oil droplets reach the surface of the ocean. Here, we simulated numerically rising oil droplets in the ocean. Simulations were run using a C-code that calculated the rise of the oil drop. We focused on the combined effects of the ocean's density stratification and the presence of surface-active molecules (surfactants). The effects of the ratio of adsorption and desorption rates of the drop's rise velocity were quantified. Our results show that they are still running at the moment.

Synthesis of Tetralins Via Brønsted Acid-Catalyzed Intramolecular Hydroarylation of Alkenes: An Investigation of Regioselectivity, and Limitations

Jessica Lopez Lara, Amir Keshavarz, and Benjamin J. Stokes, PhD
School of Natural Sciences, University of California, Merced

We recently reported a method for the synthesis of polysubstituted indanes through intramolecular hydroxylation of β-benzylstyrenes using triphenylmethylium tetrakis(pentafluorophenyl)borate (TPFPB) as an easily handled Brønsted acid precatalyst. Based on surprising regioselectivity trends observed in the aforementioned reactions, we were inspired to study the regioselectivity, scope, and limitations of cyclization in new systems-herein, β-homobenzylstyrenes, β-homobenzylbutenes, and β-homobenzylpropenes. Our approach provides access to a wide range of polysubstituted tetralins that make up the backbone of many pharmaceutical drugs. The pregioselectivity outcomes observed in our studies contribute to an improved general understanding of electronic and steric effects in Frieden-Crafts-type electrophilic aromatic substitution reactions.



Biomonitoring of Atmospheric Mercury Pollution Using Lichen at the Monte Amiata Mercury Mining District in Southern Tuscany, Italy

Alejandra Martinez Lopez, Jaycee Martinez, and Marc Beutel, PhD
School of Engineering, University of California, Merced

We recently reported a method for the synthesis of polysubstituted indanes through intramolecular hydroxylation of β-benzylstyrenes using triphenylmethylium tetrakis(pentafluorophenyl)borate (TPFPB) as an easily handled Brønsted acid precatalyst. Based on surprising regioselectivity trends observed in the aforementioned reactions, we were inspired to study the regioselectivity, scope, and limitations of cyclization in new systems-herein, β-homobenzylstyrenes, β-homobenzylbutenes, and β-homobenzylpropenes. Our approach provides access to a wide range of polysubstituted tetralins that make up the backbone of many pharmaceutical drugs. The pregioselectivity outcomes observed in our studies contribute to an improved general understanding of electronic and steric effects in Frieden-Crafts-type electrophilic aromatic substitution reactions.

How Does the Addition of a Cover Crop and its Residue Affect Soil Aggregation and Soil Organic Carbon in a Silty Clay Loam Soil?

Yulissa Perez Rojas, Nathaniel A. Bogie, Asmeret Asefaw Berhe, and Teamrat A. Ghezzehei, PhD
School of Natural Sciences, University of California, Merced

Increased soil aggregation is associated with soil health and productivity as a consequence of increasing infiltrability, water holding capacity, and microbial activity. Aggregation helps in storage and stabilization of carbon. However, as the intensity of cultivation increases, the amount of carbon and the stability of soil aggregates can decrease. An existing challenge that we are facing today is how to increase carbon stabilization and cycling in agricultural lands without reducing productivity. The purpose of this study was to investigate how carbon and the stability of soil aggregates differ in a cover crop (CC) and a non-cover crop (NCC) field before, during, and after harvesting tomatoes. Samples were collected from Russell Ranch Sustainable Agricultural Facility in Davis, CA at four depths (0-10, 10-20, 20-30, and 30-50cm) (n=4). Each sample was separated into four aggregate sizes (>2000, 250–2000, 53–250, and 53 <μm) by wet sieving to investigate carbon and nitrogen content. Preliminary results indicate a higher fraction for the >2000μm macroaggregates at the 0-10 depth in CC vs. NCC (19% and 1%, respectively). For all depths between 0 and 20cm the amount of free light biomass was over 100% higher in the CC compared to the NCC treatment. In the 250-2000μm macroaggregate size class the NCC field contains a slightly elevated fraction of aggregates. This aggregation data, along with the forthcoming C and N data, will allow us understand the effect of cover cropping on soil structure and help make management decisions for the future of agriculture in a changing climate.

Does ROP5C hinder CD8 T Cell Response?

Felipe Rodriguez, Angel Kongsomboonvech, Anh Diep, Brandon Justice, and Kirk Jensen, PhD
School of Natural Sciences, University of California, Merced

Pluripotent stem cells (PSC) have the ability to differentiate into varying cells types. In vitro, PSC can differentiate into vascular smooth muscle cells (VSMC) which create a solid source for cells. Human induced pluripotent stem cells (HiPS) have the plasticity to differentiate into VSMC in vitro via different growth factors. In the first part of the experiment, HiPS were induced into vascular progenitor cells using vascular endothelial growth factor (VEGF) and bone morphogenetic protein 4 (BMP4). Vascular progenitor cells were then induced into VSMC using transforming growth factor beta 1 (TGF-1). TGF-1 was supplied to the cells via the feeding media at five varying concentrations. The goal of the experiment was to see how varying growth factor concentrations such as TGF-1 as well as time or maturation affect HiPS differentiation into VSMC. The success of the VSMC differentiation was be measured using three different markers. The three markers that were traced are alpha smooth muscle actin (SMA), calponin heavy metal (CNN1), and smooth muscle myosin heavy metal chain (SMMHC). As the cells mature the expected dominant markers are SMA, CNN1, and SMMHC; respectively. Results will demonstrate how varying TGF-1 concentrations and time will affect VSMC fate. Optimizing VSMC fate may allow for the future use in disease modeling or regenerative medicine.

Optimization of Vascular Smooth Muscle Cell Fate via Different Growth Factors Concentrations

Gabriela Sanchez, Edwin M. Shen, and Kara E. McCloskey, PhD
School of Engineering, University of California, Merced

Pluripotent stem cells (PSC) have the ability to differentiate into a variety of cell types, including vascular smooth muscle cells (VSMC). The McCloskey laboratory is interested in directing human induced pluripotent stem cells (hiPS) into VSMC in vitro using a staged methodology. In the first part of the experiment, hiPS were induced into vascular progenitor cells using vascular endothelial growth factor (VEGF) and bone morphogenetic protein 4 (BMP4). Vascular progenitor cells were then directed towards VSMC specification over time using transforming growth factor beta 1 (TGF-β1) and platelet-derived growth factor beta beta (PDGF-ββ) at five varying concentrations. The goal of the experiment was to see how varying growth factor concentrations such as TGF-β1 and PDGF-ββ as well as time or maturation affect hiPS differentiation into VSMC. The VSMC phenotype was measured using three different markers: alpha smooth muscle actin (Alpha-SMA), calponin (CNN1), and smooth muscle myosin heavy chain (SMMHC). Results will demonstrate how varying growth factor concentrations and time affect VSMC fate in order to generate highly pure VSMC populations for building tissue engineered vasculature products.

UAB Kidney Undergraduate Research Experience (KURE)

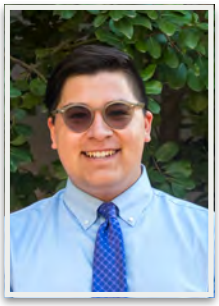
The following student scholars are part of the University of Alabama at Birmingham Kidney Undergraduate Research Experience (KURE) Program. KURE is a 9-week, paid summer program that offers exciting hands-on research experience for students with a desire to pursue careers in the biomedical sciences. The program is particularly targeted to students having no local campus access to biomedical research laboratories.

For more information, please visit http://uroc.ucmerced.edu/kure

Endothelin B Receptor and Venous Intimal Hyperplasia Development in Rat Arteriovenous Fistula

Molly Easter[1,2], Maheshika S. Somarathna[1], Tayana Isayeva-Waldrop[1], Kelly Hyndman[1], and Timmy C. Lee, PhD[1]
Department of Medicine, University of Alabama at Birmingham[1]; School of Natural Sciences, University of California, Merced[2]

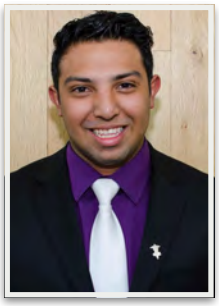
The vascular access is the lifeline for hemodialysis patients. The preferred type of vascular access is an arteriovenous fistula, a direct connection between an artery and vein. However, 60% of AVFs fail due to poor vascular remodeling and venous intimal hyperplasia development. The role of Et-b receptor in the vascular homeostasis is complex. In some vascular beds Et-b receptors can stimulate vasoconstrictor signaling on vascular smooth muscle cells. On the contrary, stimulation of Et-b signaling on endothelium cells activates the vasodilator activities. The involvement of Et-b receptor signaling in venous intimal hyperplasia formation is unclear. In this study, we compared the formation of intimal hyperplasia in transgenic Et-b deficient rats to wild type rats. We hypothesize that the lack of Et-b receptors in the transgenic Et-b deficient rats will increase venous intimal hyperplasia in arteriovenous fistulas. Arteriovenous fistulas were created in the femoral artery and vein of ET-b-deficient transgenic and wild type rats. After 7 days, the fistulas were harvested for histological and morphometric analysis. Fistula veins were stained using the Verhoeff's Van Gieson elastic tissue fiber stain. The Et-b deficient transgenic rats showed an increase in hyperplasia formation compared to the wild type transgenic rats. In conclusion, Et-b receptors play a role in decreasing the early development of venous intimal hyperplasia in arteriovenous fistulas. More research needs to be done to understand the interactions between Et-b receptors and venous intimal hyperplasia development in arteriovenous fistulas.



Increase in Alanine Availability Decreases Oxalate in Primary Hyperoxaluria Type 1

Brian Freeman[1,2], Sonia Fargue, MD, PhD[1], and John Knigh, PhD[1] Department of Urology, University of Alabama at Birmingham[1]; School of Natural Sciences, University of California, Merced[2]

Primary Hyperoxaluria (PH) is a family of inborn disorders involving glyoxylate metabolism that causes excessive endogenous oxalate synthesis which can lead to kidney stone formation. There are limited therapeutic options to treat PH. PH type 1 is the most severe and common form. It is characterized by the enzymatic deficiency of alanine:glyoxylate amino transferase (AGT) in glyoxylate metabolism. In glyoxylate metabolism, glycolate oxidase converts nontoxic glycolate into glyoxylate, a toxic metabolite. AGT converts glyoxylate and alanine to glycine and pyruvate. When AGT is enzymatically deficient, glyoxylate can be converted to oxalate. We hypothesize that increasing availability of alanine will increase enzymatic efficiency of AGT normal and pathological variants, reducing oxalate synthesis. Four transfected Chinese hamster ovary (CHO) cell lines were used for experimentation: CHO.GO, CHO.AGT-MA, CHO.AGT-MI, and CHO.AGT170, a pathogenic variant. Untransfected cells were used as a control. Cells were treated with alanine (0-10 mM) and glycolate (0–0.75 mM) for 24 hours. Indirect toxicity from glyoxylate was measured using Cell Counting Kit 8 to determine the enzymatic efficiency of AGT. Extracellular oxalate levels were measured using ion chromatography/mass spectroscopy. Enzymatic efficiency of AGT in all variants was improved with increased availability of alanine. Extracellular oxalate levels were significantly lower in AGT variants with increased levels of alanine. Increasing alanine availability in AGT normal and pathogenic variants increases enzymatic efficiency and decreases oxalate synthesis. The increase in pathological AGT enzymatic efficiency warrants future investigation in PH mouse models to confirm the results of this study.



High Salt Intake Alters ET_B Receptor Expression in Visceral Adipose

Cristhian Gutierrez Huerta[1,2], Ana Sogorovic[1], and Joshua S. Speed, PhD[1] Department of Medicine, University of Alabama at Birmingham[1]; School of Natural Sciences, University of California, Merced[2]

A correlation between salt intake and obesity has been observed in numerous human populations; however mechanisms linking dietary salt and adiposity are lacking. High dietary salt is a stimulus for the production of Endothelin-1 (ET-1) in the vasculature and renal system. Previous *in vitro* studies indicate that ET-1 plays a key role in lipid metabolism by the adipocyte. Activation of the ET_A receptor promotes lipolysis while the ET_B receptor inhibits lipolysis. We hypothesized that an increase in ET-1 in response to high salt intake promotes adipose deposition and contributes to the development of obesity. The goal of the current study was to determine the relative distribution of ET-1 receptor subtypes in various sites of adipose deposition, and determine if high salt intake impacts relative distribution. Mice were fed normal (NS, 0.49% NaCl) or high (HS, 4% NaCl) salt diet and ET_A and ET_B receptor gene expression was measured in epididymal and subcutaneous. Our results indicate that ET_B receptor expression is 17-fold higher than ET_A expression in epidydimal fat of mice fed NS. Interestingly, HS fed mice had only a 6-fold difference (ET_B/ET_A) in ET-1 receptor expression. In contrast, subcutaneous adipose had 6.7 fold higher ET_B to ET_A expression, and HS had no effect on this ratio (6.7-fold ET_B/ET_A). These data indicate that ET_B receptors are the dominant ET-1 receptor on adipose and ET_B receptor expression on visceral fat is sensitive to changes in salt intake.

Evidence for Reactive Oxygen Species Increasing Endothelin-1 and Renal Injury in Humanized Sickle Mouse

Eric Lee[1,2], Malgorzata Kasztan, PhD[1], and David M. Pollock, PhD[1]
Cardio-Renal Physiology & Medicine, Division of Nephrology, University of Alabama at Birmingham[1]; School of Natural Sciences, University of California, Merced[2]

Sickle cell disease (SCD) alters renal structure and function that often leads to morbidity and mortality. SCD creates a heightened state of hypoxia and increased oxidative stress, via increased reactive oxygen species (ROS). The effects are thought to contribute significantly to sickle cell nephropathy (SCN). Moreover, it has been shown that endothelin 1 (ET-1) is elevated in the plasma of SCD patients and contributes to the development and progression of SCN including glomerular ROS production. The aim of our study was to determine effects of the anti-oxidant drug, tempol, on ET-1 and glomerular injury in humanized sickle cell mice (HbSS). HbSS mice and genetic controls (HbAA) were treated with tempol (1mmol/L) or vehicle for two weeks and placed in metabolic cages for the last 2 days. Markers of kidney injury, urinary protein and albumin concentrations were measured using Bradford and immunoperoxidase assays, respectively. Urine osmolality was determined by vapor pressure osmometer. Glomeruli were isolated to determine ET-1 mRNA expression. Glomerular ET-1 mRNA expression in tempol-treated HbSS mice revealed significant decrease when compared to untreated HbSS group (1.03±0.22 vs. 2.57±0.17). Tempol also significantly reduced proteinuria and albuminuria in HbSS mice to levels similar to controls (3.9±0.3 vs. 5.9±0.8 and 45.3±10.6 vs. 94.1±24.9, respectively). Moreover, tempol-treated HbSS showed promising trend towards decrease in urine output and increase in urinary osmolality (n=4-7), but more experiments are needed. Tempol had no effect on control HbAA mice. These findings support the hypothesis that ROS contribute to elevated ET-1 and renal injury in HbSS mice.

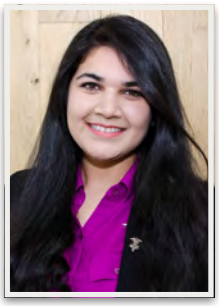
Joint Genome Institute Partnership (JGI)

The following student scholars are participants in UC Merced's NSF CAMP partnership with the Joint Genome Institute, located in Walnut Creek, CA. The Department of Energy's Joint Genome Institute (DOE JGI) is managed but the Department of Energy's Office of Biological and Environment Research (OBER) to produce high-throughput DNA sequencing and analysis in support of its missions in alternative energy, global carbon cycling, and biogeochemistry. CAMP offers extensive resources and unique opportunities for students to excel in their respective fields of study. This valuable partnership provides UC Merced students with the opportunity to experience research in a national laboratory setting.

Comparison Analysis of HiSeq & NovaSeq

Antonio Gonzalez[1,2], Matthew J. Blow, PhD[2], and Anna Lipzen, PhD[2]
School of Natural Sciences, University of California, Merced[1]; Computational Analysis Group, DOE Joint Genome Institute[2]

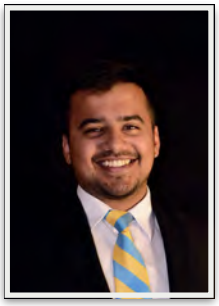
DNA resequencing involves sequencing genomic DNA of an organism for purposes of identifying sequence variants compared with a related organism with a sequenced reference genome. The most recent generation of high-throughput sequencing technologies has provided unprecedented opportunities for high-throughput functional genomic research. At the Department of Energy Joint Genome Institute over 100 trillion bases of DNA are sequenced annually on Illumina's HiSeq 2500 System. Illumina's newest iteration, the NovaSeq 6000 System was recently installed at JGI with plans to eventually replace the HiSeq System as the main sequencing platform. This report evaluates the use of the NovaSeq System for resequencing projects by performing a comparison analysis between both platforms on an *E.coli* data sample. We sequenced the same DNA sample on established technology (Illumina HiSeq) and on the new NovaSeq System. We compared both datasets to the reference genome and identified sequence variants. At the individual read level, Novaseq data contained more mismatches per base, due to an increased error rate. However, the consensus data from the two platforms was identical, confirming that Novaseq is suitable for high throughput re-sequencing projects.



Quality Control and Metadata Management in Genomes OnLine Database (GOLD)

Mahrukh Mujeeb[1,2], Supratim Mukherjee, PhD[1], and Tatiparthi Reddy, PhD[1,2]
DOE Joint Genome Institute, Lawrence Berkeley National Laboratory[1]; School of Natural Sciences, University of California, Merced[2]

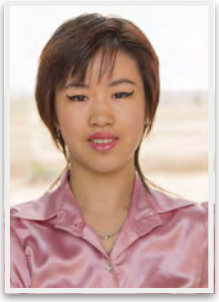
Genomes OnLine Database (GOLD) is a manually curated database that captures metadata for genomes and metagenome sequencing projects from around the world. Currently GOLD is one of the largest repositories worldwide. All projects in GOLD are organized based on a four level classification system: Study, Organism (for isolates) or Biosample (for environmental samples), Sequencing Project and Analysis Project. Currently, GOLD provides information for 32 598 Studies, 295 254 Organisms, 36 216 Biosamples, 164 380 Sequencing Projects and 144 757 Analysis Projects. Data in GOLD comes from three different sources: JGI (Joint Genome Institute) internal projects, from external users and from public database resources like NCBI (National Center for Biotechnology Information). GOLD implements standardized metagenome sample naming. This involves curating external user entered projects and imported projects as per GOLD nomenclature standards. The current research study as an intern is focused on Metadata Management and Quality Control in Genome OnLine Database (GOLD). Specific project goals for the research work are: Identifying and associating genome publications to GOLD sequencing projects, Capturing metadata from publications and Geolocation information curation/management. GOLD database is used along with Google Map Program, Two journals: Standards in Genomic Sciences and Genome Announcement as well as PubMed sources as the methodology for the research work. Approximately 12 000 biosamples' and 7000 organisms' geolocations are curated and 350 genome publications are associated. This research work is important as it aids in comparative analysis and hypothesis testing.



Genome-wide Identification of Photoperiod Dependent Bacterial Plant Colonization Genes

Sai Prabhakar[1,2], Benjamin Cole, PhD[1], and Axel Visel, PhD[1]
DOE Joint Genome Institute, Lawrence Berkeley National Laboratory[1]; School of Natural Sciences, University of California, Merced[2]

Plants have different lifestyles depending on the latitude of their habitat. Plants that have evolved to grow in northern or southern latitudes tend to be sensitive to day length, as this tends to be a good predictor of environmental features associated with seasonality. Since metabolites exuded from roots are essential to sustain bacterial colonization of the root, and photoperiod alters the allocation of starches and other metabolites, we hypothesize that photoperiod will significantly alter the ability of bacteria to colonize roots, and change the functional significance of colonization associated genes. To test these hypotheses, we colonized Arabidopsis seedlings with a transposon mutagenesis library of P. simiae WCS417r under short and long conditions, and harvested bacteria from colonized roots after 7 days. We will compare overall colonization levels under short and long days, as well as the fitness of each insertion mutant strain under these conditions. Should a difference in the microbial community arise, we will be able to identify potential colonizing genes in P. simiae based on either on their genetic or metabolic effect.



Salinity and Wetland Restoration Alter Soil Microbial Phylogenetic and Functional Diversity.

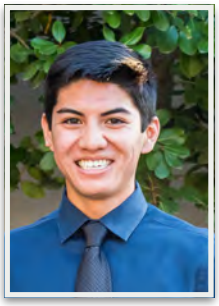
Brenda Yu[1,2], Wyatt H. Hartman, PhD[1], and Susannah G. Tringe, PhD[1]
DOE Joint Genome Institute, Lawrence Berkeley National Laboratory[1]; School of Natural Sciences, University of California, Merced[2]

Wetlands cover about 9% of Earth's land surface area and store around 35% of global terrestrial carbon. In the San Francisco Bay and Delta, efforts to restore converted wetlands have been motivated by their potential to store carbon, although harmful emissions of methane (CH_4) can result in this habitat serving as a greenhouse gas source instead of sink. Studying microbial diversity across historic and restored sites will increase the understanding of carbon cycling factors by uncovering associations with biogeochemistry. Finding predictive relationships between diversity and salinity will explain how stress can be a selective force in microbial composition, revealing indicators of resilience and adaptability. We hypothesized that the phylogenetic and functional gene diversity would be lower in restored wetlands compared to natural wetlands, and in sites of high salinity compared to low salinity. Sixteen sites spanning a range of salinities (0-62 ppt) and restoration status (historic or restored) were sampled throughout the San Francisco Bay-Sacramento Delta region. Alpha diversity of 168 samples was plotted with corresponding salinity measurements. Microbial communities showed a decreasing trend in diversity across an increasing salinity gradient, while restored wetlands contained less diversity when compared to historic wetlands of comparable salinity. The study contributes a more comprehensive understanding of significant relationships between microbial diversity and environmental factors.

Summer Undergraduate Research Fellowship (SURF)

The following student fellows are part of UC Merced's Summer Undergraduate Research Fellowship (SURF) Program. SURF is a fellowship that is offered to all undergraduate students in any discipline. This 9-week summer fellowship offers our students the opportunity to work alongside faculty and graduate student mentors and provides graduate school preparation.

For more information, please visit http://uroc.ucmerced.edu/surf



Mathematical Model for the Maturation of Natural Killer Cells

Jeffrey Aceves, Albert Millan, and Jennifer O. Manilay, PhD
School of Natural Sciences, University of California, Merced

Natural Killer (NK) cells are immune system cells with innate ability to eliminate cancerous and virally infected cells. They mature in a linear pathway starting at the double negative (CD27-CD11b-, DN), to the immature (CD27+CD11b-; iNK), then transitional (CD27+CD11b+; tNK), and finally to the most mature (CD27-CD11b; mNK) state. Mathematical models are tools of interest in biological research to predict cell behavior, in conjunction with wet lab experiments. Our objective is to develop a mathematical model that can predict the differentiation of NK cells within a specific time frame and under different conditions. Previous data from our laboratory showed that NK cell maturation is inhibited when Sclerostin domain containing-1 (Sostdc1) protein is absent in mice. We hypothesized that we could use our own biological data to create a mathematical model that predicts NK cell differentiation in Sostdc1-knockout (KO) mice. To test this, we purified iNK and tNK populations from WT and KO spleens and stimulated them with PMA and ionomycin for 1 to 4 hours, and analyzed their fates using flow cytometry to enumerate the number of cells in each population and compare NK cell differentiation in WT and KO mice. Although preliminary, our mathematical model was able to reliably predict the tNK to mNK transition, but modeling of the iNK to tNK transition requires additional parameters. Additional replicate experiments and parameters (such as proliferation) are planned. If successful, this mathematical model could be applied to control NK differentiation for cancer immunotherapies and antiviral responses.

The Relationship between Social Network Connectivity and Positive Emotion Word Use

Roberto Bernal, David W. Vison, and Rick Dale, PhD
Cognitive and Information Sciences, University of California, Merced

Linguistic Inquiry and Word Count (LIWC) is a quantitative text analysis program that uses word count strategies to extract psychological and social meaning out of the words people use (Pennebaker et al. 2003). Another method of studying word use is by analyzing social network structures and predicting general language patterns through network analysis and information theory (Vinson and Dale 2016). This study inspects datasets from Yelp and examines the relationship between measures of social network connectivity and positive emotion word use (e.g., love, nice, sweet). The number of friends each user has is a simple measure of social network connectivity. Positive emotion word use is measured by analyzing business reviews of Yelp users using LIWC. We run a linear correlation between users' number of friends (connectivity) and the percentage of positive emotion words in their respective reviews. Results suggest that users with more friends tend to write reviews with less positive emotion words. We further explore relationships between other LIWC word categories and the number of friends and run linear regression models using these LIWC word categories to determine if we can predict the number of friends by the words people use. Extending these findings to other social networks such as Twitter and Facebook will generalize the results and make a stronger theoretical case.

Identifying the Molecular Landscape Driving Cellular Transformation

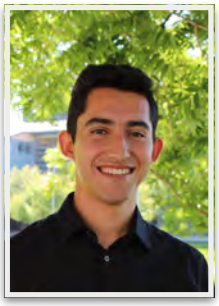
Andrew Betancourt, Manish Thiruvalluvan, Melanie LeGro, and Nestor J. Oviedo, PhD
Molecular and Cell Biology, University of California, Merced

Replicating with DNA damage is a key step in tumorigenesis. Previously, we created a model for genomic instability through RNA interference of *Rad51*, a critical component of DNA repair through homologous recombination in the planarian model organism *Schmidtea mediterranea.* Knockdown of Rad51 results in massive cell death in the tail region, while cells continue dividing with DNA damage in the anterior part of the body. Cellular division in the presence of DNA damage is a pervasive feature of cancer cells. Thus, our goal is to identify what underlying mechanisms enable cellular division carrying DNA damage. To this end, we performed high throughput RNA sequencing between the anterior and posterior region following *Rad51* knockdown and identified 30 genes that are differentially expressed. Five candidate genes were selected based on their high expression in stem cells. Candidate genes were cloned and we are performing functional validation analyses to identify the molecular network controlling cellular division in the presence of DNA damage. In addition, double-RNAi experiments will reveal if the any of these candidates could rescue the *Rad51* RNAi organisms. One or two genes may be selected for in depth analysis of their effects of planarian tissue homeostasis. Execution of these experiments may lead to the identification of novel molecular targets to treat cancer without disturbing tissue physiology.

Testing the Fibrin, Thrombin and Aprotin Ratios in Sera-Free Tip/ Stalk and Phalanx ESC-AEC/EC Cultures

Christina Blaul[1], Kara E. McCloskey, PhD[2], and Nicole Madfis, PhD[2]
School of Natural Sciences, University of California, Merced[1]; School of Engineering, University of California, Merced[2]

Endothelial cells (ECs) are used to engineer tissue grafts, and translational research in regenerative medicine. Mouse embryonic stem cells (mESCs) are induced to differentiate into EC subpopulations through mechanisms of in vitro fertilization, monolayers, or by gene therapy. Derived from stem cells, specifically mESC, the endothelial progenitor cells are isolated to differentiate proliferating populations of vascular endothelial. The specific venous, arterial and lymphatic ESC-derived EC lineages have not been studied as separate branches. The distinct features of specialized EC subpopulations have not been explored after the outgrowths of Flk-1+ in vascular progenitor cells. These specialized EC are the components found in branching blood vessels. This area of study has the potential to create fully functional arteries and veins for an injured heart.
Growing homogenous sub-cultures of proliferating sera-free stem cell-derived(ESC)-ECs requires a balanced thrombin to fibrinogen ratio. Thrombin and fibrinogen blood clots are gel-like growth factors that stimulate sprouting on angiogenic endothelial cells. During a 7-10 day period, having a higher concentration of aprotein to thrombin inhibits protiasis. Mimicking the same fibrin concentration will optimize the protocol, while decreasing cell count. The purpose of the expirement is to optimize the fibrin stability so that it lasts up to one week. To what extend can the fibrin-thrombin ratio optimize the cell count and parameters of angiogenic tip/stalk phalanx endothelial subpopulations. Cells were implanted in a microfluidic device with extremely small scaled channels of networks that the media is pipetted through for feeding.



Minimum Inhibitory Concentration of Solithromycin against E. *Coli* that cause Urinary Tract Infection

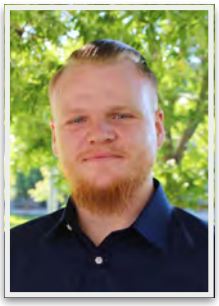
Salvador Castaneda Barba and Miriam Barlow, PhD
School of Natural Sciences, University of California, Merced

Solithromycin is an antibiotic that is currently in phase 3 of clinical development for the treatment of moderate to moderately-severe bacterial pneumonia and urethritis. This antibiotic affects 50s ribosomal subunit formation and function by binding to three sites on the ribosome. Binding to three sites enables solithromycin to increase its ribosomal binding and reduces propensity to known resistance mechanisms. In this study, 48 E.coli isolates from patients with urinary tract infection were analyzed for susceptibility to this antibiotic. This was done through minimum inhibitory concentration testing at a concentration range from 1 ug/ml to 32 ug/ml. The experiment revealed that at a concentration of 16 ug/ml, 45 of the strains were susceptible to the antibiotic. The remaining 3 strains were susceptible at a concentration of 32 ug/ml. While the concentration obtained was high, it shows that none of the strains developed resistance and that Solithromycin is effective in treating *E. coli* as well as other previously demonstrated bacteria such as Streptococcus pneumoniae and Staphylococcus aureus.

Study of the Role of Sclerotin on Expression of Self-renewal Genes in Hematopoietic Stem Cells

Michael Chi, Christie Donham, and Jennifer O. Manilay, PhD
School of Natural Sciences, University of California, Merced

Our goal is to analyze the expression of self-renewal genes in long-term hematopoietic stem cells (LT-HSCs) in wild-type and sclerostin (SOST) knockout mice. LT-HSCs give rise to all blood cell types throughout life, and expand via a process known as self-renewal. The SOST protein is secreted from osteocytes (mineralized bone cells) and previous studies suggest that when the expression of the SOST protein is removed, there is a significant increase in LT-HSC numbers and/or differentiation ability. Our hypothesis is that in the absence of SOST, the Wnt signaling pathway in LT-HSCs is not inhibited, which in turn enhances LT-HSC self-renewal and differentiation. Therefore, to investigate if SOST inhibits self-renewal genes in LT-HSCs, we studied the expression of the known self-renewal genes (Bmi1, CyclinD1, HoxB4, and Wnt3a) in both wild type and SOST knockout mice. We expect that these self-renewal genes will be upregulated in the SOST knockout mice. To test our hypothesis, we are optimizing experimental protocols for quantitative real-time polymerase chain reaction (qRT-PCR), in order to quantify self-renewal gene levels. This procedure will help to identify potential molecular and cellular mechanisms involved in activating and controlling the self-renewal and differentiation of LT-HSCs, which are critical for maintaining all blood cell types in adults.



Uta Stansburiana Coloration Study

Robert Degen, Justin Yeager, Kinsey Brock, and Dan Edwards, PhD
School of Natural Sciences, University of California, Merced

In animals, coloration and patterning can serve multiple functions including cryptic coloration to aid in predator avoidance and social coloration to aid in inter/intraspecies signaling. Additionally, these coloration types evolve differently as natural selection heavily affects cryptic coloration evolution while sexual selection affects the evolution of social coloration. One species whose coloration has been studied extensively is the common side splotch lizard (*Uta Stansburiana)*. These studies focused on the function of the three different color morphs found among the species and the biological "rock-paper-scissors" game caused by the competition between these morphs. These morphs appear discrete by the description of their function in social signaling but the coloration itself does not always appear discrete in nature and highlights how little is known about this. Additionally, it is largely unexplored how coloration among populations respond to local habitats. descriptive project aims to investigate coloration in these animals using the most advanced techniques in multispectral imaging to analyze ultraviolet and visual spectra images from roughly 450 individuals. We will compare things chromatic contrast, achromatic contrast, pattern contrast against local habitats, and UV signaling while looking for differences within populations, between populations, and between sexes. We will then measure these comparisons according to the visual sensitivities of different observer species (lizards, snakes, and birds). This analysis will then give us insights into the cryptic and social coloration of this species and what forms of selection drive the diversity seen in their coloration.

Wolbachia Infection in Merced County Mosquitos

Valeria Flores, Ryan Torres, Eunis Hernandez, and Andrea L. Joyce, PhD
Public Health, University of California, Merced

Wolbachia are a group of bacteria present in the reproductive organs of arthropods and nematodes. They are known to alter the biology of the infected organism to increase its own likelihood of transmission. Both male and female host organisms can be infected, however only females are capable of transmission. *Wolbachia* have evolved four ways to manipulate host reproduction to their favor. These four ways include feminization, parthenogenesis, male killing, and cytoplasmic incompatibility. Cytoplasmic incompatibility, the most common manipulation, occurs when a male infected with *Wolbachia* mates with a female infected with a different *Wolbachia* type or a non-infected female. Due to their natural ability to directly influence reproduction, *Wolbachia* have been of increasing interest as a control measure for mosquito-borne viruses. In this study, the presence of bacteria was examined in mosquitoes found in Merced County in order to improve current knowledge and explore future possibilities for release of infected mosquitoes. To accomplish this, mosquitoes were collected and identified to species, DNA was extracted, and then PCR was used to investigate the presence or absence of *Wolbachia* and which subgroup it belonged to. It is hoped that with the obtained results, progress will be made to control the spread of mosquito-borne diseases.

Antibiotic Resistant Bacteria in Central Valley Wastewater Systems

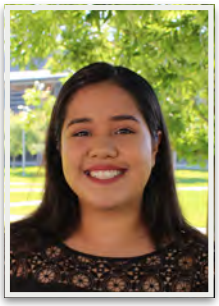
Jose Garcia, Lauren Brooks, PhD, and Mark Sistrum, PhD
School of Natural Sciences, University of California, Merced

Leakage of antibiotic-resistant organisms into water environments pose an increased risk of spreading resistance genes and altering microbial ecosystems. Wastewater treatment plants utilize heavy antibiotics to neutralize microbes before release, but overuse of the antimicrobial agents in hospitals and farms have decreased the effects over time. With the large agricultural influence in California's Central Valley, it is necessary to investigate the prevalence of antibiotic resistance bacteria in wastewater treatment plants to improve upon antimicrobial practices. We hypothesized that methicillin-resistant *Staphylococcus aureus* (MRSA) and carbapenem-resistant *Klebsiella pneumoniae* will be present in wastewater from agricultural regions of the Central Valley. Influent wastewater samples from Merced, Mariposa, Modesto, Fresno, and Los Banos were screened on antibiotic plates, cultured, and ran through PCR. Presence of MRSA and *K. pneumoniae* were detected in all five sample sites. Statistical relationships and significant of impact will later be analyzed. The data generated will help map microbial evolutionary pathways through artificial and natural water environments across the Central Valley and ultimately, be used to improve antimicrobial treatment practices in agricultural regions.

Population Structure and Local Adaptation Through the X-Chromosome

Hamelmal Gobezie and Emilia Huerta-Sanchez, PhD
School of Natural Sciences, University of California, Merced

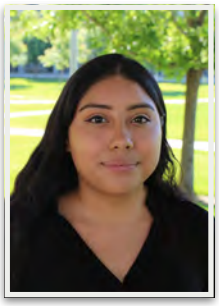
One fundamental question in human evolutionary biology is understanding how humans adapted to their local environment. We will investigate how selective pressures and demographic factors have affected the observed genetic variation on the female X chromosome. Through the usage of public data sets provided by the 1000 Genomes Project, we investigate local large frequency differences in closely related populations. Between two populations, we can measure genetic population differentiation, FST. A value of 0 may be interpreted as the two populations being genetically similar and 1 as the two populations being genetically different. We are looking at 26 different populations, therefore we will have 325 pairwise comparisons. We use the relationship between Maximal Allele Frequency Difference vs FST Global as the null model. That is, when pairs of populations do not follow this expectation, this may be interpreted as a signal of local adaptation in one of the populations. From here we will ask questions like: are these local frequency differences within genes, what does the region look like, are there other variants nearby that have frequency differences, what is their position, and more. The goal is to identify and characterize signatures of local adaptation on human X chromosomes.



Reconstructing the Immigrant Rights Movement of 2006: Bakersfield, CA

Karen Gomez, Maria D. Mora, MA, and Paul D. Almeida, PhD
School of Social Sciences, Humanities, and Arts, University of California, Merced

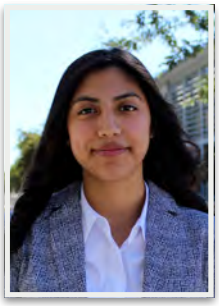
The Immigrant Rights Movement of 2006 is one of the largest mobilizations for immigrant rights in U.S. history, yet relatively little scholarly attention has been given to these mobilizations in marginalized regions and low-income cities. I conducted a case study analysis of a central valley city, Bakersfield, using a mixed-methods approach by conducting interviews of key organizers and participants along with newspaper documentation of protest events and secondary sources. My findings reveal that the legal threat of anti-immigrant law HR 4437 was present in Bakersfield but the threat alone was not enough for mobilization, framing and coalitions were also important. I also examined outcomes of the 2006 movement and found two key outcomes: 1) sustained mobilization and 2) change in consciousness of the community.



Investigating the Role that VHL-deficiency plays in B Cell Development and Immune Response

Samantha Hernandez, Betsabel Chicana, MS, and Jennifer O. Manilay, PhD
School of Natural Sciences, University of California, Merced

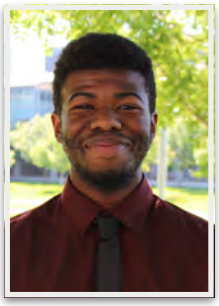
B cells are important immune cells that are required for effective immune responses to protect the body against pathogens. Previous experiments have shown that conditional knockout of the von-Hippel Lindau (VHL) gene in osteocytes leads to an increase of bone mass, therefore leaving diminutive room for the bone marrow. We have also observed that these VHL-deficient mice have a reduction in B cell progenitors in the bone marrow, as well as decreased mature B cells in the spleen, although some mature B cells do develop. We hypothesize that mature B cell function after immune challenge is altered with VHL-deficiency. In this study, we investigated the functional response of B cells in VHL-deficient mice in response to immunizations. The immunizations used included the model antigens NP-Ficoll and NP-OVA to induce T-dependent and T-independent B cell responses. We will compare responses in control and VHL-deficient mice to determine the effect of VHL on B cell function, using enzyme linked immunosorbent assays (ELISA's) to quantify antibody titer levels after immunization. Since B cell frequencies are reduced in VHL-deficient mice, I expect to observe lower levels of antigen-specific IgM, IgG3 and IgG1 levels in VHL-deficient mice compared to controls. The results from this study will help better understand B cell immunity in the absence of the VHL gene, and could inform how changes in bone homeostasis affects immune function.



Physical Activation of Peach Pit Derived Char and the Effects of Activation Time Length on its Surface Properties

Genesis Higueros, Andres Munoz Hernandez, and Gerardo Diaz, PhD
School of Engineering, University of California, Merced

Pyrolysis and gasification of waste biomass produces biochar, a porous carbonaceous material most commonly used for soil amendment, but also applied to water treatment and carbon sequestration. Activated carbons have larger surface areas in the range of 1000 to 2000 m/g, and porosity that removes contaminants more efficiently than biochar. Activated Carbon is generally derived from coal or coconut shells, which are mainly imported from Asia. The adsorptive properties of activated carbon depend on the activation parameters such as temperature, time, and atmosphere. Published results have shown that optimum properties for activated carbon are usually obtained for temperatures in the 800°C range and for activation times at which around fifty percent of the mass is lost. The objective of the project is to determine the physical activation parameters that result in optimum surface properties for peach pits derived biochar. In the preliminary experiments, pre-dried samples of biochar were tested at different activation times in a furnace at temperatures near 800°C. Steam was used as the activation agent, and nitrogen gas was used to cool the samples to around 200°C. After drying the samples, the mass loss was determined. The Brunauer-Emmett-Teller (BET) surface area, pore size distribution, and volume fraction will be obtained. Surface areas in excess of $1000 m^2/g$ are expected which will be considered good results.



Competitive Balance in the National Basketball Association: A Deeper Look Using Salary Distribution and Herfindahl Hirschman Index

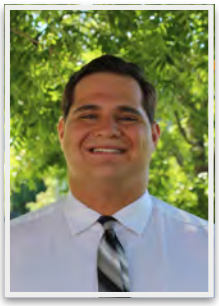
Javonte Hubbard and Justin Cook, PhD
School of Social Sciences, Humanities, and Arts, University of California, Merced

Throughout the history of sports leagues, there has always been argument about whether "superteams" (teams that generally have many high performing players) are beneficial to sports leagues and their competitive balance. This study focuses on the National Basketball Association (NBA), a league that has had its fair share of superteams throughout their history. The study, with the help of Professor Justin Cook, uses the Herfindahl-Hirschman index (HHI) to analyze market share and salary distribution amongst NBA teams between the 2005-2016 NBA seasons (12 years) and see whether there is a higher concentration of team wins within few teams or if wins are more distributed through the entire league. The argument is that because superteams have higher performing players, they will generally have higher totals in significant stats such as assist, points, and lower points allowed per game. As a result, NBA market share would be concentrated within a few teams that overall will have a negative impact on the league. The hope is that this study can be applied to all sports leagues to analyze competitive balance.

Unmanned Aerial Vehicle (UAV) Precision Landing: Improvements for Recharging Applications and Future Prospects

Sabrina Lauv, Tiebiao Zhao, Michael Andemeskel, Edgar Perez-Lopez, Alejandro Molina, and YangQuang Chen, PhD
School of Engineering, University of California, Merced

Unmanned Aerial Vehicles (UAVs) have found uses across multiple industries through delivery, rescue, military and other services. However, limitations remain due to a drone's low battery life and the costly necessity of manual battery replacement by the pilot. Autonomous battery swapping can be achieved by having the drone land precisely on a charging station and will reduce costs and increase its efficiency. GPS precision landing can be up to 1 meter off target, so other methods need to be investigated. Our team addresses the precision landing phase by using a lidar, infrared (IR) sensor, and target paired with the IRIS+ drone platform. The results of the project will be used to modify drone landing precision to within 30 cm of the target.



The Quantification of IgM to Detect Changes in Immune Function Following Development Perturbation

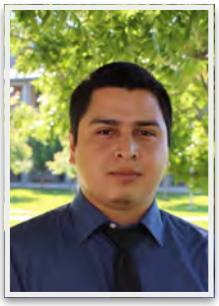
Eric J. Lebish, April Apostol, and Anna E. Beaudin, PhD
School of Natural Sciences, University of California, Merced

B1-B cells reside in the peritoneal cavity (PerC) where they mediate tolerance and initiate a rapid response to an infection through the production of natural antibody, Immunoglobulin M (IgM). B1-B cells are only produced during fetal development, and our lab has recently identified a developmentally restricted hematopoietic stem cell (drHSC) that gives rise to innate-like lymphocytes, including B1-B cells. Our lab further demonstrated that perturbation during fetal development, such as maternal infection, leads to sustained expansion of the B1-B cell population in postnatal life. Our goal is to determine whether developmental perturbation leads to an increase in natural IgM production from the expanded B1-B cell population. We hypothesized that there will be higher amounts of IgM detected in both the serum and PerC in neonates following developmental perturbation. To test our hypothesis, we will use an enzyme linked-immunosorbent assay (ELISA) to quantify the amount of IgM in the PerC and the serum. We will compare the IgM levels in the samples taken from the offspring of treated dams to control offspring. Our results from these studies will define the impact of developmental perturbation on immune function across the lifespan.

Exploring the Neural Processes of Beat and Meter Perception using EEG

Lisette Manriquez, Daniel Comstock, and Ramesh Balasubramaniam, PhD
Sensorimotor Neuroscience Lab; Cognitive and Informational Sciences, University of California, Merced

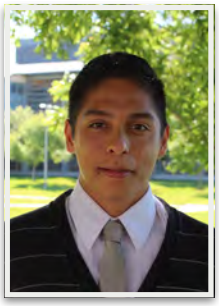
The perception of beat and meter is both essential and fundamental to every music experience. However, the neural processes underlying beat and meter perception remains unknown. The resonance theory for beat and meter perception suggest that beat perception is the entrainment of neuronal populations resonating at the beat frequency, producing higher-order resonance at subharmonics of beat frequency, corresponding to the meter. In this replicated study, we use electroencephalogram to confirm the theory that perception of beat and meter emerges from the entrainment of neurons resonating to the beat and meter. We hypothesize that the electrocortical activity generated by populations of neurons resonating to the frequency of the beat and meters presented, can be captured in the EEG. To test this, EEG is recorded on subjects while they listen to a rhythm of tones with a 2.4 Hz beat while imagining the meter of the beat as either binary or ternary. We predict that the beat will elicit electrocortical activity at the beat frequency (f = 2.4 Hz) and at the frequencies of the imagined binary (f = 1.2 Hz) and ternary (f = .8 Hz) meters. Our findings compare the electrocortical activity with the frequencies of the beat and imagined meters, as well with the original study being replicated. These results can provide closer insight into the dynamic cognitive processing of music and serves as compelling evidence of whether neural entrainment to beat and meter can be captured using EEG. Future studies can be performed using independent component analysis and dipole source localization with this data to locate and determine the neural components involved to further our understanding.



Topology Optimization of Material Discontinuities (MD) Patterns in Origami-Based Sheet Metal (OSM) Bending Using Finite Element Analysis

Gustavo Montero Contreras, Muhammad Ali Ablat, and Ala Qattawi, PhD
School of Engineering, University of California, Merced

Origami-based sheet metal (OSM) bending seeks to increase bending accuracy and reduce the high cost needed to bend a sheet metal part to the desired angle. This goal is achieved by instituting material discontinuities (MD) in the form of perforations to the sheet metal prior to bending. Previous study shows that implementing MD along the desired bending line would reduce bending forces and energy use. However, undesired stress concentrations are formed due to MD patterns. For MD to be more effective with lower bending force requirements and stress concentration, topology optimization is necessary. Therefore, this study aims to discover optimal topology that meets said requirements on three different MD patterns. Desired topology of MD is achieved using commercial finite element software ANSYS. The outline to achieving the desired topology consists of performing a bending simulation on sheet, running topology optimization process on results, extracting optimized MD pattern and validating new MD pattern by performing bending simulation with improved MD. Since the objective of the current work is to reduce stress concentrations, this work attempts to analyze current MD's with an emphasis in Global Von-Mises Stress optimization analysis seeking to cooperate or improve upon existing MD's. Derivations and relations of existing MD's to each other also observed.



Angiotensin Receptor Blockers Prevents Acute Kidney Injury in Insulin Resistant Rats

Vicente Morales[1], Esteban Sandoval[1], Akira Nishiyama[2], Alicia McDonough[3], and Rudy M. Ortiz, PhD[1]
Department of Cellular and Molecular Biology, University of California, Merced[1]; Department of Pharmacology, Kagawa University Medical School[2]; Department of Medicine, Keck School of Medicine, University of Southern California [3]

Acute kidney injury (AKI) can be exacerbated by diabetes, which is also associated with an inappropriately elevation in the renin-angiotensin-aldosterone system (RAAS). However, the contribution of elevated RAAS to AKI during the manifestation of diabetes is not well-defined. Here we tested the hypothesis that chronic blockade of AT1 ameliorates AKI in insulin resistant rats. AKI was induced by right kidney nephrectomy and an acute renal artery ischemia for 30 minutes. Three groups were used: (1) Long-Evans Tokushima Otsuka (LETO; control; n = 10), (2) insulin resistant, Otsuka Long-Evans Tokushima Fatty (OLETF; n = 7) rats, and (3) OLETF + angiotensin receptor blocker (OLETF+ARB;n=8; 10 mg olmesartan/kg/d x 6 wks). The urinary excretion ratios (mmol/mmol?) of Na+ and K+ to creatinine were measured for 3 hrs at hour-long intervals (T0, T1, T2, and T3). At T3 the average $U_{Na;Creat}V$ increased by 112% in LETO, and decreased by 29% in OLETF, while ARB stabilized levels consistent with LETO. At T3 the average $U_{K:Creat}V$ increased by 153% in LETO, and decreased by 43% in OLETF, while ARB stabilized levels to an even greater extent than in LETO (only increasing by 41%). The development of insulin resistance impairs the renal regulation of Na+ and K+ in response to acute kidney injury that is ameliorated by chronic blockade of AT1.

Reconstructing the Immigrant Rights Movement of 2006 in Stockton, CA

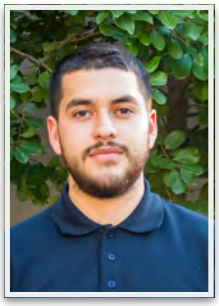
Rocio Murillo, Maria Mora, MA, and Paul Almeida, PhD
School of Social Sciences, Humanities, and Arts, University of California, Merced

The Immigrant Rights Movement of 2006 is one of the largest mobilizations for immigrant rights in U.S. history, yet relatively little scholarly attention has been given to these mobilizations in marginalized regions and low-income cities. I conducted a case study analysis of a Central Valley city, Stockton California, using a mixed-methods approach by conducting interviews of key organizers and participants along with newspaper documentation of protest events and secondary sources. My findings reveal that the legal threat of anti-immigrant law (HR 4437) was present but threat alone was not enough, other key conditions influencing the level of mobilization were: framing and coalitions. I also examined the outcomes of the 2006 movement: 1) Change in consciousness of the community and 2) Sustained mobilization.

Reconstructing the Immigrants Rights Movement of 2006 in Porterville, California

Valezka Murillo, Maria Mora, MA, and Paul Almeida, PhD
School of Social Sciences, Arts, and Humanities, University of California, Merced

The Immigrant Rights Movement of 2006 is one of the largest mobilizations for immigrant rights in U.S. history, yet relatively little scholarly attention has been given to these mobilizations in marginalized regions and low-income cities. I conducted a case study analysis of Porterville, California using mixed methods by conducting interviews of key organizers and participants along with newspaper documentation of protest events and secondary sources. My findings reveal that the legal threat of the anti-immigrant law (HR 4437) was present in all communities but threat alone was not enough, other key conditions also influence the level of mobilization: framing, coalitions, and community support. I also examine outcomes of the 2006 movement: 1) sustained mobilization. I found that there was no sustained mobilization after the massive 2006 demonstrations. In conclusion, this project closely examines the immigrant's rights movement in the city of Porterville and sheds new light on the previously ignored immigrant rights activism of the Central Valley.



Modeling of Pressure Drop and Heat Transfer Correlation through EES and Initial Phase of Large Scale Manufacturing

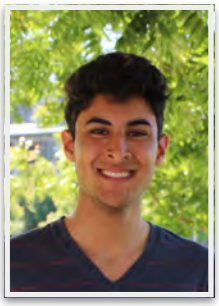
Julio Perez and Gerardo Diaz, PhD
School of Engineering, University of California, Merced

Solar thermal collectors are defined as an energy exchanger that converts solar energy to thermal energy and are often referred to as solar water heaters. Conventional solar water heaters include flat plate collectors and evacuated tubes with a heat-pipe attached to an absorber fin, however, small size of condenser section limits the rate of heat transfer and maintaining vacuum conditions over time can be challenging. A novel minichannel-tube solar thermal collector for low to medium temperature application is analyzed to demonstrate its heat transfer improvement with respect to conventional copper collector. In this study, year-round data collected by thermocouples, flowmeters and additional back-up sensors was analyzed through LabView and EES simulations. Year-round performance showed feasibility to operate on a larger scale. Due to the required precision of the minichannels in the aluminum collector tubes for large scale production, the proposed design had to consider the current manufacturing capabilities available. In order to meet the manufacturer's extrusion capabilities and keep a low pressure drop and high heat transfer, various dimensions for the aluminum minichannel tubes were simulated with EES. Furthermore, EES allowed us to consider different collector configurations. A previous design manufactured and tested at UC Merced reached a 12% improvement in thermal efficiency with respect to a copper flat plate collector and is currently being manufactured to satisfy the thermal energy needs of a middle school in Southern California.

Biomass Composition and Metabolic Flux Analysis of Melanoma Cells

Yanirong Phok, Amandeep Sanghera, Ajay Bainiwal, Simar Singh, and Fabian Filipp, PhD
School of Natural Sciences, University of California, Merced

With an estimated ten thousand deaths annually in the US [2], Melanoma is one of the most fatal of skin cancer in the United States. Humans are at risk for melanoma due to sun exposure which includes UV radiations resulting in DNA damage and impairment of DNA repair mechanisms. While the genetic basis of changes that facilitate the transformation of a normal cell to a metastatic malignant tumor cell are widely studied, the metabolic adaptations of tumor cells require further investigation. A common feature of cancer cell metabolism is the ability to differentially regulate metabolic pathways and nutrients to both maintain viability and build new biomass [1]. In this experiment, we aim to study how melanoma cells alter their metabolism to support continued proliferation by quantifying their macromolecular composition and creating a biomass equation that represents the data. Our research investigated carbohydrate, lipids, RNA, DNA, and protein. These macromolecules were extracted from three melanoma cell lines and the correlation between the macromolecule concentration and cell number was graphed. RNA and DNA extracts showed a linear graph, while protein extraction exhibited a nonlinear relationship. Further experiments will quantify the lipid and carbohydrate components and integrate these results into a complete biomass equation for use in metabolic flux analysis of melanoma cells.



Basketball Performance Predictions

Abraham Uribe and Florin Rusu, PhD
School of Engineering, University of California, Merced

Predicting the performance of basketball teams is a difficult task due to the uncertainties that may take place during a season of competition. However, using well documented data from the NBA, NCAA , and international leagues, it is possible to predict which teams will best perform for the following season. A team's potential can be quantified by each Player's Efficiency Rating. With this rating one can compare the stats of a player with other players to show which team, numerically, has the superior roster. More specifically, one can find a range of team efficiency based on which players are on the courts since only five players per team can actively compete. This method was tested in a Microsoft SQL database server using data from the NBA 2015-16 regular season to see how accurate its predictions would be compared to the result of the NBA 2016-17 season. The results show that many top teams from one season will tend to perform similarly the next, while teams of average performance will vary in the next season. This finding is similar to a referenced paper that indicates that even with data rich predictions, there is still an element of luck(unpredictability) present in each and every game. This is why it is possible to see underdog teams win games and even championships. Overall there are still elements to consider when it comes to basketball predications; such as, how to calculate team symmetry or how player injuries will affect a player's future performance.

Determining IL-7 Expression During Fetal Macrophage Development

Clint Valencia and Anna E. Beaudin, PhD
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IL-7 is a cytokine responsible for the proliferation and survival of lymphocytes, including T cells. IL-7 signals through a receptor that has two subunits, a common chain and a unique IL-7R chain. While the role of IL-7 signaling in promoting the lymphoid lineage is well-established, little is known regarding the role of IL-7 signaling in myeloid cell development. Our lab has recently shown dynamic expression of IL-7R during fetal tissue resident macrophage development. To gain additional insight into the role of IL-7R signaling in tissue resident macrophage development, we aim to define fetal IL-7 expression in relation to the expression of IL-7R expressing macrophages. We hypothesize that macrophages expressing IL-7R will associate with or migrate towards cells expressing IL-7. To test this, we will perform immunofluorescent staining on cryosections of embryonic day (E) 14.5 transgenic embryos expressing green fluorescent protein (GFP) off the IL-7 locus and the red fluorescent protein Tomato as a marker of IL-7R expression history. Macrophages will be specifically labeled with an F4/80 primary antibody, an established surface marker of macrophages. We will then image whole embryo cryosections to define the temporal-spatial relationship between IL-7R expressing macrophages and IL- 7expressing fetal cells. Results of these experiments will determine which cells express IL-7 during fetal development and will therefore shed light on the dynamics of IL-7 signaling in fetal macrophage development.

Estimating Air Pollutant (PM2.5) Levels Using Gradient and Color Information on Landscape Images

Christopher Villanueva and Shawn Newsman, PhD
School of Engineering, University of California, Merced

Air quality control and awareness presides as an important issue in today's industrialized society. Standardized metrics of air quality measures include PM10 and PM2.5, which are the concentrations of particles smaller than 10n and 2.5n in diameter respectively. In many parts of the world, equipment to measure air pollutants is not readily available, and so other methods are needed. In this project, we investigate the potential of using image processing techniques in order to estimate average local PM2.5 levels. We approach this problem using three techniques: 1) Calculating contrast in the horizon using gradient measurements, 2) Analyzing details of distant mountain details using edge detection, and 3) Measuring color frequencies in regions of the sky. Air contaminated by pollutants (PM2.5) will obscure the visibility and alter the color appearance of the sky in these images. This allows the mentioned methods to give us insight into these characteristics of the images and ultimately estimate PM2.5 levels. Experimental results show us that there is an inverse correlation between image visibility, color, and PM2.5 levels when analyzed at specific time periods and threshold parameters. Solar position and weather conditions are still to be addressed in order to present accurate estimates at diverse times and locations.

Effects of Almond Consumption for Eight Weeks on Blood Glucose Control in College Freshmen

Michael Viray, Jaapna Dhillon, PhD, Syed A. Asghar, Quintin Kuse, Natalie De La Cruz, Emily Vu, and Rudy M. Ortiz, PhD
Molecular and Cellular Biology, University of California, Merced

Daily consumption of almonds has many health benefits. Individuals that consume almonds on a daily basis may reduce their risk for metabolic syndrome or some aspects of metabolic disorders. Daily snacking of almonds may also improve cognitive function outcomes such as memory retention. Despite these recent discoveries, many potential health revelations remain elusive. An almond study was performed to further assess the potential benefits of almond snacking on the regulation of blood glucose. First-year university students (n=73, mean age:, mean BMI:) participated in an 8 week intervention (n = 35 control snack vs. n =38 almond snack). Graham crackers served as the isocaloric (325 kcal/d) control snack. Dietary recalls were obtained weekly, and blood samples were taken at the beginning (T0) and weeks 4 and 8 of the study to assess blood glucose and insulin concentrations. HOMA-IR, an index of insulin resistance will be calculated from blood glucose and insulin concentrations. Robust analyses of primary and secondary outcomes remain to be performed. It is expected that daily almond snacking by college freshman will improve glucose tolerance despite the lack of robust changes in body mass or adiposity suggesting that improvements in metabolism can be achieved independent of other commonly evaluated metrics of health, which is especially important in millennials that are nutritionally independent.

Undergraduate Research in the Humanities

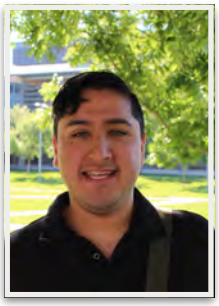
The following students scholars are part of UC Merced's Undergraduate Research in the Humanities (UROC-H) Program. The goal of the UROC-H program is to engage a cohort of 10-15 promising undergraduate students each year in faculty-mentored research and prepare them for advanced education in the humanities and humanistic social sciences.

For more information, please visit http://uroc.ucmerced.edu/uroc-h

Lyrical Expression of Shame

Nancy Aguilar and Jayson Beaster-Jones, PhD
School of Social Sciences, Humanities, and Arts, University of California, Merced

Shame is a state of being or feeling dishonored, or humiliated. The experience of shame is increased among one's person or close social network. Often times, a country music artist uses lyrical expression as a mode to establish their authenticity, and through song convey relatable emotion, such as shame. The aim of this research is to explore how shame is expressed in country music, in particular when shame and romantic relationships are lyrically expressed in country music songs. I will contextually analyze Kitty Wells, "It Wasn't God Who Made Honky tonk Angels" (1952); Kenny Rogers, "Ruby, Don't Take Your Love to Town" (1969); Charley Pride, "Why Baby Why" (1983); Carrie Underwood, "Before He Cheats" (2005). In this presentation, I will analyze how these artists manage to establish their authenticity within this genre and a brief history of country music development will be discussed. I will show the link between lyrically expressed shame in country music, and humiliation within romantic relationships. Thus, further exploration with this relationship and an artist's authenticity needs to be assessed to better understand the continued success of country music.



How Advertisements are Made Political and Provoke Emotion

Matthew Alvarez and Jayson Beaster-Jones, PhD
School of Social Sciences, Humanities and Arts, University of California, Merced

Past scholars, particularly in psychology, have focused on music's power to elicit emotions. More specifically, the literature has emphasized a common framework on how musical elements in motion picture and advertising commercials provoke a variety of emotions, particularly nostalgia and fear. There has been a lack of an interdisciplinary approach in examining how the various elements provoke emotion, especially in political commercials. In order to address this question of emotion in advertising, I conducted content analysis on three politically-oriented commercials. I will argue that music was just one important part of the many interdisciplinary elements that make advertising politically and emotionally provoking. My analysis of politically-oriented advertising relies upon integrated theory combining humanistic perspectives within sociology, psychology, ethnomusicology, visual art, literature, and history. My research examines the depiction and symbolism of important social movements and the representation of race, the incorporation of gospel music to denote Black cultural experiences, the use of black and white imagery to signify historical time periods, the integration of poetic rhetoric such as metaphor and repetition through lyrical voice narration, and the focus on human faces and speech to create a realistic political portrait and intimate space for the viewer. Thus, I argue that political advertising blends all these elements together to form, persuade, and pitch a cohesive political message and to sell both their brand, and a particular political ideology.

Uncovering the Narrative: Chinese Power and Presence in Merced County, 1866 to 1884

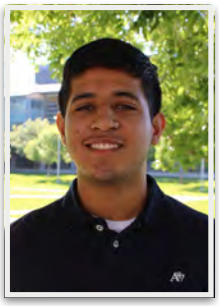
Verenize Arceo and David Torres-Rouff, PhD
School of Social Sciences, Humanities, and Arts, University of California, Merced

Stereotypes enforced by European Americans, with strong social and political capital, largely influenced the presence of Chinese residents in Merced County's history in the late 1800s. European Americans often held beliefs that Chinese residents did not contribute to the formation of Merced County. By examining Merced County's census records, county tax assessment rolls, and grantee records from 1866 to 1884, these archival documents reveal that Chinese residents were acquiring and expanding county spatial boundaries; ultimately, increasing their presence in the area. This growing visibility, as seen in the formation of Chinatowns in Snelling and Merced, has not been thoroughly recognized by scholars; thus, leaving a void in the history of Chinese residents in the Central Valley. Preliminary research seeks to fill these gaps and add to growing scholarship centered on Chinese residents in California. Continued research will seek to construct maps that tie Chinese residents to spatial boundaries in Merced County to adequately demonstrate the physical presence and power Chinese residents had in the area through financial and land capital. Furthermore, this project demonstrates Merced County's role in a larger national narrative concerning the neglect of minority history, as part of a greater history of the United States.

Teach the Child: Children, Shakespeare, and Empathy

TaNayiah Bryels and Katherine S. Brokaw, PhD
School of Social Sciences, Humanities, and Arts, University of California, Merced

This study looks into the effects of an early introduction to Shakespeare in various capacities on grade school children, and how it affects their development of empathy and interactions with fellow children. I argue that introducing students to diverse and modernized Shakespeare, in a hands-on and straightforward fashion (instead of traditional and more alienating way) increases understanding in children, helping marginalized children develop higher self-esteem, and helping non-marginalized students develop empathy and deeper understanding for their classmates. Research for this was largely hands-on; interviews were conducted with Shakespeare actors across California, and small workshops were conducted with groups of child actors in Merced. Some book research was also conducted, to analyze methods of modernizing Shakespeare, and place the argument in the larger context of the world of Shakespearean criticism. Preliminary findings support the argument, and prove that children not only favor more modernized Shakespeare performances that reflect their community, but enjoy the opportunity to dig into those performances, and benefit emotionally from both seeing and participating in local Shakespeare that favors diversity and creativity over traditionalism. Children are benefitted by seeing themselves and their diverse peers reflected in Shakespearean theatre, one of the most highly respected art forms of our day.



Music Therapy and Alzheimer's Health: Focusing on the Environmental Factors

Sergio Cabrales and Jayson Beaster-Jones, PhD
Global Arts Studies Program, School of Social Sciences, Humanities, and Arts, University of California, Merced

Music Therapy is not just a resource that provides socializing and entertainment for elderly in nursing homes, it is a health intervention that uses music as an element to address, maintain, and promote emotional, social, and cognitive needs of individuals. Music therapy is one way to improve Alzheimer's patient's quality of life, including their physical, mental, and social health. The benefits music therapy with Alzheimer's patients are well known to researchers, but many studies don't emphasize the environmental issues affecting the quality of life of Alzheimer's patients. These issues include nursing training, medical practice, lack of family involvement, and nursing home environment. In this presentation, I argue that quality of life among Alzheimer's patients in nursing homes are negatively affected by the environment of long-term care. By using music therapy as an intervention in nursing homes, I suggest that overall quality of life will be improved. By closely conducting a literature review, this project will bring vital recognition on the importance of music therapy to help reduce environments negative effects on Alzheimer's patient's quality of life.

What is "First Generation"? Defining and Identifying the Term "First-Generation" among First-Generation College Students in Higher Education

Jessica M. Calderon and Anneeth K. Hundle, PhD
School of Social Sciences, Humanities, and Arts, University of California, Merced

The topic of First- Generation in Higher Education has been a topic widely researched in several academic disciplines e.g. Psychology, Sociology, and Anthropology etc. Research done varies in social, academic, and financial disadvantages to cognitive, psychological and educational preparedness. Although there has been research done in numerous topics of "First- Generation", there is very little research done in what identifies a "First- Generation" college student and how it is defined as in a system of Higher Education. Preliminary research indicate that there is a vague set of identifications that are used to identify what a "First-Generation" college student is, however; the way the term is defined varies completely. This project will addresses the issue that in systems of Higher Education there is no clear understanding as to what defines and identifies a "First- Generation" college student and it will also address the issues that programs that were created to assist "First- Generation" college students have to face due to this unclear term. I argue that further research will indicate that programs that were created to assist First- Generation college student face difficulties when trying to properly assist and identify First-Generation college students and First-Generation students face difficulties in their academic and social complexity due to the lack of a solid sense of institutional identity within the community.

Forgotten Stories: Chinese Immigrants in Merced County from 1885-1990

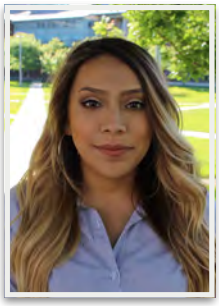
Leslie Gonzalez and David Torres- Rouff, PhD
School of Social Sciences, Humanities, and Arts, University of California, Merced

Chinese Americans in the Central Valley during the second half of the 19th Century were misrepresented by European Americans who had higher social and class standing. Chinese immigrants were forced to live in unsuitable living conditions, and thus were seen in the same light as their surroundings. Remaining objects rather than subjects, Chinese immigrants during that time were forced to negotiate with the social identity given to them by the European Americans. Looking through Merced County Assessment Tax Records, Grantee Records, and Census Records from 1850-1900, I examine how Chinese immigrants created communities amongst themselves and the relationship between their social identity and their communities. I consider factors on the lives of Chinese immigrants such as their economic success, property accumulation, and the spatial organization of Chinese American communities overtime in Merced County. Analyzing the information gathered from official records will offer a solution to the lack of evidence about Chinese Americans in the history of the Central Valley.

History of War on Drugs in Washington DC

Eva Hernandez and Tanya Golash-Boza, PhD
School of Social Sciences, Humanities, and Arts, University of California, Merced

This research project explores at the factors that led to mass incarceration in Washington DC and the effects of incarceration on the city from 1985 to 2000. I am working on tracking several court cases and newspaper articles in that time period related to drug offenses and drug gangs in order to create a narrative, that provides an insight to laws and policies used that led to an increase of incarceration. A key area of focus will be Racketeer Influenced and Corrupt Organization (RICO) and similar laws due to their application on street crews and gangs starting in 1992. We expect to find that the introduction of RICO and similar laws increase sentencing time among those incarcerated ultimately affecting incarceration rates and the city. This preliminary research will be paired with interviews, content analysis of city budgets, and agreements with federal agencies in order to go more in depth into identifying factors leading to the increase of incarceration rates. Through the use of census data combined with visual representation of the city from three different time periods such as 1990, 2000, and 2010, we expect to see a change in the general layout of the city in correlation with arrest rates and arrest locations. In conclusion, the project seeks to identify factors that led to an increase of incarceration rates in Washington DC while looking at how the city changed in relation to the increase.



Language, Cultural, and Service Disparities Within Health Narratives of Primarily Spanish Speaking Individuals in Merced County

Yuliana Hernandez-Mora and Dalia Magana, PhD
School of Social Sciences, Humanities, and Arts, University of California, Merced

About 49.6 percent of the current 80,608 population of Merced, California is of Hispanic or Latino race and ethnic origin (Brown University 2010). This makes up almost half of the entire city's population. Naturally this leads to the Spanish language representing over 34 percent of the languages spoken in all households in the city of Merced over time (Statistical Atlas 2015). The presence of any primary language other than English, creates various linguistic barriers that are heavily obvious in medical settings where Hispanic individuals with limited English proficiency must depend on non-Spanish speaking physicians and professionals for medical treatment. The barriers present are not only limited to language disparities culturally, but the two individuals have different constructions of behavior that is appropriate to such an encounter. This study further investigates these kinds of disparities that are present in a larger scale that is the entirety of Merced County, where the city of Merced is located. By interviewing Spanish speakers, I reveal the severity and consequences of such barriers in medical settings. In my study, I consider various contributing factors, such as how long an individual has been in the country after immigrating, the presence and efficiency of medical staff, including interpreters, as well their expectations of medicinal practices. The interviews allow individuals with low English proficiency an alternative voice to share their struggles in these settings without fear of repercussion or other consequences. This study primarily seeks to uncover, within their narratives, their true sentiments, ambiguities and even hostilities that can arise in these

The Relationship of Music and Autobiographical Memory Within the Kenyan Diaspora Living in the SF/Bay Area

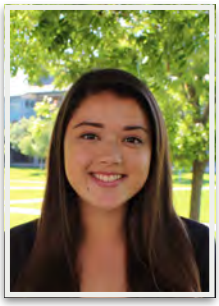
Daria Imbukwa and Jayson Beaster-Jones, PhD
Global Arts Study Program, School of Social Sciences, Humanities, and Arts,
University of California, Merced

The questions of whether or not music shapes the memory of an individual is widely debated within the field where music and science meet, with scholars such as Carlos Silva Pereira, How Music Affects the Brains and Jennifer Lynn Stubing, Music, Mood, and Memory: An In-Depth Look How Music Can be Used as a Trigger to Elicit Specific Emotional Responses and Associated Memories, arguing that music shapes the mood and memory of an individual. Also that music can be utilized as a trigger tool, to evoke emotional responses. However, these articles have not adequately addressed the issue of how music can be used as a mean of healing or how music shapes the autobiographical memory. There need to be more in-depth details about those two focuses. My paper addresses the use of how music can create a triggering response within a person's brain, and how it can be used as a tool of healing the individual mentally or emotionally. Also, it addresses the relationship between music and autobiographical memory with the Kenyan diaspora in SF/ Bay Area, in order to show how the music of Kenya has shaped the people of Kenya in the age range of 30 and above. I will discuss autobiographical memory, triggers, and Kenyan music, and juxtapose against the misconceptions of music and memory, in order to reveal the previously misunderstood connections between music and autobiographical memory. I argue that Kenyan music has shaped the autobiographical memory of the Kenyan diaspora, living in the SF/ Bay Area, ages 30 and above, In conclusion, this project, by closely examining the relationship between music and autobiographical memory with the Kenyan diaspora in the SF/ Bay Area, sheds new light on the rarely acknowledged issue of memory loss, mental illnesses/ cognitive

Barriers and Dynamics of First-Generation Transfer Students at UC Merced

Santana Juache and Anneeth Kaur-Hundle, PhD
Department of Anthropology, School of Social Sciences, Humanities, and Arts,
University of California, Merced

The purpose of this study is to understand the dynamics of first-generation transfer students, focusing on their experiences. National data has shown that first-generation transfer students graduate at lower rates than incoming freshman, but especially if they are students of color (Crisp and Nunez 2014, 297). Even when transfer students attend four-year universities, the rates are still low in comparison to the other two groups, but even lower for students of color, who are a part of a lower socioeconomic status. This study uses in-depth interviews and participant-observation to closely examine the personal experiences first-generation transfer students face that impact their education, and attempts to understand if institutional racism plays a part in this. Although, there is lots of quantitative data that shows both the graduation gap and racial gap amongst transfers, there *is little qualitative data gathered from the students themselves*, that explains why these gaps exists or expands our understanding of how and why they exist. The qualitative data in this study adds context to the "hidden struggles" first-generation transfer students face that can impede their path to success in higher education. This study focuses on the socioeconomic and racial experiences of these students at UC Merced since the institution is a largely made up of minorities and has a population of first-generation transfer students that continues to expand.



Modern Shakespeare Audience, Shakespeare's Continued Relevance in Scholarship and Literature, as well as in Culture and Human Experience

Alison Luna and Katherine Brokaw, PhD
School of Social Sciences, Humanities, and Arts, University of California, Merced

How can Shakespeare be made relevant to a modern audience? Shakespeare wrote during the era of English Renaissance Theatre, between 1562 and 1642. Since then, theatre has changed in many ways, from subject matter to language to overall purpose. The times have changed, the audience has changed, and William Shakespeare himself is long dead, so why do people still care about his work, and how do they try to preserve it? My study aims to answer these questions through pointed observation and analysis of several productions of various Shakespeare plays across California. Each production had a different take on Shakespeare, and a different way of attempting to bring the audience in. My research concludes that theatre adapts to changing times and new audiences not only with the proliferation of new plays, but also reformation of old ones.

First Generation Hispanic Immigrants in Merced County: Health Narratives and Actions Taken in Response to Health Care Barriers

Maria Rivas Reyes and Dalia Magana, PhD
School of Social Sciences, Humanities, and Arts, University of California, Merced

Merced County's Spanish speaking population faces health care barriers at the singular and systematic levels. These barriers include transportation to medical facilities, high waiting times at medical offices, lack of interpretation services, lack of health insurance, limited coverage of health insurance, and high costs of health care services. They also encounter communication and cultural barriers. Although literature is replete with barriers Hispanic populations encounter in different rural settings, less often reported are the actions that first generation Hispanic immigrants take to aid their illnesses in response to facing said barriers. The current study collected health narratives from eighteen first generation Hispanic immigrants from Merced County. Congruent with previous research findings, the health narratives reported by participants revealed that they encountered at least one health care barrier. Almost consistently, the findings showed that first generation Hispanic immigrants turned to conventional medicine, used over the counter drugs, tended to seek care only in urgent cases, and even went back to their home countries to find the medical care they couldn't access in their cities. These findings may continue to help us understand how the Spanish population of Merced County understands the barriers that stand in their way from medical care.

A Qualitative Analysis of Health Survey Marginalia

Akhila Yechuri and Mariaelena Gonzalez, PhD
School of Social Sciences, Humanities, and Arts, University of California, Merced

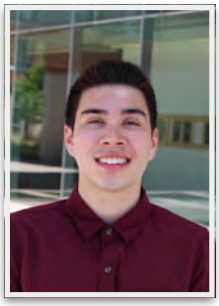
Consistent oral hygiene habits are paramount for the efforts to preserve our overall health. This study analyzes marginalia in oral health surveys by examining survey responses to observe overall trends and barriers to dental care access. Items in surveys frequently receive elaboration and other complex answers from respondents; however, any nonadherence to survey format is nearly always excluded from the collected data. These additions and qualifications often convey responses outside the expectations of the survey (McClelland [American Psychological Association, 2, (2016)]). An insufficient amount of research regarding marginalia in conducting surveys has occurred; and the literature in this area is sparse. The overall purpose of this study is to examine oral health beliefs, knowledge, attitudes, practices and access to care through the analysis of marginalia in conducted surveys. I do so, through a codebook I developed, through which I analyze and expound upon significant trends and patterns in the 300 surveys that I examined. Preliminary data so far shows that English speakers and women are far more likely to display nonadherence to survey format. Overall, this analysis highlights lingual and social disparities in the way studies are conducted, specifically in the case of self-administered surveys. Examining these processes of marginalia is important to consider for future studies regarding survey administration. My analysis will contribute to the betterment of academia in public health and data collection.

Merced Nanomaterial Center for Energy and Sensing

MACES

MERCED NANOMATERIALS CENTER FOR ENERGY AND SENSING

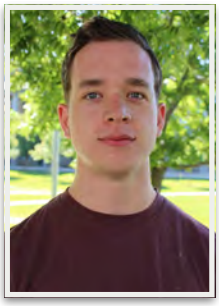
MACES Summer Undergraduate Research Fellowship Program: MACES (Merced Nanomaterial Center for Energy and Sensing) was established with support from NASA in the fall of 2015. Our educational mission is to establish a vertically integrated STEM program that will produce a highly skilled and diverse workforce for NASA missions and beyond. One of the key components of the program is a 9-week long summer undergraduate research program that recruits students from local community colleges and nearby CSU campuses. Students will work side by side with UC Merced graduate students and faculty. Through structured mentoring and intensive hands-on training, students in the program will gain the experimental skills that allow them to effectively and safely work in a laboratory setting. This will be complemented by a weekly seminar series that introduces students to different research topics conducted in MACES and at NASA. Upon completion, students will be able to demonstrate basic knowledge of their research area and to summarize their own research.



Atomic Layer Deposition of Solid-Oxide Fuel Cell Cathode

Brandon Fields[1, 2] and Min Hwan Lee, PhD[2]
California State Polytechnic University, San Luis Obispo[1]; School of Engineering, University of California, Merced[2]

Fuel cells are a strong candidate for the next-generation of clean energy. The main components that make up fuel cells are electrodes, and the electrolyte, similar to a battery. My project consists of using ALD (Atomic-Layer-Deposition) to precisely coat the electrode(Cathode)/electrolyte interface, as well as the outer surface of the electrodes. Doing this will increase the efficiency and productivity of the fuel cell, as well as increasing the time the fuel cell can run without breaking down. This gets done by that fact that using ALD on the electrode/electrolyte interface increases the amount of TPBs (Triple-Phase Boundaries); in which the electrode, electrolyte, and fuel are all in contact and available to react which increases ion-conductivity. Also using ALD on the outer electrode layer strongly prevents agglomeration and allows for the electrode to continue to act as a catalyst for a much longer time-period. ALD is the coating method of choice due to that fact that is extremely precise because it is a self-limiting reaction, and the two precursors cannot bond with themselves so only a certain thickness of a single precursor will be coated regardless of the amount of time being exposed to the surface. The results showing increases efficiency will be shown through an oxygen partial pressure EIS test.



Uniform spreading of lipid films on nanopaper increases size and yield of liposomes using the PAPYRUS method

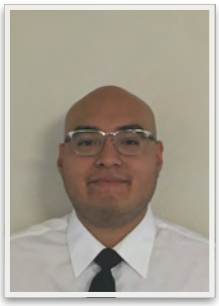
Joshua Greschler[1, 2], Joshua R. Greschler[2], Melissa Xu[2], and Anand Subramaniam, PhD[2]
Allegheny College[1]; Department of Bioengineering, School of Engineering, University of California, Merced[2]

Lipid vesicles, or liposomes, structurally mimic the plasma membranes of living cells. Lipid vesicles have applications ranging from abiogenesis to targeted delivery of medicines throughout the body. The PAPYRUS (Paper-Abetted liPid hYdRation in aqUeous Solution) method developed by our lab uses commercially available cellulose filter paper, a ubiquitous material, to fabricate giant vesicles. Here we report modifications to the initial PAPYRUS protocol which improve yield and consistency in the formation of vesicles. We use a material termed nanopaper, which is composed of nanocellulose fibrils and is denser than filter paper, upon which we spread a uniform thin film of lipids. Washing of the surface of the nanopaper after an incubation period in an aqueous buffer consistently yields free large vesicles in the buffer of diameters ranging from 10 to 250 microns. An optimized protocol using 24 well plates with standardized volumes and incubation periods allows for consistent high yield batches of large vesicles.

Using Fluorescence spectroscopy to monitor the self-assembly of DNA origami

Terell Keel[1, 2], Melissa Goodlad[2], Huan Cao, PhD[2], and Tao Ye, PhD[2]
California State University, Sacramento[1]; Merced Nanomaterials Center for Energy and Sensing, University of California, Merced[2]

Fluorescence spectroscopy is a useful technique for detecting conformational changes in proteins and DNA. In this study, fluorescence spectroscopy is used to monitor the DNA origami folding process in an attempt to identify the optimum folding temperature in solution. Identification of the optimum folding temperature can facilitate and curtail the folding process; dramatically reducing folding time and increasing yield. The sample DNA was stained with Syber Green 1 dye in order to monitor the folding process. The fluorescent intensity of the staining dye embedded into the DNA has a direct relationship with the rate of folding. Previous experiments indicate that 50ºC is the best folding temperature for this particular origami structure. The test solution consisted of a single-stranded viral DNA isolated from M13mp18, excess staple DNA, and buffers. A temperature program was created comprising a 10 hour incubation period at 70ºC with 3 consecutive fluorescence measurements, 10 minutes apart, from 70ºC to 40ºC. The fluorescence parameters were set at 497nm excitation and 520nm emission wavelengths. The results were then subtracted from the fluorescence program of the staple solution. Completion of the temperature program indicated a prime temperature of 55ºC; slightly higher than the previously determined temperature of 50ºC.



Characterization of electron transfer in plasmonic nanoparticle/Zinc oxide crystal composites

Miguel Rodriguez[1, 2], Katerina Nikolaidou[2], and Sayantani Ghosh, PhD[2]
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Metal oxide wide band gap semiconductors loaded with plasmonic nanoparticles are currently being investigated as electrodes for solar water splitting. Zinc oxide (ZnO) is a favorable material due to its ease of fabrication which enables preparation of different nanostructures, using low temperature techniques that make large scale manufacturing viable, as well as high electron mobility. By studying the electronic interactions between ZnO crystals and plasmonic nanoparticles, further investigations can be done to enhance hot electron transfer and light absorbance. Gold and silver nanoparticles with diameters ranging from 5nm to 20nm are drop-casted on a ZnO crystal and their distribution on the ZnO crystal is imaged by means of scanning electron microscopy (SEM) to correlate different nanoparticle distribution with the observed electrode characteristics. The emission characteristics are measured through photoluminescence (PL) spectroscopy, and PL intensity quenching is expected to be observed due to electron transfer from the ZnO crystal to the metallic nanoparticles. Probing of these characteristics will verify if ZnO crystal/metallic nanoparticle composites show potential applications in solar water splitting devices, which will provide a route towards efficient light trapping and economic scalability.

Spectroscopy for Low-dimensional Nanomaterials

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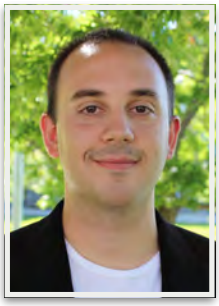
Perovskite quantum dots (PQD) and two-dimensional MoS_2 nanosheets have various applications in materials industry, attributed to their tunable band structure and exceptional charge carrier dynamics. Thus, synergistic combination of PQD and MoS_2 represents an emerging frontier for optoelectronic and energy harvesting and has attracted immense interest. To this end, the emerging field needs simple, high throughput and reproducible approaches to synthesize, assembly and characterize PQDs, 2D-MoS_2 and the binary nanocomposites. Photoluminescence (PL) measurements are an important tool in understanding fundamental properties relevant to aforementioned application. We first propose to systematically characterize PQD using a reflection and transmission optical setup for static and dynamic PL. Using temperature dependent PL spectroscopy, we observe crystal phase transitions in PQDs at low temperatures and probe charge carrier dynamics of different PQDs synthesized. The crystal phase transition from tetragonal to orthorhombic causes the emission spectra of PQDs to widen as temperature decreases. Two main effects of the phase transition are an increase in recombination rate and a shift from free carrier to exciton dominated recombination. PL spectroscopy's utility as a tool for characterizing charge carrier dynamics of materials can operate as a check for nanomaterial quality in future industry applications.



Testing for Superlubricity of Castor Oil as a Lubricant between NiTiNOL 60 and Steel

Michael Walker[1, 2], Azhar Vellore[2], Kimberly Rodriguez[2], and Ashlie Martini, PhD[2]
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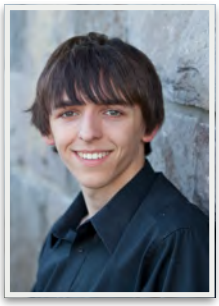
Our study is being conducted in attempt to replicate the results of a similar project that was conducted by Dr. Qunfeng Zeng at the Key Laboratory of Education Ministry for Modern Design and Rotor-Bearing System at Xi'an Jiaotong University. Dr Zeng and his associates ran numerous tests in which a NiTiNOL 60 bearing slid on steel under castor oil lubrication. In their tests, they were able to reach superlubricity (Coefficient of Friction <<0.01), with a COF of 0.008. So far in our research, we have not yet obtained results close to that of the other groups. Initially our tests were to match those of our predecessor who is not present this summer, and then we started experimenting to create a comprehensive stribeck curve, to see if our curve would match the the one in the research paper and to see if their Hersey number would lie on our curve. After those tests we planned to match our tests in terms of average pressure, as the pressure on our bearing is much higher because of its smaller size. In order to decrease the pressure to match the 280 MPa in the published paper we must decrease the load that is applied in our tests. Our next step is to implement our plan once a piece is made for our machine to allow us to test at lower loads. Once we finish these low load tests, that would conclude what I am able to do because I will have attempted to match each condition that I can.



The Synthesis and Analysis of Conductive Poly-Diaminonaphthalene variations for electrochemical energy storage applications

Andrew Williams[1, 2], Ian M. Hill[2], Zhihan Wang[2], and Jennifer Lu, PhD[2]
Oregon State University[1]; University of California, Merced[2]

Poly-Aniline (PANI) has proven to be a powerful polymer due to its conductive properties. When layered with graphene oxide (GO), PANI can be used in energy storage applications such as supercapacitors. Due to the successes of PANI, Poly-Diaminonaphthalene (PDAN) can potentially improve upon what has already been done with PANI. The structure of DAN (before polymerization) is two aniline molecules bound together at the carbon rings. Many variables can be changed to alter the properties of PDAN. Different initiators will create different polymer chains, and phytic acid will crosslink the polymers that are formed. A series of tests was done to compare different polymerization conditions. It was found that phytic acid prevents film construction with GO, instead making a thick gel. The ideal initiator was Iron (III) Chloride, which can dissolve with the DAN in multiple solvents (Butanol and NMP were the most effective). The dissolution lead to longer polymer chains which allowed for consistent layering within GO. The consistency of Iron (III) Chloride in Butanol or NMP without Phytic Acid proved to be the ideal conditions for DAN polymerization.

Accelerated STEM Pathways through Internships, Research, Engagement, and Support

ASPIRES
Accelerated STEM Pathways through Internships, Research, Engagement, and Support

The "Accelerated STEM Pathways through Internships, Research, Engagement, and Support" (ASPIRES) program is a collaboration between Canada College's Engineering Department, San Francisco State University of Engineering, and UC Merced. The project is supported by a grant from the US Department of Education through the Minority Science and Engineering Improvement Program (MSEIP), Grant No. P120A150014

1. The overarching goals of the ASPIRES program are:to increase the retention and success in STEM courses among community college students from traditionally underrepresented minority (URM) groups in STEM;
2. To increase awareness of and interest in STEM careers among k-12 and community college URM students; and;
3. To increase the number of URM students receiving AS degrees and transferring to four-year institutions to pursue STEM degrees.

Developing a Game with a Collect-to-Score Objective to test Human Intelligence and Behavior through Foraging and Cognitive Science

Bianca Corine Doronila[1, 2] and Christopher T. Kello, PhD[2]
Cañada College[1]; Cognitive Science, University of California, Merced[2]

Cognition uses mental action to acquire knowledge through thinking, experiences, and senses. For this research, a game was developed through Unity 3D software, a game engine that lets the creator build high quality 2D or 3D games across most platforms available. Unity can be used with C# or Javascript language to write syntax for the project. Unity has its own database that can be used to implement the code written, as well as an ASSET store for prebuilt 3D models. A 3D game is required for this project so that the gameplay is natural and embodied. The objective of the game requires a user to play as a first-person character and 'forage' across an open field and collect coins on the ground to investigate how well they can search for resources as a common function of their cognitive process. In addition, the parameters of the space, the quantity and clustering of coins are varied to avoid repetition. The controls are coded to be used by mouse and keyboard, and hopefully, later improved for VR and joystick compatibility. In addition, scoring and foraging paths are recorded to measure the user's performance. The measurements shall provide data for cognitive scientists to determine how the human cognitive skills works and functions. There exists other research that use gaming applications to implement their goal.

Decomposition of Toluene and Naphthalene (model tars) via Application of Atmospheric Pressure Dielectric Barrier Discharge Plasma

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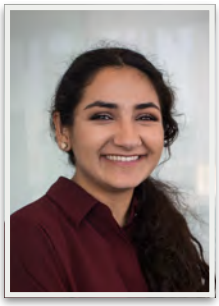
Cañada College[1]; Thermal Science and Energy Conversion, University of California Merced[2]

Gasification is a thermochemical process that involves the conversion of carbonaceous materials into syngas which is mostly composed of carbon monoxide, hydrogen, and heavy byproducts called tars (combinations complex aromatic hydrocarbons). Biomass gasification faces the challenge of commercialization due to fuel line clogging by tars. Dielectric barrier discharge (DBD) plasma is an energy-efficient source of material treatment that allows in-line decomposition of tars into volatile hydrocarbons, reducing excessive energy and waste produced by current cleaning methods. Because the molecular composition of Toluene and Naphthalene are similar to byproducts produced by the biomass gasification process, they were chosen as model tars for DBD plasma treatment. We designed a system composed of three modules, heating & mixing, plasma, and sampling. The first module is designed to raise the temperature to mimic conditions that might take place in a biomass gasifier. The DBD plasma treatment (30 kV AC peak-to-peak, 15 kHz) is used in the decomposition of Toluene and Naphthalene. The sampling module is used to capture unprocessed tars. Gas chromatography is used to analyze the sample and determine its composition. This will allow us to determine the amount of Toluene and Naphthalene that was decomposed. The results will provide an indication of where the system can be optimized and implemented.

Center for Cellular and Bimolecular Machines

The Center for Cellular and Biomolecular Machines (CCBM) is a National Science Foundation (NSF) Center of Research Excellence in Science and Technology (CREST) at the University of California, Merced. The NSF-CREST CCBM uses an interdisciplinary approach cutting across scientific and engineering methodologies to: 1) Pursue a fundamental understanding of the structure, dynamics and functioning of multi-scale biomolecular and cellular assemblies with the goal of enabling control of function in vivo; 2) Use these fundamental principles to design and develop novel bio-inspired functioning machines ranging from designer cells and tissue to diagnostic and therapeutic devices, and 3) Host an integrated, interdisciplinary training program for graduate students that uniquely emphasizes both physical and biological components and provides research and training experiences for undergraduate and high school students that will enhance the recruitment of those traditionally underrepresented in STEM research.



Investigating the Fold-Switching Mechanism of Biological Clock Protein KaiB in Cyanobacteria

Summer Al-Hamdani[1, 2], Alicia Vazquez[2], and Andy LiWang, PhD[2]
College of Science and Mathematics, California State University, Fresno[1]; School of Natural Sciences, University of California, Merced[2]

Most organisms evolved with an internal timekeeper known as a circadian clock to adjust to predictable changes in temperature and light caused by Earth's rotation. Cyanobacteria circadian clocks are a good model to study, since they are simplistic and can be reconstructed *in vitro*. The core oscillator contains a three-protein system composed of KaiA, KaiB, and KaiC. KaiB exists mainly as a tetramer. The truncated mutation (denoted by YY) of KaiB is a dimer. In this state, KaiB can switch between two topographical folds with distinctive functions: active and inactive states. To study the mechanisms behind KaiB fold switching abilities, KaiB genes were modified using a polymerase chain reaction (PCR) to create a P70A KaiB mutant. KaiB has a trans-cis isomerization at residue 70, so proline was changed to alanine to lock it in a trans position (the inactive state). The genes were ligated into a plasmid for transformation into *E. coli* cells. After gene expression, the mutant KaiB proteins were extracted and purified. The proteins were exposed to high temperatures to test their stability

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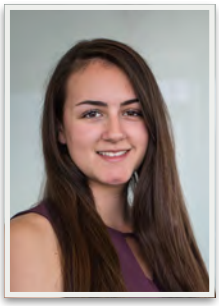


Designing a protein based Calcium (Ca^{+2}) sensor

Rachel Choate[1, 2], Abhigyan Sengupta, PhD[2], Mourad Sadgi[2], and Victor Muñoz, PhD[2]
California State University, Stanislaus[1]; University of California, Merced[2]

Heart failure is one of the leading causes of death in the world. A common hypothesis is that changes in calcium levels within cardiac muscle causes failure. In order to test this hypothesis, an efficient calcium sensor needs to be developed. The project in the Munoz lab that I worked on was developing a protein based single molecule Ca^{+2} ion sensor. We have started with a naturally occurring Ca^{+2} sensor named Calmodulin and mutated it to convert to a single molecule sensor. Several intermediate steps are necessary for the development of a protein based calcium sensor. At first, we have designed a plasmid for the chosen protein. Then we have expressed the protein in *Escherichia coli* cells, extracted by cell lysis, and purified the protein by liquid chromatographic techniques. After purification, we needed to label the protein with fluorophores and re-purify the labeled product. Once the labeled protein is in hand, we will be able to move onto spectroscopic experiments to explore the folding and unfolding thermodynamics and kinetics in absence and in presence of calcium ion. During my project, I have expressed, extracted, and purified one mutant of Calmodulin (CaM_attotrp) and can move on to spectroscopic experiments. I successfully completed the same process with the protein GPW (wild type), but failed to get good expression of the mutant GPW_1. I have also learnt the basics of absorption, fluorescence spectroscopy and circular dichroism.

Chemical Synthesis of Organic Ligand and Determination of the Cytotoxicity of Gold Nanoparticles

Shoji Hishida[1,2], Makiko Quint[2], and Sayantani Ghosh, PhD[2]
Merced College[1]; School of Natural Sciences, University of California, Merced[2]

One of the primary obstacles to modern tissue engineering is the development of a perfusable vasculature within the generated tissue. While a few methods exist, there are still many challenges to overcome to effectively incorporate the vasculature into existing primary tissue. A recently developed technique for microscale cargo delivery utilizes microshells composed of mesogen-functionalized gold nanoparticles (NPs). These microshells have the potential to be used to encapsulate growth factors and possibly entire vascular cells. The shells can later be optically ruptured to release their contents at a time that is developmentally appropriate in order to induce vascularization in the primary tissue. As part of the ongoing development of this cargo delivery system, a new organic ligand used for functionalizing the NPs is being synthesized. Before testing the potential application of these microshells in tissue engineering, the cytotoxicity of the components of the microshells must be examined. Proliferation and viability assays were carried out on cultures of C2C12 myoblast cells with various concentrations of gold NPs suspended in the culture media to identify potential cytotoxic effects. A gradient of different nanoparticle concentrations were tested in order to determine the optimal conditions for application in a cell culture.

Patterning Supported Lipid Bilayers on Paper Using Inkjet Printing

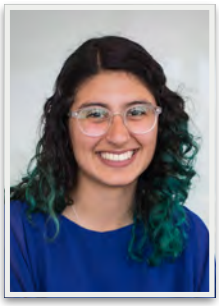
Jacob Orozco[1,2], Joseph Pazzi[2] and Anand B. Subramaniam, PhD[2]
Merced College[1]; Department of Bioengineering, School of Engineering, University of California, Merced[2]

Ink jet printers have been engineered to print images onto flexible sheets such as paper and transparencies in an automatic and consistent fashion. These experiments take advantage of this concept and attempts to print a lipid bilayer onto nanopaper using an ink-jet printer, specifically the Canon Pixma MX922 model. This involved initially testing if isopropanol based inks can print, since the lipid being used, 1,2-Dioleoyl-sn-glycero-3-phosphocholine (DOPC), is soluble in this without vesicle formation. After confirming the ability to print using isopropanol based inks, lipids were then inserted to be printed onto nanopaper. Afterwhich, these dry lipids on nanopaper were then hydrated in buffer and observed to assure the formation of a lipid bilayer. Printing manually, by pipette, shows the formation of a bilayer was successful by the use of fluorescence recovery after photobleaching (FRAP). FRAP testing on inkjet printed lipids on nanopaper shows the formation of a bilayer only when the print is repeated several times onto the paper. Future experiments will require fidelity and qualitative testing from inkjet prints for potential exploration of applications of this newfound technique.

Computational Modeling of Multiple Kinesin Motor Proteins on Microtubule Bundles

Boris G. Rudolfs[1,2], David A. Quint, PhD[2], and Ajay Gopinathan, PhD[2]
California State University, Fresno[1]; School of Natural Sciences, University of California, Merced[2]

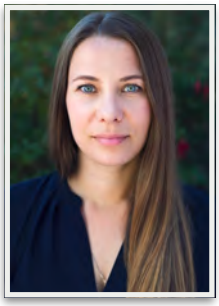
The directed movement of micron scale sized cargo within a single cell is moderated by a large family of motor proteins that have the ability to “walk” along complex networks of cytoskeletal filaments. We focus our study to just two components of this system, Kinesin-1 and Microtubules. This two-component system has been studied *in vitro* [refs] and well characterized quantitatively using measures such as run length and force-velocity measurements. Utilizing optical trapping techniques have uncovered a rich dynamic phase space that directly correlates genetic manipulations to overall motor function and dynamics. However, *in vitro* studies so far have only been able to study simplistic realizations of this very complex system with regards to motor-cargo composition and cytoskeletal topology. We study Kinesin-1 via computer simulations (*in silico*), which allows us to reconstruct more complex realization of this system and then we predict what the behavior should be by measuring the standard experimental outputs, such as run length and force-velocity relationships. Using a coarse-grained model to simulate our system allows us to gather population level statistics, which we have used to probe multi-motor cargo assemblies walking on microtubule bundles. Our preliminary results agree with previous experimental work for single microtubule systems and multi-motor complexes. Our focus now is to analyze the effect of microtubule bundles on the dynamics of multi-motor cargos.



Directing vasculogenesis in microfluidic devices for tissue engineering

Hannah Ochoa Sanchez[1,2], Lian E. Wong[2], and Kara E. McCloskey, PhD[2],
Merced College[1]; School of Engineering, University of California, Merced[2]

The field of tissue engineering combines cells and materials in hopes of repairing or replacing damaged tissues and organs. In the body, blood vessels move oxygen and nutrients throughout the body, however, to build sufficient tissues and organs *in vitro* a functional vascular network needs to be established to improve integration and implantation. Currently the McCloskey lab is utilizing microfluidic devices that enable the formation of vascular networks. The microfluidic devices are made from molded polydimethylsiloxane (PDMS) and by co-culture human umbilical vein endothelial cells (HUVEC) and normal human lung fibroblasts (NHLF) to form perfusable microvasculature. In collaboration with Dr. Ghosh we set out combine light activated delivery vehicles made of gold nanoshells in our microfluidic device to guide the formation of these vascular networks. We analyzed the toxicity of these components (gold nanoparticles, liquid crystals, and ligands) by creating a growth curve and performed a live/dead assay. Results confirmed that these materials do not inhibit the growth of cells.



Self -organization and Collective Oscillation of *Escherichia coli* in Aquatic Suspensions

Margarita Savageau[1,2], Jeremias Gonzalez[2], Pooja Chopra[2], and Bin Liu, PhD[2]
California State University, Stanislaus[1]; School of Natural Sciences, University of California, Merced[2]

Self-organization of collective biological systems often emerges in forms of globally coherent patterns from active individuals that typically employ random movements. As an archetype of such phenomena, bacterial swarms exhibit large-scale vortex-like flow structures with individual cells dispersing in random motion. So far, most studies of these swarms have been documented in a quasi-2D medium, such as the solid-liquid interface of an agar plate, or the liquid-air interface of a droplet. To free such studies from those potential boundary effects, we explore the collective behaviors of motile bacteria, here, *Escherichia coli*, that are suspended in a bulk fluid. We captured their collective movements at different heights, as captured and scanned by a 3D tracking microscope. We observed coherent large-scale flows emerging from the random movement of individuals. Even in the middle of the bulk media. This verification of coherent structures in a 3D specimen allows us to understand further the mechanism of coherence applying controlled external perturbations, such as an array of micropillars.

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