THE SEVENTH ANNUAL

UCMERCED
UNDERGRADUATE SUMMER RESEARCH SYMPOSIUM

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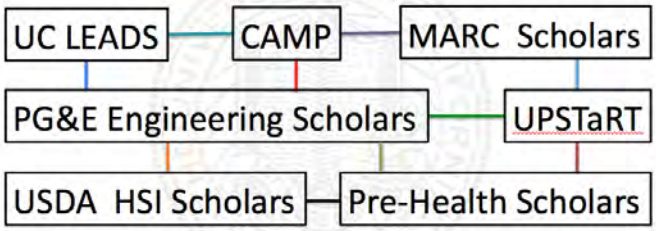
UC Merced Undergraduate Research Scholar Creed

Undergraduate Research Programs are for high-achieving, motivated students who want to prepare for and excel in graduate school and careers in STEM.

Scholars take their academic work seriously, work hard to maintain good grades, are interested in pursuing mentored research opportunities in their field of study, and have the long-term goal of pursuing a doctoral degree.

Undergraduate Research Scholars are expected to represent the ideals of academic excellence by achieving to the best of their abilities and engaging in enriching academic and professional experiences throughout their undergraduate careers.



Undergraduate Research Programs Staff Information

Undergraduate Research Programs at UC Merced offer an array of services designed to assist our Scholars in acquiring the skills and tools necessary to become successful graduate students, scientists and leaders. The collaborative summer program served forty-one student participants across seven programs and three academic schools. Our 2013 summer program staff was composed of two program directors, Mr. Jesus Cisneros and Dr. Tony Jimenez as well as two program representatives, Ms. Krystle Statler and Mr. Iqbal Atwal. A special thank you to our Faculty Mentors and everyone who took part in developing our scholars into future researchers and leaders.

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PG&E ENGINEERING
SUMMER SCHOLARS PROGRAM

The PG&E Engineering Summer Scholars Program at UC Merced is a unique and exciting program designed to provide undergraduate students majoring in engineering disciplines with hands-on research experience to broaden their education and build their credentials for professional careers or graduate school following graduation. The PG&E Engineering Summer Scholars Program, funded by a gift from Pacific Gas and Electric Company, provides unique experiences for talented engineering undergraduates through involvement in faculty-mentored independent research, GRE training, career and graduate preparation seminars, leadership development, advising and other scholarly activities and resources.

Name: Krystal Cunningham

Major: Materials Science & Engineering

Home City: Los Angeles, CA

Krystal Cunningham is a graduating senior at the University of California, Merced in Material Science and Engineering and currently does research under the supervision of Professor Masa Watanabe. She plans on pursuing a Ph.D. in Aerospace Engineering. Aside from school she is passionate about working with youths and plans on working with NSBE to implement a chapter in Jamaica.

Constant-Force Pulling of Single – Walled Carbon Nanotubes in Toluene and Water Environments

Krystal Cunningham, and Masa Watanabe, PhD, School of Engineering; School of Natural Sciences, University of California, Merced

Various single-walled Carbon nanotubes (CNTs) were studied using molecular dynamics simulations in the GROMACS software. The main objective of this study was to understand how structures of CNTs respond to tensile stresses in the different solvent environments: water and toluene. In this study, models of various armchair and zigzag CNTs were pulled by constant forces in the x- or y-axis direction to investigate their structural deformations. The pulling simulation mimicked an atomic force microscope (AFM) pulling for CNTs along their channel axis or perpendicular to the axis. Based on the simulations conducted in this work, it was found that a

greater deformation occurred in smaller armchair and zigzag models. In both environments, little deformation occurred in both types of CNTs,however, larger Zigzag CNTs remained in tact under constant forces. The overall result of this study was that deformation of CNT structures depends strongly on their chirality, but less on its environment. Our simulation results were compared to other independent studies done by G. Cao et al and H. Gao et al . Furthermore, this study will have implications for important materials science and biological subareas including utilizing carbon nanotubes therapeutically.

Name: Enrique Alejandro Daza

Major: Bioengineering

Home City: San Mateo, California

Enrique Alejandro Daza is in his final year studying the field of Bioengineering and Economics. He previously studied the environmental effects of Nano Particles on algae species for two years at the University of California Merced, as well as the environmental effects on nematode gene expression last summer at the Georgia Institute of Technology. Finally, He contributed to designing a specialized heart monitor for cardiologist at the University of Melbourne, Australia. Enrique plans to one day earn his MBA and continue into the business side of Science. He enjoys lifting heavy objects repeatedly for no external reason.

Constructing a DNA Origami Scaffold for Investigations of the Group Functions of Motor Proteins

Enrique Daza[1], Jing Xu2; School of Engineering, University of California Merced1; School of Natural Sciences, University of California Merced[2]

Motor proteins are nano-machines that drive the fundamental process of mechanical motion in cells. Multiple motors work together to deliver cellular materials, such as neurotransmitters and other signal molecules, across the spatial extent of individual cells (including neurons). Defects in motor-based motion precede diseases, including neurodegeneration, and are correlated with cancer. Utilizing recent development of programmable DNA Origami nanotechnology (1, 2), I custom designed a scaffold that is 14nm by 14.5nm by 14.5nm in size, capable of grouping up to 11 motors together in close proximity. My customized DNA Origami scaffold will enable future investigations of the group functions of motor proteins in a geometry closely mimicking that observed in cells.

References:

1. P. W. Rothemund, Folding DNA to create nanoscale shapes and patterns. *Nature.* 440, 297-302 (2006).

2. N. D. Derr, B. S. Goodman, R. Jungmann, A. E. Leschziner, W. M. Shih, S. L. Reck-Peterson, Tug-of-war in motor protein ensembles revealed with a programmable DNA origami scaffold. *Science.* 338, 662-665 (2012).

Name: Sandra Diaz

Major: Materials Science & Engineering

Home City: Modesto, California

Sandra Diaz is a fifth year undergraduate student in Material Science and Engineering. Her research interests include material sustainability specifically studying the mechanical properties of an aluminum face and polyurethane foam core sandwich structure by using analytical, numerical, and experimental analysis. She expects to graduate in the Spring of 2014. Sandra has also participated in the UC Berkeley COINS Summer Research Program alongside Dr. Keasling, specifically researching and developing a biosensor that can detect a small molecule in bacteria culture. Sandra is an advocate for women participation in the STEM field and on her spare time, she volunteers as a mentor for the Lift While You Lead women's program that strives to promote higher education for young women.

The Mechanical Properties of Sandwich Panels and Their Dependence on Foam Density

Sandra Diaz, and Lilian P. Dávila, PhD, School of Engineering, University of California Merced

Sandwich panels consist of two stiff materials (skins) separated by a lightweight core material. The core material effectively increases the moment of inertia of the sandwich panel with little increase in the weight, creating an efficient structure for resisting bending and buckling loads. The goal of this study is to evaluate and predict the mechanical properties of sandwich structures, consisting of two 6061 Al sheets and a polyurethane foam core, as a function of three different foam densities (32.04 kg/m^3, 63.69 kg/m^3, and 96.1 kg/m^3). Computer simulations and analytical analysis were carried out in this project in order to create an efficient procedure for future design considerations. A Finite Element Method (FEM) program, COMSOL Multiphysics 4.3, is used to predict the load-displacement curves and stiffness of the sandwich structure when it is subjected to a three-point bending test. The results are compared with the predicted values from the analytical analysis and with previous experimental findings. Predicted results show that the stiffness increases as foam

density increases, implying that the density and strength of the foam in the sandwich structure have a direct relationship, and affect the overall properties of the combined foam-sheet system. Future work will involve assessment of the feasibility of these sandwich structures as vehicle impact absorbers by conducting real experimental tests.

Name: Daniel Linarez

Major: Mechanical Engineering

Home City: Riverbank, California

Daniel Linarez is a 5th year undergraduate student in Mechanical Engineering at the University of California, Merced and researches alternative forms of sustainable energy focusing specifically on sustainable plasma gasification of biological material. He expects to graduate in the spring of 2014. Daniel Linarez was born and raised in the Central Valley originating from Riverbank, California. He is a first generation Mexican-American and he is the first in his family to pursue an education at a major university. Daniel's lifetime accomplishments include obtaining a doctorate degree in the field of alternative forms of sustainable energy. Daniel believes that the role of an Engineer is to utilize his/her knowledge to give back to society by developing innovative ideas, which ultimately provide a better quality of life. Through the 2013 PG&E Engineering Summer Scholars Program, Daniel hopes to be exposed to groundbreaking research leading the way in sustainable energy.

Regenerative system for generation of superheated steam by induction heating

Daniel Linarez, Gerardo C. Diaz, PhD; School of Engineering, University of California, Merced

Induction heating has demonstrated to be an effective method of heating several magnetic metals. One intriguing application of metal induction heating is in superheated steam generation. Previous studies have successfully used induction heating systems for generation of steam at super-heated temperatures. However, these systems required elevated power levels, and additional system components, such as primary boilers, thus increasing total energy consumption. In this study, a novel induction heater system design was explored with the primary design criteria being significant reduction in total power used in the efforts of increasing overall system efficiency. The proposed induction heater system was observed to successfully generate steam, although the entire flow rate of water was not completely heated to steam phase. Other issues involved the reliability of the electric circuitry. Some components are more prone to failure than others. Future work includes implementation of upgraded circuit components for improving system reliability. In addition, temperature and flow rate measurements need to be implemented to perform an energy balance analysis of the system in order to determine overall system efficiency.

Name: Rudy Maltos

Major: Environmental Engineering

Home City: Bakersfield, California

Rudy Maltos is a senior undergraduate student studying environmental engineering. His current research deals with minimizing water flow through the Friant Dam that will allow salmon to swim downstream, by building computer models to simulate a variety of scenarios so that the optimal water release plan can be implemented. He is expected to graduate fall 2014 and plans to attend graduate school. Rudy has spent the last year working with Engineers for a Sustainable World (ESW), to build a bio-diesel distiller, a community garden, and help promote the ideas of sustainability. During the school year Rudy works for the Outdoors Experience Program (OEP), where he has the opportunity to show students the beauty of nature, by taking them backpacking in the mountains. It is Rudy's passion for the outdoors and his interest in mechanics that has led him to study environmental engineering.

Maximizing benefits of water through the Friant Dam using optimization-based models

Rudy A. Maltos, and Yihsu Chen, PhD; School of Engineering, University of California, Merced

Water from the Sierra Nevada's is essential for California agriculture; it also provides water for the millions of people that live in the central valley. A large portion of this water flows through the Friant dam, located 15 miles northeast of Fresno. This dam restricts the downstream flow of water that salmon need to survive. Our lab develops economics models with detailed hydrological presentation of San Joaquin River to optimize water allocation. We consider two scenarios: baseline and minflow. The baseline scenario replicates the situation when water is solely used for municipal and agricultural purposes. On the other hand, the 'minflow' case needs to balance the use between for human and ecological purposes. This poster presents the preliminary results that highlight the difference in water release patterns under the two scenarios.

Name: Adolfo Rojo

Major: Materials Science & Engineering

Home City: Lamont, California

Adolfo Rojo is a senior in Material Science and Engineering and is currently researching the potential of 3D ZnO nanostructures as electrodes for a more powerful ecofriendly battery. He is the youngest boy in a family of 13, volunteers on weekends and is the current treasurer of the Society of Hispanic Professional Engineers (SHPE). He enjoys traveling and eating new and exciting foods.

Engineering ZnO nanostructure anode for enhanced cyclability of Ni-Zn batteries

Adolfo Rojo, Jose F. Flores, Jennifer Q. Lu; School of Engineering, University of California, Merced

Nickel-Zinc (Ni-Zn) batteries are a green energy solution that combines high energy and power densities utilizing earth abundant materials. However in the Ni-Zn system, the Zn anode material dissolves in the alkaline electrolyte during discharging resulting in low cyclability and eventual disappearance of Zn species. Zinc Oxide (ZnO) nanostructures with high surface area were directly grown on copper current collector substrates using low-cost and abundant materials. The 3D ZnO nanostructures offer large surface area capable of fast rate of plating and dissolution. In this study, to mitigate Zn loss, polymers [poly(acrylic acid) (PAA) and poly(pyrole) (PPy)] were electrografted on ZnO nanowire surfaces as a protective layer. ZnO nanostructure with and without polymer protection were investigated electrochemically to observe whether ohmic loss, due to the disappearance of the Zn species was, diminished. This method offers a new possible pathway for creating longer lasting zinc anode.

Name: Andrew Siordia

Major: Materials Science & Engineering

Home City: San Fernando, California

Andrew is a 5th year Materials Science and Engineering undergraduate with a research focus on carbon-based-emulsion-assisted PV-PEC cells for the advancement of solution materials processing. The PG&E Summer Scholars Program has helped sponsor Andrew's carbon-based research for use in solar cells. He expects to graduate in the Spring of 2014 and pursue graduate study. Andrew has previously participated in the COINS Program at UC Berkeley contributing to the sensing branch of the Crawler Project through analyzing humidity effects on H_2S sensing with integrated Matlab scripts. He has provided dozens of undergraduate engineers with the ability to be young professionals through his position as the Professional Development Chair of the Mu Delta Chapter of Theta Tau. Andrew thinks it is important for students to have every possible opportunity to excel in their fields and professionalism is the start of being a great asset in industry and academia. While not in school, he likes to spend time with his family in San Fernando for the holidays making tamales for several families and also travelling to different parts of the United States.

Emulsion Assisted Dimensional Transition of Graphene Nanoribbons for Energy Harvesting

Andrew F. Siordia, Ishihara Hidetaka, Tomas Oppenheim, Jaskirajeet Sodhi and Vincent Tung School of Engineering, University of California, Merced

Buckled sheets, such as a crumpled piece of paper, represent a ubiquitous form of material deformation, which can be viewed as elastic sheets that have been strongly deformed by some

external forces. The resultant dimensional transition from flat sheets to three-dimensional (3-D) heavily crumpled particles introduces unprecedented materials properties that do not exist in their parent 2-D structures. These include mechanically responsive electronic structures, catalytic properties, and a surface area increase, thus opening up new research avenues for energy harvesting applications. To facilitate the dimensional transition in a controllable fashion, we studied electromechanical coupling at oil/water interfaces in tandem with theory, modeling, and device fabrication in a multi-scale and synergistic manner. Particularly, this research provides a systematic characterization of the evolving electronic structures stemmed from dimensional transition of 2-D nano membranes into 3-D hierarchical architectures through elegant control of the salient mechanical features of the individual atomically thin sheets which can not be achieved in conventional aerosol technique.

Name: Senam Tamakloe

Major: Materials Science & Engineering

Home City: Palmdale, California

Senam Tamakloe is an upcoming third year undergraduate student pursing her major in Material Science & Engineering. She expects to graduate in the spring of 2015. Her interest in Biomaterials science entails elements of medicine, biology, chemistry, tissue engineering, and material science to improve life as we know it; along with Nanoscience technology which involves the study, manipulation, and control of both chemical and biological matter on nanoscale. She is interested in working on projects with practical world applications. Senam's belief in science and service to her community propelled her to work at AV Hospital as a volunteer, and doing a Pre-Engineering internship at City of Lancaster's Public Works. Senam is currently working alongside Professor Min Hwan Lee, researching electrochemical energy systems (e.g. fuel cells and batteries) due to their scalability and high conversion efficiency, and reversing the electrochemical process in order for the system to be used as an energy generating or storing system. Apart from research, Senam holds the position as the National Society of Black Engineer's 2013-2014 Academic Excellence where she believes all students can achieve academic excellence, and encourages students, especially freshmen, to have a mentor. Senam enjoys taking road trips around California and plans to attend the Olympics and the World Cup one day.

High Energy Density – Technological Advancements for Renewable Energy

Senam Tamakloe, Yongjie Wang, and Min Hwan Lee, PhD; School of Engineering, University of California, Merced

There is a variety of energy storage technologies available or under development. But each technology has some inherent disadvantages that make it practical/economical for a limited range

of applications. However, electrochemical energy storage systems such as batteries offer many benefits due to their scalability and energy/power density potential. For further improvement, especially in terms of energy/power density, a better electrode design and development of relevant fabrication processes are necessary. For our research, we utilized the Electrophoretic Deposition (EPD) method to coat various thin films of battery electrodes. We used the EPD to form graphene oxide films, resulting in a coherent contact with the underlying current collector and thus, enabled an enhanced battery performance and durability. After preparing electrodes with this technique, the samples were examined using two different microscopes: Scanning Electron Microscope (SEM) and Atomic Force Microscope (AFM). SEM imaging provides the information on the material's nanostructure down to ~10 nm resolution. AFM enables visualization of the surface geometry with even higher resolution, and probes the volumetric cycling of electrode films caused by repeated charging and discharging process in liquid electrolyte. Finally, the electrochemical performance was characterized by a battery analyzer, which enables us to measure the charge capacity and life cycle of a given rechargeable battery. I present a series of experimental setup and resulting data, which characterizes the performance of newly prepared graphene-based electrodes.

Name: Teresa Tan

Major: Computer Science & Engineering

Home City: Rowland Heights, California

Teresa Tan is a fifth year Computer Science and Engineering Major within the School of Engineering, expecting to graduate by fall semester of 2013. She decided to join a research program during the summer between 2013 and 2014. Teresa is hoping to gain experience through the research program that would bring her closer to her career choice in computer science, assisting individuals that have technical issues with software programs and/or hardware. Being raised by a single mother, Teresa learned that the greatest contribution a human can make to the society is assisting others in solving their problems, helping these individuals make an impact towards a more advanced future.

UC Merced Visibility Camera System

Teresa Tan and Professor Shawn Newsam, PhD, School of Engineering, University of California, Merced

Due to the pollution, the air quality is terrible in California's Central Valley. The goal of this project is to create the UC Merced Visibility Camera System based on a high resolution camera system that is able to capture images every fifteen minutes. The images captured using this system will 1) be used for research on image-based pollution estimation and 2) bring public awareness to the air pollution. Key to the project is a publicly accessible website that shows images that have been recently captured by the visibility camera and gives a brief summary of the project's purpose. The

website also displays the current air quality including both the PM 2.5 (particulate matter measuring 2.5 micrometers or less) and AQI (Air Quality Index) values from the California Environmental Protection Agency Air Resources Board. The webpage will contain pictures of good and bad days, reasons for poor visibility, the camera system used to show the results, and links to where some of the data is taken. Contact information will also be provided on the website if there are any questions and concerns from individuals that visit the webpage. The archive of images and pollution measurements will be used for research on image-based pollution estimation.

Name: Ana Zivanovic

Major: Environmental Engineering

Home City: Alameda, California

Ana Zivanovic is a fourth year undergraduate student studying Environmental Engineering and is currently exploring the Hestia approach, a method of spatial analysis used to analyze the carbon emissions on a building point basis. With the decision to take a fifth year and graduate in the spring of 2015, Ana plans to continue preserving a proficient academic standing by both doing well in her classes and pursuing further research opportunities in the areas of hydrology and energy and sustainability. At the same time, Ana hopes to maintain her campus leadership titles such as Chief Justice in the Student Government and the University of California, Merced and Committee Leader for the annual student-run You See Leaders Conference. Instinctively, shy, being able to gain the respect of her university peers has been life changing for Ana; spending most of her childhood summers in Serbia, making friends was easy, yet upholding friendships proved to be difficult. Using her diverse cultural experiences, linguistic skills, as well as her extensive background in the liberal arts, Ana desires not only to enter the work force as a well-rounded individual, but also serve as a mentor to other students emerging into the fascinating field of engineering.

Parcel by Parcel Towards a More Refined Carbon Emissions Estimation for Livermore, California

Ana Zivanovic[1], Andrew Zumkher, MS[2], J. Elliott Campbell, PhD[1]; [1]School of Engineering, University of California, Merced; [2]Environmental Systems Graduate Group, University of California, Merced

Carbon accounting has become imperative in instituting regulations, developing major policies, and in expanding urban metabolism research. For years, city agencies have reported carbon dioxide equivalent (CO2e) emissions across large spatial distributions (city scale). More evidence, however, proves that focus should be turned towards higher spatial resolution estimates (ie building scales). Still, how effective are these high-resolution estimates in comparison to city-scale investigations? Do they represent how each sector contributes through the use of natural gas? There have been few attempts to conduct such high-resolution bottom-up emissions analysis, the most refined being

performed by the scientists behind the Hestia Project. For this project, an approach related to the Hestia method was applied to the Livermore, California. Residential sector emissions were estimated by down-scaling the 77 Livermore neighborhoods using a variety of geospatial datasets for modeling area; carbon emission sets per household were estimated for the Western United States by the United States Energy Information Administration. Results suggest natural gas upper-level estimations of 201,644 metric tonnes CO2/year, while findings show that making utility statistics and analyses available to the public is crucial in further exploring energy consumption.

UC LEADS

Leadership Excellence Through Advanced Degrees

The goal of the University of California's Leadership Excellence through Advanced Degrees (UC LEADS) program is to educate California's future leaders by preparing promising students for advanced education in science, technology, mathematics and engineering (STEM). 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 impacted their advancement in their field of study. Once chosen as UC LEADS Scholars, the students embark upon a two-year program of scientific research and graduate school preparation guided by individual Faculty Mentors. Scholars are provided with an excellent opportunity to explore their discipline, experience a research environment, and improve their opportunities for future study in their chosen field. The Scholar gains valuable educational experience, the University a better prepared and more diverse graduate applicant pool, and the State, well-educated future leaders.

Name: Arthur Chow

Major: Biological Sciences

Home City: Tracy, California

Arthur Chow is a third year undergraduate student majoring in Molecular Cell Biology. He is currently working underneath the supervision of Dr. Manilay, whose research focuses on the development of B-lymphocytes in mice and how they fare during hematopoiesis. Arthur expects to graduate in the spring of 2015. After his undergraduate career, Arthur hopes to either obtain a Ph.D. and perform clinical research, or attend medical school and eventually become a pediatrician. Aside from research, Arthur also works in the admissions unit of UC Merced as a bobcat caller assisting incoming freshman with any questions or concerns about the university. He especially enjoys this job because he feels it is important to help inexperienced students feel more prepared for the challenges that can arise during an undergraduate career. In his spare time, Arthur enjoys running, playing soccer, solving Rubik's cubes and assembling computers. He also enjoys going home and spending quality time with his sister and parents on the weekends.

Analysis Of Immune System Cells In Sclerostin-Deficient Mice

Arthur Chow*, Larrisha Coney*, Yvette Pellman, BS and Jennifer O. Manilay, PhD, Molecular and Cell Biology, University of California, Merced **equal contribution*

When sclerostin (SOST), an essential glycoprotein for proper bone formation, is absent, hyperactive bone growth occurs along with a decrease in bone marrow cavity size. Recent studies have shown that *Sost* has significant influence over developing bone marrow environments that sustain B cells; however knowledge of its role in B cell function is limited. We are investigating the effects of age and gender on B cell function in *Sost*-knockout mice. Peripheral blood samples will be analyzed at set time points to observe changes in mature and immature B cell populations in *Sost*-knockout and B6 mice. We hypothesize that B cell populations will be altered in the absence of *Sost*, and if so, will raise questions for certain anti-SOST antibody drug treatments of osteoporosis.

Additionally, we are testing the efficacy of zinc-based fixation for flow cytometric analysis of immune cells in *Sost*-knockout mice. Zinc-based fixation can reduce research costs considerably, if epitopes are not altered by the fixation. To investigate this, fresh and zinc-fixed splenic cells obtained from a B6 mouse were fluorescently compared by staining them with CD19, CD11b, CD45, Ly-6C, CD4, CD8, and CD11C antibodies. Both cell types displayed similar fluorescence intensity, indicating the possible practicality of zinc-fixation on other cell types. For future experiments, we will test antibody cocktails and apply this method to cells in *Sost*-KO mice.

Name: Marina Fernandez

Major: Mechanical Engineering

Home City: La Jolla, California

Marina Fernandez is a fifth year undergraduate student in Mechanical Engineering at UC San Diego, expected to graduate in the Spring of 2014. Her research interests include Mechatronics and Automation, as well as Renewable Energy Systems. She currently works in the UC Merced Mechatronics, Embedded Systems and Automation (MESA) lab researching the development of health monitoring systems for small UAVs. In addition, she has ongoing research at the UC San Diego Coimbra Solar Forecasting Lab, exploring the effect of contrails on solar energy absorption. She hopes to combine both research interests as she pursues her Ph.D. In addition to research, Marina has been involved on multiple design teams, both commercial and humanitarian, and hopes to use her powers for the greater good. In addition to her love of science and technology, Marina enjoys singing, traveling and spending time with her friends and family, be it through board game tournaments or exploring new eateries in the San Diego area.

Development of an Inexpensive Health Monitoring System for Small UAVs

Marina I. Fernandez[2], Emerinciana Nolasco[1], YangQuan Chen, Ph.D.[1]; [1]University of California, Merced: Mechatronics, Embedded Systems, and Automation Lab; [2]University of California, San Diego

In recent years, small Unmanned Aerial Vehicles (UAVs) have been used for carrying expensive payloads for scientific research and other applications, but can result in large monetary losses should these fail mid-mission. Monitoring the real-time health of the small UAVs can alert the user of the status of crucial components and prevent damage to expensive equipment. This project examines the feasibility of developing an inexpensive in-flight UAV health monitor by testing sensors that can be embedded into small RC planes for relaying the status of the components. Flux sensors, potentiometers, and contact sensors were tested for monitoring three key components: wing bend, control surface flutter, and motor securement. The sensors were later connected to wirelessly transmit the UAVs status to the monitoring system, lighting up LEDs corresponding to each component's condition. Results show that the system can report the real-time sensor readings in 0.5 second intervals to an accuracy of ±10%, visually alerting the user of dangerous conditions. Should this system be applied on a functional small UAV, the user can prevent failing conditions of key components. This could save more than 200% of the cost of the sensors by reducing accidents caused by a system failure and prevent damage to both the UAV itself and the payloads it carries.

Name: Youstina Gad

Major: Physics

Home City: Cairo, Egypt

Youstina Gad is a third year undergraduate student in Physics. She researches Quantum Dot Molecules and their possible implications on future technologies. She also serves as a Sunday school teacher-assistant working with preschool kids and translating between English and Arabic. She came from Egypt in 2008 in pursuit of a better education and better opportunities in serving the community. She values community service and feels it is the most impactful way to influence society. She hopes to work in a position that helps people and values science.

Measuring Dipole-Dipole interaction in Biexcitons in InAs/GaAs Quantum Dot Molecules.

Youstina N. Gad, Mark Kerfoot, Cyprian Czarnocki, Davis Lu, Christopher Bush, Michael Scheibner, School of Natural Sciences, University of California, Merced

Quantum dots have an inherent inhomogeneity due to lack of human control of their exact growth. Basically, no two dots are alike. This inhomogeneity makes it difficult to couple dots together in a way one would couple atoms to form a molecule. Therefore, to control such a system, one needs to

device a different way of interaction that is independent of structural details. Electric fields, for example, provide such a mechanism. Here we aim to optically measure the dipole-dipole interaction between two excitons that occupy separate quantum dots in a closely spaced quantum dot pair. The optical transition, with the two excitons, is similar to the neutral exciton transition, but with a slight change in the energy, that is due to the dipole-dipole interaction between the two excitons. We determine the dipole-dipole interaction by a comparative measurement between the transition energy of the state with one exiton, and the state with an exciton in each dot. This measurement will then be usable in controlling a system of coupled quantum dots, so called quantum dot molecules, for use in quantum information processing and in the creation of logic gates implemented as optical switches.

Name: Charlesice Hawkins

Major: Biological Sciences

Home City: Alliance, Ohio

Charlesice Hawkins is currently pursing a B.S. in both Cognitive Science and Human Biology. She expects to graduate in the spring of 2015 and continue on to graduate school to obtain her Ph.D. in Neuroscience. She has had experience working in a computational cognitive neuroscience lab and is currently involved in a molecular biology lab. She intends to examine the molecular mechanisms of different neurological disorders. In her spare time, she enjoys quad skating as a roller derby referee.

Evaluating brain pathology in a rat model of Type II Diabetes Mellitus: a possible link with Alzheimer's disease

Charlesice C. Hawkins, Carlos Rodriguez-Ortiz, PhD, Ruben Rodriguez, Rudy Ortiz, Ph.D., and Masashi Kitazawa, PhD; School of Natural Sciences, University of California, Merced.

Type II diabetes mellitus (T2DM) is a fast growing disease, as over 20 million people are affected in the U.S. It occurs when the body develops a resistance against insulin and does not properly utilize glucose. Insulin resistance and other comorbidities of T2DM such as hypertension, inflammation, and increased oxidative stress may damage blood vessels in the brain. Approximately 60-70% of T2DM patients develop neuropathic conditions, and it has also been listed as a risk factor for Alzheimer's disease (AD). However, the exact molecular link between T2DM and AD has not been fully elucidated. To investigate this connection, brains from a Cholecystokinin-1 (CCK1) receptor mutant rat model for type II diabetes and obesity were examined using biochemical and histological techniques in search of features of AD-like neuropathology. This rat model develops a metabolic syndrome characteristic of T2DM in an age-dependent manner. In the present study, oxidative stress, amyloid-precursor protein (APP), inflammation, and synaptic markers were examined.

There were slight increases in inflammation and APP in the brain of T2DM rat model, suggesting that T2DM phenotypes may trigger AD-like neuropathology at later ages. In perspective of such trends, longitudinal examinations of brain pathology of this model will further provide insights into the molecular link between T2DM and AD.

Name: Kimberly Nguyen

Major: Chemical Sciences

Home City: Sunnyvale, California

Kimberly is a third year undergraduate student majoring in chemistry. She is currently involved with Patricia LiWang's lab, which is studying chemokines and their role in HIV entry inhibition and anti-inflammation and is under the instruction of post graduate Li Zhang. Through hard work and perseverance, Kimberly intends to graduate with her degree during the Spring of 2015. Growing up as the eldest child of three and in a home with only one parent, she has learned how to motivate and push herself to achieve more. She truly believes that one's future will be determined by one's will and efforts.

Sub-cloning of highly potent HIV inhibitors 5P12 RANTES and 5P12 RANTES-Linker-C37 into *Pichia pastoris* overexpression system

Kimberly Nguyen, Megan Schill, Li Zhang and Patricia LiWang, School of Natural Sciences, University of California, Merced

HIV plagues approximately 34.2 million people worldwide and 2.5 million new HIV cases were discovered in 2011 alone. Currently, there is no approved cure but progress has been made towards HIV prevention. The proteins 5P12-RANTES and 5P12-Linker-C37 have been shown to be potent HIV entry inhibitors. These inhibitors bind to chemokine receptor CCR5 embedded in the cell membrane of T cells, and the linked C peptide moiety of 5P12-Linker-C37 also binds to the HIV protein gp41, to prevent conformational changes necessary for the entry of HIV into the cells. Presently, these proteins are being studied for possible use in animal and clinical trials. However, protein production of these inhibitors using *Escherichia coli* has resulted in low yield. We hypothesize that utilizing a eukaryotic overexpression system, *Pichia pastoris*, will increase protein production. For this reason, molecular biological techniques including PCR, restriction enzyme digestion, ligation, and transformation were used to sub-clone the DNA sequences encoding 5P12-RANTES and 5P12-Linker-C37 from a pET28a *E. coli* vector into a pPICZα vector. The product vectors have been sequenced to check for proper insertion of the gene and will be used for later integration into *Pichia pastoris* for a series of expression tests.

Name: Steven Telles

Major: Electrical Engineering

Home City: Azusa, California

Steven Telles is a senior undergraduate student in Electrical Engineering at the University of California, Santa Cruz. His research interests are in different areas of electric power such as, transmission, generation, integration of microgrids to the main power grid, and recently renewable energy sources obtained by plasma gasification. He expects to graduate in the Spring of 2014. Steven worked as a lab technical assistant for one year where he had the opportunity to practice organizational, administrative, and problem solving skills that arise from working with lab equipment or running experiments. Steven recognizes the importance informing younger students of the opportunities a STEM degree can lead to, and has led outreach efforts to local high schools through SHPE. Steven enjoys mountain biking and cooking in his spare time.

Non-Thermal Plasma Gasification with a Planar Gliding Arc Reactor

Steven Telles and Gerardo Diaz, PhD; School of Engineering, University of California, Merced

In order to cut down on energy consumption, industries must begin to look to new sources of energy from readily available sources. The agriculture industry produces a significant amount of waste that can be converted into a fuel source, syngas. Reforming the waste into syngas is typically achieved through thermal plasma gasification. However, this process consumes a lot of electric power and is cost-effective only on a large scale. Gliding arc plasmas are non-thermal plasmas that have been demonstrated to provide a low-power alternative to other plasma generating techniques. We propose to build a low-cost planar gliding arc reactor that will efficiently gasify bio-mass waste and produce syngas. By generating non-thermal plasma with a gliding arc reactor, the production of syngas from bio-mass waste can be done efficiently, for low processing volumes of waste.

Name: Emmanuel Villanueva

Major: Psychology

Home City: Fresno, California

Emmanuel Villanueva is a third year undergraduate students as a psychology major. He expects to graduate in the spring of 2015. However, before Emmanuel graduates, he will delve into researching the way various emotions influence the human immune system, specifically the pathway. Emmanuel has a special interest in the elder population and hopes to gear his research towards this population that he feels is often neglected. As a UC LEADS scholar, Emmanuel combines

immunology, neuroscience, and psychology in order to contribute to the emerging field of psychoneuroimmunology (PNI). If it seems as though Emmanuel is nowhere to be found because he is not volunteering at a senior home, at the gym, nor on the soccer field, then his is most likely nourishing himself well at his local cafeteria.

Can Emotions Influence the Immune System?

Emmanuel Villanueva, Jitske Tiemensma, PhD, School of Social Sciences, Humanities and Arts, University of California, Merced

There is growing and compelling evidence of emotions having the potential to significantly influence the immune system. However, there appear to be inconsistencies in the literature with some studies showing an effect of positive or negative mood states on immune markers while other studies do not observe any effect of emotions on the immune system. Moreover, the specific pathways through which emotions might influence the immune system remain unclear. The present structured literature review was performed to highlight the findings of previous studies with regard to the relation between emotions and the immune system, as well as to explore the possible pathways through which emotions might influence immune functioning. Databases Pubmed, EBSCO, and Science Direct were surveyed using specific keywords in order to carry out the present structured literature review. This review shows the importance of emotion regulation and underscores its elusive pathway. Evidence in some of the literature highlights the benefits positive emotions can have on an individual's immune responsiveness; whereas other studies show incongruent results. There is inclusively evidence in animal research for a reverse relation between cytokines and the immune system. Further research is needed to determine the existence of a single or multiple neurochemical pathway(s) that give(s) rise to the interaction between emotion regulation and the immune system.

Name: Nicholas White

Major: Bioengineering

Home City: Garden Grove, California

Nicholas White, most often called Nick for short, is a Junior in Bioengineering and researches Tissue Engineering, looking specifically at vascular growth and production in order to see if there is a way to manipulate the vascular growth for diseases such as cancer and a few brain disorders. He expects to graduate in the Spring of 2015. Nick has spent a few years serving in management teams and has been developing professional skills that he hopes to one day take into industry as he hopes to one day make a cost effective way to treat many diseases. Nick believes in making an impact through community service, and one day hopes to change the lives of many through medical, social and economic means. He works with the National Society of Black Engineers in order to impact the

community and serves as the Northern California Zone Chair and is a representative for the pre-college, college, and professional chapters. He enjoys traveling, learning, and working on stuff that is interesting.

Site Directed Differentiation of ESC-EC using a Fibronectin-VEGF Matrix Blend

Drew E. Glaser[1], **Nicholas S. White[2],** Kara E. McCloskey[1,2]; [1]Biological and Small-scale Technologies, University of California, Merced; [2]School of Engineering, University of California, Merced

It has been observed that fibronectin (Fn) contains binding sites for vascular endothelial growth factor (VEGF), and may aid VEGF-activated differentiation of embryonic stem cells (ESCs) in to endothelial cells (ECs). Moreover, directed VEGF-Fn binding may be used in a less complicated and more cost effective approach to site-directed differentiation such as "click chemistry". Therefore, we examined the extent of the physical binding between soluble VEGF and Fn. and After verify the binding between VEGF and Fn, we then determined the correlating number of vascular progenitor cells, by measuring Flk-1 expression after four days in induction from ESC in our patented serum-free induction medium. Preliminary data indicates that the VEGF does bind to sites in the fibronectin matrix. After quantifying this phenomenon, we have examined that this growth factor-matrix blend may be used to enhance site directed differentiation of ESC-EC.

The California Alliance for Minority Participation (CAMP) in Science, Technology, Engineering, and Math, is a statewide initiative funded by the National Science Foundation (NSF). The objective of CAMP is to strengthen the quality and quantity of underrepresented students receiving baccalaureate degrees in Science, Technology, Engineering, and Mathematics (STEM) at the University of California (UC). CAMP offers extensive resources and unique opportunities for students to excel in their respective fields of study. The CAMP program began at UC Irvine in 1991; currently, nine UC campuses participate in the program.

Name: Rubi Almanza

Major: Applied Mathematics

Home City: Planada, California

Rubi Almanza is a fourth year undergraduate student in Applied Mathematics with an emphasis in Economics and a minor in Natural Sciences Education. She expects to graduate in the spring of 2014. At UCM she is the co-founder and coordinator of the RISE (Readying Intellectual Students Everywhere) Program, which focuses on providing informational workshops about higher education to high school students from the area. Her work in this program is the result of her participation in the Latino Leadership Initiative at the Harvard Kennedy School last summer. Being apart of the RISE Program has allowed Rubi to practice the leadership skills she learned at LLI and at the same time give back to her community, which she is very passionate about. Rubi is a first generation college student who wishes to serve as a role model to her family by being the first to obtain a Bachelor's degree in science.

Gradient Based Optimization for Structural Variation Discovery

Rubi Almanza, Shawn Belloso, Natalie Azevedo, Ramiro Navarrete, Suzanne Sindi, PhD, and Roummel Marcia, PhD; Applied Mathematics, University of California, Merced

The human genome, a sequence of over 3 billion nucleotides, defines the complete DNA sequence of an individual. We are only beginning to understand the genetic basis for the difference in characteristics between individuals. Recently, structural variants (SVs) such as deletions,

duplications, insertions and inversions are thought to be important contributors to phenotypic variation. Identifying the SVs present in a single individual is challenging because examination of an entire genome is not possible; in fact, current technology limits DNA sequencing to small fragments. Recently, the declining cost of DNA sequencing has enabled the sequencing of thousands of individual genomes. These data sets represent an important resource for cataloguing human genetic diversity; however, most methods for predicting SVs are not designed to simultaneously analyze many individuals because of the complexity of the solution space.

We present a novel approach for predicting SVs in the genomes of multiple individuals. We utilize gradient-based optimization to determine the SVs present in each individual. Importantly, our approach is capable of representing the relatedness of individuals in a study to constrain the set of possible solutions and increase the prediction accuracy. Our approach represents a significant improvement for structural variants detection methods, as relatedness of individuals has not been considered before. Furthermore, our model will be useful for the study of populations and the identification of relation between individuals not seen before.

Name: Larrisha Coney

Major: Biological Sciences

Home City: Oakland, California

Larrisha Coney is a fourth year student majoring in Developmental Biology with a minor in Cognitive Science. She hopes to one-day research speech restoration for those with brain damage to Broca's area or other language facilities. Larrisha is fascinated with exploring biology related phenomena and in summer 2013 she will be researching cell response and signaling in the immune system. Larrisha expects to graduate spring of 2014. She will be the first person in her family to attend and graduate from the University of California. Larrisha also held executive positions in student organizations such as the National Society of Black Engineers and the Distinguished Ladies. While in those positions, she practiced effective time management, public speaking and community event coordinating. Larrish enjoys exposing youth to STEM and thrives to be an example for her family and hometown that where you come from does not determine the depth of your goals. She also enjoys spending time with her family, watching comedy TV shows from the 90's and crunchy sushi.

SOST's Impact on B Cell Development and Optimizing Zinc Fixation Methods

Larrisha Coney*, Arthur Chow*, Yvette Pellman, BS, and Jennifer O. Manilay, PhD; Molecular and Cell Biology, University of California, Merced ** equal contribution*

The microenvironment of hematopoietic stem cells is important for development of the immune system. Without the glycoprotein sclerostin (SOST), hyperactive bone growth occurs and bone marrow cavity size decreases. Studies have shown *Sost* affects microenvironments that sustain B

cells, however little is known of its role in B cell function. We are investigating the effect of age on B cell function in *Sost*-knockout (KO) mice versus control B6 mice by analyzing blood samples. We hypothesize B cell populations will be altered in absence of *Sost*. These studies have significant biomedical importance for gauging if current clinical trials of anti-SOST antibodies for treatment of osteoporosis may have unforeseen impacts on the immunity of B cells.

Furthermore, we are testing zinc based fixation (ZBF) by analysis of fluorescent stained antibodies using flow cytometry. ZBF may optimize duration of cell use if antigenic determinants are maintained by the fixation. We are focusing on antibodies indicating stages of development in hematopoietic cell lineages. Previously fixed and fresh splenic cells obtained from B6 mice were marked for B220, CD11B, MHCII, CD45, CD4 and CD8. The cells shared similar fluorescence for all antibodies except B220. The next steps will be to test clones of antigens that displayed dissimilar fluorescence and test antibody cocktails for future application of ZBF methods to *Sost*-KO cells.

Name: Viridiana Murrillo

Major: Biological Sciences

Home City: Pomona, California

Viridiana Murillo is completing her fifth year as an undergraduate student majoring in Human Biology with a minor in Public Health. Since September 2011 she has been conducting research under the mentorship of Dr. Jennifer O. Manilay. Her research focuses on improving cell culture techniques that will produce higher yields of self-renewing hematopoietic progenitors (blood stem cells) from embryonic stem cells that can be used for various medical treatments and therapies. One of her major accomplishments includes having the privilege of presenting her research at the Society for the Advancement of Chicanos/Latinos and Native Americans in Science (SACNAS) 2012 National Conference in Seattle, Washington. Also, as a National Science Foundation funded California Alliance For Minority Participation (NSF CAMP) Scholar she has been equipped with the necessary tools to prepare her for graduate school. Viri is the oldest of four children and a first generation college student. She aspires to be a role model and mentor for her younger siblings and other members of the Chicano Latino community. As a member of the Merced Healthy House she enjoyed taking health interpreter training and helping the Merced underserved and migrant communities. With her free time she likes dancing, baking and horseback riding. She loves to see new places and hopes to one day travel to Italy.

Determination Of Cytokine Receptor Hematopoietic Profiles For The Enhancement Of In Vitro Differentiation Of Embryonic Stem Cell Derived Progenitors

Viridiana Murillo, Heather L. Thompson, Bryce T. McLelland, and Jennifer O. Manilay, PhD, School of Natural Sciences, University of California, Merced

Cytokines play a critical role in hematopoietic development. Our goal is to establish an *in vitro* microenvironment that will produce high yields of transplantable self-renewing embryonic stem cell (ESC)-derived hematopoietic progenitors (ES-HP). We will determine the cytokine receptor profiles of ES-HP generated via co-culture of distinct ESC lines with the OP9 bone marrow cell line. Our ES-HP generated with this system resemble the definitive hematopoietic progenitors found *in vivo* in murine fetal liver and adult bone marrow. We hypothesize that determination of the ES-HP cytokine receptor expression profiles (IL-2Rγ,IL-3Rα, IL-6Rα, IL-7R, TGFβR2, TPOR, SCFR, LIFR, FLT3R) can be utilized to improve production of ES-HP by addition of the appropriate cytokines to the cultures. ES-HPs will be stained for the developmental maturity markers, CD41 and CD45. Fluorescence activated cell sorting will be used to isolate ES-HP populations from Day 7 and Day 16 co-cultures. RNA will be extracted from these purified ES-HPs and reverse transcriptase PCR (RT-PCR) will be used to determine the relative expression of cytokine receptors present in ES-HP derived from four different murine ESC lines (D3, 129-GFP, R1, B6). Positive RT-PCR results will be further confirmed by cell surface level protein expression on ES-HP. This data can then be used for the strategic improvement of ES-HP culture techniques.

Name: Alexandro Perez-Tovar

Major: Mechanical Engineering

Home City: Los Banos, California

Alexandro Perez-Tovar is a 4th year undergraduate student in Mechanical Engineering at the University of California, Merced and researches alternative forms of sustainable energy focusing specifically on Sustainable Plasma Gasification. He expects to graduate in the spring of 2014. Alexandro Perez-Tovar was born and raised in the Central Valley originating from Los Banos, California. He is a first generation Mexican-American and also the first of his family to attend a university. Alexandro's lifetime accomplishments include obtaining a master's degree in the field of sustainable energy.

Design, Fabrication, and Calibration of Orifice Plate for Flow Measurements in Plasma Gasification System

Alexandro Perez-Tovar, and Gerardo C. Diaz, PhD, Mechanical Engineering, University of California, Merced

With an increasing problem of waste management and the continuous depletion of fossil fuel sources in our world, researchers are looking at different methods of alternative energy. Current research in plasma gasification shows that it is a strong candidate for managing waste and converting it into an alternative fuel source known as syngas--a hydrogen and carbon monoxide mixture. However, to fully understand if the system can be utilized as a solution, several parameters

must be determined to calculate the mass and energy balance of the system, as well as the efficiency. This was done by, first, measuring the flow rate of the syngas produced using a calibrated orifice plate. Knowing this parameter is the essential first step in aiding to finding the efficiency of our system and whether it is a strong candidate for converting waste to energy. In the continuation of this research we will also be looking at the rate at which the biomass waste is gasified in the system and the amount of steam being generated.

Name: Myriam Zavalza

Major: Biological Sciences

Home City: Uruapan, Michoacan, Mexico

Myriam Zavalza is a senior at the University of California, Merced. She is working towards her Bachelor of Science in Human Biology and a minor in Psychology. Myriam has always been passionate about the sciences for which she got recruited to join Dr. Monica Medina's laboratory and study endosymbiotic relationships among environmental stressors and impacts on marine organisms. She has been an active scholar participating on poster competitions, science week events and national conferences such as the National Conference of Developmental Biology 2013. She continues to work hard and plans to complete a doctorate degree in the future. Since her passion for science is so big, she is still discovering in what to obtain her Ph.D. For the summer, she will work along with Dr. Escobar on artificial lipid bilayers. Her ultimate goal is to make proud not only herself but to make her family proud since she is a first generation student, raised in Mexico who came back to the United States her junior year of high school. Myriam is also an advocate of community service for which she forms parts of various clubs and organizations on her campus that hose such services. She also enjoys traveling for which she spent a semester abroad studying in Maastricht, Netherlands and exploring Europe; now she plans to visit South America next!

Parasympathetic Regulation of Ventricular Action Potential in Murine Models

Myriam Zavalza[1], Yuriana Aguilar[1], Ariel L. Escobar[2]; School of Natural Sciences[1], School of Engineering[2] University of California, Merced

The electrical activity of the heart, including the regulation of the heart rate, is differentially controlled by the autonomic nervous system (ANS). Although it has been well established that the vagal innervation of the heart regulates the chronotropism and the excitable properties of the atrium, the role of parasympathetic regulation of the ventricular action potentials (AP) it is still a subject under debate. The experiments presented here were designed to shed some light on the molecular mechanism by which a parasympathetic innervation can regulate ventricular excitability. The principal neurotransmitter in parasympathetic pathway is Acetylcholine (ACh), an ester of acetic acid and choline, which is released locally from varicosities in the synaptic cleft

and rapidly degraded by Acetylcholinesterase (AChE), a cleaving enzyme. The role of cholinergic regulation of the excitable properties in the ventricular free wall was asses by performing electrophysiological recordings of Aps in Langendorff-perfused mouse hearts. Intact mouse hearts were perfused with drugs that can interfere/ modulate a downstream parasympathetic pathway. Specifically, hearts were perfused with synthetic cholinergic agonist (Carbamilcholine) and antagonist (Atropine) to definitively establish the role of parasympathetic regulation of ventricular APs. In addition, the turnover of endogenous Acetylcholine release was evaluated by impairing the enzymatic activity of AChE with the AChE-inhibitor Paraoxon. Altogether, the experiments presented in this poster seek to define the role of vagal stimulation on the ventricular function under physiological conditions.

USDA UNDERGRADUATE RESEARCH & MENTORING in the AGRICULTURAL SCIENCES

Name: Ana Arteaga

Major: Chemical Sciences

Home City: Merced, California

Ana Arteaga is a fourth year chemistry student. She is currently doing research under the guidance of Professor Rudy Ortiz. Before this, she was doing research in Dr. Erik Menke's lab. After graduating from UC Merced, Ana wants to continue her education and obtain a Ph.D. in Medicinal Chemistry. Ana is the first in her family to attend college. Her inspirations are her sisters and she wants to be a good role model for them. She is constantly encouraging them to go to college and get an education. Ana's pastimes include running, rock climbing and hiking.

Optimizing High Performance Liquid Chromatography Method for Measuring Plasma and Organ Angiotensin II from Insulin Resistant Rats

Ana L. Arteaga, Andrew Y. Lee, Ruben R. Rodriguez, Jacqueline Minas, Rudy M. Ortiz; Department of Molecular Cell Biology, University of California, Merced

Angiotensin II (Ang II) is the principal hormone of the renin-angiotensin system (RAS), and is up-regulated during insulin resistance and metabolic syndrome. To better assess the contribution of increased RAS on the development of insulin resistance, comprehensive analyses of tissue (plasma and organ) levels of Ang II is necessary. While antibody-derived methods are common for measuring many hormones, there are many advantages to measuring by high performance liquid chromatography (HPLC) including smaller sample volumes or amounts and increased accuracy and sensitivity. For this study, tissues were collected from three groups of rats (n = 5-6/group): 1) lean, strain control Long Evans Tokushima Otsuka (LETO), 2) untreated insulin resistant Otsuka Long Evans Tokushima Fatty (OLETF) rat, and 3) OLETF + angiotensin receptor blocker (ARB; 10 mg olmesartan/kg/d x 6 wks). We hypothesized that measurements by HPLC will provide better analytical refinement of tissue Ang II than measures by traditional antibody methods. In the 2012 study the LETO kidney Ang II levels were 176±8 fmol/g compared to the 2011 Ang II levels 158±23 fmol/g. This same trend appears between the two studies in the plasma Ang II levels (189±45 vs 67±4 fmol/ml). HPLC measurements are currently in progress.

Name: Fredy Cisneros

Major: Mechanical Engineering

Home City: Dos Palos, California

Fredy Cisneros is a third year undergraduate student in Mechanical Engineering with minors in Applied Mathematics and Management. He expects to graduate in the spring of 2015. Fredy has efficiently spent his college years by maximizing his college experience. As a freshman, he was a founding member of the Theta Chapter of Sigma Delta Alpha Fraternity Incorporated while maintaining his academic standing on both the Dean's and Chancellor's lists. Fredy is a fun and outgoing person but he knows very well how to separate business from pleasure.

Exploring the Lasing Threshold of CdSe/ZnS Quantum Dots (QD) in 4-Cyano-4'-pentylbiphenyl (5CB) Liquid Crystal (LC)

Fredy M. Cisneros, Andrea Rodarte, and Sayantani Ghosh, PhD, School of Natural Sciences, University of California, Merced

Semiconductors on the nanometer scale known as Quantum Dots have been gaining popularity since their discovery in the early 1980s. In laser technology, we make use of their electronic characteristics to implement them as the active laser medium. By tuning their size and shape one can control their emission frequency thus making lasers at multiple frequencies. In this project, we fabricate LCs doped with QDs to investigate the minimum power needed for the QDs to lase. QDs do not disperse easily throughout the LC because they are very big compared to LCs. This constrains us to using a very small concentration of QDs in our samples. Currently, we have optically pumped our samples up to 3 watts of power but have not observed any lasing from the QDs nor any phase changes have occurred in the LC. The next step will consist of increasing both the excitation power and the concentration of the QDs. If we manage to make the QDs lase, we will be a step closer to creating smaller, lighter, and economically fabricated lasers that do not require any cooling and operate at room temperature.

Name: Maritza Flores-Marquez

Major: Environmental Engineering

Home City: Tulare, California

Maritza Flores-Marquez is a fourth year undergraduate student at the University of California, Merced, where she is majoring in Environmental Engineering with a minor in Public Health. She expects to graduate in the spring of 2015. Her lifetime accomplishment has been to be the first in her

family to attend a university. By being part of the 2013-2014 Undergraduate Research Summer Scholar's Program, she hopes to gain vital skills that will help her in graduate school and as well as in a future in STEM. Maritza comes from a small family that taught her to value and obtain and education for her parents were unable to attain one. During Maritza's free time, she enjoys baking, watching movies and spending time with family and friends.

Ionic Strength and pH Dependence of Aqueous Cadmium and Lead Ion Sorption on Kaolinite

Maritza Flores-Marquez[1], Molly Small[2], Peggy A. O'Day[2]; [1] School of Engineering, University of California, Merced, [2] School of Natural Sciences, University of California, Merced

Distinguishing reactive surface area of minerals from geometric surface area can aid in accurate simulation of mineral dissolution, precipitation, mobility of nutrients, and transport of contaminants. Reactive surface area consists of the reactive sites participating in mineral surface reactions. Study of aqueous cadmium (Cd^{2+}) and lead (Pb^{2+}) adsorption onto kaolinite, a common clay mineral, will contribute to the quantification of reactive surface area as a function of pH and ionic strength. PHREEQC, a theoretical aqueous speciation and surface complexation modeling program, was used before experimentation to determine equilibrium conditions for a given input solution. Metal ion adsorption from $PbCl_2$ or $CdCl_2$ solution ($5x10^{-5}$ -M) on kaolinite in a $CaCl_2$ electrolyte solution (0.1-M or 0.01-M) was determined in 24-hour batch experiments at constant pH. After reaction, samples were centrifuged, and supernatant solution was removed and filtered. Inductively Coupled Plasma Optical Emission Spectrometry measured total Cd^{2+} and Pb^{2+} solution concentrations. Metal coverage on the kaolinite surface was determined by difference from measured solution concentration and mineral surface area. Results indicated that Pb^{2+} adsorption was unaffected by ionic strength (0.02-M, 0.2-M, or 0.002-M) at constant metal concentration since the final surface coverages were similar. For Cd^{2+}, surface coverages were higher at higher metal solution concentration ($4.55x10^{-4}$-M) than at lower concentration ($5x10^{-5}$-M) at 0.02-M ionic strength, however, surface coverages were unaffected by ionic strength (0.02-M and 0.2-M) at constant metal concentration. The reacted kaolinite will be analyzed using Nuclear Magnetic Resonance and X-Ray Absorption Spectroscopy to quantify and describe the surface reactivity of minerals.

Name: Carlos Gomez

Major: Bioengineering

Home City: Hawthorne, California

Carlos Gomez is a fourth year undergraduate student in Bioengineering and researches planarians to gain insights into the fundamental mechanisms of stem cell regulation regarding cancer and regeneration. He is expecting to graduate in the Spring of 2015. Carlos has been working hard for the past

couple of years to not only become the first in his family to graduate with a college degree, but the first to enter graduate school and obtain a doctorate degree. To do this, he has started challenging himself by taking on a minor in chemical sciences and joining various clubs and programs. Carlos thinks that education is important, but being involved in other extracurricular activities also helps shape who they are. From his extracurricular activity of long-distance running, Carlos has completed three marathons, multiple half-marathons, various cross country events, and additionally learned about the depths of his determination and perseverance. Carlos says he was also able to accomplish these feats through the encouragement of his friends and family. He says that it was due to both their guidance and support that helped him reach to where he is today.

Regional differences in stem cell proliferation and the initiation of cancer

Carlos O. Gomez, and Néstor J. Oviedo, PhD, School of Natural Science, University of California, Merced

Cells with DNA damage ultimately have three fates: repair the DNA, undergo apoptosis, or continue functioning with the abnormal DNA. Understanding how stem cells (SCs) with abnormal DNA continue to proliferate is crucial for gaining insight into cancer initiation. Planarians are used in this study because they contain SCs similarly regulated as the ones found in humans. SCs in planarian are known as neoblasts and these cells participate in tissue regeneration and cancer initiation along the anterior-posterior (AP) axis. These flatworms provide an excellent paradigm to track SC behavior and cellular transformation in the adult body. Specifically, we are interested in understanding how mechanisms of DNA repair and cancer initiation are different along the AP axis. We have created mutant planarians with AP abnormalities by using pharmacological treatments and genetic manipulations with RNA interference. Once the polarity was disrupted, we induced DNA damage on SCs through the use of chemical agents and irradiation. The damage is planned to be assessed by whole-mount immunostaining. From that data, we aim to determine whether SCs located in the anterior use different DNA repair mechanisms than SCs in the posterior. We expect a slight variation among the two regions based on previous evidence showing that SCs produce different structures depending on their location.

Name: Laura Jalpa

Major: Earth Systems Science

Home City: East Palo Alto, California

Laura Jalpa is a third year undergraduate student in Earth Systems Sciences who is interested in the field of Soil Science. She expects to graduate in the spring of 2015 and attend graduate school. She hopes to also attain a Ph.D. in soil science and one day become a professor. Laura also would like to travel

to other countries and do volunteer work. Laura enjoys hiking, camping, and running as often as she can. On the creative side, she likes to cook and knit.

Relationship of Soil Carbon and Nitrogen Concentrations with Elevation and Vegetation Coverage

Laura Jalpa, Emma McCorkle, Asmeret Asefaw Berhe, PhD, School of Natural Science, University of California, Merced

Carbon (C) and Nitrogen (N) are two of the most essential nutrient elements in soil. In most temperate ecosystems, plant productivity is typically limited by the availability of nitrogen. Concentrations of both C and N in soil are influenced by topography, extent of vegetation cover, and net primary productivity. The rate of loss of C and N concentrations occur through processes of decomposition, denitrification, erosion, and leaching. In this study, we evaluate the correlation of soil C and N concentrations, and C:N ratio with the extent of vegetation coverage and elevation. We collected 35 samples from three transects in the Kings River Experimental Watersheds (KREW), in the southern part of the Sierra Nevada mountains in California. We covered the crest, backslope, and depositional toe-or foot-slope landform positions. Measurements of total C and N in soil were carried out using the dry combustion techniques in an Elemental Combustion System (ECS). Vegetation coverage decreased from the crest to the backslope and increased significantly in the deposition site of the slope, mirroring observations of C and N concentrations at the bottom of the slope. This information will be critical to further evaluate how topography controls soil and vegetation dynamics in upland temperate forest ecosystems such as the Sierras.

Name: Maria Rodriguez

Major: Political Science

Home City: San Diego, California

Maria Rodriguez, who likes to go by Ria will be graduating in 2013, with a Bachelor's of Arts in Political Science with an emphasis in International Relations. Ria is the first in her family to have graduated from college and be born in the United States. She hopes to receive her MPH (Master's of Public Health) and work for a federal agency such as USDA or a non-profit organization. Ria would love to establish her career in Washington, D.C. or Boston and after a few years, move back to California.

Sugar sweetened beverage consumption is higher in normal weight than overweight and obese adolescents: Implications for future increased prevalence of obesity

Maria Rodriguez[1], Priscilla Montez[1], Simon E. Weffer[1' 2], and Rudy M. Ortiz[3]; [1]School of Social Sciences, Humanities and the Arts, University of California, Merced; [2]Department of Sociology and the Center for Latino & Latin American Studies, Northern Illinois University; [3]Department of Molecular & Cellular Biology, University of California, Merced

The National Youth Physical Activity and Nutrition Study indicates that approximately 57% of adolescents in high school consume a sugar-sweetened beverage (SSB) at least once per day even though weekly consumption of 100% fruit juice, milk, and water are greater. Because high consumption of SSBs is associated with the development of metabolic disorders (ie, insulin resistance and obesity) and can displace the intake of water or milk, robust measures of consumption among adolescents is important for assessing the potential impact on public health. The associations among beverage consumption (water, milk, juice and soft drinks) with regards to body mass in Hispanics in rural areas are not well examined. Surveys collected self-reported data on daily beverage consumption and related to direct measures of BMI from non-Hispanic white (312 males, 301 females) and Hispanic (671 males, 610 females) adolescents (13-17 years old.) On average, 49% of overweight and obese adolescents, regardless of race and gender, drank more water than their normal weight counterparts. 61% of normal weight non-Hispanic white females reported consuming more soft drinks per day than their obese and overweight counterparts regardless of race. Furthermore, 46% of normal weight and overweight Hispanic males drank more juice per day than white males. The lack of higher SSB consumption in overweight and obese adolescents suggests that either SSB consumption is not a principal cause of their increased weight or that most of these adolescents are beginning to reduce their intake to address their weight issues. The higher SSB consumption in normal weight females is alarming because we have reported reduced physical activity levels in this group, and thus, suggests that this group is susceptible to weight gain and increasing the prevalence of overweight and obesity in this population of adolescents, further burdening the epidemic that plagues the United States.

Name: William Zeledon

Major: Computer Science & Engineering

Home City: Dos Palos, California

William Zeledon is an incoming third year undergraduate student of Computer Science & Engineering at the University of California, Merced. He has maintained an above average GPA while also holding leadership positions in several organizations. Within the organizations he has strived to work with the community and bring others to indulge in community service. William enjoys helping others, especially those in his community. He is also very technologically savvy, continuously looking to upgrade his outdated items to newer and better objects.

Sheep fire emissions suggest an impact to air quality in the San Joaquin Valley, CA, USA

William Zeledon, Ricardo Cisneros, Ph.D., Public Health, University of California, Merced

This study investigates the fire emissions of Sheep Fire and determines if the pollutants emitted have an impact to air quality in the San Joaquin Valley. Forest fires in the western United States have increased in size and intensity leading to bigger impacts on air quality. This increase is believed to be in part created by fire suppression activities implemented at the beginning of the century and warming of the earth caused by Green House Gases (GHG). According to the San Joaquin Air Pollution Control District forest fires impact air quality by emitting great amount of pollutants. The pollutants emissions presented here are: carbon monoxide (CO), methane (CH_4), ammonia (NH_3), oxides of nitrogen (NO_x), sulfur dioxide (SO_2), volatile organic compounds (VOC), 2.5µm particulates ($PM_{2.5}$), and 10µm particulates (PM_{10}). Data was collected via the California Air Resource Board, and other databases. We used ArcGIS and the BlueSky Playground model to create emission estimates for spatial and temporal analysis of the Sheep Fire occurring in Kings Canyon National Park and Sierra National Forest 7/29/2010-10/01/2010. We conclude that the Sheep Fire emitted large amounts of pollutants comparable to 5.61% of California's 2008 annual emissions. Fire emissions of Sheep Fire contain large quantities of pollutants that are dispersed into the sky, which can have a lasting impact to air quality.

UPSTART
Undergraduate Physician Scientist Research Training

Name: Steven Duval Ruilova

Major: Molecular and Cellular Biology

Home City: Folsom, California

Steven Duval Ruilova is a junior majoring in Molecular/Cell Biology. As a freshman, Steven was awarded the NSF REU Computational Biology Research Scholarship. His sophomore year, he was awarded the USDA Fellowship, giving him the opportunity to conduct research at the USDA federal laboratory at The University of California, Davis. Upon his return, he joined the Ortiz lab on campus in which he currently continues his research. Apart from his aspirations in the Sciences, Steven also works as an intern at the offices of Senator Anthony Cannella, California 12th district in Merced. Steven's parents, Luis D. Duval PhD, MBA and Maria Ruilova-Duval, PhD, are undoubtedly his biggest source of inspiration in the Sciences while his brother, Jhostyn Duval, remains his biggest inspiration in all his political endeavors.

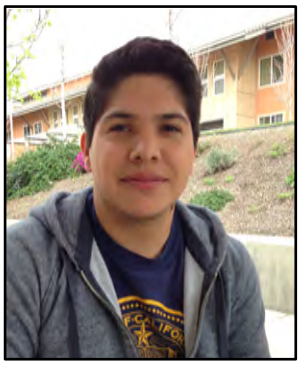
A Combination Therapy of Olmesartan/Exenatide Decreases Renal ER Stress

Steven Duval Ruilova[1], Carmen De Miguel[2], Rudy M. Ortiz[1], Jennifer S. Pollock[2]

[1]School of Natural Sciences, University of California, Merced, 5200 Lake Road, CA 95340; [2]Section of Experimental Medicine, Georgia Regents University, Augusta, GA 30912

Insulin Resistance (IR) has been associated with elevated activation of the Renin-Angiotensin System (RAS), $U_{Na}V$ excretion and heightened blood pressure (BP). Elevated levels of Endothelin-1 (ET-1) have been described in cardiovascular diseases. Although evidence shows that increased levels of ET-1 lead to renal dysfunction, specific molecular mechanisms remain unclear. To elucidate these processes, we propose Endoplasmic Reticulum (ER) stress as a potential mechanism for ET-1 induced-renal injury. We hypothesized Metabolic Syndrome/Type 2 Diabetes to be associated with increased renal expression of ET/ER stress markers. Additionally, we hypothesized that treatment with Olmesartan (an Angotensin Receptor Blocker), Exenatide (Glucagon-like Peptide-1 analog), or a combination, decreased expression of ET, NOS and ER stress markers. OLETF/LETO rats were subjected to individual/combined treatments of Olmesartan (10ug/kg/day) and Exenatide (5ug/kg/day) for 6 weeks. qRT-PCR analysis of ET system, ER stress and NOS system markers in whole kidney tissue showed increased relative mRNA expression in OLET rats treated with individual drugs, while amelioration was observed in combination treatment of

olmesartan/exenatide. In conclusion, a combination olmesartan/exenatide therapy decreases renal ER stress, ET and NOS markers, which suggest this combinatorial therapy as a plausible preventive treatment for Metabolic Syndrome/Type 2 Diabetes-induced renal damage.



Name: Julio Flores

Major: Molecular and Cellular Biology

Home City: Mexicali, Mexico and Montclair, California

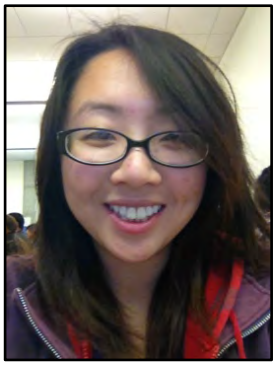
Julio Flores is a third year undergraduate student at UC Merced majoring in Molecular and Cellular Biology. Following his graduation in May of 2014, he intends to matriculate to an MD/PhD program. Julio has been investigating protein redistribution on cells with inclusion body myopathy under Professor Kitazawa at UC Merced for one year prior to becoming involved with the UPSTaRT program. Since the summer of 2012, Julio has also been part of the Center of Excellence on Health Disparities Program at UC Merced, where he contributed to the number of educated underrepresented students competent of addressing the increasing health disparities of the Central Valley. In addition to being involved in research, Julio—president of Phi Delta Epsilon CA Lambda—expects to continue serving his community by organizing events to help the underserved people of Merced. Growing up in Mexicali, Mexico, Julio was able to experience the beneficial consequences of helping unprivileged populations by taking care of his ill grandparents, who like many others in the area did not have access to adequate health care. In 2010, Julio moved to Montclair, CA to attend high school and eventually earn an education at UC Merced. In his spare time, Julio enjoys playing soccer for the UC Merced team as well as volunteering at the Emergency Department at the local Mercy Hospital.

Iron exposure reduces viability and plasticity of diabetic BMVECs subjected to stroke *in vitro*

Julio Flores[1], Mohammed Abdelsaid PhD[2], and Adviye Ergul MD, PhD[2], [1]School of Natural Sciences, University of California, Merced, [2]Physiology, Georgia Regents University

Diabetes increases the incidence of ischemic stroke as well as worsens outcomes and increases bleeding into the brain. We have previously shown that diabetic Goto-Kakizaki (GK) rats have increased yet dysfunctional angiogenesis, profuse bleeding into the brain and poor vascular repair if subjected to stroke. The effect of bleeding on endothelial cell survival and repair is unknown. Here, we test the hypothesis that iron exposure reduces brain microvascular endothelial cell (BMVEC) viability and plasticity after ischemia/reperfusion in diabetes. To test this hypothesis, BMVECs isolated from Wistar (non-diabetic) and GK (diabetic) rats were treated with 0.1 mM iron (III) sulfate, incubated 6 hours in hypoxia (0.1% O_2), and reoxygenated overnight. The cells were subjected to cell proliferation, migration and tube formation assays. GK BMVECs showed increased

cell proliferation, migration and tube length under normoxia. Hypoxia reduced all three measures of angiogenesis for GK BMVECs. Additionally, treatment with iron further reduced the migration and tube length of GK BMVECs exposed to hypoxia while it did not have an effect on control cells. These results suggest that iron has a deleterious effect on survival and angiogenic properties of diabetic BMVECs. More work is needed to investigate the exact mechanism of iron-induced impairments but our work identifies iron chelation as a novel therapy to improve recovery after stroke.



Name: Beverly Li

Major: Chemical Sciences

Home City: San Francisco, California

Beverly Li is a third year undergrad majoring in chemistry with a biological emphasis. She wants to get into medical school such that she can aid people. She has recently found out that she loves to conduct research and hands on projects. Aside from academics and research, she is the Vice President of Communications for an organization on campus called American Medical Student Association. She enjoys contributing, volunteering, and supporting causes not only in local communities, but also other communities. She hopes that her experience with UPSTaRT will bring her new knowledge as she puts all her skills and efforts into the program. Lastly, she loves puzzles, learning new material, and meeting new people.

Attenuating the Development in Hypertension in Male and Female Spontaneously Hypertensive Rats (SHR) decreases Renal T Cells in Only Female SHR

Beverly Li, Ashlee J. Tipton, and Jennifer C. Sullivan, PhD, Experimental Medicine, Georgia Regents University

The kidney is critical in the long-term control of blood pressure, and renal inflammation has been linked to the progression of hypertension. SHRs' age related increase in blood pressure (BP) is similar to the human population making them a good experimental model of essential hypertension. Previous experiments have shown a sex difference in the renal immune cell profile: male SHRs have more pro-hypertensive renal T helper17 cells (Th17) while females had more BP-lowering T regulatory cells (Tregs). Male and female SHR were randomized to receive tap water (vehicle) or the BP-lowering drugs, hydrochlorothiazide and reserpine, in drinking water from 5 to 12 weeks of age. BP was measured by tail cuff, and kidneys were isolated for flow cytometric analysis of T cells. Treatment did not significantly change the measurement of metabolic parameters and urinary electrolyte excretions between control and treated groups. Control SHRs maintained the sex difference in the renal immune cell profile. Attenuation of the development of

hypertension did not significantly change the renal T cell profile in male SHR, however, in females there was a decrease in renal Tregs and Th17 counts which abolished the sex difference in the T cell profile.

Name: Carly Stilphen

Major: Biological Sciences

Home City: Lodi, California

Carly Stilphen is an undergraduate pursuing a bachelorette degree in Biological Sciences with a minor in Cognitive Science at the University of California, Merced. She graduates in the spring of 2013 and plans on applying to MD/Ph.D. programs. Her current research focuses on the effects of alcohol on glial cells in the blood brain barrier in drosophila. In previous semesters at UC Merced she has researched minimal group dynamics and long distance dispersal via rafting in establishing phylogeographic diversity in giant algae and isopods. She also spent last summer as an intern at Ohio State University, researching the functional consequences of HSPB1 mutations in the formation of motor neuropathy. Although she is passionate about her research, her academic studies take equal priority and she strives to be at the top of her class. Carly thinks it's important that everyone has an equal chance in getting involved with science, whether it's helping fellow undergraduates or helping create a curriculum to teach to elementary students. In her free time, Carly enjoys discovering Yosemite Park and Redwood National Forest, as well as watching Disney movies with her siblings. She believes that the song "On my way" by Phil Collins explains her current adventure throughout life: "Tell everybody I'm on my way, and I'm loving every step I take." Although the future holds many uncertainties for her, she is excited to see where her education takes her.

The Proton Channel HVCN1 is Expressed in the Medullary Thick Ascending Limb of the Kidney

Carly A. Stilphen, Paul M. O'Connor, PhD, Experimental Medicine, Georgia Regents University

Oxidative stress in the renal outer-medulla contributes to the development of hypertension and renal disease in the Dahl salt-sensitive rat. We have previously demonstrated that an unknown proton channel is responsible for enhanced superoxide production in medullary thick ascending limb (the greatest source of reactive oxygen species in the outer medullary region) of Dahl SS rats. The goal of our study was to determine whether the voltage-gated proton channel HVCN1 could be this unidentified channel. We hypothesize that HVCN1 is expressed in mTAL of Dahl SS rats. In order to test our hypothesis we quantitated HVCN1 mRNA (RT-PCR) and protein (immunohistochemistry) in mTAL of wild-type and HVCN1$^{-/-}$ (negative control) Dahl SS rats. Our

results showed that HVCN1 mRNA was expressed 6.4 folds higher in mTAL of wild-type rats compared to HVCN1$^{-/-}$ rats (n=4/p=.04). In addition, HVCN1 protein expression was found to be significantly greater in mTAL of wild-type rats compared HVCN1-/- rats (4382au ± 921au, 1459 ± 708au respectively, n=5/p=0.036). We conclude that HVCN1 is expressed in the renal medullary thick ascending limb of Dahl SS rats. Our data indicates that HVCN1 could be the unidentified proton channel and contribute to oxidative stress and the development of hypertension in Dahl SS rats.

Pre-Health
Scholars Program

Name: Marco Antonio Rodriguez

Major: Bioengineering

Home City: Delhi, California

Marco Antonio Rodriguez is a third year Bioengineering student born and raised in Merced County. He expects to graduate in 2015 and at the moment think of attending an MD/Ph.D. program. He hopes to become involved in Multiple Hereditary Exostoses research in the future due to it being a hereditary disorder in his family and the undergraduate research opportunity can be a segway to this goal. As a hospital volunteer and a Yosemite Leadership Program member, he is also passionate about health and leadership. Marco became the older sibling in his family after his sister passed away due to cancer in 2008. In his free he enjoys playing soccer with his two younger brothers.

Title: Fabrication, Micro-patterning, and Optical Analysis of Polymeric Electrospun Nanofibers for Biological Applications

Marco Antonio Rodriguez[1], Harry Calvin Cramer III[1,3], Selena Romero[2,3], Venu Polineni[3], Anand Gadre[3,]; [1]School of Engineering, University of California, Merced; [2]School of Natural Sciences, University of California, Merced; [3]Stem Cell Instrumentation Foundry, University of California, Merced

Biological applications have a need for the development of artificial scaffolds capable of recreating the conditions necessary for bone tissue regeneration. The procedures for creating such scaffolds require the fabrication and patterning of nanoscale polymeric electrospun fibers. Our current research project at the Stem Cell Instrumentation Foundry (SCIF) will focus on the development of such scaffold with nanofibers composed of SU-8, an epoxy based negative photoresist. The electrospinning process is a simple, versatile, and widely used method of producing nanofibers by applying a high voltage (typically 5-30 kV) to create an electrically charged jet of a polymer solution, which solidifies to leave behind a polymer fiber. After electrospinning of the photoresist, the samples will be soft baked in an oven. The soft baking step is followed by lithographic patterning using contact aligner (Quintel© Q-2001 CT Mask Aligner SOP). In this work, we aim to show that the electrospun photodephynable polymer retains its photoresist properties and that it can be directly patterned in various forms by photolithography. We will perform the optical analysis of the patterned nanofibers via the usaged of the confocal microscope (Nikon Eclipse EZ-C1), and then functionalize such patterned samples by adhering cells onto the fiber surface.

Correlation of cell differentiation and proliferation with respect to the topography of the patterned nanofibers will be analyzed for scaffolding as well as implantable medical device applications.

Name: Joanna Valenzuela

Major: Biological Sciences

Home City: Modesto, California

Joanna Valenzuela is a first generation college student at the University of California, Merced. Joanna is a third year undergraduate student and expects to graduate in Spring 2015 with a Bachelor's of Science in the Biological Sciences with an emphasis in Human Biology. Her career goals include becoming a doctor and practicing general medicine in her hometown where she can help underrepresented minority communities. In her spare time, Joanna enjoys volunteering her time at the hospital, walking her dogs and spending time with family and friends.

Effects of a Type 2 Diabetes Mellitus (T2DM) Treatment Drug and Angiotensin Receptor Blocker on Brain Pathology in a T2DM Rat Model

Joanna Valenzuela, Carlos Rodriguez-Ortiz, Ph.D., Ruben Rodriguez, Rudy Ortiz, Ph.D., and Masashi Kitazawa, PhD; School of Natural Sciences, University of California, Merced

Type II diabetes mellitus (T2DM) is associated with an increased risk for developing Alzheimer's disease (AD), but the exact molecular mechanisms of this connection have not been fully identified. Nevertheless, hypertension and high blood sugar levels observed in T2DM may augment the risk for AD because these conditions have been shown to increase damages to blood vessels, affect blood flow as well as cause an up-regulation on the production and deposition of amyloid-beta peptides, leading to inflammation and other neuropathological changes present in AD. In this study, we investigated whether two FDA approved drugs (exenatide) and hypertension (olmesartan) also protected from neuropathology in a rat model of T2DM. T2DM rats were treated with an angiotensin receptor blocker (olmesartan, 10 mg/kg/day), exenatide (5 ug in diet/day), or both for 6 weeks. Staining and western blot were utilized to determine whether these drugs had any disease-modifying effects in the brain. The findings showed no significant neuropathological changes, however, rats specifically exposed to olmesartan alone, exhibited a trend of decreasing inflammation. Follow-up studies will be conducted to further explore a possible molecular link between T2DM and AD as well as any impacts of ameliorating T2DM on AD-like neuropathology in the brain these results.

Name: Melissa Williams

Major: Biological Sciences

Home City: Paso Robles, California

Melissa Williams is a third year undergraduate student, majoring in Biological Sciences with an emphasis in human biology. She expects to graduate in Spring 2015. Melissa has spent a year as a member of the National Society of Black Engineers learning how to be culturally responsible and excel academically while impacting the community. This has led her to aspire to increase the number of African Americans in STEM. In her free time, Melissa enjoys learning different instruments as well as traveling.

Urinary Sodium Excretion Decreases In the Early Stages of Insulin Resistance

Melissa E. Williams[1], Jacqueline N. Minas[1], Ruben Rodriguez[1], Daisuke Nakano[2], Akira Nishiyama[2], and Rudy M. Ortiz[1]; [1]Department of Molecular & Cellular Biology, School of Natural Science, University of California Merced; [2]Department of Pharmacology, Kagawa Medical University, Kagawa, Japan

Type II diabetes is associated with an activated renin-angiotensin system and glomerular damage, contributing to impaired urinary Na+ excretion ($U_{Na}V$) and volume-dependent hypertension. However, mechanisms contributing to elevated blood pressure (BP) during early onset insulin resistance (IR) are not well defined. Understanding the effects of onset IR to glomerular damage (proteinuria; $U_{TP}V$), impaired $U_{Na}V$ and BP, 3 groups of rats were studied (n=6/group); 1) non-IR, Long Evans Tokushima Otsuka (LETO), 2) untreated, IR Otsuka Long Evans Tokushima Fatty (OLETF), 3) OLETF + angiotensin receptor blocker (ARB; 10 mg olmesartan/kg/d). Systolic blood pressure (SBP), $U_{Na}V$, $U_{TP}V$ were measured at 8 and 15 weeks, a time frame for onset IR. At 8 weeks, no differences in SBP, $U_{Na}V$, and $U_{TP}V$ between LETO and OLETF rats existed. Therefore, OLETF represented a non-impaired phenotype. At 15 weeks, an 18% increase in mean SBP in OLETFs associated with a 46% decrease in mean $U_{Na}V$ suggests that impaired renal Na+ regulation contributes to onset IR-associated hypertension. Mean $U_{TP}V$ was 107% higher than LETO, signifying that impaired $U_{Na}V$ was due to glomerular damage. Conversely, ARB treatment in OLETFs reduced SBP by 18% $U_{TP}V$ by 20% and increased $U_{Na}V$ 100%, suggesting that ARB improves early IR-associated hypertension and proteinuria.

Name: Debby Lee

Major: Biological Sciences

Home City: Wilton, CA

Debby Lee is a junior majoring in Human Biology. She recently competed and won a national fellowship awarded by the American Physiological Society, which will allow her to start her first summer research experience. Debby will be collaborating with Dr. Rudy Ortiz and analyzing the unique endocrinology and metabolic functions of northern male elephant seals, which will contribute to the understanding of evolutionary development and insulin signaling. Aside from research, she also works as a student assistant for the tutoring department of the Bright Success Center during the school year and worked with her boss in the past year to make tutoring more effective and efficient for students.

Thyroid Hormone Changes Associated with Prolonged Food Deprivation in Adult Male Northern Elephant Seals

Debby Lee[1], Bridget Martinez[1], Daniel E. Crocker[2], Rudy M. Ortiz[1]; [1]Department of Cellular and Molecular Biology, University of California, Merced; [2]Department of Biology, Sonoma State University, Rohnert Park, CA

During food deprivation, deiodinase type 1(DI1) is increased to raise the mono-deiodination of the inner ring to promote the production of reverse T3, which suppresses cellular metabolism to protect the organism from energetic burdens imposed during periods of reduced energy intake. Thyroid hormones (TH) thyroxine (T4) and triiodthyronine (T3) promote basal metabolism in mammals but its levels are typically suppressed with prolonged fasting. TH plasma concentrations were measured in male northern elephant seals to better understand DI1. To address our hypothesis that natural fasting in elephant seals stimulate an increase in DI1, we measured plasma concentrations of rT3, free T3 (fT3), free T4 (fT4), total T3 (tT3), and total T4 (tT4) in male elephant seals (n=10) over 10 weeks of fasting. Fasting did not alter the concentrations of plasma thyroid hormone rT3, fT3, tT4. However fT4 increased (0.25± 0.03ng/dL to 0.78 ± 0.08ng/dL) suggesting that there is an increased potential for TH-mediated cellular effects. Conversely, tT3 decreased (63± 5 ng/mL to 50 ± 4ng/mL) between early and late fasting suggesting that DI2 or DI3 may be contributing to the dynamic changes in TH metabolism. Overall these findings reveal unconventional mechanisms of TH activity, regulation, and metabolism associated with prolonged food deprivation in a fasting-adapted mammal.

Name: Meagan Moreno

Major: Biological Sciences

Home City: San Jose, California

Meagan Moreno is a third year undergraduate student majoring in Biology with an emphasis in Human Biology at the University of California, Merced. She is currently studying cardiovascular disease in relation to the onset of diabetes by analyzing the effects of various treatments administered to the OLETF rats with metabolic syndrome. As an aspiring physician, she holds an executive board position for Phi Delta Epsilon International Medical Fraternity, which she credits a majority of her success in college as its member provide the support system she needs to stay determined. The National Society of Collegiate Scholars also recognized Meagan for her academic achievement. Although her ultimate goal is to become a physician, she is considering obtaining a Ph.D. in Nursing because she spent a great time of her childhood observing the emergency room while waiting for her mother, who is a registered nurse, to get off of work. After graduating in 2015, she is planning to take a year off to work as a medical scribe and travel. Outside of her studies, Meagan enjoys baking and hiking to relieve stress.

The Acute Treatment of Exenatide Increases Blood Pressure Through an Up-regulation of Aldosterone

Meagan Moreno, Ruben Rodriguez, Andrew Lee, Guillermo Vazquez, Steven Duval Ruilova, Rudy M. Ortiz, PhD, School of Natural Sciences, University of California, Merced

Metabolic syndrome is associated with increased activation of the renin-angiotensin system contributing to hypertension, but what is unknown is if glucagon-like peptide-1 (GLP-1) mimetics ameliorate hypertension via increased natriuresis. To assess the acute effects of angiotensin receptor type 1 (AT_1) and GLP-1 receptor (GLP-1r) activation on urinary sodium excretion ($U_{Na}V$) and systolic blood pressure (SBP), these were recorded at days 0, 2, and 7, and weekly for six weeks in five groups of rats: 1) untreated, lean LETO (n=7), 2) untreated, obese OLETF (n=5), 3) OLETF + angiotensin receptor blocker (ARB; 10 mg olmesartan /kg/d; n=4), 4) OLETF + GLP-1 mimetic (Ex; 10 ug exenatide/kg/d; n=7), and 5) OLETF + ARB + Ex (combo; n=6). Urinary aldosterone excretion ($U_{Ald}V$) increased by 342.2% in Ex on day 2 compared to OLETF and was consistent with a 155.81% $U_{Na}V$ decrease and 7.6% SBP increase from OLETF. However, the 23.18% $U_{Ald}V$ reduction in combo group was associated with reduced $U_{Na}V$ (22.99%) and SBP (15.88%) compared to OLETF proposing activation of AT_1 has a greater contribution to the insulin resistance-associated increase in SBP than the impaired $U_{Na}V$. By day 7, Ex $U_{Ald}V$ measured lower than OLETF by 73.22% accompanied by increased $U_{Na}V$ (176.2%) and decreased SBP (2.25%) suggesting GLP-1r activation acutely increases SBP possibly mediated by elevated aldosterone.

GUEST PRESENTERS

Modeling Electronic Excitations of a Solute in Water

Enrique Alameda Jr., Christine M. Isborn, PhD, School of Natural Sciences, University of California, Merced

This study focuses on the accurate modeling of the electronic energy levels of chromophores in aqueous solution, specifically the anion of photoactive yellow protein (PYP), deprotonated *trans*-thiophenyl-*p*-coumarate, and its neutral analog. To make progress in many areas of solution phase chemistry, we need accurate models of solute-solvent interactions. These interactions are often oversimplified due to computational limitations, for example studying the solute alone, using fixed molecular mechanical (MM) point charges as model for the solvent, or using a polarizable continuum model (PCM), which neglects specific solute-solvent interactions. We have studied the electronic energy levels of the PYP chromophore using three distinct models of the surrounding environment: a quantum mechanical (QM) water cluster, PCM, and MM waters. The latter two methods were combined with explicit quantum mechanical waters. Based on our initial studies we have concluded that the minimum number of QM waters needed to converge the bright state excitation energies of the anion PYP chromophore is ~75 QM waters for an MM model and ~100 waters for PCM. The neutral analog required ~40 QM waters for an MM model and ~50 for PCM. However we note that the PCM and MM models using a large amount of waters do not converge to the same excitation energy, which we intend to investigate in future studies.

TNF-α suppression rescues GPx activity in Insulin Resistant Rat Kidney

Matthew L. Carter, Andrew Lee, Ruben Rodriguez, Max Thorwald, Rudy M. Ortiz, MD, PhD, Department of Molecular and Cellular Biology, University of California, Merced

Metabolic syndrome is associated with elevated renin-angiotensin system (RAS), hypertension, insulin resistance (IR), and inflammation associated with the production of reactive oxygen species (ROS). This study assessed the effects of blocking 1) RAS, 2) tumor necrosis factor-alpha (TNF-α) mediated inflammation, 3) and non-RAS-mediated hypertension on the activity of the antioxidant enzymes, glutathione peroxidase (GPx), catalase (CAT), and superoxide dismutase (SOD) in the kidney of IR, Otsuka-Long-Evans-Tokushima-Fatty (OLETF) rats. Lean and obese rats (n = 5-7/group) were randomly assigned to the following groups: 1) untreated Long-Evans-Tokushima-Otsuka (LETO)(lean, strain control), 2) untreated OLETF, 3) OLETF + angiotensin receptor blocker (ARB)(10 mg olmesartan/kg/d x 10wk), 4) OLETF + TNF-α blocker (ETAN)(1.25 mg etanercept/kg/d x 10wk), 5) OLETF + calcium channel blocker (CCB)(3 mg amlodipine/kg/d x 10wk), and 6) OLETF + ARB+ ETAN (COMBO)(same doses x 10wk). TNF-α suppression decreased

IR index by 33% and systolic blood pressure by 50%. In addition, OLETF exhibited a 23% decrease (41 ± 4 vs. 32 ± 3 nmol/min/ml) in mean GPx activity. TNF-α blockade reversed the decrease in GPx activity (45 ± 4 nmol/min/ml) demonstrating that TNF-α contributes to dysregulation of antioxidant enzymes in the IR kidney. In contrast, CAT and SOD activities were not significantly different among groups suggesting that dysregulation of antioxidant enzymes is targeted during IR conditions.

The modulation of phosphorylated myocardial and vascular eNOS isoforms by angiotensin receptor blockers and GLP-1 mimetics in a model of metabolic syndrome.

Shantanu V. Srivatsa, Rudy M. Ortiz, PhD, School of Natural Sciences, University of California, Merced

Endothelial nitric oxide synthase (eNOS) oxidizes L-arginine to L-citrulline and nitric oxide (NO), resulting in multiple cardiovascular protective effects including anti-atherogenic effects, vasodilation, inhibition of platelet activation and adhesion, suppression of smooth muscle cell proliferation. Uncoupled, dysfunctional eNOS switches production of NO to O_2^-, which may further uncouple eNOS. The resultant reactive oxygen species (ROS) have been implicated in myocardial hypertrophy, myocardial fibrosis, as well as impaired vasodilation.. Both uncoupling and up-regulation of dysfunctional eNOS have been demonstrated in diabetic models through phosphorylation at various sites. One of the major sites, Ser1177 has been implicated in the upregulation of NO production in response to cardiovascular stress. Currently the pattern of phosphorylation of eNOS isoforms regulated by ARBs and GLP-1 mimetics in a model of metabolic syndrome and the implications for eNOS activity regulation are unknown

Objective: (1) To define the pattern of expression of eNOS in the OLETF(Otsuka Long Evans Tokoshima Fatty) rat model of insulin resistance and metabolic syndrome which mimics the pathological changes of human diet induced obesity related type 2 diabetes mellitus(T2D). **(2)** To assess the relative roles of chronic angiotensin-1 and Glucagon-like peptide(GLP-1) receptor activation on eNOS expression in myocardium and aorta in the OLETF model.

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