



2016-2017 Senior Research Booklet



Table of Contents

Social Sciences & Humanities

Niveditha Achanta	4
Common Core State Standards' (CCSS) Effects on SAT	
Scores	
Oluwafunmike Aderonmu	4
A Conflict of Interests: Revisiting Development Assistance	
Committee Members' Tied Aid Policy Post 2001	
RaNelle K. Bradley	5
Shakespeare's Adaptation of Golding's Venus and Adonis:	•
From Narrative to Drama	
Tawny Bussey	5
Emotional Face and Eye Gaze Processing in Typically and	
Atypically Developing Children	
Sarah A. Coon	6
Overcoming Student Distraction: How Cognitive Stress	
Affects Multitasking and Learning	
Mark Patrick Cubillan	6
Attentional Capture While Dual Tasking	
Jaclyn Dewitt	7
Developing a Peer Mentoring Program for the UC Davis	
University Honors Program	
Tiffany N. P. Do	7
The Campus-Community Debate: Re-Viewing Asian	
American Studies as a Community in the 1980s	
Emily Dorrance	8
The Efficacy of Philanthropy in Establishing Equitable Park	
Access: A Study of Public-Private Partnership (P3) Parks	
Jasmine Gunkel	8
Pleasures of the Flesh: An Inconsistency in Our Thoughts	
About the Ethical Use of Animal Bodies	
Mei Lin Jackson	9
Small Happiness and China's Invisible Children: Unravellin	g
the Unwanted Girls Myth of the One Child Policy	
Dana Jacobs	9
Energy Expenditure of Stone Tool Knapping Oldowan and	
Acheulean Technologies	
John M. Klyver 1	0
Statistical and Narrative Medical Analysis of the Success of	of
an Inner-City Clinic	
SueBin Lee 1	0
Development of Smart Clothing for Visually Detecting	
People at Night	

Kristi M. Lin	11
Designing an Anti-Memorial to Land Lost	
Patricia J. McNeill	11
Site Formation Processes and Human Use Analysis at	
Varsche Rivier 003, Western Cape, South Africa	
Nava Ratna	12
Social Support Buffers Against the Effects of LGBTQ-	
Related Peer Victimization on Depression Symptoms	
Andres Rodriguez Lombeida	12
Fortune 500 Companies in Social Media: Communication	n
Patterns	
Julianna Roy	13
Assessing the Effect of Justice Violations on Spontaneou	IS
Perspective-Taking	
Breanna Schenkhuizen	13
Percy Jackson and the Olympians: Adapting Greek	
Mythology for a Middle Grade Audience	
Malavika Shankar	14
Healthy Women, Healthy Lives: Introduction of Women's	
Health Issues in the Undergraduate Curriculum	
Riley N. Sims	14
An Eye Tracking Investigation of Attention Shifting Betwee	een
Affective Central and Peripheral Faces	
Joanna Tang	15
Student-Facilitated Course on King Arthur	
Brynna Thigpen	15
Episodic Future Thinking and Math Achievement	
Alyssa M. Vandenberg	16
The Role of Mothers in Shakespeare's Plays	
Christian Wirawan	16
Developing Course-Based Undergraduate Research	
Experiences (CUREs) in STEM and Assessing Their Relation	ion
to Student Interest and Retention in STEM Fields	
Maria Angelica Wong Chang	17
Early-Stage Technologies and the Public University:	
Lessons About Intellectual Property and Social	
Responsibility From the UC Blackwelder Tomato Harvest	ter
Muheng Yu	17
Am I the Right One for Muscular Men? A Glance at the	
Effects of Media Images of Ideally Muscular Men on Your	ng
Adult Women	

Science, Technology & Mathematics

Gabrielle Allenbeck	19
Optimization of DNA Extraction and ITS Amplification of	
Pathogenic Fungal Species in Field Samples of Vitis vinife	era
Camille C. Andre	19
Proinsulin Expression in Immature and Dysfunctional Beta	1
Cells	
Anne Ashmore	20
Fruit Morphology and Developmental Deviation Within	
Vanilla pompona Subspecies	
Kimya Baradaran 2	20
Health Benefits of Fitbit Charge Physical Activity Trackers	in
the General Population	
Lisa D. Bell	21
Examining the Basis for Differential Recovery Rates of	
Muscle Mass and Strength Between Aged Fischer Brown	
Norway and Fischer 344 Rats	
Kimberley A. Berg	21
Characterization of Novel Factors in RNA:DNA Hybrid	
Metabolism	
Benjamin Bigelow 2	22
Using an Ex Vivo Approach to Study the Gut-Brain Axis	
Stephan Burroughs 2	22
Discrete Mesh Parameterization	
Aileen Chhen	23
Disconnects Between Pre-Clinical and Clinical	
Studies Influencing Hsp90 Inhibitor Success as a	
Chemotherapeutic	
Shiang-Wan Chin	23
Artificial Intelligence and Machine Learning in Financial	
Services	
Chessie Cooley-Rieders	24
The Effect of Seastar Predator Cues on Muscle	
Biomechanics and the Concentration of Twitchin Within	
the Adductor Muscles of the California Mussel (Mytilus	
californianus)	
Amanda E. Crofton	24
Effect of Nutrition on Maternal mRNA Contribution to the	
Embryo in Drosophila melanogaster	
Christina Day	25
Differential Gene Expression in Shaded Brassica rapa	

Gayathri Dileep	25
Investigating Rbfox3 Sufficiency for SNORD116 RNA Clou	d
Formation	
Ardavan Farahvash	26
Investigating a Missing Link in the Mechanism of	
Cytochrome c oxidase: Prediction and Analysis of Internet	וב
Water Chains	
Alexis Faria	26
The Transmission of Bifidobacteria Via the Built	
Environment: Infants and Mothers as Sources	
Valerie Fates	27
Effect of Age on the Tenogenic Ability of Tendon	
Proper-Derived and Peritenon-Derived Progenitor Cells i	n a
Murine Model	
Elise Hickman	27
Effects of p,p'-DDT and p,p'-DDE on Respiration and	
Substrate Utilization in Brown Adipocytes	
Erin Hsu	28
Effect of meta-Topolin on Shoot Growth in Paradox Waln	ut
Rootstock and Scions	
Srujan Kopparapu	28
Spp1 SUMOylation Modulates Homologous Recombination	on
During Meiosis	
Ada J. Kwong	29
Synthesis of Gyramide-Bound Photoaffinity Reagents for	
DNA Gyrase	
Mariana Leal	29
The Effects of Malnutrition and Human Lysozyme on	
Hepatic Metabolism	
Jason F. Leddy	30
CDK9 Inhibition Prevents Injury-Induced Subchondral Bo	ne
Resorption by Targeting Osteoclast Precursors	
Alicia Lim	30
Quantification of Oleuropein in Olive Leaf Supplements of	and
Purification of Its Derivatives	
Yuqing Liu	31
Statistical Learning in Intelligent Supply Chain Managem	ent
WeiYu Lu	31
Multi-Modal Sensation From Culex quinquefasciatus	
Iris N. Mollhoff	32
Structural-Functional Analysis of a Diterpene	
Synthase From Golden Larch Toward Manufacture of	
Biopharmaceuticals	
Catherine Nguyen	32
The Influence of Social Dominance on Parental Care in	
Columba livia	
Lakshmidevi Pabbisetty	33
Differentially Expressed Genes Involved in Leaf Shade	
Response in Brassica rapa	

Angela Parnay	33
Miscommunication Between Regulators and Local	
Communities During the Aliso Canyon Methane Blowout	
Rasika Patkar	34
Effects of Sialic Acid on Inflammation	
Kira Pearson	34
Noise Pollution and Interspecies Interactions	
Zoë T. Rossman	35
When Yawning Occurs in Elephants	
Natalia Sachs	35
Does What the Chickens Eat Affect the Chicken We Eat?	
Lauren Salinero	36
Biofilm in Neonatal Feeding Tubes: Bacterial Compositio	n,
Relationship to Gut Microbiota, and Potential Clinical	
Predictors	
Samantha Schuster	36
The Physiological Role of BRCA2 in Meiotic Recombinati	on
Jothika Tamizharasu	37
Determining the Retention and Survival of Bifidobacteriu	т
longum subsp. infantis on Different Surface Types	
Alison Thorngren	37
The Effect of Feeder Design and Feed Management on	
Profitability of Free-Range and Pastured Poultry Farms	
Isaac Fan-Sau Tseng	38
Elderlift - Improving Elderly and Disabled Mobility throug	h
Accessible Transportation	
Lo Tuan	38
The Role of Autophagy in Sister Chromatid Resolution	
During Anaphase	
Kyra van der Zalm	39
The Perception of Pain Associated With Injections in Dail	ry
Cattle	
Quynh Vo	39
Construction and Expression of a Polycistronic Plasmid	
Encoding Human Protein Complex Composed of Tubulin	
Binding Cofactor D,E, and Arl 2	
Dean Watson	40
Strawberry Runner Colonization by Fusarium oxysporum	f.
sp. fragariae	
Benjamin Wigman	40
Exploring Catalysts for AllyIsilane Oligomerization	
Reactions	
Garrett Woodworth	41
Kabrya: A Machine Learning Device for Everyone	
Erin Woolley	41
The Effects of Drought Conditions on California Crop	
Production Decisions	

Wafa Zeidan

Engineering

Brian Be Team # Erik Bec Team #2 Philip Cl Team #2 Dmeiri Team #2 Meghan Team #1 John En Team #4 Merritt R Dylan Fi Kabrya: Daniel F Team #7 Nathani Team #1 Kathlee Team #9 Model (Marie-Pi Team #4 Merritt R Joeseph Team #1 Alexis O Team #1 Claire S Team #9 Solution Akash S Kabrya: Sorbera #100: Ex Bradley Team #5 Garrett

42 Characterization of an In Vivo Transgenic Reporter System for Thyroid Hormone in the Frog Xenopus laevis

Brian Becker	44
Team #55: Right Here Right Nowcamille C. Andre	
Erik Becker	44
Team #76: Jackalope Pav (Personal Air Vehicle) Flying	Car
Philip Chen	45
Team #29: Special Study Course Management System	Naji
Dmeiri 45	
Team #29: Special Study Course Management System	
Meghan Doherty	45
Team #101: Rapid Whole Blood Hemolysis Detection	
John Engel	46
Team #40: Foundation Analysis And Design For Lake	
Merritt Residential Development	
Dylan Finch	47
Kabrya: A Machine Learning Device for Everyone	
Daniel Fust	47
Team #72: Heat Pump	
Nathaniel-Georg Gutierrez	48
Team #12: Congestive Heart Failure - Drug Delivery Sys	tem
Kathleen Hornbacker	48
Team #96: Canine Suspensory Ligament Instructional	
Model (Cslim)	
Marie-Pierre Kippen	49
Team #40: Foundation Analysis And Design For Lake	
Merritt Residential Development	
Joeseph Lacommare	49
Team #1: Crutch Force Sensor	
Alexis Okasinski	50
Team #1: Crutch Force Sensor	
Claire Sasse	50
Team #98: Excelerate: Low Cost Lower Limb Prosthetic	
Solution	
Akash Shah	51
Kabrya: A Machine Learning Device for Everyone Antho	ony
Sorbera 51 Team	ו
#100: Exo-K9 (Canine Fixation Device)	
Bradley Wang	52
Ieam #55: Right Here Right Now	
Garrett Woodworth	52
Kabrya: A Machine Learning Device for Everyone	

Social Sciences and Humanities

Niveditha Achanta

Oluwafunmike Aderonmu

Sponsor Name: Dalia Ghanem

Research Title: Common Core State Standards' (CCSS) Effects on SAT Scores

Abstract: Quantifying the impact of Common Core State Standards (CCSS) on learning outcomes has implications for education policy reform for public schools across the United States and California. This paper examines the effectiveness of Common Core State Standards, which are internationally benchmarked K-12 public education standards for English Language Arts (ELA) and Mathematics, first implemented in 46 states in 2010. I use Scholastic Aptitude Test (SAT) Verbal and Math scores as my response variables, employing a difference-in-differences approach to estimate the causal effect of Common Core on these scores. I use state level longitudinal data from 1995 to 2014 and California public high school longitudinal data from 1999 to 2015 in order to measure changes in SAT Math and Verbal scores before and after Common Core implementation. The preliminary results from my analysis suggest that Common Core had no statistically significant effect on these test scores during the period I examined.

Sponsor Name: Jeannette Money

Research Title: A Conflict of Interests: Revisiting Development Assistance Committee Members' Tied Aid Policy Post 2001

Abstract: Evidence against the use of tied foreign aid has driven a push in the international development community to untie more aid, as the 2001 Recommendation to Untie Aid illustrates, which called on OECD donor countries to untie their bilateral aid to the greatest extent without reducing aid flows. Despite commitments made by donor countries, not all members have fully untied their bilateral aid due to pressures from domestic interest groups which favor tied aid. Given this, I argue that use of informal aid tying mechanisms evident in the prevalence of de facto tied aid serves to mitigate pressures donors face from domestic interest groups and the international community such that donor states with a stronger record of development-friendly initiatives will see a rise in proportion of de facto tied aid. I conduct a statistical correlation analysis examining the effect of donors' scores on the Commitment to Development Index (CDI) and the proportion of aid contracts granted to firms from the donor country as tied aid in the years 2007, 2009, 2010 and 2013. The findings do not suggest that a stronger record of development-friendly initiatives in the proportion of de facto tied aid among donor countries.

Background

- In response a group of major donor countries from the OECD known as the Development Assistance Committee produced the 2001 Recommendation to Untie aid, publicly committing to untie official development assistance (ODA) flows to LDCs and later to HIPCs in 2008
- Since the Recommendation, DAC member states overall increased their share of untied aid, up to 80% in 2010; yet some countries have untied more than others
- While 20% of foreign aid remains tied officially, research indicates that **up to 60% of aid remains tied informally, pointing to an increase in this practice following the recommendation** (Carbone 2014, Ellmers 2011, OECD 2012).



RaNelle K. Bradley

Tawny Bussey

Sponsor Name: Cheryl Ross

Research Title: Shakespeare's Adaptation of Golding's Venus and Adonis: From Narrative to Drama

Abstract: Shakespeare's Venus and Adonis, an adaptation of Ovid's myth published in 1593, was a huge success in his lifetime. A close reading of Shakespeare's Venus and Adonis reveals that Shakespeare adapts the familiar story from Ovid-known mostly through Golding's English version-from a narrative mode to a dramatic one, while consideration of the context and audience for the poem provides insight into why he shifts the original into this strikingly different approach. How can Shakespeare's Venus and Adonis give us insight into the complicated process of an adaptation? Why did Shakespeare adapt the poem in a dramatizing way? The success of Shakespeare's adaptation raises guestions concerning both the adaptation process and the reception of an adaptation. Answers may be found with an understanding of the social status of playwriting versus the status of writing poetry. Perhaps, a moment when the theaters were closed could have provided an opportunity for writing to add to the social status of the playwright when he returned to his primary occupation of writing for the public stage.



Sponsor Name: Susan Rivera

Research Title: Emotional Face and Eye Gaze Processing in Typically and Atypically Developing Children

Abstract: The ability to recognize emotion and follow gaze is essential for social learning in children and can impact object processing. Children with fragile X syndrome (FXS) and autism spectrum disorder (ASD) share many social traits, but impairments in emotional processing may differ. This study examines these processes in three groups of children-typically developing (TD; N=67, ages 67-71 months), ASD (N=19, ages 32-68 months), and FXS (N=22, ages 10-79 months). On an eye tracker, participants were shown a neutral or fearful face, with an object on each side, for one second. Next, the eyes on the face stimulus shifted gaze towards one object (target object) for 5 seconds. Lastly, the objects were shown alone for 5 seconds. Results indicate, regardless of age, children in the TD and FXS groups look more to the target than distractor object on neutral, but not fearful trials. Children with ASD do not look more to the target than the distractor in either emotional condition. These findings suggest children with ASD may not follow the social cue, while TD and FXS groups follow the cue of the neutral but not the fearful face. Future analyses will explore overall looking behavior to the face itself..



Sarah A. Coon

Mark Patrick Cubillan

Sponsor Name: Narine Yegiyan

Research Title: Overcoming Student Distraction: How Cognitive Stress Affects Multitasking and Learning

Abstract: With the advent of mobile technology, off-task multitasking has become the norm in college classrooms. Previous research has shown that the prevalent choice of multitasking by students has a negative effect on their learning. Yet, little is known about factors that can discourage students from engaging in multitasking. The primary objective of this study was to address this question. Specifically, the effect of cognitive stress on students' goals and their decisions to multitask during lectures was explored. This study collected data on the multitasking activities of students during a pre-recorded lecture that was projected on a large classroom screen. Students were asked to attend to the lecture material under high and low stress conditions. In conditions where cognitive stress was high, the decision to multitask was expected to become less rewarding, incentivizing students to allocate cognitive resources toward relevant educational goals and away from off-task activities. In conditions where cognitive stress was low, students were expected to shift cognitive resources toward activities that met their personal goals (i.e. social interaction). The findings can help more efficiently control the amount of multitasking in classrooms by adjusting instructor teaching style, leading to improved learning outcomes.

Sponsor Name: Steven Luck

Research Title: Attentional Capture While Dual Tasking

Abstract: In day-to-day life, we constantly search complex visual scenes for objects that are relevant to our immediate goals. One key question is whether certain kinds of salient stimuli can involuntarily "capture" our visual attention. For example, do we attend to a stop sign simply due to its bright red color? In the current study, we measured how cognitive control to avoid salient distractors may wax-and-wane with increasing task demands. More specifically, we compared performance on a visual search task under full and divided attention. To divide attention, we had participants perform a visual search task with a concurrent tone counting task. We predicted that if cognitive demands were increased through a concurrent dual-task, cognitive control would decrease causing increased attentional capture by the salient task-irrelevant distractors. However, much to our surprise, both electrophysiological and behavioral evidence suggest that a concurrent dual-task does not increase attentional capture to task-irrelevant stimuli. We will discuss implications and directions for future research.





Jaclyn Dewitt

Tiffany N. P. Do

Sponsor Name: J. David Furlow

Research Title: Developing a Peer Mentoring Program for the UC Davis University Honors Program

Abstract: Peer mentoring has been shown to provide clear benefits for both mentors and mentees by allowing mentors to develop transferable leadership skills and mentees to have a sense of community and support as they transition into college. In an attempt to determine if a peer mentoring program is a good fit for the University Honors Program (UHP) at UCD, I have studied the benefits and risks of mentoring, contacted other university mentoring programs, and received current student feedback through surveys and focus groups. This process based on previous research and student voice has led to the development of a peer mentoring framework to pair incoming first-year with second- and third-year UHP students. This framework extends to trainings, workshops, and a handbook to prepare mentors with expectations for and support in the program. Moving forward, this framework can be used as the basis for a UHP Peer Mentoring Program at the beginning of next Fall Quarter.

Sponsor Name: Richard Kim

Research Title: The Campus-Community Debate: Re-Viewing Asian American Studies as a Community in the 1980s

Abstract: Asian American studies emerged from the late 1960s social movements. As part of the broader movements for social change in American society, the core principles of Asian American studies emphasized social transformation, empowerment, and knowledge production. These principles also stressed the importance of community engagement as communities were viewed as primary sites for social change. The 1980s, however, brought significant challenges to the field such as demographic changes in Asian American communities, neoconservatism, and institutional cooptation. Out of these struggles, a campus-community debate emerged that contended scholars on college campuses were disconnected from the communities they were studying and supposed to serve in keeping to the founding principles of the field. In my thesis, I challenge this dichotomization of the campus and community. I argue that scholars' responses to the dilemmas of the 1980s reveal the ways the campus can be viewed as a form of community in itself. The 1980s were a critical time for Asian American studies, as the field struggled to secure its position within the academy while adapting to the changing times. As many of the challenges of the 1980s have continued, reexamining the campus-community debate has implications for how we view the field today.





COLLECTIVE MEMORY

"community history [that] is stored, preserved, and shared as a set of events in the memory of individuals"

Wendy L. Ng

Emily Dorrance

Jasmine Gunkel

Sponsor Name: Gwendolyn Arnold

Research Title: The Efficacy of Philanthropy in Establishing Equitable Park Access: A Study of Public-Private Partnership (P3) Parks

Abstract: Public-private partnerships have become popularized as a strategy to fund the creation of urban green spaces, yielding high profile parks such as the High Line in New York and Grand Park in Los Angeles. While P3 arrangements are highly varied, encompassing everything from financial deals to development agreements to stewardship contracts, there are concerns that the planning processes for P3 parks do not adequately incorporate a discussion of municipal objectives or equitable access for marginalized communities. This study evaluates community outreach efforts and discussions of equity for several P3 parks through analysis of planning documents and news articles. Next, these intentions are compared to actual equity outcomes through evaluation of subsequent news coverage as well as spatial analysis. Finally, this analysis aims to identify shortcomings of current methods, as well as channels for improving equity outcomes in P3 parks in order to provide the public health benefits of green spaces to key populations.

Sponsor Name: Tina Rulli

Research Title: Pleasures of the Flesh: An Inconsistency in Our Thoughts About the Ethical Use of Animal Bodies

Abstract: Our way of dividing the uses of nonhuman animal bodies into permissible and impermissible is unprincipled. If we examine the guiding principles behind why certain uses of animal bodies for human pleasure, animal fighting and bestiality, are considered impermissible, we can see that consistently applying these principles leads us to conclude that a practice we currently accept, animal product consumption, should also be considered impermissible. I will examine the roles of health, harm, intent, consent, and humanity defining boundaries in the justifications given to support the current way animal bodies are divided into permissible and impermissible, and conclude that if any of these give us reason to find bestiality or animal fighting impermissible, they also give us reason to find most animal product consumption impermissible. I will argue that this inconsistency in our views is glaring even when we examine it using different normative ethical theories, namely Virtue Ethics, Utilitarianism, and Deontology. To amend this, I argue we should move most consumption of animal products into the impermissible category, rather than move animal fighting and bestiality into the permissible category.



The Argument

- P1: For one practice to be morally permissible and another to be morally impermissible, there must be a morally significant difference between them
- P2: There are no plausible morally significant differences between • (a) bestiality and animal fighting and (b) most animal product consumption
- C1: It is not plausible that bestiality and animal fighting are impermissible, but that most animal product consumption is permissible.
- P3: Either bestiality, animal fighting and most animal product
- consumption are all impermissible, or they are all permissible.
- P4: Moving animal fighting and bestiality into the permissible category would force us to embrace unacceptable moral conclusions.

Mei Lin Jackson

Dana Jacobs

Sponsor Name: Dr. Jonathan London

Research Title: Small Happiness and China's Invisible Children: Unravelling the Unwanted Girls Myth of the One Child Policy

Abstract: My personal experience of being a child born in China and internationally adopted because of the One Child Policy (OCP) has led me to assess the societal effects of one of the world's most daring social experiments. The OCP was a policy that incorporated a much larger scope than limiting the number of child births. This report aims to go beyond the unwanted girls narrative beginning with the population increase during the Cultural Revolution and the understanding of Chinese familial hierarchies and traditions. The personal anecdotes from mothers who fought to keep their child and forced to abandon their children, explicitly demonstrate the decisions families were faced with, and the situations children had to endure, as a consequence of China's birthing policies. The hukou system (Registration method used by the Chinese government to document the size of each family), published research on hidden children and extensive analysis on the OCP regulation and implementation analyze and contextualize the implications created. While the OCP, implemented by the Chinese government in 1979, was designed solely to reduce the country's population, it created many unintended and severe consequences which are analyzed herein, including China's "Hidden Children," skewed sex ratios and the abandonment of thousands of baby girls. The findings demonstrate necessary questions China must address in the future, with the implementation of the Two Child Policy in 2015, the class of hidden children emerging into adulthood, and the once abandoned children, searching for answers around the world. The unwanted girl myth has been fully unraveled, and even with the many issues China's future holds, it is certain that abandoned girls were wanted.



Research Title: Energy Expenditure of Stone Tool Knapping Oldowan and Acheulean Technologies

Abstract: Early humans started to produce stone tools in Africa some 3 million years ago. This major innovation would be linked with the introduction of meat in their diet, a change that would help support the caloric costs of an expanding brain. This model rests on the assumption that since the emergence of tool-making behavior, the energetic rate of return for stone tool production (and use) is such that benefits exceed the cost. Technology may have well helped early humans adapting to environmental constraints, however, little is known about its physiological costs. Here, I designed an experiment to investigate the energy expenditure necessary to produce two of the earliest stone tool technologies: Oldowan and Acheulean. By collecting and analyzing the expired air of participating subjects as they produce stone tools, I am able to determine the physiological cost of producing such tools in comparison with seated metabolism. Using Homo sapiens as a reference, the results will help model the physical exertion contributed to the transition between stone tool technologies for extinct species. This project provides the initial data necessary to launch a deeper investigation into the entire process including raw material collection, stone tool production, butchery, and meat consumption.



John M. Klyver

SueBin Lee

Sponsor Name: Amy Clarke

Research Title: Statistical and Narrative Medical Analysis of the Success of an Inner-City Clinic

Abstract: San Francisco's Tenderloin District is one of the poorest and most crowded districts within the city. Many of its residents live in single-room occupancies, or SROs, and immigrants, the homeless, and the mentally ill make up unusually large proportions of the local population. Accordingly, the Tenderloin presents a remarkable medical challenge, as a wide variety of ailments ranging from mental disorders to traumatic injuries can be found within the district. In response to the these difficulties, City Impact, a local outreach, and its associated medical clinic have begun Home Visit and Patient Advocate Programs to reach out to the residents. This talk addresses a project evaluating the success of these programs from a statistical standpoint, via a patient self-report survey. In addition, it also includes a narrative medical analysis focusing on the patient-provider experiences and interactions. City Impact explicitly states its desire to cultivate successful relationships with the local residents, and this project evaluates its level of success through its medical clinic.

Sponsor Name: Susan Avila, Thomas Maiorana, and Helen Koo (former)

Research Title: Development of Smart Clothing for Visually Detecting People at Night

Abstract: This research is to research and prototype the best safety method for bicyclists and night time athletics to ensure their safety in the dark. Lumière is the first prototype that focuses on safety methods and ready to wear smart clothing for bicyclists and night time athletes to enhance their visibility at night. With data found from fundamental research of safety measurements of bicyclists and pedestrians with automobiles, Lumière will assist bikers and night runners in their commute. For those without any access to automobiles, walking and biking are relied upon as one of the primary form of transportation. Biking is not only a healthy and environmentally friendly way of traveling but also a great way to initiate efficient and safe mode of public transportation. Assisting this seemingly modest way of commute is supporting national goals of improving health through prevention, increasing access to opportunity, and reducing greenhouse gas emission. Hence, recognizing that there are increase of injuries and fatalities in bicycling, it is crucial to focus and implement safety wear for bicyclists.



Kristi M. Lin

Patricia J. McNeill

Sponsor Name: N. Claire Napawan

Research Title: Designing an Anti-Memorial to Land Lost

Abstract: Traditionally, memorial designers have sought to use permanent materials such as stone to preserve moral lessons for society. However, traditional memorials do not reflect the regenerative process in which individuals remember, heal, and transform. Landscapes offer living materials that change over time. Thus, landscape designers are equipped to facilitate the renewal of memories as they evolve and become relevant at different moments. In contrast with traditional memorials, anti-memorials incorporate landscape processes such as tides, wind, growth, and decay. Through formalizing impermanence, antimemorials recognize the significance of on-going marginalized issues and their absence in societal memory. Although the emerging field of anti-memorials is focused on human loss, this project looks at how one would design an anti-memorial to land loss. In some places in California, land is subsiding at a rate of one foot per year due to groundwater over-pumping. This project compares the landscape materials, longevity, interactivity, and outcomes of contemporary anti-memorials in order to develop a set of guidelines for their use as landscape design activism. Using the guidelines, this project will propose a design for an anti-memorial to land lost and critique society's tendency to forget about the environment until after it is too late.

Sponsor Name: Teresa Stelle

Research Title: Site Formation Processes and Human Use Analysis at Varsche Rivier 003, Western Cape, South Africa

Abstract: The archaeological site of Varsche Rivier 003, Namagualand, South Africa has produced a sequence of material culture spanning the Middle and Later Stone Age (MSA and LSA). Radiocarbon and optically stimulated luminescence dating of deposits produced dates from two periods of occupation (MSA: >46,000 years; LSA: <2,000 years), but the contact levels of the deposit are heterogeneous in nature. We propose that human reuse and occupation of this site has had significant effect on the integrity of the contact deposits. Factors such as sleeping/bedding hollows, rock clearing, and hearth clean-up are activities that would significantly disturb the substrate, obscuring earlier deposits. Using spatial analysis to decipher human impacts, we show how human behavior in the LSA obstructed upper deposits left by occupants from the MSA, accounting for the uneven stratigraphy. 3-D modeling and GIS software allow for visualization of deposits, including the spatial distribution of land-snail, charcoal, and rocks, and allow for the development of scenarios of how site formation processes and human impact affected the stratigraphy over the millennia. These methods allow us to distinguish intact from disturbed deposits, facilitating a better reconstruction of site use, which will contribute to our understanding of early modern and huntergatherer behavior.

- 2015, 2016



Nava Ratna

Andres Rodriguez Lombeida

Sponsor Name: Paul Hastings

Research Title: Social Support Buffers Against the Effects of LGBTQ-Related Peer Victimization on Depression Symptoms

Abstract: Lesbian, gay, bisexual, transgender, and queer (LGBTQ) individuals face victimization from peers and the general population because of their divergence from heterosexual norms. These sources of stress can lead to poor mental health outcomes. However, social support from friends may protect against LGBTQ-related victimization. This study tested whether social support from friends would buffer against symptoms of depression when participants reported more stress and more LGBTQ discrimination by peers. We predicted that perceived and experiences of general and LGBTQ-related stress would be positively associated with depression; and that social support would be negatively associated with depression. Further, we predicted that social support would moderate the links between LGBTQ-related victimization and depression symptoms. Our findings showed that perceived stress, general stressors, social support predicted depression symptoms (R2=0.75, F(6, 95)=20.81, p<0.01). Our results also showed that participants reported more depression symptoms when they also reported more LGBTQ-related victimization and less social support (b=-0.64, t(3, 98)=-5.56, p<0.001). The link between LGTBQ-related victimization and depression symptoms did not exist for participants who reported more social support from friends (b=-0.25, t(3, 98)=-1.94, p>0.05). The moderating effects suggest that having supportive friends may protect against mental health problems for LGBTQ individuals.

Sponsor Name: Jorge Peña

Research Title: Fortune 500 Companies in Social Media: Communication Patterns

Abstract: This study examined the communication style of Fortune 500 companies in the primary (e.g., raw materials), secondary (e.g., manufacturing), and tertiary (e.g., services) economic sectors that communicate through social media. An automated analysis of Facebook and Twitter entries of the companies reveals that primary sector companies use more words, more positive emotion words (e.g., thanks, honored, support), and more work-related words (e.g., CEO, office, company), but fewer second personal pronouns (e.g., you, your) in their posts in comparison to secondary and tertiary sector companies. In addition, companies used more words and more second person pronouns on Facebook but more negative emotion words on Twitter (e.g., pain, problem). On Facebook, primary sector companies posted longer updates and tertiary companies used more second person pronouns. On Twitter, primary sector companies used more work-related words. The study illustrates how companies from different economic sectors tailor their communication with their audience on social media.



Julianna Roy

Breanna Schenkhuizen

Sponsor Name: Jeffrey Sherman

Research Title: Assessing the Effect of Justice Violations on Spontaneous Perspective-Taking

Abstract: Gollwitzer and Rothmund's (2009) 'SeMI' model proposes that people high in victim-sensitivity tend to react strongly to perceived injustice. As they seek to restore justice they do so with an egocentric bias, failing to account for the perspectives of others around them. Previous research has investigated the effect of justice violations on deliberate perspective-taking. In contrast, no research to date has investigated its effect on spontaneous perspective-taking. The present study investigates the extent to which victim-sensitive participants are able to spontaneously assess visual information from others' perspectives when they perceive injustice. We manipulated perceived injustice by having participants complete either fair or unfair variant of the Ultimatum Game. Following this, we measured spontaneous perspective-taking task (Todd, Cameron, & Simpson, 2016). We predicted that individuals who are high in victim-sensitivity will make more egocentric errors in the perspective-taking task when exposed to unfairness in the Ultimatum Game. This work adds to our understanding of early cognitive processes that relate to egocentric perspective taking in the face of injustice.



Sponsor Name: Cheryl Ross

Research Title: Percy Jackson and the Olympians: Adapting Greek Mythology for a Middle Grade Audience

Abstract: Starting in 2005, Rick Riordan began adapting Greek mythology in his middle grade novel series, Percy Jackson and the Olympians. The unique relationship between Riordan as both an educator and parent and the adolescent audience with which he is so familiar drives this adaptation. Riordan pulls much of his story from Greek mythology, but specifically adapts it to be appropriate for a middle grade audience, toning down sexuality and violence. Characters not taken from mythology are a composite of Riordan's own experience with adolescents, created from modern psychological theories of adolescent development to serve as models for adolescent readers. Percy Jackson and the Olympians has become a New York Times bestseller, popular enough among readers to result in two movies, a number of tie-in books, and several follow-up series. Studying the series allows for insight into one way to understand and connect with an adolescent audience. The series also suggests one way that classical mythology can be conserved in modern times.

Malavika Shankar

Riley N. Sims

Sponsor Name: J. David Furlow

Research Title: Healthy Women, Healthy Lives: Introduction of Women's Health Issues in the Undergraduate Curriculum

Abstract: Studies reveal that exposure to undergraduate research is one of the primary ways of engaging students in scientific thinking and practices, but it also plays a role in students' future educational and career trajectories. What resources exist nationally to assist the incoming freshman and transfer students with their access to such experiences, and how might such practices be supported at UC Davis? Data was collected from institutions nationally, including the University of Southern California (USC), and the University of Texas (UT), to evaluate the presence of current freshman year research programs and services. Specific programs to include freshmen in undergraduate research were not universal. Based on studies at Wichita State University, the combination of research in a first year seminar has been shown to increase graduation rates and increase retention in STEM majors for underrepresented minority students. This leads to my proposal for the combination of a hands on first year research seminar, particularly in the field of women's health at UC Davis. A focus on the field of women's health would promote discussion on campus in this vital area, and support interdisciplinary research projects across the social and biological sciences. Additional research is needed to examine the feasibility, impact, and structure of a hands on interdisciplinary research seminar in the field of women's health, with a model proposed here based on our findings.

Sponsor Name: Susan Rivera

Research Title: An Eye Tracking Investigation of Attention Shifting Between Affective Central and Peripheral Faces

Abstract: Previous research indicates that infants differentially disengage from fearful faces compared to happy faces in the presence of non-face peripheral stimuli (Peltola et al., 2008). The current study uses an overlap eye tracking task to investigate the role of peripheral emotional stimuli in facilitating disengagement from centrally located emotional stimuli. Twenty 7- to 44-month-old children (projected N = 50) were shown trials in which a fearful, happy, or neutral face was displayed in the center of the monitor for 500 ms, followed by a fearful, happy, or neutral face in the peripheral fearful, happy, or neutral stimuli. This analysis revealed a main effect of emotion, F(2, 38) = 6.757, p = .003, hr2 = .262, such that participants oriented to peripheral fearful faces [M = .392, SE = .013] faster than peripheral happy faces [M = .471, SE = .023, p<.01] or peripheral neutral faces [M = .506, SE = .028, p < .01]. Though data collection is ongoing, these preliminary results support Fox et al.'s (2000) threat hypothesis, suggesting that threatening faces are easier and faster to process than non-threatening faces.



Joanna Tang

Brynna Thigpen

Sponsor Name: Professor Seeta Chaganti

Research Title: Student-Facilitated Course on King Arthur

Abstract: In accordance with the ASUCD-approved pathway for undergraduate-taught courses, I designed and taught an upper-division Medieval Studies 198 course entitled "Legends of King Arthur." The main objective of this course is to introduce the genre of Medieval Arthurian literature by following the evolution of the Arthurian story from its humble 5th Century historical beginnings to its incorporation into Latin pseudo histories to its metamorphosis into a courtly French romance, and all the way to the quintessential legendary epic that it becomes in the High Middle Ages. I designed supplemental lectures for each 80-minute biweekly class session that contextualized each story in its historical, political, cultural, religious, and literary backgrounds. I also designed discussion questions, short writing assignments, and a final writing project that helped students analyze relationships of texts to each other and to their historical contexts, identify and track how history evolves into myth, and hone critical thinking, writing, close-reading, and textual analysis and cross-referencing skills.



Sponsor Name: Simona Ghetti

Research Title: Episodic Future Thinking and Math Achievement

Abstract: Episodic future thinking is the mental simulation of first-person future event with rich detail of context (Tulving, 2005). Though knowledge about a possible future event (semantic prospection), or reasoning about alternative outcomes of past events (counterfactual reasoning) may provoke futureoriented behavior, episodic future thinking may do so more strongly because it allows one to experience the thoughts and feelings associated with desired future events before they happen (Tulving, 2005). We test this hypothesis by comparing the effects of episodic future thinking, semantic prospection, and counterfactual reasoning on performance of a challenging math task in 9- to 12-year-olds and college students using a novel paradigm. We also look at the number of process-based versus outcome-based strategies used in each condition. We predict that episodic future thinking will result in greater performance gains and more process oriented strategies compared to the other mentalization conditions (semantic prospection and counterfactual reasoning), oriented but that this may not be true for all age groups given developmental differences in these abilities.



Brynna Thigpen pictured above (3rd from the left)

Alyssa M. Vandenberg

Christian Wirawan

Sponsor Name: Frances Dolan

Research Title: The Role of Mothers in Shakespeare's Plays

Abstract: Parents have a profound impact on the lives of their children—and in Shakespearean plays, the relationship between parents and their children is often at the forefront of the narrative. Mothers in Shakespeare's plays tend to be absent, as in King Lear, thus creating an ambiguity regarding the role of the mother. In many of the plays, this absence seems particularly noticeable, as the conflicts of these stories revolve around the characters' search for maternal figures in their lives. Additionally, the juxtaposition of the mothers' absence and the characters' desire for a maternal figure highlights an apparent fear surrounding mothers—the fear of the control that mothers are often seen as exercising on children. In my thesis, I will examine the fantasies regarding mothers in Shakespeare's The Taming of the Shrew, Macbeth, and King Lear to discover how parents, particularly mothers, shape the narrative. Building on my research about Shakespeare's plays, I will conclude by considering some of the differences and similarities between views of mothers in Shakespeare's views of motherhood today.

Sponsor Name: J. David Furlow

Research Title: Developing Course-Based Undergraduate Research Experiences (CUREs) in STEM and Assessing Their Relation to Student Interest and Retention in STEM Fields

Abstract: National efforts to reform undergraduate STEM education emphasize integrating students into research early in their careers. Course-based undergraduate research experiences (CUREs) provide students with the unique opportunity to participate in a research project that is of interest to the scientific community. Students entering research-intensive institutions face unique challenges including lack of sense of community, unfamiliar large-enrollment courses, and difficulty approaching faculty. Many students declare STEM majors, but general science courses have left some students uninterested or unable to connect class concepts to problems of today. CUREs have the potential to not only improve student scientific thinking and data analysis skills, but also impact long-term student retention in STEM disciplines. To test the impact of CUREs at UC Davis, several courses were developed on taking faculty's current scientific research and applying it to a small classroom setting for undergraduates. We are currently using surveys and student reflections to evaluate the immediate impact of these CUREs and plan to continue tracking the students to assess any long-term effects. We here describe the efforts to implement the first CURE courses offered at our institution, their impact on students, and current plans to scale up the offering of these courses in future quarters.



Maria Angelica Wong

Muheng Yu

Sponsor Name: Colin Milburn

Research Title: Early-Stage Technologies and the Public University: Lessons About Intellectual Property and Social Responsibility From the UC Blackwelder Tomato Harvester

Abstract: For early-stage technologies developed within public universities, two issues arise: the need for a system of technology transfer to the industry for development, manufacture, and commercialization; and the uncertainty about social and economic consequences and barriers for introducing a new technology into the market. The latter is of particular concern, as public universities hold both social and economic responsibilities in their role as public institutions. This work takes the UC Blackwelder tomato harvester as a case study for early-stage technologies developed in public research universities, to argue the relevance of intellectual property in connecting university and industry, and of appropriate policies in making university research achieve positive social and economic returns. As the history of the tomato harvester shows, the patentability of university research was key in the technology transfer between the UC and the Blackwelder Manufacturing Company. At the same time, the end of the bracero program stimulated the adoption of the harvester, while a lack of foresight led to a lawsuit between the UC and California Rural Legal Assistance (CRLA). Therefore, the tomato harvester exemplifies the importance of intellectual property and appropriate policies in the development and introduction of early-stage technologies initiated in a public university.

Sponsor Name: Laramie Taylor

Research Title: Am I the Right One for Muscular Men? A Glance at the Effects of Media Images of Ideally Muscular Men on Young Adult Women

Abstract: Research has shown that idealized body images in the media can have negative effects on audiences. While abundant studies have focused on the effects of viewing media images of idealized bodies of the same gender, the effects of viewing media images of idealized bodies of the opposite gender have received little attention. Therefore, an experiment was conducted to examine the effects of exposure to media images of ideally muscular men on young female perceptions of their own bodies. Romantic confidence as a mediator and female body esteem as a moderator were also tested. Young women (M age = 20.36) were exposed to media images of men who either ideally muscular (n = 224) or non-ideally-muscular (n = 202), but otherwise comparable in attractiveness. Results showed that exposure to media images of idealized male bodies indirectly caused young women to perceive their own bodies more negatively by reducing their confidence in attracting and interacting with good-looking men. Also, viewing media images of ideal-body males caused young women who had high preexisting esteem of their bodies to feel worse about their bodies. This study implies that media portrayals of ideally muscular men can negatively affect young women, especially those with high preexisting body esteem.



Science, Technology and Mathematics



Gabrielle AllenbeckChang

Camille C. Andre

Sponsor Name: Dario Cantu

Research Title: Optimization of DNA Extraction and ITS Amplification of Pathogenic Fungal Species in Field Samples of Vitis vinifera

Abstract: Grapevine permanent woody structures are affected by a variety of fungal diseases that cause yield and quality reduction as well as significant economic losses. In many cases, a grapevine's symptoms are not entirely attributable to a single causal organism and it is not uncommon to find the DNA of several organisms in infected tissues. This raises questions about the dynamics of these microbial communities and how their interactions may contribute to disease development and progression in the vineyard. This work aims to optimize metagenomic and metatranscriptomic sequencing methods for the detection, identification and guantitation of fungal trunk pathogen species in grapevines. The thesis project is a component of this larger project in the Cantu Laboratory in the Department of Viticulture and Enology. This thesis research specifically addresses the optimization of DNA extraction to include fungal DNA which is present in incredibly low quantities relative to the amount of grapevine DNA. Additionally, this thesis project addresses the optimization of Internal Transcribed Spacer primer efficiency for sequencing, which is the current standard for fungal community studies and is used as a reference in the larger project.

Sponsor Name: Mark Huising

Research Title: Proinsulin Expression in Immature and Dysfunctional Beta Cells

Abstract: Type 1 diabetes, a chronic illness affecting millions, is caused by the immune system's destruction of the insulin producing pancreatic beta cells. A challenge in the search to cure T1D is discovering how to regenerate beta cell mass after autoimmunity has destroyed most beta cells. Research suggests that new beta cells may regenerate throughout life. Understanding this process may provide insight into the ability to promote beta cell regeneration. My research focuses on finding immature beta cells in human pancreas that produce insulin but lack necessary markers of mature beta cells. The problem is that these immature beta cells resemble beta cells that are dysfunctional as a consequence of diabetes. Currently, there is no way to differentiate between immature and dysfunctional beta cells. I hypothesize that the amount of proinsulin (the precursor form of insulin) detectable in beta cells may differentiate between the two types of beta cells. In young, non-diabetic pancreas donors, I observed immature cells that express less proinsulin in comparison with mature cells. If we can use proinsulin as a marker to distinguish between immature and dysfunctional beta cells, this could inform on the number of beta cells being formed and destroyed in both diabetics and non-diabetics.



Anne Ashmore

Kimya Baradaran

Sponsor Name: Sharman O'Neill

Research Title: Fruit Morphology and Developmental Deviation Within Vanilla pompona Subspecies

Abstract: Vanilla is a tropical orchid that grows in equatorial climates. Its cultivation is a multi-billion dollar industry, and it is regarded as the most popular aroma in the world. There are three main species of vanilla: V. planifolia, V. pompona, and V. tahitensis, but V. planifolia produces the vast majority of commercial vanilla. However, climate change has drastically reduced global V. planifolia populations, leading many to consider alternative sources of the flavor. This study examines a subspecies of V. pompona, referred to as V. pompona subsp. grandiflora, as a potential commercially viable plant. In addition, it seeks to provide a morphological comparison of V. pompona's subspecies in order to suggest that it be reclassified as an independent species. To obtain relevant data, I will use a digital caliper to measure the daily growth of V. pompona subsp. grandiflora and V. pompona subsp. pompona fruits. In addition, I will collect information about significant fruit development milestones, including column loss, column mass, and flower loss. If significant, these data will suggest that V. pompona subsp. grandiflora is its own species. This will provide new grounds for considering V. pompona subsp. grandiflora as a commercially viable alternative to V. planifolia.



Sponsor Name: Gretchen Casazza

Research Title: Health Benefits of Fitbit Charge Physical Activity Trackers in the General Population

Abstract: Physical inactivity is a major killer since it is a determinant of common health problems including obesity, hypertension, heart disease and cancer. We hypothesize that physical activity trackers will motivate the general public to increase fitness, resulting in improved health. Current studies showing effects of physical activity trackers are limited due to short studies, discontinuous tracking, uncontrolled environments, and testing specific populations. The purpose of our study is to measure health changes in the general public during and after using the Fitbit Charge physical activity tracker for 6 months. Our study consists of logging resting and exercise values recorded in a controlled environment upon receiving the Fitbit, and on 2 follow-ups. Thus far, results of the first follow-up have shown significant improvements in waist circumference, waist to hip ratio, resting and exercise heart rates, diastolic and mean arterial blood pressures, and relative and absolute maximal oxygen uptakes. Our study will compare short and long term health changes as well as required and optional Fitbit usage, with results applicable to the general population. In this way, physical activity trackers can be shown to result in health benefits and aide in the prevention of several diseases.



Lisa D. Bell

Kimberley A. Berg

Sponsor Name: Sue Bodine

Research Title: Examining the Basis for Differential Recovery Rates of Muscle Mass and Strength Between Aged Fischer Brown Norway and Fischer 344 Rats

Abstract: Sarcopenia is the gradual loss of muscle mass and strength associated with aging. The impact of aging on the size and strength of muscle tissue was examined by performing hindlimb suspension and reloading on two strains of aged rats, Fischer Brown Norway (FBN) and Fischer 344 (F344). The hindlimb muscles were examined after 14 days of unloading, and following 3, 7 and 14 days of reloading. Both strains showed significant hindlimb muscle atrophy and decreases in force production after unloading, but the F344 rats recovered more strength and muscle mass after two weeks of reloading compared to the FBN rats. To investigate this disparity in recovery rate of the two strains, protein levels of ER stress markers and expression of genes associated with the neuromuscular junction (NMJ) were measured in the tibialis anterior (TA), soleus, and medial gastrocnemius (MG) muscles following unloading and reloading. In addition, specific fiber-type cross-sectional area analysis was performed in the TA. Preliminary data indicated elevated levels of ER stress and NMJ instability in the FBN rats. A better understanding of the mechanisms responsible for impaired muscle regrowth with age could contribute to future advances in the prevention of muscle loss in the growing elderly population.

Sponsor Name: Frederic Chedin

Research Title: Characterization of Novel Factors in RNA:DNA Hybrid Metabolism

Abstract: Co-transcriptional RNA:DNA entanglements, or R-loops, form when an RNA transcript has the opportunity to anneal to a complementary strand of DNA, displacing the other strand of the DNA duplex. These three-stranded nucleic acid structures are known to cause genomic instability. However, research has also correlated R-loop formation with numerous biological processes, supporting the existence of R-loop-mediated pathways. Given this, I hypothesize that proteins have evolved to bind RNA:DNA hybrids and serve to mediate the function of these nucleic acid structures. The goal of this project is to characterize proteins that interact with RNA:DNA hybrids in order to answer two fundamental questions: 1) What are the molecular pathways in humans that mediate R-loop metabolism in normal cells; and 2) How do perturbations in R-loop metabolism lead to RNA:DNA hybrid-driven genomic instability? Informed by two independent screens, I postulate that ILF2, ZFR, MATR3, FUS and DHX9 are primary factors in RNA:DNA hybrid metabolism. To test the model, I will perform knockdowns of candidate genes in human cells and observe changes in nuclear morphology and RNA:DNA hybrid levels by high-resolution immunofluorescent microscopy.





Benjamin Bigelow

Stephan Burroughs

Sponsor Name: Helen Raybould

Research Title: Using an Ex Vivo Approach to Study the Gut-Brain Axis

Abstract: The vagal afferent neurons (VAN) provide a neural communication pathway between the central nervous system and the gastrointestinal tract. This pathway allows for the transduction of endocrine signals, released from the gastrointestinal tract, into neural signals in the VAN. These signals cause changes in feeding behavior level. A comprehensive understanding of this neural-endocrine pathway is vital to address the growing trend of obesity and diabetes. This research investigates the potential of using cultured VAN as a model for further studies. VAN tissue collected and cultured ex vivo will be exposed to stimulation by endocrine signals such as CCK or Leptin and/or by changing the media environment to represent a fasted or fed state. Western blot and immunocytochemistry will be used to measure receptor expression and changes in secondary messenger levels. It is proposed that the phenotypic changes observed during treatment of ex vivo tissue will resemble those observed when an animal is treated using similar conditions in vivo. We will determine if ex vivo cultured VAN neurons are an accurate model by comparing data from current experiments to previous studies done in vivo. The use of an ex vivo approach will allow for further understanding of the gut-brain axis.



Sponsor Name: Patrice Koehl

Research Title: Discrete Mesh Parameterization

Abstract: The study and comparison of 3D shapes are important in many fields from neuroscience to archeology. For example, neuroscientists are interested in the progression of brain shape as its deterioration is a clear sign of disease. Patrice Koehl and Joel Hass have developed a method implemented in the program MatchSurface to compare such 3D shapes (Koehl and Hass, PAMI, 36:466, 2014). MatchSurface is designed for shapes of genus zero, i.e. that are topologically equivalent to the sphere. It starts by projecting the shape to be studied onto the sphere, a process referred to as parameterization. It performs this parameterization by first projecting the mesh that represents the shape onto the plane, and then performs an inverse stereographic projection to project from the plane to the sphere. MatchSurface uses the method SSP introduced by Springborn et al (TOG, 27:77, 2008) for parameterization with the aim of producing a conformal (angle preserving) map from the original shape to the plane. While the SSP method is successful at preserving angles, it is unable to parameterize meshes with significant singularities. The goal of this project is to research other conformal parameterization methods, develop a tool in C++ to use the methods, and compare the robustness and conformality of these methods. To do this, we wrote a program that interfaces with the Computational Geometry Algorithms Library (CGAL) to utilize its tools and pre-implemented parameterization methods. In addition, we implemented the Ricci Flow parameterization method (Jin et al, TVCG, 14:1030, 2008) in the program. We found the latter to be the most robust and conformal method that we have tested.





Aileen Chhen

Shiang-Wan Chin

Sponsor Name: Kenneth Kaplan

Research Title: Disconnects Between Pre-Clinical and Clinical Studies Influencing Hsp90 Inhibitor Success as a Chemotherapeutic

Abstract: Hsp90 is a molecular chaperone protein that facilitates protein homeostasis during cell stress. As a result, Hsp90 contributes to the stabilization and over expression of client proteins characteristic of canonical cancerous phenotypes. Pre-clinical studies demonstrated that chemical inhibitors of Hsp90 are effective in degrading clients in cancer cells, highlighting the potential of Hsp90 as a chemotherapeutic. However, 30 years of clinical trials have shown only modest impacts on patient outcomes. Our hypothesis is that the lack of clinical progress will correlate with a disconnect between pre-clinical findings. To test this hypothesis, we will compare clinical studies with distinct patient responses to the pre-clinical data for the specific drug and cancer type. We predict there will be a strong correlation between the success of the clinical trial and the adherence to pre-clinical findings. I have chosen to focus on clinical trials involving Tanespimycin, an Hsp90 inhibitor, given to patients with blood cancers, such as leukemia and myeloma. I will compare the efficacy of the clinical treatment and the biomarkers measured with data published in pre-clinical studies using the same inhibitor and cancer types. I will create a correlation index to present the degree of connection between clinical outcome and pre-clinical findings.

Sponsor Name: Martin Hilbert

Research Title: Artificial Intelligence and Machine Learning in Financial Services

Abstract: In the modern time there is a lot of uncertainty with regard to automation and artificial intelligence. There are many industries being transformed by this technology. Specifically focused in financial services, there are many branches of evolution. As with change there are always optimistic adopters and those that resist it. Understanding the nature of markets is a crucial skill in developing understanding of how technology will be implemented. The biggest areas of interest within the realm of artificial intelligence and machine learning is around risk management. An area that is focusing in on this subject is within the stock market. With traders using trading algorithms they aim to increase their profitability. The nature of finance and the stock market has transformed because of these new methods of trading. The bid ask spread between trades is shrinking as a direct result of artificial intelligence, although many traders argue that there is still arbitrage yet to be priced into many trades.





Chessie Cooley-Rieders

Amanda E. Crofton

Sponsor Name: Anne Todgham

Research Title: The Effect of Seastar Predator Cues on Muscle Biomechanics and the Concentration of Twitchin Within the Adductor Muscles of the California Mussel (Mytilus californianus)

Abstract: Biotic and abiotic conditions within the rocky intertidal affect the distribution limit of the ecologically important California mussel (Mytilus californianus). Seastar predation by prying the mussel's shells is a biotic factor limiting the lower distribution of mussels in the intertidal zone. Seastar presence can cause growth of adductor muscles in some mussel species to presumably resist prying by holding the valves closed. Twitchin, a specialized 'catch' tissue within the adductor muscle, is responsible for low energy closure of the valves. It is unknown whether twitchin concentrations within the adductor muscle are related to the ability of mussels to resist prying, or if exposure to predation can affect twitchin concentrations. To examine whether the presence of predators affects the capacity of mussels to resist prying and alters the properties of mussel adductor muscles, Mytilus californianus were exposed to seastar (Pisaster ochraceus) predator cues for a 6-week period. Individuals who received seastar cues are expected to have elevated twitchin concentrations within the adductor muscle and show greater resistance to a prying test using a Material Testing System. This study provides insight into the influence of predation on essential components of mussel's adductor muscles and mechanisms underlying predator-prey dynamics of mussel-seastars interactions.

Sponsor Name: Susan Lott

Research Title: Effect of Nutrition on Maternal mRNA Contribution to the Embryo in Drosophila melanogaster

Abstract: Maternally deposited RNAs and proteins drive early embryonic processes prior to zygotic genome activation. Also, in the presence of environmental stressors and decreased maternal reproductive resources, there is a tradeoff between offspring number and size. While increased offspring size improves fitness in harsh nutritional conditions, it becomes maladaptive in postnatal environments with greater nutrient availability. However, the interaction between parental nutrition and maternal contribution of mRNA to the embryo is largely unknown. This study seeks to characterize the entire transcriptome of maternally deposited mRNA under varying parental nutritional conditions. To determine this, Drosophila melanogaster individuals were placed in environments with 100%, 25%, 10%, or 5% of standard nutritional content, where they developed from embryos into adult flies. Offspring were collected as stage 2 embryos, since all mRNA transcripts are maternally derived at this point in development. Single-embryo RNA extraction isolated maternal mRNA, which was made into RNA-Seq libraries and sequenced. The data will show whether, as nutritional content decreases, there is less mRNA deposited per offspring, or more mRNA deposited per offspring and fewer total offspring. The results will also elucidate transcripts and genes that are important to animal development and survival against environmental stressors experienced by the previous generation.



Christina Day

Gayathri Dileep

Sponsor Name: Dr. Julin Maloof

Research Title: Differential Gene Expression in Shaded Brassica rapa

Abstract: Understanding plant response to limited environmental conditions can help maximize productivity in crop plants, such as the agriculturally important oilseed Brassica rapa. To study gene regulation of plant growth and resource allocation in response to shade, we grew the Brassica genotype R500 in four light treatments of high to low red/far-red ratio (R:FR). Results from morphological data indicate the high possibility of differential gene expression between sun and shade treatments, which will be confirmed with further analysis in conjunction with corresponding RNA and genetic data.

Sponsor Name: Janine LaSalle

Research Title: Investigating Rbfox3 Sufficiency for SNORD116 RNA Cloud Formation

Abstract: Prader-Willi syndrome (PWS) is a complex neurodevelopmental disorder caused by the absence of a paternal gene, normally an individual's only active copy of this gene, on chromosome 15. The SNORD116 gene in this region produces RNA, which forms a cloud in the nucleus of neurons. RNA needs to be processed, or spliced, in order to form an RNA cloud. This may require the protein Rbfox3, which is only found in neurons. In non-neuronal cells, however, these RNA clouds do not form, potentially due to the absence of Rbfox3. Thus far, Rbfox3 has been shown to be necessary in the formation of RNA clouds, since the clouds do not form once it is taken out of neurons. We will investigate whether Rbfox3 is also sufficient for the formation of RNA clouds, by testing if the addition of Rbfox3 results in RNA cloud formation in cells where they do not normally form. For this experiment, we will insert an active form of Rbfox3 in nonneural brain cells called astrocytes, in which RNA clouds do not usually form. If Rbfox3 is sufficient for the formation of RNA clouds, we should later find RNA clouds in the nucleus of these astrocytes.



Gene x Shade Environment Interactions in Brassica rapa Ľ High I High N What are the downstream effects? Which genes respond to shading that cause the differences in growth

Ardavan Farahvash

Alexis Faria

Sponsor Name: Alexei Stuchebrukhov

Research Title: Investigating a Missing Link in the Mechanism of Cytochrome c oxidase: Prediction and Analysis of Internal Water Chains

Abstract: Cytochrome C Oxidase (CcO) is the terminal enzyme in the respiratory electron transport chain; its bi-nuclear center (BNC) catalyzes the reduction of oxygen to water. Key to understanding the mechanism of this catalysis is the question of how protons are transported to the BNC – presumably by water chains in the enzyme, which have not been resolved in experimental X-ray structures so far. Here we present an analysis of the solvation of CcO near the BNC, and a potential solution to the problem of missing water chains in X-ray structures. Through analysis of the BNC with the solvation software Dowser++, recently developed in our group, it was shown that there are several energetically favorable solvation sites near the BNC, and that these sites could account for the missing water chains leading to the BNC. MD simulations were performed to investigate the dynamic nature of water molecules in these predicted solvation sites.

Sponsor Name: Zachary Lewis and Dr. David Mills

Research Title: The Transmission of Bifidobacteria Via the Built Environment: Infants and Mothers as Sources

Abstract: Bifidobacteria inhabit the infant gastrointestinal tract and have been linked to increased resistance to pathogens. It is unknown how infants acquire bifidobacteria, though it has been hypothesized that this bacteria is passed from mother to child or between infants, possibly via the surrounding human-built environment. This study investigates potential built environment-mediated transmission of bifidobacteria to infants. To determine if bifidobacteria were present in locations frequented by infants and mothers, swab samples were collected from surfaces with which they come into contact, including surfaces in lactation rooms (where only mothers are present), baby-changing tables (with which both mothers and babies interact), and daycare centers (where children mutually interact). Dual swabs were collected at each sampling location: one for plating onto selective media and the other for DNA sequencing analysis of the microbiota. Isolates were obtained from the plates and identified using Matrix-assisted Laser Desorption lonization (MALDI) Biotyper and bifidobacteria-specific Terminal Restriction Fragment Length Polymorphism (Bif-TRFLP). Preliminary results confirm that bifidobacterial vectors. Future experiments will investigate whether bifidobacteria may be transmitted between infants and how the microbiota of these surfaces differs between sites, environmental conditions, and over time.



Valerie Fates

Elise Hickman

Sponsor Name: Michael Mienaltowski

Research Title: Effect of Age on the Tenogenic Ability of Tendon Proper-Derived and Peritenon-Derived Progenitor Cells in a Murine Model

Abstract: Tendons become more susceptible to injury with age. The effect of age on the two distinct regions of the tendon, the peritenon and the tendon proper, has yet to be studied. Since differences exist between the ability of progenitor cells in tendon proper and peritenon to generate tendon-like tissue in vitro, examining how these properties change with age will help further our understanding of possible repair mechanisms in vivo. This study will compare the effects of age on tenogenic capabilities of tendon proper and peritenon-derived progenitor cells from the Achilles tendon of mice. Thus far, progenitor cells isolated from two tendon regions of young and old mice have been cultured and seeded in a regenerative construct model. Tenogenic properties of these constructs will be tested through biomechanical strength testing, a collagen content assay and gene expression assays, namely RT-qPCR (reverse transcription quantitative polymerase chain reaction). These methods will reveal tendon like properties via physical strength, production of structural tendon components and expression of known tenogenic genes. Upon its completion, this project will contribute to the understanding of this tendon repair model and enable improvement of medical treatment for tendon injury.

Sponsor Name: Michele La Merrill

Research Title: Effects of p,p'-DDT and p,p'-DDE on Respiration and Substrate Utilization in Brown Adipocytes

Abstract: Dichlorodiphenyltrichloroethylene (DDT) is an insecticide used widely in the United States in the mid-1900s. Although DDT was banned in the United States in 1972, it is still widely used in Asia and Africa for malaria control. DDT and its metabolite dichlorodiphenyldichloroethylene (DDE) are both highly stable and lipophilic, allowing them to persist in the environment and bioaccumulate. Importantly, epidemiological studies show an association between exposure to DDE and risk of both obesity and diabetes. Perinatal exposure to DDT causes impaired thermogenesis, decreased energy expenditure, and increased insulin resistance in mice. We hypothesize that DDT and DDE may interfere with metabolism in brown adipose tissue, a tissue that plays a key role in non-shivering thermogenesis. To test this, brown adjpocytes were exposed to DDT and DDE, and mitochondrial function was measured. Preliminary results show significantly decreased basal respiration in brown adipocytes exposed to 1-1000 nM DDT. These results suggest dysfunction of the mitochondria or impairment in the processes delivering substrates to the mitochondria.





Erin Hsu

Srujan Kopparapu

Sponsor Name: Richard Evans

Research Title: Effect of meta-Topolin on Shoot Growth in Paradox Walnut Rootstock and Scions

Abstract: A number of paradox walnut rootstocks and scion varieties are difficult to propagate in vitro. Application of the cytokinin 6-benzylaminopurine (BA) in growth media has had varied effects upon genotypes, promoting shoot development in some and not in others. Usage of the aromatic cytokinin meta-topolin (mT) has been shown to increase shoot multiplication rates in several species of Prunus (Gentile et al. 2014) and Malus (Dobranzki et al. 2002). In this experiment, the effects of BA and mT upon walnut growth and shoot multiplication were examined and compared. Ten walnut shoots of each genotype (VX211 and CR10) were grown in media with 2.2 μ M, 4.4 μ M, and 8.8 μ M of mT without BA, whereas the control was treated with 4.4 µM of BA without mT. Shoots were grown through three subcultures lasting 21 days each and examined for shoot growth and multiplication at the end of each cycle. Preliminary results show no significant differences in shoot multiplication between the control and mT treatments; however, shoots of scion variety Chandler CR10 appear to have greater leaf and petiole development with the application of mT.

Sponsor Name: Neil Hunter

Research Title: Spp1 SUMOylation Modulates Homologous Recombination During Meiosis

Abstract: Meiosis is the cell division process that halves the genetic material in preparation for fertilization. During meiosis, reciprocal exchange of DNA between homologous chromosomes occurs via the DNA repair process called homologous recombination (HR). The resulting crossovers are required for accurate chromosome segregation, and drive genetic diversity. HR is initiated by the formation of DNA double-stranded breaks (DSBs), mediated by the meiosis-specific protein Spo11. Defects in HR have been linked to birth defects, sterility, and cancers. Accordingly, meiotic recombination is highly regulated via the post-translational modification of proteins; this includes modification by the Small Ubiquitin-like Modifier (SUMO), which covalently attaches to lysines on target proteins and controls their stability and function. We have developed an efficient method for proteome-wide identification of SUMOylation sites. One identified target is Spp1, a subunit of the COMPASS protein complex that promotes Spo11-catalyzed DSB formation. Using site-directed mutagenesis, we generated strains that are unable to SUMOylate Spp1 (SPP1-SNM, SUMO-No-More, mutants). When combined with spo11 hypomorphic mutants that form reduced numbers of DSBs, SPP1-SNM causes defects in meiosis, which are manifested as reduced spore viability. These data suggest that SUMOylation of Spp1 plays an important role in promoting DSB formation and/or downstream steps of meiotic HR.



Ada J. Kwong

Mariana Leal

Sponsor Name: Jared Shaw

Research Title: Synthesis of Gyramide-Bound Photoaffinity Reagents for DNA Gyrase

Abstract: Antibiotic resistant bacteria are on the rise, and it is imperative that new drugs be developed to fight them. Unexploited targets that cause bacterial death are an important area of study for such development. We are targeting DNA gyrase, a protein that helps uncoil DNA during replication and transcription in bacteria because it can be distinguished from the analogous human protein, Topoisomerase II. Gyramides are small molecules that have been shown to successfully inhibit DNA gyrase. Previously, our group synthesized and screened an initial batch of gyramides that showed good inhibition activity, but they were cytotoxic to human cell lines. In order to tailor the gyramide analogs to target bacterial cells exclusively, we can utilize photoaffinity reagents to gather a better understanding of the approximate location and shape of the binding site. Presented here is our recent progress towards synthesizing and studying the gyramide-bound photoaffinity reagents as well as our work towards various analogs.

Sponsor Name: Carolyn Slupsky

Research Title: The Effects of Malnutrition and Human Lysozyme on Hepatic Metabolism

Abstract: Childhood malnutrition is frequently observed in developing nations and significantly impacts the developing immune system, thereby increasing morbidity and mortality. Repeated enterotoxigenic E. coli (ETEC) infections can decrease nutrient absorption thereby creating a vicious cycle of malnutrition and illness. Human milk contains high levels of lysozyme—an antimicrobial enzyme that may help protect children from pathogenic infections. This study examines the connection between malnutrition and the presence of antioxidant and pro-oxidant metabolites. Weanling piglets were fed a protein- and energy-restricted diet for 3 weeks, after which the diet continued either without supplement (n=6) or was supplemented twice daily with 250 mL of goat's milk (n=6) or transgenic goat's milk expressing human lysozyme (hLZ; n=6) for 2 weeks. A subset (n=4) from each group was further challenged with ETEC. The liver metabolome was investigated at each time point using 1H-NMR spectroscopy. Piglets supplemented with either milk are expected to have lower levels of oxidative stress associated with malnutrition and be better able to respond to ETEC challenge.





Jason F. Leddy

Alicia Lim

Sponsor Name: Dominik Haudenschild

Research Title: CDK9 Inhibition Prevents Injury-Induced Subchondral Bone Resorption by Targeting Osteoclast Precursors

Abstract: Common joint injuries substantially increase the risk of osteoarthritis (OA). Following injury, secondary joint damage results when an inflammatory response degrades cartilage and leads to the breakdown of joint bone – known as subchondral bone resorption. This process is accomplished by bone-resorbing cells called osteoclasts. Subchondral bone resorption increases the likelihood of developing post-traumatic OA (PTOA). Because current clinical joint injury treatments do not address this issue – and cannot curtail PTOA – developing a strategy to limit subchondral bone resorption might help prevent PTOA. Previous experiments, in which mouse anterior cruciate ligaments (ACL) were ruptured, showed that subchondral bone resorption is prevented by inhibiting the activity of CDK9, a kinase that influences inflammatory gene expression. We hypothesize that CDK9 inhibitors target bone resorption pathways by inhibiting osteoclasts. This could happen in three ways: First, preventing osteoclast differentiation – limiting resorption activity per osteoclast. Third, by affecting both proliferation and differentiation. This study examines the effects of CDK9 inhibition on osteoclasts. Our results show that CDK9 inhibitors suppress both proliferation and differentiation of osteoclast precursor cells. These insights may lead to the development of post-injury treatments that prevent osteoarthritis.

Sponsor Name: Selina Wang

Research Title: Quantification of Oleuropein in Olive Leaf Supplements and Purification of Its Derivatives

Abstract: Oleuropein aglycone is a derivative of the bitter polyphenolic compound oleuropein, and is produced by the hydrolysis of oleuropein during olive fruit maturation and olive oil processing. There is interest in determining the amount of oleuropein aglycone present in olive oils, as it is an antioxidant, has possible therapeutic effects for various diseases, and contributes to the oxidative stability of olive oil. However, oleuropein aglycone standards are not currently commercially available. This project aims to produce pure oleuropein aglycone from ten olive leaf supplement samples, which all claimed to contain at least 20% of oleuropein on the label. Oleuropein will be extracted and purified from the olive leaf supplements using column chromatography. The pure oleuropein will then be enzymatically hydrolyzed to oleuropein aglycone. In addition, high performance liquid chromatography (HPLC) will be used to determine the concentration of oleuropein in each olive leaf supplement sample, and the experimentally determined concentrations will be compared to the labelled concentrations.



Yuqing Liu

Sponsor Name: Hao Chen

Research Title: Statistical Learning in Intelligent Supply Chain Management

Abstract: The supply chains are experiencing a transformation driven by the application of data. Lam Research Corporation is a leading company in the semiconductor industry and has more than 800 purchase orders created by engineers every day. This project aims to improve the current purchases system by quoting from suppliers ahead of time based on the evaluation of whether a product in the database will be purchased in the future and estimation of the expedite fee. I use the order history data from 2014 to 2016 and build 3 predictive models with machine learning and statistical methods. Each modeling process involves statistical tests for feature selection, variable transformation and cross validation. There are also adjustments to the modeling methods corresponding to different business functions of the models. Two models are implemented and based on a 2-month pilot run, they save the work of 4 employees and expedite 3 days of delivery time for 40% orders at the company.

WeiYu Lu

Sponsor Name: Walter Leal

Research Title: Multi-Modal Sensation From Culex quinquefasciatus

Abstract: Mosquitoes are vectors of diseases such as malaria, dengue, chikungunya, Zika and many types of encephalitis. In California, the southern house mosquito, Culex quinquefasciatus is a vector of the West Nile virus. Mosquitoes use their olfactory system to sense and approach human and other host animals as a potential source of a bloodmeal. Odorant molecules can bind to mosquitoes' odorant receptors in their antennae to trigger an electric signal which is transmitted to the brain, allowing the mosquitoes to locate their host, but also to avoid danger. To prevent mosquito bites, people use mosquitoes' olfactory system to repel them, through mosquito repellents. One such repellent is DEET, the "golden standard" repellent used worldwide to protect host from bites. In our lab, we use DEET and other commercially available repellents such as IR3535, picaridin and PMD to conduct bioassays. Our lab previously demonstrated that odorant receptor 136 (CquiOR136) is the DEET receptor in Culex quinquefasciatus. In this study, the expression pattern of CquiOR136 was examined in all olfactory tissues by qPCR. Additionally, newly designed behavior experiments, coupled with gene silencing strategy, were used to determine whether mosquitoes detect DEET with other olfactory structures rather than the antenna.



Iris N. Mollhoff

Catherine Nguyen

Sponsor Name: Philipp Zerbe

Research Title: Structural-Functional Analysis of a Diterpene Synthase From Golden Larch Toward Manufacture of Biopharmaceuticals

Abstract: The diversity of plant diterpene metabolites offers a rich source of known and potentially new biopharmaceuticals. Among these, the microtubule-destabilizing activity of pseudolaric acid B (PAB) holds promise for new anticancer treatments. Availability of PAB is limited to low-yielding isolation from the coniferous tree golden larch (Pseudolarix amabilis, Pxa) or multi-step chemical synthesis. This presentation will discuss the discovery and mechanistic analysis of golden larch terpene synthase 8 (PxaTPS8) and subsequent cytochromes-P450-mediated steps in the pathway. PxaTPS8 is an unusual diterpene synthase (diTPS) that catalyzes the first committed step in PAB biosynthesis by converting geranylgeranyl diphosphate into a previously unknown 5,7-fused bicyclic diterpene, coined "pseudolaratriene." Combined NMR and quantum chemical analysis verified the structure of pseudolaratriene in PAB metabolism. Homology modeling combined with site-directed mutagenesis of PxaTPS8 revealed several catalytic residues that suggested a substantial divergence of PxaTPS8 from other TPSs, leading to a distinct carbocation-driven reaction mechanism. Ongoing research includes the elucidation of the downstream PAB pathway via the analysis of candidate genes, including several cytochromes P450 monooxygenases.



Sponsor Name: Rebecca Calisi

Research Title: The Influence of Social Dominance on Parental Care in Columba livia

Abstract: In social groups, dominant animals benefit from increased access to resources and mating opportunities. However, maintaining dominance sometimes requires individuals to decrease other activities, including parental care. This raises the question of whether or not offspring benefit from dominant parents because they may get high quality food, but infrequent care. In this study, I examined the impacts of social dominance on parental care in pigeons (Columba livia). I hypothesized that higher ranking animals will have lower-quality offspring because they allocate more time to maintaining dominance. I conducted daily observations of two pigeon colonies in person and by camera to determine social hierarchies. To evaluate parental investment, I video recorded parents at the nest to measure the amount of time spent there during incubation and nestling stage. I measured nestling mass and tarsus length to determine growth rate, which can serves as a determinant of offspring quality. My behavioral data support the presence of social hierarchies within each colony. I will present my research thus far on the relationship between dominant and subordinate parents and chick offspring quality. These results can improve understanding of social hierarchy-parental investment trade-offs, lending more insight into parental care strategies in birds.

Lakshmidevi Pabbisetty

Angela Parnay

Sponsor Name: Julin Maloof

Research Title: Differentially Expressed Genes Involved in Leaf Shade Response in Brassica rapa

Abstract: Brassica rapa is an important crop plant and can serve as a model organism because of its close relationship to other Brassica crops and it has a sequenced genome. Based on prior experiments, it is known that B. rapa alters its growth in response to shade, or a low red/far red ratio. Growth differences between light treatments include taller plants, larger leaves, and longer internodes. However, we do not know when or how these changes occur across development. To understand how B. rapa changes growth in response to shade, we conducted an experiment to profile gene expression in two leaf ages. B. rapa plants were grown in a growth chamber and measurements of parameters such as height, leaf length, and petiole length were taken in addition to leaf tissue for RNA profiling. During initial plant development, half of the plants were in shade conditions and half were in sun. After three weeks, half of the plants in each treatment were switched to the opposite treatment to decouple the developmental effect. Differential gene expression analysis between treatments will provide gene targets related to phenotypic changes. Ultimately, these candidate genes may be used to breed crop plants that are more crowding tolerant.

Sponsor Name: Suzana Sawyer

Research Title: Miscommunication Between Regulators and Local Communities During the Aliso Canyon Methane Blowout

Abstract: On October 23, 2015 a steady release of natural gas was discovered around a well in the Aliso Canyon storage facility in Los Angeles, California. During the four months it took to seal the well, the released gases caused many health problems for those living nearby, such as bloody noses and nausea. These health concerns led to the relocation of thousands of families and spurred community activism. Though many government agencies worked to seal the well and determine the short- and long-term health impacts, communication failures between regulators and the community produced distrust and panic. Expressions of scientific uncertainty, misinformation, and lack of direct communication exacerbated the fear already present in the community. Also, the context and environment of meetings between regulators, engineers, and community members influenced the language used when exchanging information, as well as the thoroughness of the knowledge provided. This study analyzes the relationship between information expression and the activism of the public by examining interviews with community members and regulators, podcasted community meetings, hearings, news publications, and online government resources. Understanding the role communication plays during times of environmental disasters can help regulators better manage future relationships with communities in crisis.





Rasika Patkar

Kira Pearson

Sponsor Name: Emanual Maverakis

Research Title: Effects of Sialic Acid on Inflammation

Abstract: Common foods such as dairy products, red meat, and hen eggs contain the monosaccharide sialic acid. Studies have shown that sialic acid levels are significantly different in patients with various immunological ailments such as cancer, rheumatoid arthritis, and allergies, suggesting that it plays a role as an immune moderator. The goal of this study is to examine the effects of different sialic acid treatments on inflammatory response based on changes in glycosylation on an immune cell. Monocytes, a type of white blood cell, will be treated with different concentrations of two types of sialic acid, NeuAC and NeuGC. Some of the cells will be treated with lipopolysaccharide, an inflammatory agent. Changes in glycosylation will be determined by lectin binding using flow cytometry. For the treatments that give interesting results, qPCR will be used to examine changes in gene expression of glycosylation enzymes. Conclusions from this study can eventually lead to suggestions for changes in diet or sialic acid supplements that can help reduce chronic inflammation.

Sponsor Name: Gail Patricelli

Research Title: Noise Pollution and Interspecies Interactions

Abstract: Anthropogenic noise may significantly impact wildlife, and in particular birds, on both small scales (parents and offspring communication), and broader scales (reproductive success and species interactions). These disruptions may negatively impact local population sizes over time, yet to date no experimental field study has studied the effects of noise pollution at the community level. I will experimentally test the potential impacts of noise pollution on tree swallow (Tachycineta bicolor) nestling condition and fledging success through monitoring adult foraging behavior and insect composition. If the presence of noise decreases insect abundance, adult tree swallows will have reduced foraging efficiency. I predict their nestlings will have decreased condition and an overall decreased fledging success rate. The study will take place in two breeding sites in Davis, California where nest boxes are randomly assigned to either traffic noise playback or control conditions (no noise playback). I will net insects and collect insect boluses from adult tree swallows from both treatment groups. Nestling growth will be measured weekly and the number of successful fledgings will be recorded. If my hypothesis is correct, anthropogenic noise has the potential to harm multiple species indirectly by disrupting food chain dynamics.



Zoë T. Rossman

Natalia Sachs

Sponsor Name: Lynette Hart

Research Title: When Yawning Occurs in Elephants

Abstract: This study aimed to describe yawning in elephants, a previously unreported behavior. Considering the widespread occurrence of yawning among mammals, one would expect that elephants should also yawn. Following preliminary data collection that confirmed the presence of yawning in Asian elephants in a zoo setting, this study was carried out with 9 captive African elephants (Loxodonta africana) at a private reserve in South Africa. Observations were conducted daily on 7 of the elephants that were managed for interactions with tourists. At night, all 9 elephants were maintained in an enclosure where they were illuminated with infrared lights, and continuously recorded by video cameras. Yawning occurred regularly when elephants awakened from recumbent sleeping/resting bouts (recumbencies), especially following the final recumbency before morning. All observed elephants exhibited yawning, and yawning occurred significantly more frequently in some individuals. Yawning was rare during the daytime and during nighttime periods was only associated with arousal from recumbency. There were also 6 occurrences of potential contagious yawning observed. This study is, to our knowledge, the first to describe yawning patterns in elephants. These findings contribute to the knowledge about elephant behavior and provide a useful comparison for factors influencing yawning and contagious yawning across different species.



Research Title: Does What the Chickens Eat Affect the Chicken We Eat?

Abstract: As the poultry industry is breeding larger and faster-growing chickens to meet consumer demand, meat quality is being compromised by the increased incidence of myopathies. This study seeks to determine if the essential amino acid methionine in by-products is a suitable substitute for synthetic methionine and has a sufficient bioavailability to promote optimal growth and development in broiler chicks. Fifteen broiler chickens that were fed a traditional 100% corn/soy diet are being compared to fifteen fed an alternative diet containing by-products comprised of 60% corn/soy, 20% sunflower seed meal, and 20% roasted cowpea for six weeks. Gross visual analyses and gene expression analyses using qPCR are to be completed on the pectoralis major and pectoralis minor muscles, and a hydroxyproline assay to determine collagen content will be performed on the pectoralis major muscles. These approaches will be used to determine the differentiation of cell types in pectoralis major muscles and the incidence of inflammation in pectoralis minor muscles. It is hypothesized that diets with by-products providing methionine allow for growth similar to diets containing artificial methionine, and white striping will be decreased in birds with slower growth rates.



Lauren Salinero

Samantha Schuster

Sponsor Name: David Mills

Research Title: Biofilm in Neonatal Feeding Tubes: Bacterial Composition, Relationship to Gut Microbiota, and Potential Clinical Predictors

Abstract: Tube feeding is a common practice in Neonatal Intensive Care Units (NICUs); however, feeding tubes have been found to harbor large communities of microbes that may put vulnerable infants at risk. In this study, 16S ribosomal DNA sequencing technologies were used to identify the bacteria present in 100 feeding tubes and 92 fecal samples collected from NICU patients. The types of bacteria found in the pharyngeal, esophageal, and gastric sections of the feeding tubes, as well as in residual liquid held in the tubes, will be characterized separately and compared. The relationship between feeding tube biofilm composition and gut microbiota will also be evaluated. Furthermore, clinical data such as the frequency of tube changes, gestational age of the patient, use of probiotics, and type of nutrition (mother's own milk, pasteurized donor milk, or formula) will be used to identify clinical factors associated with particular patterns of biofilm composition. Ultimately, the findings of this study may help inform clinical decisions and guide NICU protocol in order to minimize infants' exposure to harmful microbes.



Sponsor Name: Dr. Neil Hunter

Research Title: The Physiological Role of BRCA2 in Meiotic Recombination

Abstract: Homologous recombination occurs when a damaged chromosome uses a complementary sequence on the intact homologous chromosome as a template for repair. Homologous recombination is an important mode of DNA repair in both somatic and germ cells. In somatic cells, BRCA2 facilitates RAD51 loading onto DNA lesions; therefore, its absence leads to genomic instability. This study seeks to better define BRCA2's meiotic role. For the first time, we optimized Brca2 immunostaining, revealing punctate foci specifically localized along Sycp3-staining chromosome axes. Brca2 is detected throughout meiotic prophase, always in association with Sycp3. To further our understanding of Brca2's meiotic role, we have conditionally mutated Brca2 in cells undergoing meiosis. Mice containing a floxed Brca2 allele were crossed with lines expressing Cre recombinase under meiosis specific promoters. Oocyte chromosome spreads from age-matched mutant and control mice were used to analyze meiotic defects. Brca2 mutants show a significant decrease in the normally synchronous progression of oogenesis and high incidence of abnormal chromosome axes. Defects are also evident on histological sections of Brca2 mutant ovaries, which contain a significantly lower number of follicles. With these results, we conclude that functional Brca2 is essential for complete axis formation, the progression of gametes through meiosis, and ovarian follicle formation.



Jothika Tamizharasu

Alison Thorngren

Sponsor Name: David Mills

Research Title: Determining the Retention and Survival of Bifidobacterium longum subsp. infantis on Different Surface Types

Abstract: Colonization of bifidobacteria in the infant gut provides beneficial effects to the host, including development of the immune system. It is unclear how some species of bifidobacteria are transmitted to the infant and one route might be through the built environment. In fact, preliminary results from our group have shown that Bifodobacterium longum subsp. infantis (B. infantis), a fundamental colonizer, can be isolated from various surfaces in lactation rooms. This study aims to optimize the methods used to isolate bifidobacteria from environmental samples and to determine the magnitude of retention and the extent of survival of B. infantis on various surfaces. To determine these latter parameters, B. infantis was applied to paper, wood, plastic, and fabric surfaces and bacteria was isolated from each surface at multiple time points after exposure. The number of colony-forming units was determined by plating on selective media. Maintaining plates in an anoxic environment for at least 18 hours prior to isolation enabled maximized growth and increased quantification accuracy. Survival of B. infantis was significantly longer on fabric compared to other surfaces. Differences in retention were not statistically significant. This knowledge will advance understanding of the persistence and viability of bifidobacteria in the built environment.



Sponsor Name: Maurice Pitesky

Research Title: The Effect of Feeder Design and Feed Management on Profitability of Free-Range and Pastured Poultry Farms

Abstract: There is currently no uniform way of feeding chickens in the industry of free-range and pastured poultry. The designs of feeders and the management decisions of when and how to provide feed vary significantly between facilities. This makes it impossible to calculate metrics like a Feed Conversion Ratio (FCR) which diminishes our knowledge of sustainability and profitability. A small-scale experiment was carried out using ~140 hens, two different forms of feed, and two different feeder designs to measure how they affected the economics of the farm, considering the income from selling eggs as well as the money lost to feed wasted due to feeder design. A number of larger poultry farms have been asked various questions about how they fed their chickens and how it affected their profits. Current data suggest that feeders that are more accessible for the chickens cause more feed waste, and that wasted feed can make a dramatic impact on a farm's profits. The aim is to eventually collaborate with engineers to design a possible feeder that would maximize availability while minimizing feed wastage and also take into account common management issues such as size, ease of use, and weight of the feeders.

Isaac Fan-Sau Tseng

Lo Tuan

Sponsor Name: Gale Okumura and Tim McNeil

Research Title: Elderlift - Improving Elderly and Disabled Mobility through Accessible Transportation

Abstract: California's aging population is expected to grow twice as fast as the overall population according to the California Department of Aging. Yolo County, CA in particular is experiencing a projected increase of 50-99% growth in elderly people aged 60 and above as the year 2020 nears. Senior life satisfaction has therefore, become a pertinent concern in society. Disabled mobility has been proven to correlate tightly to elderly life-satisfaction according to a study by Cumhuriyet University, Turkey. Age-related illnesses and physical disabilities reduce individual mobility, and therefore, lead to lowered life-satisfaction. Modern transportation is also designed primarily for the working young individual, often inaccessible to elders without the help of caretakers or assistants. This project aims to improve elderly life satisfaction via an accessible transportation device that increases their mobility within the city of Davis. I will employ usercentered and iterative design processes supported by interview-based research with community partners, as well as secondary research. By focusing directly on senior citizen and disabled needs in the design process, this project will help combat the mobility challenges related to an aging population.



Sponsor Name: Kenneth Kaplan

Research Title: The Role of Autophagy in Sister Chromatid Resolution During Anaphase

Abstract: Successful chromosome maintenance requires accurate and complete replication of each chromosome, and starting in anaphase the segregation and physical resolution of sister chromatids. The Kaplan lab found that the Aurora B kinase responds to topologically linked sisters, which results in a change to its substrate targeting. One potential downstream target of Aurora B are members of a membrane fusion complex known as ESCRT III that is implicated in membrane abscission during cytokinesis as well as the process of autophagy, an evolutionarily conserved pathway in eukaryotes by which cytoplasmic cargo sequestered inside double-membrane vesicles are delivered to the lysosome for degradation. The connection between autophagy and DNA damage led us to hypothesize that tangled sister chromatids trigger a change in autophagy that is important for cell survival when cells divide in the presence of topologically linked sister chromatids. To test this hypothesis, I measured the effect of autophagy mutants on cell viability under conditions where cells have difficulty resolving sister chromatids. Results from preliminary experiments raise the interesting possibility that defects in autophagy actually improve cell viability. Next, I plan to measure the effect of autophagy activation on viability of cells under replication stress, and monitor chromosome damage in autophagy mutants.



Kyra van der Zalm

Quynh Vo

Sponsor Name: Cassandra Tucker

Research Title: The Perception of Pain Associated With Injections in Dairy Cattle

Abstract: Injections are a common health care procedure in all species and involve puncturing of the skin. Dairy cattle are one such species that receive various injection types. Studies on infant and adult humans have shown that variables such as speed of injection and needle diameter can contribute to pain associated with injection, however limited research has been done on dairy cattle. It is known that dairy cattle and other animals experience pain and studies in cattle have demonstrated that some injections have long-term effects such as bruising and muscle damage. The purpose of this research study is to investigate the pain in dairy cattle during routine injections. Data collection will include non-invasive dependent variables such as behavioral responses. Previous studies have shown that these can all be indicators of acute pain in dairy cattle. Understanding the perception of pain is important for the welfare of dairy cattle and provides insight into further research on how to minimize pain associated with injections.

Sponsor Name: Jawdat Al-Bassam

Research Title: Construction and Expression of a Polycistronic Plasmid Encoding Human Protein Complex Composed of Tubulin Binding Cofactor D,E, and Arl 2

Abstract: Microtubules are essential components of cytoskeleton. Their subunits are alpha-beta tubulin heterodimers, whose concentration in cells drives microtubule dynamic. During the process of forming native heterodimer subunits, there are five conserved tubulin binding cofactors (named TBC A to E) and Arl2 (ADP ribosylation factor-like 2) which are involved and regulate the concentration of soluble tubulin subunits. The structure and function of these cofactors in bovine, pig, and yeast have been subjected for research many decades ago. They are chaperones which control biogenesis and degradation of tubulin heterodimers. Here, the conserved protein complex of cofactor D,E, and Arl2 in human is studied. This complex is not stable enough to be expressed and purified from bacterial culture, which also lacks post-transciption modification process. The complex is expressed in insect cells using Bac-to-Bac baculovirus expression system and purified using Nickel column and gelfiltration. The structure of the complex is further studied by cryo-EM.



Dean Watson

Benjamin Wigman

Sponsor Name: Thomas Gordon

Research Title: Strawberry Runner Colonization by Fusarium oxysporum f. sp. fragariae

Abstract: Strawberry production in California requires coordinated action between high-elevation nurseries and fruit-production fields. At high-elevation nurseries, mother plants are established in the spring that produce runners (= stolons), which rise to new plants (= daughter plants). In the autumn, daughter plants are used to establish plantings in commercial fruit-production fields in the coastal regions of California. Fusarium wilt of strawberry, caused by the soil-borne fungal pathogen Fusarium oxysporum f. sp. fragariae (Fof), is a growing threat to the strawberry production industry worldwide. Symptoms of the disease typically include stunting, wilting, crown discoloration, and eventual plant death. One possible explanation for the increasing incidence of Fusarium wilt in fruit-production fields is the introduction of the pathogen from high-elevation nurseries via contaminated transplants. The present study evaluates the ability of Fof to colonize the stolons of infected mother plants and infect daughter plants without producing identifiable symptoms, providing a potential mechanism for the contamination of transplants. Furthermore, the movement of the pathogen through daughter plants is being analyzed. Preliminary results indicate that Fof does colonize the stolons and daughters of infected mother plants, and there is some evidence to suggest that there is a difference in colonization frequency between strawberry cultivars.

Sponsor Name: Annaliese Franz

Research Title: Exploring Catalysts for Allylsilane Oligomerization Reactions

Abstract: Silicon-containing materials have broad applications, and so investigations into new siliconcontaining oligomers and polymers are of great potential value. The use of catalysts can provide efficiency and desired selectivity in a chemical synthesis. In this study, various catalysts were screened to optimize the oligomerization of a relatively unexplored monomer, allylsilanes. Several metal salt Lewis acids (Sc(OTf)3 and Y(OTf)3) and the Brønsted acid H3PO4 provided full consumption of the monomer in the presence of sodium tetrakis[3,5-bis(trifluoromethyl)phenyl]borate (NaBArF). It was determined that both NaBArF and the acid catalysts are required for oligomerization. Reaction progress was monitored by 1H NMR spectroscopy, and utilized in combination with MALDI-TOF mass spectrometric analysis to characterize the oligomers' structures. Investigations into the role of the catalyst were performed using a proton scavenger to determine the metal salt catalysts role as either a Lewis or Brønsted acid. A variety of allylsilanes undergo oligomerization; this is advantageous as structure can influence the properties of potential materials or the silvl group can be involved in further chemical transformations to provide more diverse structures. Future studies will determine the potential usage of this new class of oligomer in the design of new materials.



Garrett Woodworth

Erin Woolley

Sponsor Name: Rajeevan Amirtharajah

Research Title: Kabrya: A Machine Learning Device for Everyone

Abstract: Machine learning has the potential to revolutionize the way humans live by automating processes that require a human mind. However, the current dearth of information in many fields where machine learning could be applied, serves as a roadblock handicapping this potential. Thus, the team created a wearable data collection device which uses 10 prominent sensors and machine learning techniques to allow researchers to collect optimal data. In hopes of making the solution as user-friendly as possible, the team made firmware drivers to get readings from the sensors as well as an application which reads the data for the user and outputs it in real time.

Sponsor Name: James Sanchirico

Research Title: The Effects of Drought Conditions on California Crop Production Decisions

Abstract: California is one of the nation's leading agricultural producers, growing 14% of all U.S. agricultural products. The impacts of climate change on local temperature and precipitation levels combined with the state's history of drought, however, are putting this sector at risk. As water becomes more scarce throughout the state, the pressure on the agricultural sector to use the resource more efficiently increases. The current body of research is primarily focused on how policymakers can influence water conservation in agricultural irrigation through changes in the price of water. In this study, I examine the relationship between water availability and crop choice in California agriculture, in order to better understand the impacts that continued drought conditions may have on agricultural production decisions in California. Using crop survey data, compiled by the California Department of Food and Agriculture, and temperature and precipitation data, I compare pre- and post - drought production of different crop types.



Sensors

Our Device contains the following types of sensors:

- 1. Galvanic Skin Response
- 3. Magnetometer
- 4. Gyroscope Altimeter
- Pulse Oximeter
- Thermopile Thermometer
- Ambient Color

Wafa Zeidan

Sponsor Name: J. David Furlow

Research Title: Characterization of an In Vivo Transgenic Reporter System for Thyroid Hormone in the Frog Xenopus laevis

Abstract: Thyroid hormone (TH) is essential in initiating metamorphosis in Xenopus laevis, African clawed frog. TH is also important for human development; for example, cretinism, a condition that leads to short stature and impaired brain development in infants, results from insufficient TH. Founder lines of X. laevis carrying a TH response element (TRE)-luciferase reporter gene co-injected with a marker gene expressing green fluorescent protein (GFP) in the eye lens were evaluated for the co-segregation of the reporter and marker transgenes in the F3 generation, including the effect of Triiodothyronine (T3) on luciferase activity in lens-GFP+ tadpoles. The luciferase activity serves as a surrogate for TH receptor (TR) target gene induction. Week-old GFP+ tadpoles were treated with either DMSO (vehicle), or 10nM T3 from each mating, and tissue extracts were tested for luciferase activity and normalized for total protein concentrations. Data revealed that F2 GFP+ adult mated with a wild-type animal produced 50% GFP+ offspring with an average fold activation of 60.8 for 10nM T3 treated tadpoles over DMSO. Evidence suggests co-segregation of GFP marker and inducible luciferase reporter genes through the F3 generation, and induction of the luciferase reporter in response to T3.



Engineering

Brian Becker

Erik Becker

Adviser: Dr. Xin Liu

TEAM #55: RIGHT HERE RIGHT NOW

Abstract: "Right Here, Right Now" is a location-based social media app on the Android platform, with which people see posts and events hyper-locally. Using "Right Here, Right Now," users may also keep up with friends' activities both to-use student database and functions for maintaining customized vocabulary lists, review exercises, diagnostic quizzes, and examinations. Another primary feature is a "passage reading" screen, which presents an appropriate passage from a curated list of books, with highlighted vocabulary words, allowing readers to more clearly track the context of their vocabulary words. The fully webbased application is built for modern desktop browsers and uses the latest open-source technologies to facilitate future development and maintenance.

Adviser: Dr. Steve Velinsky

TEAM #76: JACKALOPE PAV (PERSONAL AIR VEHICLE) FLYING CAR

Abstract: The goal of this project is to design and manufacture a 1:4 scale prototype for a VTOL (vertical takeoff and landing) flying car, which is the second iteration of this concept. This prototype uses three stabilizing rotors set up in a tri-copter configuration during hover, as well as a set of main lift rotors that supply the majority of the prototype's thrust. After taking off vertically, the stabilizing rotors turn off while the main lift rotors rotate forward, allowing the prototype to transition to horizontal, wing-borne flight with a canard configuration. This design, at full scale, conforms to legal road width regulations while being able to seat four people in a single row. The future of this design will be a personal flying car that allows the user to travel without the necessity of using commercial airlines.



Philip Chen

Naji Dmeiri

Adviser: Dr. Xin Liu

TEAM #29: SPECIAL STUDY COURSE MANAGEMENT SYSTEM

Abstract: The computer science department at UC Davis offers internship and research credit for students in the form of ECS 192 and ECS 199 (ECS 92 and ECS 99 for students of lower division standing). Recently, more students have been using either these courses to fulfill graduation requirements, so the department has taken measures to formalize the process. The current registration and enrollment processes for internship and research courses requires many manual and error-prone steps from both instructors and students. The goal of this project is to automate, formalize, and streamline a significant portion of the processing effort. Special Study Course Management System (Special Study CMS) is a website that automates a significant portion of the formal registration and enrollment process through which students earn internship and research credit. The website guides students through the initial registration process and keeps them on track for milestones and deadlines. Additionally, it provides an interface for coordinating professor and advisors to verify submitted documents and to provide feedback to students. At the end of each guarter, students' coursework is archived so it can be easily referenced in the event of an ABET (Accreditation Board for Engineering and Technology) accreditation audit.

Adviser: Dr. Xin Liu

TEAM #29: SPECIAL STUDY COURSE MANAGEMENT SYSTEM

Abstract: The computer science department at UC Davis offers internship and research credit for students in the form of ECS 192 and ECS 199 (ECS 92 and ECS 99 for students of lower division standing). Recently, more students have been using either these courses to fulfill graduation requirements, so the department has taken measures to formalize the process. The current registration and enrollment processes for internship and research courses requires many manual and error-prone steps from both instructors and students. The goal of this project is to automate, formalize, and streamline a significant portion of the processing effort. Special Study Course Management System (Special Study CMS) is a website that automates a significant portion of the formal registration and enrollment process through which students earn internship and research credit. The website guides students through the initial registration process and keeps them on track for milestones and deadlines. Additionally, it provides an interface for coordinating professor and advisors to verify submitted documents and to provide feedback to students. At the end of each guarter, students' coursework is archived so it can be easily referenced in the event of an ABET (Accreditation Board for Engineering and Technology) accreditation audit.



Meghan Doherty

John Engel

Adviser: Dr. Anthony Passerini

TEAM #101: RAPID WHOLE BLOOD HEMOLYSIS DETECTION

Abstract: We have created a point of care device to rapidly detect whole blood hemolysis when blood is drawn for laboratory testing. The device separates plasma from whole blood, which is analyzed by a handheld spectrophotometer. The hemolysis index is displayed to the user. This device will allow confirmation that the blood specimen is suitable for testing and eliminate excess time required for redraws if the specimen has gross hemolysis. The device is lightweight and portable so that healthcare personnel can use it in both standard conditions or emergency situations.

Adviser: Dr. Ross Boulanger

Abstract: Our team presents possible foundation choices for two proposed buildings in Oakland, California. The study includes geotechnical recommendations and design criteria for foundations and earthwork construction at the project site. The analysis and results of the geotechnical conditions at the site, based on boring logs taken by Woodward-Clyde Consultants in 1984, and URS Greiner Woodward Clyde in 1986, are also included in this study. For each foundation type considered, we analyzed both settlement and capacity. For the 8-story building, only shallow foundations are considered. For the 18-story tower, a shallow mat foundation as well as piles were analyzed.



TEAM #40: FOUNDATION ANALYSIS AND DESIGN FOR LAKE MERRITT RESIDENTIAL DEVELOPMENT

Dylan Finch

Daniel Fust

Sponsor Name: Rajeevan Amirtharajah

Research Title: Kabrya: A Machine Learning Device for Everyone

Abstract: Machine learning has become an increasingly hot topic in the world of computing. The applications for machine learning are vast, and neural network algorithms are currently being used extensively in areas such as image recognition. This paper discusses the acceleration of a Neural Network Inference algorithm designed to recognize handwritten digits. This is a simple form of image recognition, using only a 28 by 28 pixel image, but the algorithm idea is largely the same for larger systems. The algorithm was originally run purely in software. Using an FPGA, a hardware accelerator was designed and implemented providing speedups on the order of 10x when compared to pure software.

Adviser: Dr. Jason Moore

TEAM #72: HEAT PUMP

Abstract: The design of a heat pump system installation and integration into a UC Davis campus building in order toreduce the carbon footprint of the campus and increase the overall efficiency.

Sensors

Our Device contains the following types of sensors:

- 1. Galvanic Skin Response
- 2. Accelerometer
- Magnetometer
 Gyroscope
- 5. Altimeter
- 6. Pulse Oximeter
- 7. Thermopile
- 8. Thermometer
- 9. Ambient Color





Nathaniel-Georg Gutierrez

Kathleen Hornbacker

Adviser: Dr. Anthony Passerini

TEAM #12: CONGESTIVE HEART FAILURE - DRUG DELIVERY SYSTEM

Abstract: Current methods for treating congestive heart failure do not have an avenue for automatically delivering heart failure medication with little to no input or interaction from the patient outside of the hospital setting. In particular, a system for automated heart failure drug delivery based on hemodynamic changes does not exist. Current methods are largely comprised of in-hospital visitations and treatments, causing hospitalization costs due to heart failure to increase every year. The objective of the CHFDDS is to create a processing block for an automated drug delivery system delivering heart failure medication, in the form of diuretics (Lasix), to heart failure patients. The device will be capable of reading in inputs, such as pulmonary artery pressure and weight, to determine the proper steady-state delivery of the diuretics, specifically if the drug should be increased, decreased, or remain at steady state. This will minimize patient interactions with taking drugs as well as lower hospitalization costs.

Adviser: Dr. Anthony Passerini

TEAM #96: CANINE SUSPENSORY LIGAMENT INSTRUCTIONAL MODEL (CSLIM)

Abstract: Detaching the suspensory ligament from the abdominal wall is an essential part of a canine ovariohysterectomy (spay) procedure. To perform this detachment, surgeons rely on tactile skills to navigate the body cavity. Therefore, obtaining these tactile skills is crucial for veterinary students to sufficiently practice this procedure. Unfortunately, the limited availability of cadavers denies some students the chance to practice. This presented a need for a teaching model that accurately emulates the force and technique required to detach the suspensory ligament in order to provide all veterinary students the opportunity for repeated and realistic practice of suspensory ligament detachment. CSLIM is a model that aims to accurately mimic the suspensory ligament detachment procedure in order to familiarize students with the skills needed to complete this step of an ovariohysterectomy. This has been achieved through a durable, reusable model design that allows for multiple procedure attempts without prolonged suspensory ligament replacement time. This model is also portable, cost effective and accurate with regard to canine anatomy. Ultimately, the goal of this model is to refine the technique required to execute suspensory ligament detachment and reinforce the students' understanding of the force necessary to detach it.



Marie-Pierre Kippen

Joeseph Lacommare

Adviser: Dr. Ross Boulanger

TEAM #40: FOUNDATION ANALYSIS AND DESIGN FOR LAKE MERRITT RESIDENTIAL DEVELOPMENT

Abstract: Our team presents possible foundation choices for two proposed buildings in Oakland, California. The study includes geotechnical recommendations and design criteria for foundations and earthwork construction at the project site. The analysis and results of the geotechnical conditions at the site, based on boring logs taken by Woodward-Clyde Consultants in 1984, and URS Greiner Woodward Clyde in 1986, are also included in this study. For each foundation type considered, we analyzed both settlement and capacity. For the 8-story building, only shallow foundations are considered. For the 18-story tower, a shallow mat foundation as well as piles were analyzed.

Adviser: Dr. Anthony Passerini

TEAM #1: CRUTCH FORCE SENSOR

Abstract: A device that is able to detect the weight being loaded and the position of forearm crutches. This will be used to improve patient tailored stroke patient rehabilitation.



Alexis Okasinski

Claire Sasse

Adviser: Dr. Anthony Passerini

TEAM #30: WORK OF HEART

Abstract: The design objective of the Work of Heart (WOH) device is to create a physical and interactive model of the cardiovascular system that simulates the hemodynamic (delivery of blood) response to the baroreceptor reflex to enhance the student learning experience. The baroreceptor reflex, one of the body's main homeostatic mechanisms, monitors and regulates the mean arterial pressure (MAP).

Adviser: Dr. Anthony Passerini

TEAM #98: EXCELERATE: LOW COST LOWER LIMB PROSTHETIC SOLUTION

Abstract: In developing countries, a market has evolved for a lowcost prosthetic device that allows lower limb amputees to live with a higher quality of life. There are six identified children that are living under the guardianship of a hostel in the Kathmandu valley; three are transtibial amputees and three are transfemoral amputees. They do not have regular access to a prosthetic care facility and current devices are improperly fitting, do not prevent pressure ulcers, and provide limited mobility. The objective of our project is to develop a low cost prosthetic solution for lower limb pediatric amputees in developing countries, using this representative population of six identified children in Nepal.



Akash Shah

Anthony Sorbera

Sponsor Name: Rajeevan Amirtharajah

Research Title: Kabrya: A Machine Learning Device for Everyone

Abstract: Machine learning has become an increasingly hot topic in the world of computing. The applications for machine learning are vast, and neural network algorithms are currently being used extensively in areas such as image recognition. This paper discusses the acceleration of a Neural Network Inference algorithm designed to recognize handwritten digits. This is a simple form of image recognition, using only a 28 by 28 pixel image, but the algorithm idea is largely the same for larger systems. The algorithm was originally run purely in software. Using an FPGA, a hardware accelerator was designed and implemented providing speedups on the order of 10x when compared to pure software.

Adviser: Dr. Anthony Passerini

TEAM #100: EXO-K9 (CANINE FIXATION DEVICE)

Abstract: Our objective is to provide a new method for treating maxillomandibular injuries in canines that reduces the risk of improper fracture healing as compared to current methodology used by our clients at the UC Davis School of Veterinary Medicine. The device must provide structural support and maintain proper bone alignment and dental occlusion. It will be reusable, provide stabilization of the skull, and be impact resistant to allow optimal healing that would yield better results than internal fixation.

Sensors

Our Device contains the following types of sensors:

- 1. Galvanic Skin Response
- 2. Accelerometer
- 3. Magnetometer
- 4. Gyroscope 5. Altimeter
- Pulse Oximeter 6.
- Thermopile
- Thermometer
- Ambient Color





Bradley Wang

Garrett Woodworth

Adviser: Dr. Xin Liu

TEAM #55: RIGHT HERE RIGHT NOW

Abstract: "Right Here, Right Now" is a location-based social media app on the Android platform, with which people see posts and events hyper-locally. Using "Right Here, Right Now," users may also keep up with friends' activities both near and far. In order to help users keep up with all the latest and best content, "Right Here, Right now" is fully interactive and determines post visibility based on post popularity and proximity. On this platform, users may post, like, and reply to posts and events, follow other users, and attend events.

Sponsor Name: Rajeevan Amirtharajah

Research Title: Kabrya: A Machine Learning Device for Everyone

Abstract: Machine learning has the potential to revolutionize the way humans live by automating processes that require a human mind. However, the current dearth of information in many fields where machine learning could be applied, serves as a roadblock handicapping this potential. Thus, the team created a wearable data collection device which uses 10 prominent sensors and machine learning techniques to allow researchers to collect optimal data. In hopes of making the solution as user-friendly as possible, the team made firmware drivers to get readings from the sensors as well as an application which reads the data for the user and outputs it in real time.

Sensors

Our Device contains the following types of sensors:

- 1. Galvanic Skin Response
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