



**UCLA POSTDOCTORAL
SCHOLARS AND
MENTORS AWARDS
VIRTUAL CEREMONY**

April 13, 2021

The **UCLA POSTDOCTORAL SCHOLARS & MENTORS AWARDS VIRTUAL CEREMONY** recognizes the important contributions that postdoctoral scholars and their mentors make to the missions of research, teaching, and public service at UCLA.

The ***Chancellor's Award for Postdoctoral Research***, established in 1998, is conferred on particularly accomplished individuals with nominees coming from virtually every discipline at UCLA - from the basic and applied sciences to the professional schools, social sciences, and the humanities. Of the 884 registered postdoctoral scholars at UCLA, 35 have been nominated for the award this year. An important criteria tied to the award selection is that an individual's research accomplishments must show clear potential to have meaningful and enduring implications in their field.

In 2012, the former Society of Postdoctoral Scholars also began honoring exemplary faculty in recognition of the importance of excellent mentorship for postdoctoral research success. Today, the Postdoctoral Scholars Association continues that tradition of the ***Postdoctoral Mentoring Award*** by recognizing faculty who as positive role models develop a supportive lab or work environment; collaborate on research projects; encourage confidence and creativity; foster excellent written and verbal communication skills; help establish professional networks at this campus and others; and actively support the transition from postdoctoral to independent research or other careers. Also representing various disciplines across campus, 24 faculty members have been nominated for this year's award.

We are very pleased to have you join us today as we acknowledge and honor the accomplishments and contributions of the award nominees and all postdoctoral scholars and their mentors at UCLA.

UCLA POSTDOCTORAL SCHOLARS & MENTORS AWARDS CEREMONY

Virtual Awards Ceremony

Zoom

Welcome & Introductions

Susan L. Ettner, *Interim Dean for Graduate Education*

Remarks

Roger M. Wakimoto, *Vice Chancellor for Research*

Chancellor's Award for Postdoctoral Research

Susan L. Ettner, *Interim Dean for Graduate Education*

Roger M. Wakimoto, *Vice Chancellor for Research*

Daniel Wong, *Assistant Dean, Academic and
Postdoctoral Services, Graduate Division*

Postdoctoral Mentoring Award

Leslie Sedgeman, *Chair, Postdoctoral Association at UCLA*

Caroline Johnson, *Vice-Chair of Operations,
Postdoctoral Association at UCLA*

Closing Remarks

Susan L. Ettner, *Interim Dean for Graduate Education*

~ NOMINEES ~

**2020-21 CHANCELLOR'S AWARD
FOR POSTDOCTORAL RESEARCH**

Adeyemi Adebisi

Atmospheric & Oceanic Sciences

One of the largest uncertainties in predictions of future climate changes is the poorly understood effects of aerosols - fine particles in the atmosphere - on clouds and radiation. The dominant aerosol species by mass is suspended soil dust, which impacts clouds, precipitation, land and ocean ecosystems, and other critical components of the Earth system. Despite these important impacts, climate models have difficulty simulating key dust properties, which has resulted in substantial uncertainty in dust impacts on the Earth system. In particular, it remains unclear whether dust warms or cools the global climate, in part because models have difficulty simulating the dust size distribution accurately. Recent measurements indicate that climate models overestimate fine dust (with diameters $\leq 5 \mu\text{m}$), which cools the climate, whereas they underestimate coarse dust (with diameter $\geq 5 \mu\text{m}$), which predominantly warms the climate system. Adebisi integrated dozens of in-situ measurements of dust size distributions with satellite observations of dust properties and an ensemble of climate model simulations to determine how much coarse dust is in Earth's atmosphere. He discovered that the atmosphere contains about 17 million metric tons of coarse dust, which is approximately four times what current climate models account for. This is an important finding because this missing coarse dust warms the climate system by an estimated $\sim 0.15 \text{ W/m}^2$, which substantially raises the likelihood that dust net warms the global climate system. Because past work has interpreted the approximate doubling of atmospheric dust since pre-industrial times as having cooled the planet, this work contributes to a paradigm shift in our thinking of the impacts of dust on past and future climate changes.

Research Mentor: Jasper Kok, Atmospheric & Oceanic Sciences

Rachel Blakey

Institute of the Environment and Sustainability

Rachel Blakey's research, as the La Kretz Postdoctoral Fellow for California Conservation, leverages 20 years of research by her conservation partners at Santa Monica Mountains National Parks Service and the behavioral ecology expertise of her research mentors, Prof. Blumstein (UCLA) and Dr. Seth Riley (NPS), to address a key conservation concern: how do top carnivores respond to the wildfires that are increasing in severity and extent in the world's fire prone regions. Using mountain lions (*Puma concolor*) as her focal taxa, she is addressing this question at local (Santa Monica Mountains) and statewide (California) scales, involving statewide Californian mountain lion biologists and NASA remote sensing scientists as collaborators. Her first manuscript has revealed that urban mountain lions increase risk-taking activities following large wildfire. This provides evidence for a shifting landscape of fear after wildfire, where female and subadult puma space use is more strongly influenced by the perceived risk of adult males, rather than humans. She is currently building from this work to determine the mechanisms underpinning mountain lion movement behavior within pyrodiverse landscapes, with a

special focus on three-dimensional vegetation structure, as revealed by lidar. During her postdoc, she has been invited to present at two fire ecology conference symposia for The Wildlife Society (2020) and the International Association for Landscape Ecology (2021) annual meetings. Rachel is an active participant in Prof Blumstein's lab and recently co-authored a paper with five lab members and a collaborator from University of Arizona developing the logic of the role of scale in urban biodiversity and conservation. During the pandemic, Rachel has directed a large part of her energy to remotely mentoring and collaborating with UCLA and NPS research students including seven PhD students, one Masters student, two undergraduates and one high school student. These collaborations, featuring students as first authors, span an array of subjects from ecological and evolutionary insights into SARS-CoV-2 (an interdisciplinary collaboration with UCLA disease ecologists and evolutionary scientists) to the global effects of human weekend recreation on mammal movement behavior (led by two UCLA undergraduates and collaborating with a researcher at Radboud University, the Netherlands).

Research Mentors: Daniel Blumstein, Ecology & Evolutionary Biology & Institute of the Environment & Sustainability/Seth Riley, Institute of the Environment & Sustainability

Katherine Chen

Medicine

Dr. Katherine Chen, MD, is an internal medicine physician pursuing a career as a clinician-investigator in population health. As a postdoctoral scholar in the National Clinician Scholars Program, her research examines the role of urban planning and public policy in shaping or mitigating population health disparities. Dr. Chen's work focuses on three policy-relevant themes whose importance has been magnified by the COVID-19 pandemic: (1) the health implications of housing stress and displacement, (2) the impact of the urban environment on access to health care, and (3) opportunities for health systems to address the social determinants of health. Dr. Chen's research has shown that during any given year, about 1.4 million California adults who recently moved because of unaffordable housing costs are at heightened risk of missing out on necessary medical care. She subsequently published a report and policy brief exploring how the COVID-19 pandemic has worsened transportation barriers to health care. In search of strategies to address health disparities related to housing and transportation, Dr. Chen published a pair of studies demonstrating that reform to federal policies governing hospitals' tax-exempt status could promote equity by better aligning the priorities of health systems and communities around the social determinants of health. Collaborations with mentors across departments and institutions have been central to Dr. Chen's success in developing rigorous, grant-funded evaluations on these timely and interdisciplinary topics. In addition to publishing in peer-reviewed journals, she has been invited to present to national, state, and local audiences in health care, public health, urban planning, and policymaking; her work has also been featured in radio and print interviews. As part of her postdoctoral training, Dr. Chen is pursuing a PhD in Health Policy & Management with support from UCLA's Specialty Training and Advanced Research fellowship. Her ongoing clinical practice at a safety-net community health clinic ensures that her research remains grounded in patient stories. She has volunteered for additional clinical roles during the COVID-19 pandemic, and she continues to teach resident physicians how to care for patients with complex medical and social needs through clinical precepting and didactic seminars.

Research Mentor: Joann Elmore, Medicine/ Tery K. Nuckols, General Internal Medicine

Zachary Cohen

Semel Institute

Zachary Cohen's research uses data-driven predictive algorithms to match individuals to the right level of care (e.g., clinician-provided psychotherapy versus coach-supported digital therapy) or to the specific treatment modality that is optimal for them (e.g., medication versus cognitive-behavioral therapy). As a postdoctoral scholar working on UCLA's Depression Grand Challenge, Dr. Cohen has led an effort to develop a suite of evidence-based online therapy modules and smartphone tools to help prevent the onset of mental health problems, and to help individuals struggling with depression, worry, panic, social anxiety, trauma and sleep dysregulation. In this program, therapy is tailored by selecting specific modules and adapting therapy content based on the individual's unique concerns. Dr. Cohen spent the past two years building a search ecosystem optimized for the development, delivery, evaluation and adaptation of personalized psychological therapies. The program he and his team developed is unique in its flexibility and the ease with which it can be expanded. The digital therapy platform is based on a content management system, which includes a "module builder" and "tool builder" that allow researchers with zero programming experience to easily adapt existing online modules or smartphone tools, and to add new modules or tools at minimal cost. Other researchers at UCLA and elsewhere will benefit greatly from the unique infrastructure in the years to come. It promises not only to facilitate clinical trials and research that will improve our understanding of how and for whom treatments work, but also to increase access to high-quality care for underserved communities. In addition to his work on digital therapy, Dr. Cohen uses his expertise in data-science for "big data" precision mental health analyses that combine samples from multiple studies. Dr. Cohen has been invited to contribute authoritative reviews and chapters, to collaborate/consult on grants at home and abroad, and to help craft policy recommendations as a member of the George W. Bush Institute's Mental Health and Wellbeing task force. His expertise will now be turned to developing and improving personalization algorithms related to this novel digital therapy program, using the unique data that his system will collect.

Research Mentors: Michelle Craske, Psychology

Marie Collin

Civil and Environmental Engineering

Many industrial sites are striving to reduce their environmental impact. More and more, effective technologies are developed to safely dispose of wastewater streams. These wastewaters include coal ash landfill leachate, contaminated groundwater, and produced water. They typically contain high levels of contaminants such as heavy metals, alkali cations, and/or halide anions. A potential option to safely dispose of these liquid wastes is to stabilize them in a solid matrix. In short, the liquid waste reacts with a cementitious material. The resulting solid formed is composed of a variety of hydrated phases. It can bind the contaminants, either as insoluble species or by incorporation in the hydrated phases. In this context, the reaction of fly ashes (a by-product of coal combustion) with a calcium-based additive is of interest. As they react together, similar hydrated phases as that observed with regular cementitious materials forms. The use of

fly ash instead of other cementitious materials (such as ordinary Portland cement) significantly reduces CO₂ emission of the process. However, uncertainties remain on how several key parameters might affect fly ash reactivity. These key parameters include: the liquid waste composition and concentration, the fly ash composition, and the calcium-based additive composition. All could affect the mineralogical composition of the final solid which is detrimental to the solid capacity to bind contaminants. My work aims at accurately and rapidly predict how these key parameters will affect the final solid performances. To do so, I studied a large variety of experimental setups, then modeled them using thermodynamic modelling. I incorporated the experimental and simulated results in a model that can predict fly ash reactivity from the initial setup composition. Once the model is validated for a larger range of setups, I will use it to predict the performances of a variety of waste encapsulation materials. As a result, it will be possible to select the best performing materials for liquid waste of interest. This will ensure that the waste management process has the lowest environmental impact possible in terms of both CO₂-footprint and contaminant retention.

Research Mentor: Gaurav Sant, Institute of Carbon Management, Civil and Environmental Engineering

Graciél Diamante

Integrative Biology and Physiology

Decades of industrialization and expansion in human population have led to an increase in the amount of industrial chemicals being produced. The continued presence of contaminants in the environment is a major health concern due to the risks it poses to humans, yet our understanding of the impacts of prevalent chemicals on biological systems is limited. Dr. Graciél Diamante's research goal is to use cutting-edge multiomics systems biology approaches to investigate toxicity and its role in disease development. The main direction of her research is to examine how contaminants in the environment interact with the genome, epigenome, and microbiome to impact gene network dynamics in different tissues using both bulk and single cell RNA sequencing, reduced representation bisulfite sequencing, and 16S rRNA sequencing. She has also developed and applied computational and bioinformatics skills to analyze and integrate multi-omics datasets and to conduct advance network modeling. Her skills in multi-tissue multi-omics techniques have broadened the understanding of the molecular pathways affected by important environmental contaminants such as endocrine disruptors, diesel exhaust particles and nanoparticles. Her research offers a comprehensive understanding of how environmental chemicals can contribute to human health and can help direct future preventative and therapeutic strategies to mitigate the negative impact of environmental pollutants. Graciél's productivity, unique interdisciplinary training combining experimental and computational big data approaches, and rapid professional growth during her post-doctoral tenure ensure her leadership in pushing the environmental toxicology field forward through modern big data approaches.

Research Mentor: Xia Yang, Integrative Biology and Physiology

Lucia Fernandez del Rio

Chemistry and Biochemistry

My main research studied the mechanisms of biosynthesis, transport, and distribution of

coenzyme Q (CoQ). CoQ is an essential lipid in respiration and an important antioxidant in our cells. CoQ deficiencies are frequent in aging and in age-related diseases, but can also occur as a result of genetic mutations and/or medical treatments. Currently, the only treatment available is CoQ supplementation but supplements are usually quite inefficient. In order to make CoQ a more effective therapeutic tool, it is crucial to define the mechanisms responsible for its uptake and distribution, which currently remain elusive. My research used baker's yeast as a model organism. Unlike mammalian cells, yeast lacking CoQ (known as coq mutants) can grow by fermentation on glucose without the involvement of respiration. However, coq mutants are unable to grow on non-fermentable carbon sources unless they are supplemented with exogenous CoQ, thereby restoring mitochondrial respiration. Analyzing the ability of CoQ-less mutants to recover their growth in non-fermentable medium when supplemented with CoQ, I discovered that the accumulation of CoQ biosynthetic intermediates impaired the assimilation of exogenous CoQ and prevented the restoration of respiration. Moreover, a screen of 40 gene deletions considered to be candidates to prevent exogenous CoQ from rescuing growth of the CoQ-less *coq2Δ* mutant, identified six novel genes as necessary for efficient trafficking of CoQ to mitochondria. The proteins encoded by these genes represent essential steps in the pathways responsible for transport of exogenously supplied CoQ to its functional sites in the cell, and associate CoQ distribution with endocytosis and intracellular vesicular trafficking pathways conserved from yeast to human cells. In addition, several scientific collaborations allowed me to explore additional aspects of CoQ metabolism. Among others, I participated in: (1) the description of the Endoplasmic Reticulum-Mitochondria Encounter Structure (ERMES) complex as a necessary structure for coordination of CoQ biosynthesis in yeast; (2) the confirmation of the existence of a conserved pathway between plants and mammalian cells for the use of the dietary polyphenol kaempferol in CoQ biosynthesis; and (3) the discovery of n-3 polyunsaturated fatty acids as regulators of CoQ content and biosynthesis in mammalian systems.

Research Mentor: Catherine Clarke, Chemistry and Biochemistry

Adrian Flores

Comparative Literature

Since beginning his UC President's Postdoctoral Fellowship in July 2020, Adrián Flores has begun revising his Ph.D. dissertation, *What Is Suicide? Entanglements of Philosophy and Literature in the "Afterlife of Slavery,"* into a book manuscript. This project surveys modern philosophical, literary, and psychiatric discourses to excavate the antiblack racial logics in the study of suicide causation and prevention. In October 2020, he published an article drawing from this research, "Antiphilosophy in Toni Morrison's *Song of Solomon*: Is Black Suicide Possible?" in *The Comparatist*. It examines how Black suicide figures in the racial iconography of the Western and African American literary tradition. In December, he submitted "Breathing in Blackness," which explores the relation between the philosophy of *pneuma* (breath) and the concept of "negrophobia," for a special issue of *Qui Parle*. Currently, he is working on an article for *Aztlán: A Journal of Chicano Studies* that examines the construction of the Latinx immigrant subject as an icon of social responsibility, demonstrating how this moral conception pivots on antiblack fantasies of achieving freedom from racial denigration. Reflecting his commitment to antiracist scholarship, Flores established the "Afropessimist Reading Group at UCLA" in September 2020, which reads Black feminist thought to explore the relationship between antiblackness and critical theory. Over 20 professors and graduate students from across

the humanities and social sciences are involved. As the co-chair of the Critical Feminist & Queer Studies Working Group of the Cultural Studies Association, Flores recently organized a panel of emergent scholars to examine “Black suicide” as a philosophical question about social death rather than an experiential problem of pathology. In May 2021, he will present an invited lecture at the Experimental Critical Theory Institute (UCLA) on new research examining how Black psychiatrists in the 1960s and 1970s reconstituted suicide as a political category—as a form of “self-lynching”—that interrogates the notion of agency, troubles the narrative of a post-Civil Rights era and disrupts the moral coherence of the “suicidological imagination.” He plans to submit this latest research for publication to the African American Review in the spring.

Research Mentor: Eleanor Kaufman, Comparative Literature and English

David Gonzalez

Medical – Cardiology

Air pollution is a leading health hazard, responsible for millions of global deaths annually, mostly due to cardiovascular disease. Exacerbated cardiovascular burden from air pollution is expected in the future due to climate change. However, the precise mechanisms underlying air pollution-induced cardiovascular disease are poorly understood, impeding development of therapeutics. The strongest linked component to cardiovascular disease is particulate matter (PM). Thus, there is an urgent need to understand how PM contributes to the burden of cardiovascular disease, especially atherosclerosis, an inflammatory disease characterized by narrowing of arteries by plaque deposition. Dr. Gonzalez is an atmospheric chemist who has made promising contributions to fundamental knowledge on the reactive oxygen species chemistry under physiologically relevant conditions. His postdoctoral work seeks to understand the relationship between particle composition and inflammation in PM-induced cardiovascular diseases. Dr. Gonzalez investigates a novel pathway which hypothesizes that PM disrupts pulmonary Fe metabolism resulting in systemic inflammation. During his first year, he received an NIH Supplement to Promote Diversity tied to a R01 grant. The supplement proposes to assess pulmonary and intestinal changes in Fe homeostasis and their relationship to atherosclerosis models exposed to PM. Despite having zero experience with animals, Dr. Gonzalez quickly learned fundamental techniques, colony management, and planned inhalation exposure experiments. In his PhD, Dr. Gonzalez optimized a probe for specific detection of .OH radicals, a species involved in oxidative stress. Published measurements cellular OH generation are uncertain and relied on non-specific .OH assays. Dr. Gonzalez applied this .OH probe to cell cultures exposed to PM. Preliminary results indicate .OH generation in murine macrophages exposed to PM. Dr. Gonzalez confirmed this would be a novel finding. Dr. Gonzalez continued graduate school collaboration with Dr. Andrew Ghio has given him access to pulmonary expertise for his postdoctoral work. Using this collaboration, he characterized the iron status of novel mice models deficient in myeloid oxygenase -1 (mHO1-/-) developed by Dr. Araujo. mHO1-/- mice exhibit iron overload in liver and spleen compared to controls. These animals will be used as models of iron overload pertinent to investigate the Fe homeostasis pathway for PM health effects.

Research Mentor: Jesus Araujo, Medical – Cardiology

Erica Grodin

Background: Alcohol use disorder (AUD) is a chronic relapsing disease with a major public health impact. The development of efficacious medications for AUD is a crucial research priority. To that end, modulation of neuroimmune function is a promising AUD treatment target. Chronic alcohol consumption induces a proinflammatory state, such that individuals with AUD have increased neuroinflammation. Ibudilast, a neuroimmune modulator which selectively inhibits phosphodiesterases (PDE) -3, 4, 10, and 11, and macrophage migration inhibitory factor, shows promise as a novel pharmacotherapy for alcohol use disorder (AUD). However, the mechanisms of action underlying ibudilast's effects on the human brain remain largely unknown. Thus, the current study examined the efficacy of ibudilast to improve drinking outcomes and attenuate neural reward signals in individuals with AUD. Methods: Fifty-two non-treatment-seeking individuals with AUD were randomized to receive ibudilast (n=24) or placebo (n=28). Participants completed a two-week daily diary study during which they filled out daily reports of their past day drinking, mood, and craving. Participants also completed an fMRI alcohol cue-reactivity paradigm half-way through the study. Results: Ibudilast, relative to placebo, reduced the odds of heavy drinking across time by 45% (OR=0.55, (95% CI: 0.30, 0.98)). Ibudilast also attenuated alcohol cue-elicited activation in the ventral striatum compared to placebo ($F(1,44)=7.36$, $p=0.01$). Alcohol cue-elicited activation in the ventral striatum predicted subsequent drinking in the ibudilast group ($F(1,44)=6.39$, $p=0.02$), such that individuals who had attenuated ventral striatal activation and took ibudilast had the fewest number of drinks per drinking day in the week following the scan. Discussion: These findings extend preclinical and human laboratory studies of the utility of ibudilast to treat AUD and suggest a biobehavioral mechanism through which ibudilast acts, namely, by reducing the rewarding response to alcohol cues in the brain leading to a reduction in heavy drinking. These findings also provide novel insights into the role of neuroimmune modulation in AUD, including its effects on neural and behavioral outcomes of high clinical significance.

Research Mentors: Lara Ray, Psychology

Rongfeng Hu

Biological Chemistry

Social interactions involve some of the most complex decisions that animals must make on a day-to-day basis in order to secure their survival, reproductive success, and overall well-being. A remarkable feature of social behavior is the extraordinary sex differences between females and males that are universally present across species. Sex differences have been shown to exist at multiple levels in the brain, including gene expression and circuit function, yet the representation and causal role of these differences in the brain remains poorly understood. Using cell-type specific functional manipulations, we discover that a specific brain area, the medial amygdala, plays a sexually dimorphic role in parental behavior. By measuring sexually dimorphic gene expressions at the single-cell transcriptomic level, we find that the medial amygdala displays molecular sex differences that may underlie behavioral sex differences. Our results provide important insight into the connection between sex differences across transcriptomes, cells, and circuits in regulating sexually dimorphic behavior. Another key factor that promotes sociality is social reward, which is a rewarding experience associated with general social interaction that provides positive reinforcement. Characteristic abnormalities in reward processing, such as those seen in autism spectrum disorders, depression, and schizophrenia, likely represent inappropriate integration of such information. We develop an automated

operant conditioning system to measure social reward in mice and find that adult mice of both sexes display robust reinforcement of social interaction. Moreover, we find that the medial amygdala mediates social reward through their projections to the medial preoptic area in the hypothalamus and promotes dopamine release in the nucleus accumbens. Finally, activation of this circuit can robustly overcome behavior associated with aversive experiences. Together, these findings establish the medial amygdala as a key node for regulating social reward in both sexes. Collectively, the work summarized here provides new insight into the molecular and circuit basis of social behavior. More importantly, they lay the groundwork for more incisive investigation of the social brain, which can help reveal a richer and deeper understanding of how we and other social animals navigate the social world and how it, in turn, shapes us.

Research Mentor: Weizhie Hong, Biological Chemistry and Neurobiology

Justin Langerman

Biological Chemistry

The paucity of insights into the molecular mechanisms underlying cell-fate transitions remains a critical impediment to realizing the next generation of therapeutic technologies and for the construction of new disease models and cell replacement strategies. In my postdoctoral work, I developed and applied single cell RNA-sequencing technologies and computational approaches to gain crucial insights into previously intractable cell fate transitions and to define cell states during development, reprogramming, and in disease states. My work produced innovation in three areas. First, I defined the critical gene expression cascades that mediate the reprogramming of somatic cells to iPSCs and linked them to the cooperative action of transcription factors. For example, I uncovered a transient gene expression program in reprogramming intermediates that determines the efficiency of the conversion. The impact of this work is underscored by the universality of the uncovered mechanisms, as they apply to iPSC reprogramming processes from different starting cell types. Second, in collaborative projects, I developed single cell RNA-sequencing approaches to understand the maturation of muscle cells and neurons during fetal development and adulthood. We defined new developmental decisions points, showed that cycling neural progenitors in the fetal brain express genes from multiple neural lineages before commitment, and uncovered that specific transcription factors are induced only at the late stages of muscle development. Notably, immature muscle cells created from pluripotent cells lack these factors, providing an avenue for improving the differentiation of cells from pluripotency stem cells. Third, in an inter-institutional collaboration, we have constructed a human atlas of the molecular changes that occur in the human airway epithelium in response to cystic fibrosis. Responding to the recent pandemic, we leveraged this knowledge to investigate the molecular basis of cigarette smoker vulnerability to SARS-Cov2 virus. This work revealed unexpectedly that smoking reduces the interferon response of lung cells, leading to higher infection rates, and identified a potential therapeutic treatment. Overall, I have used my knowledge of molecular biology techniques and computational methods to generate cutting edge approaches to define cell fate transitions, which has made me a widely sought after collaborator at UCLA during my postdoc tenure.

Research Mentor: Kathrin Plath, Biological Chemistry

Anne Le Goff

Institute of Society and Genetics

Anne Le Goff is a philosopher who has spent her postdoctoral appointment at UCLA embedded in a laboratory investigating epigenetics and stem cell science. She has uniquely combined the insights of philosophy with empirical social science methods of ethnography and interviewing to really understand the emerging science of environmental epigenetics –the study of how toxic exposure, stress, and diet impacts gene regulation and therefore development and health of humans and other animals. She observed and analyzed how scientists are looking at the effect of toxicants on germ cells, and the question of the transgenerational transmission of the effects of exposure via epigenetic marks that persist through generations of individuals. This is obviously a topic of enormous public concern, as it so directly affects human reproductive futures. During her postdoctoral training, she developed a strong portfolio of publications analyzing the concepts of epigenetic science, looking at the ethical and social implications of toxicology’s turn toward using epigenetic outcomes, and thinking about society’s responsibility to future humans in light of the demonstrated impact of man-made chemicals and pollutants on the human germ line and developing fetus and child. Indeed, Dr. Le Goff is now positioned to become a leading bioethicist specializing in issues of germ cells and the germline. Recent advances in transgenerational epigenetics, germ cell biology, and toxicology have unveiled the plasticity of germ cells and their vulnerability to environmental insults. In parallel, germ cells and the germline have become a crucial site of potential intervention with heritable human genome editing and in vitro gameteogenesis. Despite major public health and ethical implications, germ cells remain understudied and overlooked in the regulation of toxicants, while discussions of germline intervention remain separate. Her work brings together the discussion of our intentional and non-intentional interventions in the germ line in order to draw new attention to germ cells and their intergenerational role. She is a uniquely interdisciplinary scholar who will help society navigate novel biotechnologies and think through the social impacts of scientific developments.

Research Mentor: Hannah Landecker, Institute of Society and Genetics and Sociology/Patrick Allard, Institute of Society and Genetics

Mona Moieni

Psychology

Mona has established herself as a productive, interdisciplinary researcher in the fields of social and health psychology, psychoneuroimmunology, and affective science. Her programmatic line of work investigates how psychosocial processes and inflammation—a physiological process implicated in many physical and mental health conditions—interact and influence each other. During her postdoctoral appointment, Mona built on her earlier work examining how experimentally increasing inflammation in humans can lead to social and emotional changes, as well as how there may be sex differences in these effects. As a postdoc, Mona found that in response to experimentally heightened inflammation, females (but not males) show decreased reward-related neural activity, and males (but not females) report lower social status. Her work has highlighted the need to examine nuanced sex differences in how inflammation can impact social responses, which may have important implications for understanding sex disparities in emotional and inflammatory disorders. Simultaneously, Mona has built upon her

predoctoral work by studying the other side of this bi-directional relationship, investigating how interventions that alter feelings of social connection may impact inflammation. This line of work included developing an innovative, low-cost intervention to improve the well-being of older adults by increasing feelings of generativity, or feeling that one is connected and contributing to others, especially younger generations. Her study found that the generativity intervention led to improvements in social, mental, and physical well-being, as well as decreased inflammatory biology; it was also the first study to examine the effects of generativity on inflammation. She is currently re-submitting an ROI proposal to NIA to build on this study by running a larger, well-powered version of the intervention and examining neurocognitive mechanisms underlying benefits of the intervention. This will be the first study to examine neural underpinnings of generativity and will also further pave the way for this accessible intervention to be implemented on a larger scale, which may ultimately have large public health impacts. Altogether, Mona's remarkably productive postdoctoral career has continued her line of innovative, interdisciplinary work investigating how social and inflammatory processes interact, as well as how these relationships are relevant to health, sex, and age.

Research Mentor: Naomi Eisenberger, Psychology

Erica Pandolfi

Molecular Cell and Developmental Biology

During Erica's postdoctoral research tenure, she has been committed to developing methods of infertility treatment using stem cells. Infertility currently affects ~13% of all couples and brings with it great emotional and psychological distress. With a focus on women's health, Erica is investigating her ability to restore fertility to women with primary ovarian insufficiency (POI), a disease of accelerated menopause. Her research goal is to restore fertility to women with POI by using stem cells to regenerate oocytes. Using human induced pluripotent stem cells (hiPSCs), she is pioneering technology that would allow an oocyte or sperm to be generated from a simple skin cell, regardless of the donor's sex, age, or reproductive health. Erica's research is performed in collaboration with the Infertility Center of St Louis, where a cohort of women with POI have been consented to participate in this study through donation of a skin biopsy. Using this tissue, Erica has executed a project to reprogram the donated somatic cells to hiPSCs, thereby overcoming the existing epigenetic barrier that prevented the infertile women from creating oocytes. To overcome this epigenetic barrier in oocyte formation, she has reprogrammed skin tissue from women into hiPSCs lines. These hiPSC lines have each been determined to conform to established pluripotency and self-renewal standards, and are published as resources in Stem Cell Research to make them broadly available to the scientific community. Erica's next goal within the scope of this work was to differentiate the hiPSCs into germline cells. Germline cells are a cell type that eventually becomes sperm and oocytes. Erica has demonstrated her ability to create germ cells from these infertile women, an incredibly exciting feat given that these women are hypothesized as being infertile due to a lack of germ cell formation during development. Her current work investigates further development of germ-cells into oocytes through combination with somatic ovarian cells also generated from hiPSCs. These investigations provide novel research that could lead to methods of eventual fertility restoration. This method of infertility treatment would benefit not only those who are incapable of generating their own gametes, individuals in the LGBTQ+ community.

Research Mentors: Amander Clark, Molecular Cell and Developmental Biology

Huan Peng

Chemical and Biomolecular Engineering

The rapid rise of antibiotic resistance among bacterial pathogens has spurred an interest in alternative antibacterial strategies. Bacteriophages (phages) are viruses that target and infect bacterial species. Dr. Peng's research focuses on harnessing phages for treatment of bacterial infections of wounds, and for low-cost, ultrasensitive bacterial detection. Dr. Peng developed phage-nanorod conjugates that can selectively target and kill specific bacterial cells. The phages attach tightly to the targeted bacterial species, and excitation of the gold nanorods by near-infrared light stimulates highly localized release of thermal energy. The resulting heating kills the attached bacterial cells without harming other cells, such as mammalian tissue. *Pseudomonas aeruginosa* is an important bacterial pathogen on the CDC's list of serious antibiotic resistant threats. In a proof-of-concept project, phage-nanorods targeting *P. aeruginosa* effectively eradicated the bacterial biofilm while causing minimal damage to underlying mammalian cells. Light exposure also destroyed the phages, thus mitigating the biosafety concerns and enabling control over dosing. Dr. Peng's current experiments test the phage-nanorods for treating infected wounds in a mouse model. Preliminary results indicate that phage-nanorod treatment is effective, and even leads to faster wound healing compared with the standard-of-care, systemic antibiotics. Thus, phage-nanorods are a promising treatment for antibiotic-resistant bacterial infections. Dr. Peng also developed a related method for colorimetric detection of pathogenic bacteria in under 30 minutes, at a reagent cost of <\$1.50 per test. This technology combines the robust binding of phage to bacteria with the optical properties of gold nanoparticles, and can be readily adapted to target different pathogens (including human pathogens *Escherichia coli*, *Pseudomonas aeruginosa* and *Vibrio cholerae*, and the plant pathogen *Xanthomonas campestris*). The assays work in complex biological samples, such as serum, with high sensitivity and little cross-reactivity, and can be used to rapidly determine the antibiotic susceptibility profile of a bacterial strain. This method is significantly faster than the standard clinical test (culture and sensitivity). In another research direction, Dr. Peng also studies catalytic RNA encapsulated in lipid vesicles, to probe the biophysical nature of RNA-lipid interactions for building simple artificial cells.

Research Mentors: Irene Chan, Chemical and Biomolecular Engineering

Dale Prentice

Civil and Environmental Engineering

Development of thermodynamic models and databases have been the focus of my research here at UCLA. Through the development of thermodynamic simulations and practices, it is possible to gain a better understanding of solid-liquid interactions. This can be important in developing and improving low-CO₂ blended and alternative cementitious systems and optimized mixture designs for brine encapsulation. These cement alternatives have the potential of relieving some of the impact of Portland cement production which contributes 9% of the global anthropogenic CO₂ emissions released each year. Alongside reducing CO₂ emissions, these materials along with other blended cement systems may aid with waste-water brine encapsulation. At the beginning of my placement I developed new thermodynamic models for Mg-Al-[CO₃-

,SO4²⁻,OH⁻] phases which are vital to the development of slag-blended cements or alkali-activated slag systems. These models can also be used with tackling solid (fly ash) and liquid waste streams (highly concentrated brine) as by-products from the coal combustion process. It was integral to understand and predict how these waste-streams interact so that with the use of additives, an effective means of encapsulation can be formed that successfully retains contaminant. This understanding of concentrated brine systems led to the formation of a brine encapsulation toolkit which will be available to members of industry. With this, understanding of waste management can be easily disseminated to a wider audience which was a key component of another project which developed the zeo19 database. This database was developed to improve thermodynamic simulations of zeolite formation, with the emphasis of reducing failures in nuclear waste glasses as zeolite precipitation accelerates glass corrosion. This is extremely important for identifying which glass compositions are more likely to form these secondary phases. These phases would damage and crack the glass leading to the release of radionuclides. In summary, my work is conscious of mitigating the detrimental effects of humans and aims to address these concerns. It is my intention to maintain this vision of my research and in the future, I plan to focus on CO₂utilization technologies which also take advantage of solid waste streams.

Research Mentor: Gaurav Sant, Institute of Carbon Management/Civil and Environmental Engineering

Alexa Sadier

Ecology and Evolutionary Biology

Understanding the rules that underlie evolution is a long-standing goal in biology. In the past 30 years, progress in genomics, development, modeling, and paleontology has hinted at the existence of evolutionary rules in the generation of animal form. However, because this research has mainly been done on model species such as mouse, flies or emerging models, we still do not have a comprehensive understanding of the mechanisms by which these rules have shaped the incredible diversity of animal that characterize the history of life on earth. To fill this gap, I use the evolutionary adaptations of an ecologically and taxonomically hyperdiverse group, bats, as a natural experiment to investigate the ecological and developmental foundations of the evolution of animal form. During my postdoc, I investigated the evolution of color vision in bats. Before my study, bat color vision was poorly understood despite its importance to the group's success in diverse environmental conditions. I produced an unprecedented dataset incorporating data from the genetics, proteins, and ecology of dozens of bat species. I showed that UV vision has been gained and lost several times in bats by many distinct mechanisms. I further found an association between UV vision and diet. This work provides a text-book example of how traits are gained and lost during the adaptation of species to new environments. In parallel, I developed my own, independent, axis of research in which I am searching for the developmental rules that control the evolution of structures that are repeated in the body, using the incredible variation of bat teeth as a model system. Building on my PhD and postdoc research, I integrated experimental and computational approaches to build a model that explains how developmental processes control the diversity of tooth number and size. Using this system, I am currently investigating how these processes both constrain and facilitate the evolution of form, focusing on the inherent properties of the gene network that controls molar formation. By mixing evolution, ecology and developmental biology, my postdoctoral research has provided critical insights into the rules shaping the evolution of animal form

and extended the evolutionary synthesis.

Research Mentor: Karen Sears, Ecology and Evolutionary Biology

Sandro Satta

Medicine

Dr. Satta was recruited to UCLA following his PhD training in the UK. His diverse training in virology, mechanobiology, and biotechnology has allowed for his seamless transition to pursue research in developing therapeutic targets amidst the COVID-19 pandemic. In collaboration with a cadre of faculty in our UCLA ecosystem, he has developed a rapid-COVID-19-on-a-chip platform to screen the genomic sequences of Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) responsible for over 2million deaths and 107 million infections worldwide. This multi-array microfluidic platform holds promise to identify patient-specific complications from the overwhelming inflammation (cytokine storm) and microvascular thrombosis (blood clots) that afflict more than 30% of critically ill COVID-19 patients. The virus targets the respiratory tract epithelium and enters the host cells by binding to the angiotensin converting enzyme 2(ACE2) surface proteins. Once internalized, the virus completes its cycle by replicating and continuing to infect other cells in the host. To inhibit the viral internalization, Dr. Satta has developed liposome-nanoparticles linked to SARS-CoV-2 spike proteins to elucidate the interaction with the host receptors ACE2. This novel platform was selected as one among 12 US institutions among 750 applications by the American Heart Association Rapid COVID-19 Response in April 2020. In collaboration with Neurology and Bioengineering Departments (Song Li), the productivity of this award has culminated in aco-first author paper in Stroke and a UCLA provisional patent application. Dr. Satta also generated lipid-nanoparticles enriched with humanACE2, which has demonstrated a strong inhibitory effect both in-vitro and in-vivo against SARS-CoV-2 internalization in both Human macrophages and transgenic mouse models in collaboration with Dr. Zhou (UCR). In response to the current spike mutations in UK and viral variants in South Africa, he has further demonstrated the genomic sequences of open reading frames (ORFs) ofSARS-CoV-2 that are responsible in triggering the host inflammation and thrombosis. Overall, Dr. Satta is innovative and productive. He has forged collaborations with researchers from both UCLA and UCR to further investigate SARS-CoV-2 infection underlying cardiac conduction and contractile dysfunction; thus, providing a translational basis to quell complications from COVID-19 infection in our high-risk populations.

Research Mentors: Tzung Hsiai, Medicine/Song Li & Changcheng Zhou, Bioengineering and Biomedical Sciences

Matthias Stangl

Psychiatry and Biobehavioral Sciences

Spatial navigation is a fundamental behavior in both humans and animals, with deficits in navigational functions among the hallmark symptoms of severe neurological disorders such as Alzheimer’s disease. Understanding how the human brain supports our ability to keep track of where we are, and how we form a cognitive (mental) map of our environment, is thus of critical importance for the development of therapies for patients who are impaired in these functions. Matthias Stangl, UCLA postdoctoral scholar, has made numerous highly impactful scientific discoveries that elucidate the neural mechanisms underlying spatial navigation abilities, and how they may be altered during normal and pathological aging. His work has identified a maladaptive noise signal in the brain that accumulates during navigation, and demonstrates that this noise is a major cause of error that can corrupt computations of location in the aging brain. Most

recently, as a postdoctoral scholar, he has made a groundbreaking discovery showing an eural mechanism in the human brain that keeps track of other people during social experiences, which received enthusiastic reactions from the scientific community and larger media. In addition to his scientific contributions, he has developed novel software tools to perform complex analyses of spatial representations in neuroimaging data, and shared the details of his technologies via open source publications, which has already led to several high-impact publications by other research groups around the world that use these developed methodologies. His ability to collaborate and support studies beyond his own have led to co-author publications that benefit the entire field, such as the development of a novel platform for deep brain recording and stimulation in humans who have implanted brain electrodes. Moreover, he has established collaborations with the National Aeronautics and Space Administration (NASA) and the European Space Agency (ESA), and serves as a co-investigator on prestigious projects to characterize neurocognitive consequences of space flight in astronauts, and to identify the neurobehavioral risks associated with future exploratory space missions and their mitigation. His work thus far is truly innovative and has opened an entirely new area of scientific investigation in the field of human cognitive neuroscience.

Research Mentor: Nanthia Suthana, Psychiatry and Biobehavioral Sciences

Liming Tan

Neurobiology

The central goal of Liming's research is to uncover the molecular, cellular and circuit mechanisms through which experience regulates the assembly and plasticity of neural circuitry. In his early postdoctoral study, using *Drosophila* as a model for genetically hard-wired circuit assembly, he demonstrated that two interacting families of cell surface proteins, Dprs and DIPs, are novel molecular determinants for the assembly of neural circuits in different layers in the fly visual system, via a series of sophisticated genetic loss- and gain-of-function studies. This work and studies through his collaborations with other labs, firmly established that Dpr/DIP protein families act as molecular labels to instruct circuit assembly throughout the *Drosophila* nervous system. Liming then transitioned to study mechanisms by which experiences shape the structure and function of higher-order cortical circuitry, whose functions emerge and mature through learning in early postnatal life. It is generally accepted that higher-order circuitry is established coarsely by hard-wired mechanisms, and then gradually refined by postnatal experience. By contrast, he discovered that higher-order circuitry is profoundly restructured rather than refined by experience. He showed this using binocular circuitry in the mouse primary visual cortex (V1), a classic model for studying experience-dependent cortical plasticity. By longitudinally tracking functional properties of thousands of individual neurons in juvenile mice, he found that early binocular circuitry is largely dismantled, and visual experience builds a new and better one. He found that V1 comprises a hard-wired circuit laid down by the contralateral eye, and a plastic circuit driven by the ipsilateral eye. Visual experience progressively improves the plastic, ipsilateral circuit and integrates the best of it into the hardwired, contralateral circuit on a rolling basis. This selective integration fundamentally alters the structure and function of the higher-order, binocular circuitry in V1. In parallel to functional studies, Liming collaborated with Sarah Cheng, a graduate student, on single-cell RNA-seq, and identified hard-wired and experience-dependent cell types in V1 (manuscript in preparation). He is working on integrating functional imaging, circuit tracing, and spatial transcriptomics in to a comprehensive understanding of how genetics and experiences interact to establish

functional higher-order cortical circuitry.

Research Mentor: Joshua Trachtenberg, Neurobiology

Christina Termini

Orthopedic Surgery

Dr. Termini's postdoctoral research has focused on understanding the basic mechanisms that regulate adult blood stem cells, also known as hematopoietic stem cells (HSCs). HSC transplants are used in the curative treatment of tens of thousands of patients with immune disorders, leukemias, bone marrow failure diseases and solid tumors annually. As such, Dr. Termini's research findings are highly significant in the realm of regenerative medicine. Dr. Termini has taken a bold approach to address her research question by studying a class of molecules largely neglected in her field primarily due to the difficulty associated with studying their function. In doing so, she discovered and carefully investigated a novel population of HSCs with remarkable regenerative properties. Using highly sensitive and technically challenging stem cell transplantation assays, Dr. Termini demonstrated Syndecan-2 expressing HSCs outperform well-established HSC populations, providing compelling evidence challenging the current paradigm in the field regarding the molecular characteristics of HSCs. Using RNA sequence analysis, she demonstrated the population of HSCs she discovered expresses unique genetic signatures compared to conventionally identified HSCs. She then used a lentiviral knockdown approach to analyze how Syndecan-2 regulates HSC function, demonstrating Syndecan-2 regulates HSC maintenance and self-renewal in vivo through alterations in cell proliferation. As Dr. Termini is a multidisciplinary researcher, she next employed an imaginative approach using super-resolution microscopy to visualize how Syndecan-2 regulates hematopoietic cells with nanoscale precision. She has designed a novel protocol to immobilize HSCs for their visualization using Stimulated Triggered Emission Depletion microscopy. This inventive approach has allowed her to apply quantitative algorithms to demonstrate how Syndecan-2 supports molecular-scale receptor organization to sustain favorable hematopoietic signaling, clarifying processes previously indiscernible by conventional microscopy techniques. In summary, Dr. Termini has discovered a novel population of HSCs and identified a new role for Syndecan-2 in stem cell maintenance, which is a significant conceptual advance in the fields of hematopoiesis, stem cell biology and glycobiology and has potential therapeutic applications for regenerative medicine and cancer therapeutics. Her work has the potential to make bone marrow transplants more efficient and ultimately, accelerate patient recovery and improve outcomes.

Research Mentors: Karen Lyons, Orthopedic Surgery

Davis Yuri Torrejon Castro

Medicine

Anti-PD-1/PD-L1 antibodies are changing the landscape of cancer therapy. It restores antitumor immune responses, stimulating T cells to attack cancer cells in many types of cancer. However, a major challenge with this approach is resistance to therapy. Dr. Torrejon made relevant key contributions in this area. First, Dr. Torrejon discovered how to overcome resistance to cancer immunotherapy by modeling disruptions in genes involved in the interferon-gamma receptor and antigen presentation pathways. He

developed previously unknown mechanisms in the biology of tumor cell resistance; in particular, how JAK1, JAK2 and B2M gene disruptions led to resistance to immunotherapy. He utilized CRISPR/Cas9 genome editing and he originally created these genetic acquired resistant models of human melanoma and mouse cell lines. This allowed for the design of combination therapies to overcome genetic immunotherapy resistance. This work has significant clinical implications for cancer immunotherapy. In fact, Dr. Torrejon's combinatorial therapies are using in clinical trials for patients who did not respond to anti-PD-1 therapy. Second, Dr. Torrejon was instrumental in demonstrating that genetic and pharmacological inhibition of the oncogene PAK4 overcomes resistance to anti-PD-1 therapy in preclinical models, thereby providing a novel therapeutic target in aggressive types of cancer. High PAK4 expression was correlated with low T cell and dendritic cell infiltration and lack of response to anti-PD-1 therapy, which was shown to be reversed with PAK4 inhibition. The results from this study shed light into a new mechanism of resistance to checkpoint blockade therapy, and more notably, offered a novel treatment strategy to increase the percentage of patients that respond to immunotherapies. Third, Dr. Torrejon has made many important collaborations. His preclinical models were key to guide other innovative combinations like BO-112 (TLR3 agonist) to target JAK1 resistance. And he developed mouse models to understand the WNT signaling and the role of CD4 T cells in the response to anti-PD-1 therapies. In sum, Dr. Torrejon has made original and profound contributions to Cancer

Research Mentor: Antonio Ribas, Medicine

Aneta Turlik

Chemistry

Aneta Turlik has applied computational methods to solve problems in synthetic chemistry, and to guide experimental advances. Her work has led to the understanding of chemistry done by groups all over the world. She is becoming a world leader in the theoretical investigation of chemical reactions used in organic synthesis. Dr. Turlik's PhD is in experimental synthetic chemistry, but at UCLA she has become an expert in using quantum mechanics to model and understand how reactions occur and why they produce particular products. She has successfully analyzed a variety of reaction mechanisms—the details of how the reactions work – and has predicted new and more effective catalysts. Experimental chemists often develop chemical reactions by trial and error, empirically screening large sets of conditions to achieve efficient transformations. Experimental groups in the United States, France, Ireland, China, and Japan challenged the Houk group with data they did not understand: “here are our results, but we have no idea why the reactions happen this way; can you help us?” Aneta harnessed the tools of quantum mechanics and the vast computational resources available at UCLA and through NSF Supercomputers to model reactions and analyze why specific reactions occur. In each case, she figured out the mechanism of the reaction and why certain stereoisomers (specific 3D arrangements of the atoms) form. These reactions include organometallic catalysis of C–C bond formation, organocatalytic C–C bond formation, and enzyme-catalyzed cycloadditions. Her brilliance and remarkable versatility are demonstrated by her mastery of the three major classes of catalysts used by synthetic chemists. Through these projects, she is elucidating mechanistic insights that are not possible to determine by synthetic means, and is using those insights to predict more selective and more powerful catalysts. Five papers in major chemistry journals on these projects have already been published or submitted, with 4 others in progress, and she also solved a major structural problem for our medical school colleagues, published in a collaborative paper. While becoming the leading postdoctoral fellow in Houk's large group of 30 coworkers, she has also taken on mentorship of younger graduate students and undergraduates.

Research Mentors: Kendall Houk, Chemistry

Daniel Velez- Ramirez

Microbiology, Immunology and Molecular Genetics

Dr. Velez-Ramirez has obtained one of the most detailed proteomes of the eukaryotic flagellum and flagellum subdomains currently available. Moreover, he has done this in African trypanosomes, pathogens of importance to global public health. This accomplishment was made possible by his pioneering work to establish cutting-edge technologies for proximity proteomics in trypanosomes. Dr. Velez-Ramirez' work identified proteins of flagellum tip and the axoneme, the functional and structural core of the eukaryotic flagellum, including several proteins unique to trypanosomes. These parasite- specific proteins may explain unique motility of trypanosomes and present novel drug targets. His findings also provide evidence to support the emerging concept that, beyond its function in cell motility, the trypanosome flagellum is a platform for cAMP signaling. cAMP is an important molecule inside cells that converts external signals to internal cellular responses. Thus, cAMP signaling allows cells to sense the environment

and adapt to changing conditions. Working with *Trypanosoma brucei*, the causative agent of sleeping sickness in humans, and leveraging his expertise in proteomics, Dr. Velez-Ramirez next developed a platform to demonstrate cAMP- dependent changes in the flagellar phosphoproteome. Phosphorylation is a mechanisms of action for cAMP signaling in mammals, but it was not known previously if this was true for trypanosomes. His results illuminate a new way in which *T. brucei* adapts to its environment and may ultimately lead to the development of better drugs to treat sleeping sickness. As a molecular parasitologist with over a decade of experience working with trypanosomes, Dr. Velez- Ramirez has now initiated studies with *Trypanosoma cruzi*, the American trypanosome and causative of Chagas disease. *T. cruzi* infection causes enlargement of the heart, esophagus and colon, being congestive heart failure the main cause of death. Chagas disease is disseminated throughout the American continent and it is increasingly prevalent in the US. Dr. Velez-Ramirez is studying the role of cAMP in the *T. cruzi* infection cycle, in which the parasite invades a host cell, differentiates, multiplies, and bursts out to infect more cells. His findings will provide a better understanding of the mechanisms underlying the pathology of Chagas disease in humans.

Research Mentor: Kent Hill, Microbiology, Immunology and Molecular Genetics

Zhong Wan

Chemistry and Biochemistry

Dr. Zhong Wan primarily focuses on the development and investigation of high-quality heterojunctions with various materials and dimensionalities, and the exploration of the unique transport properties of these novel material platforms. Despite considerable potential of these novel two dimensional (2D) and three dimensional (3D) materials, the fundamental understanding of their charge transport properties are generally lagging behind, largely due to the difficulties of finding a stable material platform, the complicated fabrication process, and forming good electrical contacts to these materials. To this end, Zhong has developed several unique methods using van der Waals (vdW) integration approach, where atomically flat interfaces can be achieved between 2D/2D, 2D/3D, 3D/3D systems through vdW bonding, and can be extended to multiple layers forming super lattice structures. The resulting high quality interface have been demonstrated through different prospects, including electrical transport studies, magneto-optical studies, and structural analyses. His studies have led to the discovery of several new quantum material platforms, and defined general pathways to overcome the materials degrading problems during the integration, and achieve high-order vdW superlattices with various material compositions and dimensions for creating highly engineered superlattice structures with unique topography. His research thus allows to tailor the interlayer coupling, dimensionality, chirality as well as the topology of the resulting heterostructure and superlattices, and opens up brand new opportunities for both the fundamental studies and quantum technologies and generate broad excitements among diverse scientific community including materials science, physics, chemistry, and electrical engineering.

Research Mentor: Xiangfeng Duan, chemistry and biochemistry

Chenxi Wang

Computer Science

My research focuses on next-generation cloud systems. As all enterprises embrace the cloud, there is a pressing need to develop systems that make the cloud (1) more powerful (e.g., scale to many concurrent users and efficiently execute their jobs) and (2) more accessible to domain users (e.g., materials/biology researchers who need large resources to discover new materials/drugs). My work, at the high level, develops such systems. In particular, my research is motivated by a recent trend: heterogeneous hardware (e.g., GPUs, TPUs, non-volatile memory, etc.) comes at an unprecedented speed and cloud providers a rein constant need of incorporating new hardware into platforms. Adopting new hardware requires support from software systems to make the hardware available, performant, and easy to use. My work delivers such support. For example, my work built a performant system for non-volatile memory (NVM), a special type of memory that provides persistency, low energy, and large capacity compared with traditional memory (DRAM). However, accessing NVM incurs a much longer latency. I designed a system for a hybrid-memory setting where the system automatically identifies hot/cold data and migrates them between NVM and DRAM. This approach has reduced the energy costs by 52% with only a 1% latency overhead. Since energy consumption translates directly to electricity bills, these results demonstrate our approach can dramatically reduce the monetary costs cloud providers have to pay for their servers, as well as carbon footprint! Another big problem I have been working on is enabling easy hardware adoption in the cloud. In particular, my work focuses on an emerging datacenter architecture called resource disaggregation—resources are segregated based on their types into dedicated pools (such as CPU pool, memory pool, etc.), connected by high-speed network fabrics. Although disaggregation provides many benefits for cloud providers (especially for hardware adoption), it creates an efficiency challenge for applications—if an application needs to frequently access remote resources, it will experience severe performance degradation. I have developed a series of systems that make applications run efficiently, allowing cloud providers to fully enjoy the benefits of disaggregation.

Research Mentors: Harry Xu, Computer Science

Casey Wong

Anthropology

The nominee has accomplished exemplary research across the fields of Anthropology and Education, and rigorously shared his findings within high impact academic forums. Notably, his work has also directly impacted teacher preparation programs and the lives of students by supporting new ways of teaching and learning for social justice. Funded by a prestigious Lyle Spencer Foundation Grant, he's conducting innovative research that blends multiple lenses of educational linguistics, cultural anthropology and Black Feminism to examine how students are provided opportunities to engage in authentic learning experiences that sustain their cultures, languages and communities (i.e. teaching that aims to “sustain” cultures, languages and communities is known as “culturally sustaining pedagogy”). Emerging from his critical reflections on what constitutes “high quality” investigations of learning, he completed a review of research in education within one of the most prestigious journals in the field. He synthesized how educational researchers of color have creatively gathered, interpreted and shared educational knowledge, and theorized how the field of education might more broadly integrate these understandings to conduct research that advances educational justice for communities of color. Relatedly, he collaborated with H. Samy Alim and Django Paris to complete a chapter on culturally sustaining pedagogies within a high profile

handbook on the cultural foundations of learning, as well as received acceptance of an article on anti-Black racism in schooling in another top journal in the field (i.e. Educational Researcher). His research in the Department of Anthropology built upon his postdoctoral agenda in the Graduate School of Education, where he served as the lead postdoctoral scholar on the Center for the Transformation of School's Juvenile Justice and Multi-Tiered System of Supports (MTSS) projects. In partnership with the Los Angeles County Office of Education, he led a team of researchers in completing a report assessing the impact of a new model of learning designed to improve educational conditions within LA County juvenile probation camps. Based upon data collection in schools across California, he also presented his findings and made recommendations to the Orange County Department of Education on how to transform schooling to address disproportionalities in school discipline through MTSS.

Research Mentors: H. Samy Alim, Anthropology

Shuwang Wu

Materials Science and Engineering

By understanding fundamental science in water and water-polymer interactions, water-laden hydrogel materials and anti-icing materials have been advanced. Hydrogels are cross linked polymeric materials with high water content. They have wide applications in soft robotics, tissue engineering, implantable electronics, etc., but often require sophisticatedly tailoring the hydrogel mechanical properties to meet specific demands. For example, soft robotics necessitates tough hydrogels. We have developed a super hydrogel, which for the first time owns the similar structural complexity of natural tendon and even surpass tendon and commercial tough elastomers. The hydrogel exhibits extraordinary mechanical properties, 102-103 higher than current gels and 10-time tougher than the natural tendon. This work is a milestone in hydrogel and soft materials. Meanwhile, we have uncovered a fundamentally new principle to tune the hydrogel stiffness in a broad range, covering the stiffness of all soft tissues in human body. Such stiffness variable hydrogels can satisfy the demands of stem cell culturing and be in-situ altered for neuron probes to be hard when inserted and become as soft as brain tissue. This strategy presents a universal platform for broad applications from biomedical materials to wearable electronics. Furthermore, we proposed a strategy for rapid and scalable fabrication of ultra-stretchable, anti-freezing conductive gels. The gels can be stretched 15 times and remains high conductive at the temperature as lower as -50 oC. These results have been accepted by Nature, Advanced Materials, and EcoMat. Ice accumulation causes serious problems in our daily life. The daunting challenges in ice prevention and removal call for novel efficient anti-icing strategies. We proposed a low-cost, high-efficiency super hydrophobic photo thermal surface, uniquely based on inexpensive commonly seen candle soot. Upon sunlight illumination, the surface temperature can increase by 53 °C, so that no ice can form at environmental temperatures as low as -50 °C. The surface can also self-clean, which further enhances its effectiveness by removing dust and contaminants which absorb and scatter sunlight. It shows great potential and broad impacts owing to its anti-icing ability at a record low temperature, inexpensive component materials, simplicity, eco-friendliness, and high energy efficiency. The relevant results have been published on PNAS.

Research Mentors: Ximin He, Materials and Engineering

Chi-An Yeh

Mechanical and Aerospace Engineering

The designs of modern-era aerodynamics are facing unseen challenges from those in the past. Human exploration of Mars, as one of the biggest challenges for the next decade, exploits air vehicles designed for a completely different operational regime from that on Earth. The development of personalized urban flights, which is revolutionizing urban transportation and logistics, requires transcendent flight capability with gust rejection and highly agile yet safe maneuvers. These new requirements for new operational regimes and unsteady operational environments have shifted the paradigm of aerodynamic analyses. In addition to controlling the vehicles, aerodynamicists need to consider the control of flow around them to meet the new performance requirements. In the Department of Mechanical and Aerospace Engineering at UCLA, Dr. Yeh's postdoctoral research focuses on innovative flow control technologies. In this multidisciplinary research field, he dedicates his efforts to the intersection of fluid mechanics, data science, and network science. With the creative combinations of these novel toolsets, he has developed flow control strategies for steady aerodynamic applications. His flow control techniques improve operational safety of air vehicles by suppressing wing stall, which accounts for almost 25% of all fatal flying accidents. They are also developed to reduce drag and enhance fuel efficiency that translates to billions of dollars of savings in fuel cost, reduced carbon emission and cleaner air. These techniques are critically needed for the development of urban flights to revolutionize future transportation. Dr. Yeh's research relies on computational methods that are known to be prohibitively expensive for aerodynamic problems. To make flow control realizable, he developed algorithms based on data science to relief the computational cost of theoretical and numerical analyses to help understand dynamical properties of fluid-flow systems.¹He also innovatively combined network science with flow control analysis to tame turbulence, which is recognized as the last unsolved problem in classical physics.²He forged collaboration with researchers from the Air Force to develop a flow-control design guideline for suppressing flow separation.³He also worked with scholars from Japan to study transonic buffet phenomenon that must be avoided during Martian flights.

Research Mentors: Kunihiko Taira, Mechanical and Aerospace Engineering

Shu Zhang

Physics and Astronomy

Shu Zhang has conducted original research on several topics in the field of magnetism since she started her postdoc at UCLA in September 2019. Her work focuses on the fundamental understanding of unconventional transport phenomena in magnetic insulators and semimetals, as well as their potential applications in the next-generation spintronic devices for information transmission and processing. One of the key objectives of Shu's research is to study the transport of topological spin textures, which are excitations generally existing in magnets and are promising candidates for information carriers due to their topological stability. In a series of independent and collaborative work, she has demonstrated the theoretical principles in designing a few application schemes based on the hydrodynamic transport of magnetic domain walls, vortices and hedgehogs. Specific projects involve implementing an all-spin hardware platform for neuromorphic computing in a network of quasi-one-dimensional antiferromagnets, performing clean energy storage with a magnet-metal hetero

structure, and achieving generic non-local transport in three-dimensional magnets. Another direction of Shu's research aims to provide theoretical models and predictions for magnetic noise spectroscopy to detect the transport of spin degree of freedom in magnetic insulators and pseudo-spin in magnetic topological semimetals. The models enable the extraction of crucial transport parameters, such as the diffusion constant, from a non-invasive measurement of magnetic materials. Previously, the transport study of topological semimetals largely relies on second-order effects under external perturbations. The modeling of the magnetic noise provides a direct access to their intrinsic equilibrium properties for the understanding of the topology related transport. In addition, Shu has been looking into the dissipative aspects of spin dynamics, revealing the microscopic origin of damping effects on spin precession and the damping-induced nonequilibrium phenomena in collective excitations of interacting spin systems.

Research Mentors: Yaroslav Tserkovnyak, Physics and Astronomy

Wenyang Zhang

Civil and Environmental Engineering

Dr. Zhang's expertise is in the field of earthquake engineering and structural mechanics. He has been working on advanced numerical modeling and simulation of soil-structure systems for several years. Specifically, he has been working on soil-structure interaction analysis of civil infrastructures under strong earthquake motions, which is a very challenging task because it requires the interdisciplinary knowledge from many different subjects, such as soil mechanics, structural dynamics and wave propagation. Dr. Zhang has devised various advanced numerical methods to tackle such problems—specifically those that involve soil nonlinearities and complex seismic wave patterns. During the last one and a half years as a postdoctoral scholar at UCLA, Dr. Zhang has not only made great theoretical strides, but also devised tools that facilitate the application of his methods to practical engineering problems. They were employed in several projects funded by the California Department of Transportation (CALTRANS) and the California Energy Commission (CEC). For example, Dr. Zhang's novel methods to quantify soil-structure interaction effects on underground culverts during earthquakes have improved the accuracy of the current design guidelines. Dr. Zhang is currently working on several recently funded projects that involve (i) Seismic fragility development of gas infrastructure, including transmission pipelines and underground storage fields, under full range of seismic hazards (CEC) (ii) performance assessment of natural gas pipelines in areas undergoing subsidence from the withdrawal of water or oil (SoCal Gas), and (iii) development of nonlinear soil constitutive models for soil-structure interaction and wave propagation analyses (Southern California Earthquake Center).

Research Mentors: Ertugrul Taciroglu, Civil and Environmental Engineering

Zhi Zhang

Integrative Biology and Physiology

Estrogens are potent regulators of energy metabolism. The decline in estrogens during and after menopause in women is associated with many changes, including obesity and hot flashes. Estrogen based hormone therapy reduces postmenopausal metabolic syndrome but comes with higher risks of reproductive cancer. Dr. Zhi Zhang's postdoctoral

research aims to understand the effects of estrogens on the neural circuits that maintain energy and temperature balance. Using loss-of-function (cell ablation) and gain-of-function (cell activation) studies, Zhi demonstrated that estrogen sensitive neurons in the medial preoptic area potently regulate body temperature. These neurons coordinate heat production from brown adipose tissue and heat loss from the tail. The results point to a novel site and neuronal population that could mediate the effects of estrogens on heat dissipation. This new link will help us understand how changes in estrogen signaling contribute to hot flashes. In addition, Zhi demonstrated that estrogen-sensitive neurons in this region may contribute to the coordination of torpor, an extreme hypometabolic state observed in mice and other species. Activating neurons that express estrogen receptor alpha induced a dramatic decrease in basal metabolic rate and core temperature, an impressive drop of 7-10 degrees Celsius. Zhi also showed that these neurons show higher activity during natural torpor. This finding is exciting because it identifies the neurons that can trigger torpor in mice. If these neurons exist in other species, including humans, this ability to induce a deep, persistent, and repeatable state of hypothermia and hypometabolism may aid in the treatment of brain injury, stroke, or cardiac arrest. In addition, in a side project Zhi found that tamoxifen, an estrogen receptor modulator for treatment of breast cancer, alters mouse thermoregulation in ways that are consistent with hot flashes in humans (changes in heat dissipation and core temperature) and that these changes require estrogen receptor alpha in the hypothalamus. This study not only provides novel molecular targets for development of adjuvant drugs for chemotherapy, but also makes important advances in our understanding of how cancer therapy may affect quality of life in breast cancer patients and survivors.

Research Mentors: Stephanie Correa, Integrative Biology and Physiology

Zipeng Zhao

Materials Science and Engineering

Hydrogen as a renewable energy source attracts widespread attention and intense research interests. Zipeng's postdoctoral work is focused on developing, scale-up, and device application of electrocatalysts needed for hydrogen fuel cell and hydrogen generation through electrocatalysis. Development of Catalyst- Zipeng's research demonstrated that the stability and activity of the highly active platinum-nickel (PtNi) alloy nanocatalyst can be significantly improved by introducing a third element, either via dope molybdenum on the surface or alloying with copper. Furthermore, Zipeng's work revealed that the role of the third element is mainly tuning the platinum distribution on the surface of the ternary element system (Matter, 2019, 1, 1567; Nano Lett., 2018, 2, 798). Meanwhile, Zipeng's work demonstrated that surface engineered PtNi catalyst can achieve the activity record for hydrogen generation in alkaline water splitting (J. Am. Chem. Soc., 2018, 140, 9046). Scale-up of Catalyst- In order to move the developed catalyst towards application, Zipeng worked on the laboratory scale-up of the catalysts. Zipeng developed the method of one-pot synthesis of PtNi and PtNiCu catalyst, with catalyst directly grown on carbon support to save processing steps, achieve better catalyst dispersity, and stronger interaction between catalyst and the carbon support. A patent is filed based on this work (WO2020092632A1). Application of Catalystin Device- Further improving the performance of a hydrogen fuel cell is generally limited by the mass transport, which is delivery of gas reactants and removal of produced water. Mass transport is greatly affected by the structure of the catalyst layer, which is mainly composed of carbon support. Thus, Zipeng engineered the carbon support to optimize

the mass transport. As a result, the key performance targets (mass activity, durability, and rated power) set by US DOE, for the first time, are achieved simultaneously (Matter, 2020, 3, 1774). Also, Zipeng was invited to summarize the recent development of Pt-based nanocatalyst for reactions in a fuel cell and provided his perspective on the design of future catalysts in three review articles. And a start-up company is found based on his work and the patent filed to move the catalysts towards implementation.

Research Mentors: Yu Huang, Materials Science and Engineering

Shanglin Zhou

Neurobiology

Converging evidence suggests that the brain encodes time through dynamically changing patterns of neural activity, including neural sequences, ramping activity, and complex spatiotemporal dynamics. However, the potential computational significance and advantage of these different regimes have remained unaddressed. Dr. Zhou combined large-scale recordings and modeling to compare population dynamics between premotor cortex and striatum in mice performing a two-interval timing task. Conventional decoders revealed that the dynamics within each area encoded time equally well, however, the dynamics in striatum exhibited a higher degree of sequentiality. Analysis of premotor and striatal dynamics, together with a large set of simulated prototypical dynamic regimes, revealed that regimes with higher sequentiality allowed a biologically-constrained artificial downstream network to better read out time. These results suggest that although different strategies exist for encoding time in the brain, neural sequences represent an optimal dynamical regime for enabling downstream areas to read out this information. To further understand how different task structure would shape the strategies and neural dynamics implemented to timing two intervals, Dr. Zhou continued to develop recurrent neural network models (RNN) trained with different tasks: 1, 2-Stimulus task with two transient stimuli signaling different intervals as the behavior described above; 2, 2-Context with a constantly presented context stimuli of different amplitude signaling different intervals. Novel measures of dynamical properties developed by Dr. Zhou revealed that RNN trained with 2-Context applied more scaling dynamics, which endowed it with the ability to better generalize to novel intervals, whereas 2-Stimulus task exhibited more categorical timing. Such trade-off shaped by the task structure and its underlying dynamical and connection structure mechanism shed new light on how the brain processes timing information.

Research Mentors: Dean Buonomano, Neurobiology/ Sotiris Masmanidis, Neurobiology

Special thanks to the *Chancellor's Award for Postdoctoral Research* selection committee:

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WENDIE ROBBINS, *Professor, School of Nursing*

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~ NOMINEES ~

2020-21 POSTDOCTORAL MENTORING AWARD

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ALICIA IZQUIERDO, *Professor, Psychology*

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Immunology & Molecular Genetics*

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BAO WANG, *Mathematics*

GREGOIRE RUFFENACH, *Anesthesiology & Perioperative Medicine*

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ZHE CHEN, *Computer Science*

2017/18

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KIMBERLY PAUL, *Epidemiology*

CALIN PLESA, *Chemistry and Biochemistry*

BREANNA PUTMAN, *Ecology and Evolutionary Biology*

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YONGSOO YANG, *Physics and Astronomy*

2015

ALEXANDER AFANASYEV, *Computer Science*

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DONG-KEUN LEE, *Oral Biology and Medicine*

BENJAMIN A. TABAK, *Psychology*

2014

MOHAMMAD H. ASGHARI, *Electrical Engineering*

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2013

ARAM CHUNG, *Bioengineering*

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NATE KORNELL, *Psychology*

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DANIEL ROY SOLI, *Electrical Engineering*

2007

NAOMI EISENBERGER, *Psychoneuroimmunology*

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2001

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2000

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HEANEY, *Endocrinology*

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1998

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ZHI-MING SHAO, *Pathology and Laboratory Medicine*

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KELLY LYTTLE HERNANDEZ, *History and African American Studies*

2017/18

CHRISTOPHER GIZA, *Neurosurgery*

PATRICIA JOHNSON, *Microbiology, Immunology, and Molecular Genetics*

2016

MICHAEL F. GREEN, *Psychiatry*

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2015

AYDOGAN OZCAN, *Electrical Engineering*

2014

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LUISA IRUELA-ARISPE, *Molecular, Cell, and Developmental Biology*

2013

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