ARCS ADVANCING SCIENCE IN AMERICA®

SAN DIEGO CHAPTER

# ACHIEVEMENT REWARDS FOR COLLEGE SCIENTISTS

## SCHOLARS' PROFILES

## 2019-2020

CELEBRATING

35 YEARS

# 2019-2020 SCHOLARS
## SAN DIEGO CHAPTER

The San Diego chapter of ARCS began in 1985 and has grown from the original four founders to more than 100 members today. As we reach our 35th anniversary, we have made more than 1400 awards totaling well over $10 million. Our academic partners are:

San Diego State University | Scripps Research
University of California San Diego | University of San Diego

ARCS Scholars are selected by their institutions in recognition of their achievements and their exceptional promise to contribute significantly to their fields. Basic requirements have been established by ARCS® Foundation, Inc.: Scholars must be U.S. citizens and have at least a 3.5 GPA; they must be enrolled in academic degree programs in science, engineering, and medical research. Awards are unrestricted and merit-based. The San Diego chapter focuses on supporting students in doctoral programs, and the ARCS Scholars we have funded have a 98% graduation rate, compared with the national rate of 60% for graduate students in the sciences and engineering. Annual awards to Scholars range from $5,000 to $7,500. For the 2019-2020 academic year, the San Diego ARCS chapter has awarded $405,000 to 57 Scholars.

# SUMMARY

ARCS Foundation - San Diego Chapter 2019-2020 Scholars

All ARCS Scholars supported by the San Diego Chapter are enrolled in doctoral programs

**Navigate document by clicking on the Scholar name or click to the section by clicking on an institution.**

## SAN DIEGO STATE UNIVERSITY

John Matthew Allen - Cell and Molecular Biology
Erik Alexander Blackwood - Cell and Molecular Biology
Mariel Manaloto Cardenas - Chemistry
Corey Allyn Clatterbuck - Ecology
Molly Elizabeth Clemens - Ecology
Liwen Deng - Cell and Molecular Biology
Joshua Terence Kelly - Geological Sciences
Lucas Aaron Luna - Biochemistry
Clifford Dennis Pickett Jr. - Cell and Molecular Biology
Adriana Sara Trujillo - Cell and Molecular Biology
Janet Kathleen Walker - Ecology
Melissa Ann Ward - Marine Ecology
Joi LaGrace Weeks - Cell and Molecular Biology
Nicholas Benjamin Williams - Chemistry

## SCRIPPS RESEARCH

Carlos Andres Aguirre - Neuroscience
Lisa Marie Barton - Chemistry
Christopher Andrew Cottrell - Immunology
Joseph Michael McGraw - Biomedical Sciences
Anthony Nicholas Milin - Biomedical Sciences
Jessica Danielle Rosarda - Chemical Biology
Sophia Louise Shevick - Chemistry
Mia Shin - Biomedical Sciences
Leonard Heekyu Yoon - Chemical Biology

## UNIVERSITY OF CALIFORNIA SAN DIEGO

Bryce Eric Ackermann - Biochemistry
Miriam Kathleen Bell - Mechanical Engineering
Laura Brown Chipman - Biological Sciences
Gabrielle Marie Colvert - Bioengineering
Bethanny Patricia Danskin - Neurosciences
Cayce Elizabeth Dorrier - Biomedical Sciences
Michelle T Dow - Bioinformatics and Systems Biology
Mickey Finn III - NanoEngineering
Shereen Georges Ghosh - Biomedical Sciences
John Patrick Gillies - Biological Sciences
Mark Kalaj - Chemistry
Emil Mario Karshalev - Materials Science and Engineering
Kevin Richard Kaufmann - NanoEngineering
Andrew Thomas Kleinschmidt - Chemical Engineering
Jenna Joaquin Lawrence - Mechanical and Aerospace Engineering
Chi-Wei Man - Biochemistry
Ryan Jared Marina - Biomedical Sciences
Nicole Patricia Mlynaryk - Neurosciences
Colman Arthur Moore - NanoEngineering
Jessica Yi-Jun Ng - Geochemistry
Victor Wingtai Or - Chemistry
Jason Alexander Platt - Biophysics
Homa Rahnamoun - Biological Sciences
Dimitrious Adrian Schreiber - Electrical and Computer Engineering
Benjamin Shih - Mechanical and Aerospace Engineering
Matthew David Stone - Public Health - Health Behavior
Anthony Quoc Vu - Biomedical Sciences
Alexander Jeffrey Whitehead - Bioengineering
Andrew Ying - Statistics
Jiarong Zhou - NanoEngineering

## UNIVERSITY OF SAN DIEGO

Byron Batz - Nursing
Nicole Tamara Martinez - Nursing
Allison Kathleen Perkins - Nursing
Brooke Haley Rakes - Nursing

# San Diego State University

The San Diego State University doctoral programs here are offered jointly with either the University of California Davis or the University of California San Diego as noted in the Scholars' profiles.

# JOHN MATTHEW ALLEN

## San Diego State University / University of California San Diego

College of Sciences

Concentration: Cell and Molecular Biology

Specialization: Stem Cell Biology and Regeneration

Donor: Reuben H. Fleet Foundation Fund

John's project works towards understanding how cells make fate decisions. How DNA, or the "blueprints" of the cell, are physically packaged by histone proteins in the nucleus can regulate gene levels and directly influence cell fate. His work focuses on a complex that modifies histone proteins that wind DNA around them. The effect of this modification is to cause a localized compaction of the DNA and histones and cause genes to become silenced. His lab studies this complex during regeneration and examines how stem cells are regulated as re-form tissues.

Degree: B.S in Molecular Biology, Harvey Mudd College, Claremont

Awards and Honors: ARCS Foundation, Inc. - San Diego Scholar; University Graduate Fellowship; DePietro Scholarship Award

Publications and Posters:

Ochoa, S. D.; Dores, M. R.; **Allen, J. M.**; Tran, T.; Osman, M.; Castellanos, N. P. V.; Trejo, J.; Zayas, R. M. A modular laboratory course using planarians to study genes involved in tissue regeneration. Biochemistry and Molecular Biology Education 2019, 47 (5), 547–559.

Strand, N. S.; **Allen, J. M.**; Zayas, R. M. Post-translational regulation of planarian regeneration. Seminars in Cell & Developmental Biology 2019, 87, 58–68.

Strand, N. S.; **Allen, J. M.**; Ghulam, M.; Taylor, M. R.; Munday, R. K.; Carrillo, M.; Movsesyan, A.; Zayas, R. M. Dissecting the function of cullin-RING ubiquitin ligase complex genes in planarian regeneration. Developmental Biology 2018, 433 (2), 210–217.

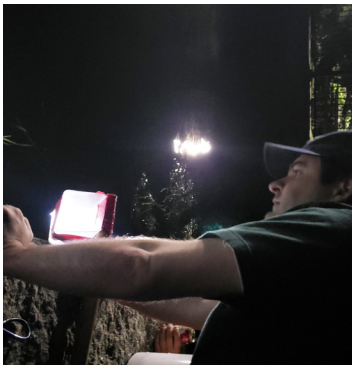
**Allen, J. M.; Ross,** K. G.; Zayas, R. M. Regeneration in invertebrates: Model systems. eLS 2016, 1–9.

Current Research (expanded description): How cells make fate decisions through development and how they maintain these states is a complicated multi-faceted question that has important implications in understanding many human diseases. Especially important is understanding how an organism can deploy a common set of DNA instructions to form multiple differentiated cell types. My work seeks to understand how cells use epigenetic instructions to guide cell fate decisions through the dynamic process of regeneration. This work will help us understand how an important but understudied epigenetic complex is affecting stem cell regulation.

Benefits to Science and Society: Stem cells can self-renew and generate other differentiated cell types. They are essential throughout embryogenesis, and in adult organisms (including humans) they are maintained to renew damaged tissues. Understanding stem cells regulation will shed insight on how they can be utilized, either in situ to potentiate existing adult stem cells to repair damaged tissues or grown in culture and be differentiated towards certain tissue fates for reintroduction. My work investigates epigenetic regulation of stem cells during homeostasis and regenerative processes.

ARCS Award: The ARCS Foundation award has been a source of continued support throughout my graduate career. I use part of this award to relieve myself of teaching obligations that significantly hinder my ability to focus solely on conducting the research that is essential to advance my thesis work. I also appreciate the chance to interact with scientific donors and to discuss my work (and science in general) with the public.





# ERIK ALEXANDER BLACKWOOD

## San Diego State University / University of California San Diego

College of Sciences

Concentration: Cell and Molecular Biology

Specialization: Molecular Cardiology

Donor: ARCS Foundation - San Diego Chapter / Karen and Bob Bowden

Ischemic heart disease is the leading cause of human deaths worldwide and is mainly due to acute myocardial infarction (AMI), where coronary artery occlusion causes rapid, irreparable damage to the heart, increasing susceptibility to progressive cardiac degeneration and heart failure. Erik has identified several lead candidate small molecules that can enhance adaptive signaling and responses in the heart and confer protection against cardiac damage during an AMI. Furthermore, because of the nature of the adaptive response targeted, he is investigating its beneficial effects in disease models targeting other organ systems.

Degree: B.S. in PreProfessional Studies, University of Notre Dame

Awards and Honors: Best Poster Award, Gordon Research Conference (GRC) on Cardiac Regulatory Mechanisms 2016, 2018; National Institutes of Health Predoctoral F31 Fellowship 2018; American Heart Association Predoctoral Fellowship 2017; Best Poster Award, International Society for Heart Research 2017

Publications and Posters:

**Blackwood, E.A.**; Azizi, K.M.; Thuerauf, D.J.; Paxman, R.; Plate, L.; Wiseman, L.; Kelly J.; Glembotski, C.C. Pharmacologic ATF6 activation confers global protection in widespread disease models by reprogramming cellular proteostasis. Nat Commun, 2019; 10:187.

**Blackwood, E.A.**; Hofmann, C.; Santo Domingo, M.; Bilal, A.S.; Sarakki, A.; Stauffer, W.; Arrieta, A.; Thuerauf, D.J.; Kolkhorst, F.; Muller, O.J.; Jakobi, T.; Dieterich, C.; Katus, H.A.; Doroudgar, S.; Glembotski, C.C. ATF6 regulates cardiac hypertrophy by transcriptional induction of the mTORC1 activator, Rheb. Circ Res. 2019; 124(1):79-93.

Jin, J-K.; **Blackwood, E.A.**; Azizi, K.; Thuerauf, D.J.; Fahem, A.G.; Hofmann, C.; Doroudgar, S.; Glembotski, C.C. ATF6 decreases myocardial ischemia/reperfusion damage and links ER stress and oxidative stress signaling pathways in the heart. Circ. Res. 2017; 120(5):862-875.

Current Research (expanded description): For my doctoral training, my research has focused broadly on molecular cardiology focusing on the cardiac structure and function in the ischemic, hypertrophic, and failing heart, in vivo. I have led a team at the SDSU Heart Institute that is focused on developing novel proteotoxic-based therapeutics for ischemic heart disease and hypertensive stress. This work has led to recent publications whereby we defined a novel link between ischemic-stress sensing in the endoplasmic reticulum and the genetic induction of antioxidants to prevent reperfusion injury. We followed up these findings by identifying small molecule activators of this pathway and demonstrated their efficacy in small animal models of reperfusion injury not only in the heart, but also demonstrated protection in the brain, liver, and kidney. Additionally, through transcriptome analysis we identified a novel link between the endoplasmic reticulum stress response and essential elements of mTOR-dependent myocyte growth. This led to the unique identification of non-canonical pathology-dependent gene induction by the ER stress response. Finally, our most recent work that is the culmination of my doctoral studies is delineating a novel link between the ER stress response and the paracrine and endocrine functions in atrial cardiac myocytes with an emphasis on mitigating hemodynamic stress and promoting cardiac function. The manuscript reporting these finds is in the final stages of preparation for submission.

Benefits to Science and Society: I have led a team at the SDSU Heart Institute that is focused on developing novel proteotoxic-based therapeutics for ischemic heart disease and hypertensive stress. We are aiming to expedite the process of high-throughput drug screening to testing of lead candidates in small and large animal models of cardiovascular, endocrine, and neurological diseases in the hopes of providing better therapeutics in the clinic for patients.

Personal Interests: Football, basketball, powerlifting, medical and scientific history, history and philosophy of science, cooking

ARCS Award: The ARCS Foundation award represents opportunity in my mind. I'm a first-generation college attendee, meaning that when I was in high school my parents gave me every chance and motivation to succeed, but in the end, it rested upon me to find the resources to find success when seeking a higher-level education. I had to hone my own study habits and recognize my weaknesses early on so as not to be ignorant and consumed by them. This also means that the idea of academic research was unheard of in my adolescent home. I was taught that reputable careers were a physician or a lawyer, but the concept of understanding a disease mechanism at its most fundamental level to find new therapeutic avenues and an eventual cure completely evaded my childhood. This put me at a severe disadvantage when I started my undergraduate career and when I joined the research field. However, my parents instilled in me and motivated me by example that hard work and persistence can overcome any deficit in life and I am relentless in the pursuit of my dreams because of this quality. To me the ARCS award represents opportunity because it is a recognition of researchers who, if nothing else, are extremely passionate, dedicated, and hardworking in their everyday lives.

# MARIEL MANALOTO CARDENAS

## San Diego State University / University of California San Diego

College of Sciences

Concentration: Chemistry

Specialization: Organic Chemistry, Chemical Methodology

Donor: ARCS Foundation - San Diego Chapter / Robin Luby

Mariel is developing various catalytic atroposelective syntheses towards pharmaceutically relevant compounds. Reactions that she is currently working on are nucleophilic substitutions and additions of specific functionalities that medicinal chemistry would be interested in (e.g. various amines, methoxy-groups). Examples of pharmaceutically relevant compounds that Mariel has worked on include: 3-aryl pyrrolopyrimidines (well-studied compounds that have direct implications in modern chemotherapeutics) and 3-aryl quinolines (which are found in many FDA-approved drugs and bioactive compounds). Her chemistry is applicable to improving workflow behind drug discovery, as the state of industry lacks cost-efficient and timely chemical methodologies to make large amounts of these biologically active compounds.

Degrees: B.S. in Chemistry, UC San Diego; Associates in Arts in Mathematical Studies, San Diego Miramar College; Associates in Science in Pre-engineering, San Diego Miramar College

Awards and Honors: University Graduate Fellowship Award, SDSU in May 2019; ARCS - San Diego Scholar, SDSU in Aug 2019; NIH Funded Student, SDSU in Aug 2017; Cal Vet Student, Cal Vet Services in Aug 2015

Publications and Posters:

**Cardenas, M. M.**; Saputra, M. A.; Sanchez, A. N.; Robinson, C. J.; Valle, E.; Gustafson, J. L. Development of atroposelective syntheses of pharmaceutically relevant N-heterocycles. 46th National Organic Chemistry Symposium. 26 June 2019, Indiana University, Bloomington, IN.

**Cardenas, M. M.**; Saputra, M. A.; Sanchez, A. N.; Robinson, C. J. Valle, E.; Gustafson, J. L. Developing atroposelective syntheses to access diverse pharmaceutically relevant scaffolds. American Chemical Society National Meeting & Exposition, Spring 2019. 1 April 2019, 3 April 2019, Orange County Convention Center, Orlando, FL.

**Cardenas, M. M.**; Toenjes, S. T.; Nalbandian, C. J; Gustafson, J. L. Enantioselective synthesis of pyrrolopyrimidine scaffolds through cation-directed nucleophilic aromatic substitution. Org. Lett. 2018, 20, 2037-2041. [doi: 10.1021/acs.orglett.8b00579] [PMID: 29561161, PMC5909700]

Current Research (expanded description): There is renewed interest in leveraging atropisomerism to synthesize more potent and selective N-heterocyclic pharmaceuticals. One unaddressed challenge is the narrow window of synthetic methodologies to directly access these important atropisomeric scaffolds on desired "gram-scale" quantities. Mariel and her coworkers in the Gustafson group at SDSU have reported an atroposelective nucleophilic aromatic substitution towards a diverse range of these aforementioned compounds in high enantioselectivities and optimal yields. Mariel selected thiophenols to add into these pharmaceutically relevant N-heterocycles, since the resulting product is synthetically and medicinally useful in drug discovery. Examples of N-heterocycles we have directly functionalized with this chemistry include 3-aryl pyrrolopyrimidines (PPYs, a well-studied kinase inhibiting scaffold) and 3-aryl quinolines (which are ubiquitous in many drug and 'drug'-like compounds). Currently, Mariel and her colleagues are expanding this chemistry towards 3-aryl pyridines, pyrimidines, and pyrazines (among the most common N-heterocyclic motifs of drug discovery).

Benefits to Science and Society: Atropiomerism (also referred to as axial chirality) is ubiquitous in all of drug discovery, as 30% of FDA approved drugs since 2011 possess at least one interconverting axis of atropisomerism. While this number is striking, the current 'industry standard' is to avoid creating stable atropisomers when possible and treating rapidly interconverting atropisomers as achiral. The current lack of synthetic methodologies to obtain 'large-scale,' industry-standard quantities of atropisomerically-pure drug scaffolds, and the reliance on chiral HPLC separation, is not useful for medicinal chemists involved in the drug discovery process.

Personal Interests: I love Harry Potter and I revisit the series only with a bowl of ice cream, going to rock concerts (particularly for music from the 60s, 70s, and 80s), and walking around San Diego.

ARCS Award: I strongly think that the ARCS Foundation award has largely benefited me in alleviating financial stressors that are related to graduate student life. It means so much to me as well to know that I am amongst a group of students that can develop science towards the community. It resets my focus that science is to largely "change the world" and advance ourselves and improve the quality of humanity. As cheesy as it sounds, I've been super humbled and grateful to attend ARCS meetings. I've gotten to talk with so many people involved, and it's actually allowed me to become even more determined to shape my research with that goal in mind. With the award, I can really hone in and shape this research without worrying about the burdens in graduate student life (like money-problems, financial setbacks, etc.).



# COREY ALLYN CLATTERBUCK

## San Diego State University / University of California Davis

College of Sciences

Concentration: Ecology

Specialization: Marine Ecology and Conservation

Donor: Virginia Lynch Grady Endowment

Seabirds are a highly-threatened taxon that are also ecological sentinels of ocean conditions, including chemical pollution. Corey's research examines contaminants found in seabird tissues to better describe the chemical environments sea life are exposed to. She uses targeted approaches to assess contaminants that are highly regulated and well-established as harmful to human health, in addition to non-targeted approaches that detect new, currently unmonitored, and unregulated contaminants of interest. The primary objective is to determine concentrations and spatial extent of contaminants and potential impacted species before the levels of these contaminants become problematic in the environment.

Degrees: M.S. in Biology, San José State University; B.S. in Biology and Anthropology, Transylvania University

Awards and Honors: SDSU University Grant Program; CSU Program for Education & Research in Biotechnology Travel Grant; CSU-Council on Ocean Affairs, Science & Technology Student Research Award

Publications and Posters:

**Clatterbuck, C.A.**; Lewison, R.L. California least tern (Sterna antillarum browni) breeding survey, 2018; CDFW; San Diego, CA, 2019.

**Clatterbuck, C.A.**; Lewison, R.L.; Orben, R.; Suryan, R.; Torres, L.; Ackerman, J.; Shaffer, S. Contaminants as ecological tracers: Does mercury load reflect foraging habits of a generalist seabird? 46th Annual Meeting of the Pacific Seabird Group, Lihue, HI, USA, Feb 27-March 3, 2019.

Shaffer, S.A.; Cockerham, S.; Warzybok, P.; Bradley, R; **Clatterbuck, C.A.**; Lucia, M.; Jelincic, J.; Cassell, A.; Kelsey, E.C.; Adams, J. Population-level plasticity in foraging behavior of western gulls (Larus occidentalis). Move. Ecol. 2018, 27, 1-13.

**Clatterbuck, C.A.**; Lewison, R.L.; Dodder, N.; Zeeman, C.; Schiff, K. Seabirds as regional biomonitors of legacy toxicants on an urbanized coastline. Sci. Total Environ. 2018, 619-620C, 460-469.

Current Research (expanded description): Monitoring physical and biological conditions in the open ocean is an inherently difficult task, particularly when monitoring toxic and harmful compounds. A large proportion of biomonitoring research focuses on a single species, a single site, and/or a small range (i.e. 1-3) of contaminant classes. While informative, the scope of such studies can limit their applicability, which is concerning as data suggests the abundance of organic and heavy metal contaminants in the ocean is increasing. Contaminants can have sub-lethal effects that affect population viability, and new, unknown contaminants enter the environment with little knowledge of their possible effects and limited ability to monitor these emerging contaminants.

My research explores how seabirds may be used as biomonitors for a rapidly-changing ocean environment. First, I show that seabird tissues can be used to indicate the magnitude and extent of a wide range of contaminants at the regional scale. I also examine relationships between seabird distribution and mercury concentrations to investigate a link between foraging habitat and observed reproductive failure in seabird colonies. Lastly, I will use tissues of wide-ranging seabird species, albatrosses (Phoebastria spp.), to characterize the type and abundance of legacy and new toxicants present in North Pacific waters.

Benefits to Science and Society: Many contaminants are incidentally introduced to coasts and oceans, where they persist and impact marine life for decades. However, we have little knowledge of how suites of chemicals impact marine life. This research is a first step to identifying these chemical suites, in addition to describing their spatial extent and magnitude. These investigations support innovation and advances in biomonitoring, to shift from reactionary to proactive monitoring and towards a stronger integration with animal ecotoxicology and ecology.

Personal Interests: Hiking, cycling, trivia nights at brewpubs, winning my fantasy football league, and spending time with dogs.

ARCS Award: Recognition of my work and my potential as a scientist is empowering. As an early career scientist, the ARCS Foundation Award has helped me see myself not only as a student, but as a peer to other scientists that have made significant contributions to science & society. As such, being an ARCS Scholar is invaluable to my identity and future as an ecologist, and has helped me gain self-confidence in completing my doctoral research.

www.coreyclatterbuck.com



# MOLLY ELIZABETH CLEMENS

## San Diego State University / University of California Davis

College of Sciences

Concentration: Ecology

Specialization: Viticulture

Donor: The Heller Foundation of San Diego

Molly is studying the impact of rising carbon dioxide levels on grapevine functions, including lifecycle shifts and leaf morphology. She has worked with researchers in France and Italy to investigate the genetics of grapevine graft compatibility. Molly will be working this year on a genetic transformation to increase drought tolerance in grapevine as a step towards more sustainable viticulture. Her work at San Diego State involves an experimental vineyard investigating alternative varieties for California from hotter and drier regions of the world.

Degree: B.S. Environmental Science, Fordham University, New York

Awards and Honors: Chateaubriand Fellowship in France; University Graduate Fellowship, San Diego State University and the Fondazione Edmund Mach; Interdisciplinary Graduate Fellowship, Area of Excellence Center for Climate and Sustainability Studies; Fulbright Graduate Research Fellowship

Publication and Posters:

**Clemens, M.**; Walker, A.; Wolkovich E. A comprehensive ecological study of grapevine sensitivity to temperature; How terroir will shift under climate change. GiESCO, Thessaloniki, Greece June 21-28, 2019.

Valim, H.; **Clemens, M.**; Frank. H. 2014. Joint decision-making on two visual perception systems. Laboratory of Informatics and Data Mining, Department of Computer and Information Science at Fordham University. Computational Intelligence, Cognitive Algorithms, Mind, and Brain (CCMB), 2014 IEEE Symposium.

Current Research (expanded description): My dissertation in the Global Change Research Group of San Diego State focuses on the effects on climate change on vineyards in California, France, and Italy. My first chapter produced a nonlinear phenological model of temperature impacts on phenology using a long-term common garden vineyard at UC Davis. My second chapter used microCT x-ray tomography scans to visualize changes

in grapevine internal leaf anatomy using samples from Grape FACE in Geisenheim, Germany. In San Diego, we created a diversity block of alternative varieties to test in Southern California for future winemaking. I worked in France learning methods for testing RNA expression, specifically quantifying mRNA and miRNA by qPCR. This year, I will be working on genetic transformations using the CRISPR-CAS9 system to develop grapevine with higher drought resistance by knocking out genes for stomatal development. My thesis is an interdisciplinary investigation of adaptations in vineyards, with the goal of sustainable agroecological solutions to the threats of climate change.

Benefits to Science and Society: Winegrapes are one of the world's most expensive and culturally important crops, currently facing climate change impacts like drought, heat waves, and increases in pest pressure. I hope that my research will benefit the grape growing communities by providing alternative varieties and sustainable solutions to some of these problems. Specifically, we are working on drought resistance grapevine varieties, which will hopefully be used in the industry one day. The current varieties we are testing in our experimental vineyard could help local growers in Temecula and Fallbrook choose alternatives that are more drought and heat tolerant.

Personal Interests: In my free time I enjoy climbing, surfing, yoga, and travelling.

ARCS Award: The ARCS Foundation award has been pivotal in my career. I have been able to enjoy my PhD more fully without the burden of financial stress living in California, far from the support of my family. I have met amazing scientists and have been exposed to the cutting-edge research they are also involved in. I feel more connected to the San Diego community through ARCS. I am so honored to have my efforts validated by an award like ARCS, which puts positive pressure on me to continue striving for excellence.



# LIWEN DENG

## San Diego State University / University of California San Diego

College of Sciences

Concentration: Cell and Molecular Biology

Specialization: Microbiology

Donor: Hervey Family Non - Endowment Fund

Liwen is interested in how the typically commensal bacterium Group B Streptococcus (GBS) is able to cause severe disease in vulnerable populations such as newborns. GBS normally colonizes the vaginal tract of healthy women asymptomatically but can be transmitted to the newborn with devastating consequences. Currently, GBS is a leading cause of neonatal pneumonia, sepsis, and meningitis in the United States. Since beginning her work in Dr. Doran's lab, Liwen has identified several bacterial factors that contribute to how asymptomatic colonization can transition and cause invasive disease in newborns.

Degree: B.S. in Physiology and Neuroscience, University of California San Diego

Awards and Honors: Rocky Mountain ASM 2nd place best oral presentation; SDSU Heart Institute/Rees Stealy Research Foundation graduate fellowship; ASM Student travel grant; SCASM 1st place outstanding graduate research

Publications and Posters:

**Deng, L.**; Schilcher, K.; Burcham, L.R.; Kwiecinski, J.; Johnson, P.M.; Head, S.R.; Heinrichs, D.E.; Horswill, A.R.; Doran, K.S. Identification of key determinants of Staphylococcus aureus vaginal colonization. mBIO (2019)

Spencer, B.L.; **Deng, L.**; Patras, K.A.; Burcham, Z.M.; Sanches, G.F.; Nagao, P.E.; Doran, K.S. Cas9 contributes to Group B Streptococcal colonization and disease. Front Microbiol (2019)

**Deng, L.**; Spencer, B.L.; Holmes, J.A.; Mu, R.; Rego, S.; Weston, T.A.; Hu, Y.; Sanches, G.F.; Yoon, S.; Park, N.; Nagao, P.E.; Jenkinson, H.F.; Thornton, J.A.; Seo, K.S.; Nobbs, A.H.; Doran, K.S. The Group B Streptococcal surface antigen I/II protein, BspC, interacts with host vimentin to promote adherence to brain endothelium and inflammation during the pathogenesis of meningitis. PLoS Pathog (2019)

**Deng, L.**; Mu, R.; Weston, T.A.; Spencer, B.L.; Liles, R.; Doran, K.S. Characterization of a two-component system transcriptional regulator LtdR that impacts Group B Streptococcal colonization and disease. Infect Immun 2018, 86(7)

Current Research (expanded description): Streptococcus agalactiae (Group B Streptococcus [GBS]) is an opportunistic pathogen that normally colonizes healthy adults asymptomatically and is a frequent inhabitant of the vaginal tract in women. However, GBS possesses a variety of virulence factors and can cause severe disease when transmitted to newborns. Despite widespread intrapartum antibiotic prophylaxis administration to colonized mothers, GBS remains a leading cause of neonatal meningitis in the US. For my PhD work, I am investigating how this bacterium is able to persist in the vaginal tract, transition from a commensal colonizer to an invasive pathogen, disrupt host barriers, and ultimately penetrate into the brain to cause infection and inflammation. I have characterized an inflammatory GBS surface adhesin which promoted bacterial attachment to brain endothelium and discovered the host endothelial receptor for this GBS factor. I have also characterized a GBS two-component system transcriptional regulator that influences meningitis as well as GBS vaginal carriage by impacting host immune signaling. Lastly, I have developed an in vivo mammalian model for vaginal colonization by another common opportunistic pathogen, Staphylococcus aureus, so that we can begin to investigate interactions between GBS and other resident microbes within this host niche.

Benefits to Science and Society: Despite widespread intrapartum antibiotic prophylaxis treatment of mothers who are carriers for GBS, this pathogen remains the leading cause of bacterial meningitis in newborns. Additionally, there is growing concern of emerging patterns of antibiotic resistance in GBS and other microorganisms present during treatment. Liwen hopes that a better understanding of how GBS interacts with the host immune system to cause disease may lead to the development of more targeted therapeutics to combat GBS infections.

ARCS Award: I am very grateful for the support of the ARCS Foundation award. This funding has enabled me to attend many conferences to present my research. At these meetings, I have received valuable feedback about my data and I have also been able to network and meet other scientists in the field of bacterial pathogenesis.

# JOSHUA TERENCE KELLY

## San Diego State University / University of California San Diego

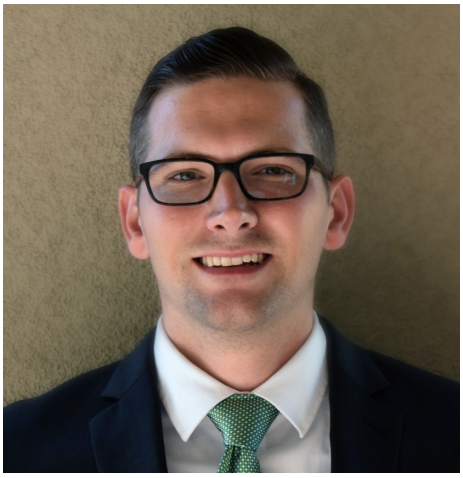
College of Sciences

Concentration: Geological Sciences

Specialization: Coastal Geomorphology, Remote Sensing

Donor: ARCS Foundation - San Diego Chapter

Josh's research involves understanding how climate influences shoreline change along the southeast coast of Queensland, Australia. He has used satellite imagery to construct a decades long shoreline change curve that was correlated to global climate cycles such as the El Niño-Southern Oscillation. He ultimately found that shoreline dynamics (erosion/growth) are controlled by variability in the Interdecadal Pacific Oscillation. He is currently using emerging satellite technologies to rapidly assess tropical cyclone impacts on Australia's coast.



Degrees: M.S. in Environmental Science, University of Massachusetts, Boston; M.S. in Oceanography, University of Rhode Island; B.S. in Geosciences, University of Rhode Island

Awards and Honors: USNC/INQUA Congress Fellowship; AAPG Raymond D. Woods Memorial Grant; GSA Graduate Student Research Grant (2); Robert D. Ballard Endowed Fellowship

Publications and Posters:

**Kelly, J. T.**; Gontz, A. Rapid assessment of shoreline changes induced by tropical cyclone Oma using CubeSat imagery in Southeast Queensland, Australia. J. Coast. Res. 2019. (in press)

**Kelly, J. T.**; McSweeney, S.; Shulmeister, J.; Gontz, A. Bimodal climate control of shoreline change influenced by interdecadal Pacific oscillation variability along the Cooloola Sand Mass, Queensland, Australia. Mar. Geol. 2019. (in press)

**Kelly, J. T.**; Gontz, A. Using GPS-surveyed intertidal zones to determine the validity of shorelines automatically mapped by Landsat water indices. Int. J. Appl. Earth Obs. 2018, 65C, 92-104.

**Kelly, J. T.;** Carey, S.; Croff-Bell, K. L.; Roman, C.; Rosi, M.; Marani, M.; Pistolesi, M. Exploration of the 1891 Foerstner submarine vent site (Pantelleria, Italy): Insights into the formation of basaltic balloons. Bull. Volcanol. 2014, 76, 844-862.

Current Research (expanded description): The ultimate goal of my dissertation is to find, if any, primary climate drivers of shoreline change in southeast Queensland, Australia. I have mapped over 9,000 km of historical shoreline positions using Landsat imagery and constructed a temporally and spatially robust shoreline change curve that is statistically correlated to the five major climate phenomena operating in the Australasian region. I observed a bimodal climate control of shoreline change dependent upon the phase of the Interdecadal Pacific Oscillation (IPO), where by the El Niño-Southern Oscillation (ENSO) controls shoreline dynamics during negative IPO phases and the Subtropical Ridge becomes dominant during positive IPO. I theorize this is due to IPO's control over the position of the South Pacific Convergence Zone and modulation of the impacts of ENSO on Australia's eastern coast. I am also using emerging satellite technologies such as CubeSat's to rapidly assess tropical cyclone-induced shoreline changes along Queensland's coast. Much of this work involves quantitatively assessing the total positional uncertainty of shoreline positions derived from CubeSat imagery as this a novel application of the new satellite data product.

Benefits to Science and Society: One of the biggest concerns of climate change is understanding how it will impact shorelines on a global scale. Where 40% of the global population live within 100 kilometers of the coast, it's becoming ever more important to understand the correlation between climate variability and shoreline dynamics. The results of Josh's research further our understanding of the coupling between climate and shoreline change and will support the development of long-term coastal management strategies.

Personal Interests: Hiking, playing soccer, traveling, exploring local breweries, and cheering on my hometown Boston sports teams.

ARCS Award: Being selected as an ARCS Scholar has proven to be a significant morale booster over the past year and has inspired me to produce scholarly work that all of the ARCS community can be proud of. The funding from ARCS has directly assisted me in my research endeavors, as I was able to purchase state-of-the-art software programs that are not available to University faculty or students. In addition, I used the funding to acquire much-needed equipment and field apparel for my field work in Australia. The funding has also provided a much-needed safety net of sorts for day to day life in San Diego, as most are well aware that living in one of the most expensive cities in the US on a graduate student stipend is not the easiest. I have also thoroughly enjoyed getting to know the other ARCS recipients, particularly the SDSU cohort, at the various University-hosted events on campus and ARCS events off. I really appreciate the professional development events that ARCS has hosted, such as the financial advising seminar at Rachel Collins' home, as they provide extremely valuable information that most of us do not receive in our day-to-day lives.



# LUCAS AARON LUNA

## San Diego State University / University of California San Diego

College of Sciences

Concentration: Biochemistry

Specialization: Enzymology; Molecular Mechanisms of Diseases

Donor: ARCS Foundation - San Diego Chapter

The Sohl Lab in the Chemistry & Biochemistry Department at SDSU aims to help alleviate disease by investigating mechanistic questions at the intersection of biochemistry, cell biology, and medicine. We explore how altered enzyme activity impacts human health using kinetic, structural and cellular tools. By understanding the molecular mechanisms of enzyme dysfunction, we can illuminate structure-function relationships, probe subsequent global cellular consequences of mutations, identify drug targets, and ultimately develop platforms for targeted therapy.

Degree: B.S. Biochemistry, University of California Santa Barbara

Awards and Honors: University Graduate Fellowship 2019; Prebys Biomedical Research Endowed Scholarship 2018, 2019; Harry E. Hamber Memorial Scholarship 2018, 2019; ARCS - San Diego Scholar 2018, renewed 2019.

Publications and Posters:

Bernatchez, J.A.; Coste, M.; Beck, S.; Wells, G.A.; **Luna, L.A.**; Clark, A,E.; Zhu, Z.; Hecht, D.; Rich, J.N.; Sohl, C.D.; Purse, B.W.; Siqueira-Neto, J.L. Activity of selected nucleoside analogue protides against Zika virus in human neural stem cells. Viruses 2019.

Avellaneda Matteo, D.; Wells, G.A.; **Luna, L.A.**; Grunseth, A.J.; Zagnitko, O.; Scott, D.A.; Hoang, A.; Luthra, A.; Swairjo, M.; Schiffer J.M.; Sohl, C.D. Inhibitor potency varies widely among tumor-relevant human isocitrate dehydrogenase 1 mutants. Biochemical Journal 2018.

Bernatchez, J.A.; Zunhua, Y.; Coste, M.; Li, J.; Beck, S.; Liu, Y.; Clark, A. E.; Zhu, Z.; **Luna, L. A.**; Sohl, C.D.; Purse, B. W.; Li, R.; Siqueira-Neto, J. L. Development and validation of a phenotypic high-content imaging assay for assessing the antiviral activity of small molecule inhibitors targeting the Zika virus. Antimicrobial Agents and Chemotherapy 2018.

Current Research (expanded description): Recently, I have been involved in studying how changes in the cellular environment can reroute metabolism by altering the catalytic activities of metabolic enzymes such as Isocitrate Dehydrogenas (IDH) 1. IDH1 catalyzes the reversible conversion of isocitrate to alpha ketoglutarate. The forward reaction is important to protect against oxidative damage and the reverse reaction is important for anaplerosis and glutamine metabolism. Normal IDH1 is amplified in various types of cancer; however, the majority of IDH1 studies use tumor-relevant mutations. Thus, there is a critical, unmet need to show how changing the cellular environment regulates IDH1 activity. Typically, the forward and reverse reactions are balanced to meet the metabolic needs of the cell. However, when the cellular environment is perturbed by a change in pH, the catalytic activity of proteins can change and the equilibrium of the forward reaction and reverse reaction can be shifted. In one piece of the project we will determine if the activity of IDH1 is sensitive to pH, and in the other we will examine the cellular consequences of IDH1 upon encountering lowered intracellular pH. The final project that I am involved with at this time is establishing mechanisms of dysfunction for DNA Polymerase Epsilon. Mutations in this enzyme are frequently observed in colorectal and uterine cancers. Studies with human DNA Polymerase Epsilon are extremely limited. In this project, we will kinetically characterize the mechanism of altered fidelity of human DNA Polymerase Epsilon and tumorigenic mutants

Benefits to Science and Society: With the Isocitrate Dehydrogenase project we hope to establish how metabolic enzyme activity is affected by changes in the cellular environment, and we hypothesize that the reverse reaction is favored at lower pH levels. We will also show how cellular metabolism is regulated by intracellular pH. In the polymerase project, we will identify unique mechanisms of novel polymerase mutations and help inform a treatment strategy in colorectal and uterine cancer patients.

ARCS Award: The ARCS award has had a monumental influence on my passion and the quality of my work. It has increased my motivation to make lasting contributions to the scientific community, and I feel like it will accelerate my degree completion. The network that ARCS provides will also be invaluable to my career development. The ARCS award has inspired me to give back to the student community at SDSU. I have decided to become more involved in chemistry tutoring and have started tutoring students in general chemistry, organic chemistry, and biochemistry. As someone who has gone through the same courses more recently, I can provide a more relatable experience and an explanation that the students can understand. It is a very rewarding experience to give back to the community and I hope for it to continue through the rest of my PhD career. An additional benefit to the tutoring experience is that I can influence someone to continue a degree in chemistry or biochemistry and inspire them to seek out a research position.



# CLIFFORD DENNIS PICKETT JR.

## San Diego State University / University of California San Diego

College of Sciences

Concentration: Cell and Molecular Biology

Specialization: Developmental Genetics

Donor: Drs. Mara and Larry Ybarrondo / ARCS Foundation - San Diego Chapter

The development of an embryo from a single cell has always fascinated C. J. Particularly, he is interested in the study of the genetic program of embryogenesis. His research aims to understand the advent of a particular cell type in a marine chordate, a ciliated neuron that is homologous to our inner ear hair cells. He is discovering what genes are responsible for producing this cell type. Due to our evolutionary connections to this organism that he studies, the properties of how this cell type develops are transferable to fields such as human hearing-loss research.

Degree: B. S. in Biology, Rhode Island College

Awards and Honors: Elliott Family Fund Scholarship; W. Christina Carlson Award for Excellence in Biology; Mary M. Keefe Departmental Award for Excellence in Biology; Rhode Island College Alumni Scholarship

Publications and Posters:

**Pickett, C. J.**; Zeller, R. Efficient genome editing using CRISPR-Cas-mediated homology directed repair in the ascidian Ciona robusta. genesis, 2018 56(11-12):e23260.

Ratcliffe, L.; Asiedu, E.; **Pickett, C. J.**; Warburton, M.; Izzi, S.; Meedel, T. H. The Ciona myogenic regulatory factor functions as a typical MRF but possesses a novel N-terminus that is essential for activity. Developmental Biology, 2018, 15;448(2):210-25

**Pickett, C. J.**; Zeller, R. Pou4 Genes during Neurogenesis (in prep).

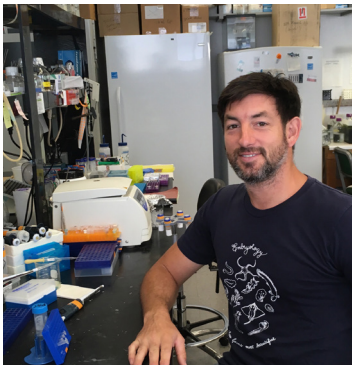
Current Research (expanded description): Our lab studies the evolution of ciliated epidermal sensory neuron (CESN) development during embryogenesis using the marine invertebrate chordate Ciona robusta. Pou4, a proneural transcription factor (TF) involved in C. robusta peripheral nervous system development is necessary and sufficient for CESN differentiation. My primary research focus aims to understand how CESNs differentiate, thus, what are the factors involved in activating Pou4? I am approaching this question in a number of ways. By having reviewed relevant literature, TF binding motif analyses, and an RNA-seq database I generated, I made informed predictions regarding genes, i.e. potential Pou4 activators and repressors, expressed in the correct pre-Pou4 location. This approach has revealed TFs that when ectopically expressed seem to increase the number of CESNs indicating activation of Pou4, and genes that decrease the number of CESNs indicating repression of Pou4. Once individual proteins are identified, I perform an overexpression screen and a CRISPR screen to establish their role as either Pou4 activators or repressors.

Benefits to Science and Society: I am passionate about understanding how sensory neurons emerge from a neurogenic field of epidermis. I think that the work I am performing is an excellent route to gain critical insights into this phenomenon.

Personal Interests: I enjoy reading, cycling, softball, gardening, cooking, and spending time with my wife.

ARCS Award: The ARCS Foundation is truly a wonderful organization. Each and every ARCS person I have interacted with since receiving the award has been friendly, sincere, smart, motivated, and dedicated to the idea that rewarding hard working and promising students of the sciences is a worthwhile and fruitful idea. It's a really special foundation, and I feel so honored to have been recognized by them.





# ADRIANA SARA TRUJILLO

## San Diego State University / University of California San Diego

College of Sciences

Concentration: Cell and Molecular Biology

Specialization: Molecular Mechanisms of Heart Disease

Donor: ARCS Foundation - San Diego Chapter

Adriana's research uses the fruit fly model system to explore the disease mechanisms by which mutations can cause dilated cardiomyopathy, a type of heart disease associated with heart enlargement. This disease can be caused by mutations in myosin, the protein responsible for producing muscle contraction. She is currently implementing multidisciplinary approaches (molecular, cellular, and whole tissue) to better understand how changes within the structure of the myosin molecule lead to biochemical defects and how these abnormalities relate to the structural and physiological decline of muscles.

Degrees: M.S. in Cellular and Molecular Biology, San Diego State University; B.S. in Cellular and Developmental Biology and minor in Chemistry, California State University Fullerton

Awards and Honors: SDSU University Graduate Fellowship; NIH NRSA F31 Diversity Pre-doctoral Fellowship; Rees-Stealy/SDSU Heart Institute Research Fellowship; Recipient of the NIH Research Supplement to Promote Diversity in Health-Related Research

Publications and Posters:

Achal, M.*; **Trujillo, A. S.***; Melkani, G. C.; Farman, G. P.; Ocorr, K.; Viswanathan, M. C.; Kaushik, G.; Newhard, C. S.; Glasheen, B. M.; Melkani, A.; Suggs, J. A.; Moore, J. R.; Swank, D. M.; Bodmer, R.; Cammarato, A.; Bernstein, S. I. A restrictive cardiomyopathy mutation in an invariant proline at the myosin head/rod junction enhances head flexibility and function, yielding muscle defects in drosophila. J Mol Biol 2016, 428 (11), 2446-2461. *co-first authors

**Trujillo, A. S.**; Ramos, R.; Bodmer, R.; Bernstein, S. I.; Ocorr, K.; Melkani, G. C. Drosophila as a potential model to ameliorate mutant Huntington-mediated cardiac amyloidosis. Rare diseases 2014, 2 (1).

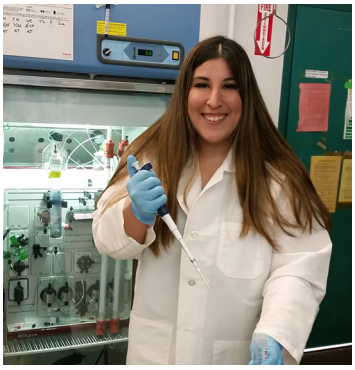
Current Research (expanded description): My project explores the disease mechanisms by which mutations can cause dilated cardiomyopathy (DCM), a type of heart disease associated with heart enlargement. DCM can be caused by mutations in genes coding for the molecular machinery responsible for heart contractions, resulting in heart pumping defects, physiological alterations, and ultimately, heart failure. In Dr. Bernstein's lab, I previously generated fruit fly models to determine the exact mechanistic basis of disease. I previously isolated mutant protein from our fly models, optimized a procedure to form a protein complex containing the contractile machinery, and assessed the protein complex structure using electron microscopy (collaboration with Drs. Hanein and Volkmann, Sanford Burnham Prebys). Recently, we obtained high resolution cryo-electron microscopy data to solve the structure of the mutant protein complex, to understand the structural basis of disease. Using biochemical and muscle performance assays, I determined the biochemical defects caused by two DCM mutations, and related these defects to muscle functional impairments. Eventually, our fly models will serve as a platform for testing therapeutic strategies for ameliorating defects associated with heart disease.

Benefits to Science and Society: Though dilated cardiomyopathy represents the most common form of inherited heart disease, the molecular mechanisms of disease are not well understood. Our main goal is to better understand how the disease arises due to specific mutations, which will help us design targeted drug regimens intended to restore muscle defects in our fruit fly models. We can then use our fly models as a platform for testing promising drug candidates, to evaluate potential drug therapies for human patients.

Personal Interests: In my free time, I enjoy playing the piano and volunteering at a local dog rescue.

ARCS Award: This award has greatly reduced my financial burden, allowing me to focus on engaging in productive research in the field. This will enhance my ability to produce high-quality publications, permitting me to make strong progress towards degree completion and in meeting my professional goals. It has also allowed me to better focus on training and mentoring undergraduates, to improve my mentoring skills and to extend a positive influence on other students. Additionally, these funds covered technology-related expenses necessary for completion of my research. I also appreciate the opportunity to network with scholars and supporters at ARCS events.





# JANET KATHLEEN WALKER

## San Diego State University / University of California Davis

College of Sciences

Concentration: Ecology

Specialization: Marine and Wetland Ecology

Donor: Virginia Lynch Grady Endowment

In southern California, over 85% of natural salt marsh habitat has been lost to human development, and while there have been attempts to restore marsh habitat, the overall outcomes tend to be variable. Restoration success of marine plant habitats is largely determined by the abundance of foundational species, like salt marsh cordgrass. However, we often lack an understanding of the factors influencing cordgrass density and their spatiotemporal variation. The central goal of Jan's research is to help address this research gap by focusing on the role of Pacific coast crabs in structuring salt marsh habitats along the California coast.

Degree: B.S. in Environmental Science, University of Virginia

Awards and Honors: Point Reyes National Seashore Association's (PRNSA); Neubacher Marine Science Grant (2019); COAST Graduate Student Research Award Program (2019); U.S. National Park Service, Cabrillo National Monument, Graduate Fellow (2018-2019)

Publications and Posters:

**Walker, J.K.**; Grosholz, E.D.; Long, J.D. The consequences of burrowing crabs for plant community composition and restoration. Oral Presentation, Coastal and Estuarine Research Federation. November 2019.

**Walker, J.K.**; Grosholz, E.D.; Long, J.D. Crab identity and density drive site-specific effects of burrowing crabs on plant community composition. Oral Presentation, California Estuarine Research Society. December 2018.

**Walker, J.K.**; Grosholz, E.D.; Long, J.D. Plant tissue, species, and population influence palatability for a salt marsh burrowing crab. Oral Presentation, Western Society of Naturalists. November 2018.

**Walker, J.K.**; Long, J.D. Site-specific effects of burrowing crabs on plant community composition in California salt marshes. Oral Presentation, Society of Wetland Scientists. June 2018.

Current Research (expanded description): Restoration success of marine plant habitats is largely determined by the abundance of foundational species, like cordgrass (Spartina spp.) in salt marshes. In fact, mitigation requirements associated with marsh habitats can list a specific target number of cordgrass plants that must be supported in the restored environment. Cordgrass has been targeted due to its amplitude of services, such as sediment accretion, flood attenuation, and habitat for endangered species. However, we often lack an understanding of the factors determining plant community structure. For example, although 1) burrowing crabs can decrease environmental stress for cordgrass and 2) crab and plant compositions differ between marshes, we lack an appreciation of how the impact of crabs on cordgrass density varies in space and time. To address this research gap, I have conducted a series of field and laboratory experiments manipulating burrowing crabs along the California coast. As I near the end of my dissertation, my work suggests that burrowing crabs need to be considered in salt marsh management because they can strongly control the density of cordgrass - a primary target for restoration outcomes.

Benefits to Science and Society: Much focus of salt marsh management has been on restoring and preserving native cordgrass plants in our California marshes. In San Francisco Estuary, the Invasive Spartina Project has installed over 300,000 plants at 40 revegetation sites. However, there may be associated factors that determine the growth and success of these plants. Understanding the role of crabs in determining plant community composition, and thereby mediating plant stress, is important when considering management strategies of these cordgrass stands and overall ecosystem function.

Personal Interests: I love backpacking and trail running with my fur-friend - Kudzu. I also enjoy teaching yoga, drinking coffee, and chasing the sunset.

ARCS Award: With the help of the ARCS Award this past year, I had the freedom to travel to all my field sites in southern and northern California in order to conclude multiple ongoing projects, while also expanding my research into other ecosystems. Travel expenses and technician assistance are some of the biggest obstacles I have to overcome in order to finish my dissertation. The flexibility of the ARCS Award funds has allowed me to optimize my travel plans and to train multiple undergraduate assistants.

https://jankwalker.weebly.com



# MELISSA ANN WARD

## San Diego State University / University of California Davis

College of Sciences

Concentration: Marine Ecology

Specialization: Ocean Biogeochemistry, Chemical Oceanography

Donor: Reuben H. Fleet Foundation Fund

Seagrass meadows improve water quality, stabilize sediments, and are home to many economically and ecologically valuable species; yet most of California's seagrass meadows have been lost. By exploring the ability of seagrass to sequester carbon and alter water chemistry, we can quantitatively evaluate the carbon services gained through seagrass conservation and restoration. This work will help inform state and federal management efforts to restore these habitats while maximizing the carbon services they provide, which will become increasingly more important in the face of climate change.

Degree: B.S. in Biological Sciences, University of California Irvine

Awards and Honors: Geological Society of America Graduate Student grant winner 2019; Russell J. and Dorothy S. Bilinski Fellowship Winner 2018; Rafe Sagarin Fund for Innovative Ecology, Best Talk- 2nd place, Western Society of Naturalists 2017; UC-wide Carbon Neutrality Competition: People's Choice Award 2016

Publications and Posters:

**Ward, M.**; Hill, T. M.; Ricart, A.; Gaylord, B.; O'Donnell, B C.; Capece, L.; Shukla, P., Kroeker, K.; Sanford, E.; Oechel, W. Synthesizing multiple carbon fluxes in a temperate, Pacific seagrass meadow. Global Biogeochem. Cycles (in review).

Kroeker, K.; Kindinger, T.; Hirsh, H.; **Ward, M.**; Koweek, D.; Hill, T.; Jellison, B.; Lummis, S.; Rivest, E.; Waldbusser, G.; Gaylord, B. Seagrass community metabolism studies reveal opportunities and challenges for local mitigation of ocean acidification. Ecological Applications (in review)

**Ward, M.** San Francisco State University, Distinguished speaker series. Title: Carbon services of California coastal habitats. San Francisco, CA 2018.

**Ward, M.A.**; Hill, T.M.; Ricart, A.; Gaylord, B.; O'Donnell, B.C.; Shukla, P.; Kroeker, K.; Oechel, W.C. 2018. A synthesis of seagrass carbon services: Implications for restoration and climate change management. Poster presentation. 9th National Summit on Coastal and Estuarine Restoration and Management.

Current Research (expanded description): My research investigates the role that seagrasses play in coastal carbon cycling. Seagrasses have been noted for their disproportionally high ability to remove CO2 from seawater through primary production and burial in sediment. Simultaneously, seagrass coverage has been declining rapidly on both global and local scales. As such, state and federal agencies have been directed to consider seagrass conservation and restoration as strategies to enhance carbon stocks and locally ameliorate impacts from ocean acidification (OA), a service that provides economic and ecological value. However, to date, there is no data on the potential of California seagrasses to lessen the impacts of OA or store carbon in their underlying sediments. The State has been hindered by lack of data on how to select optimal locations for seagrass restoration and conservation to maximize these benefits.

Benefits to Science and Society: My research will fill these knowledge gaps in order to quantitatively evaluate the carbon services gained through seagrass conservation and restoration.

ARCS Award: The help the ARCS award provides not only relieves financial stress, but it encourages and inspires me to continue my research. As I move from my PhD to pursue a career as a scientist, I hope that I can continue to conduct high caliber research that explores innovative solutions in climate change management. Given that my priorities and goals fall in step with those of the ARCS Foundation, I am grateful to be a part of this unique community of scholars, where I can contribute to the growing body of research they produce. I would not be where I am today without this scholarship and community!

Melissa-ward.weebly.com



# JOI LAGRACE WEEKS

## San Diego State University / University of California San Diego

College of Sciences

Concentration: Cell and Molecular Biology

Specialization: Cancer Biology

Donor: Legler Benbough Foundation

To study amplified malate dehydrogenase 1 (MDH1) in lung cancer, Joi created two cell clones that reveal increased MDH1 levels and enzymatic activity in non-small cell lung cancer (NSCLC). Metabolic studies on MDH1 knock out (KO) cells reveal a 50% reduction in TCA cycling suggesting that decreased activity of MDH1 has the potential to slow down tumor progression. Her studies will increase our understanding about the effects of changing MDH1 levels on cell behavior and how changes in MDH1 activity can eradicate cancer cells.

Degrees: M.S. in Cell and Molecular Biology, San Diego State University; B.S. in Chemistry, University of North Carolina Chapel Hill

Awards and Honors: ARCS - San Diego Scholar; Ford Foundation Scholarship; San Diego Fellowship, UCSD; Harold and June Grant Memorial Scholarship, SDSU.

Publications and Posters:

**Weeks, J.**; Wells, G.; Alexander, S.; Metallo, C.; Sohl, C.D. Investigating the reversible MDH1 catalytic reaction in squamous non-small cell lung cancer. Proceedings of the American Association for Cancer Research, Atlanta, GA March 28-April 3, 2019; Vol 60; Philadelphia, PA, 2019.

Huang, C.H.; Mendez, N.; Echeagaray, O.H.; **Weeks, J.**; Wang, J.; Vallez, C.; Gude, N.; Trogler, W.; Carson, D.; Hayashi, T.; Kummel, A.C. Conjugation of a small molecule TLR7 agonist to silica nanoshells enhances adjuvant activity. ACS Appl Mater Interfaces. 2019, 11, 30, 26637-26647.

Wang, J.; Barback, C.V.; Ta, C. N.; **Weeks, J.**; Gude, N.; Mattrey, R.F.; Blair, S.L.; Trogler, W.C.; Lee, H.; Kummel, A.C. Extended lifetime in vivo pulse stimulated ultrasound imaging. IEEE Trans Med Imaging. 2018, 37, 1, 222-229.

Current Research (expanded description): To study amplified malate dehydrogenase 1 (MDH1) in lung cancer, Joi created fourteen single cell clones as a tool in squamous non-small cell lung cancer (NSCLC) cells. Levels of MDH1 were found to be more than five times higher in two of the clones compared to the other 12 and to have increased MDH1 enzymatic activity over the control. Preliminary metabolic studies on MDH1 knock out (KO) cells reveal that KO cells have a ~50% reduction in tricarboxylic acid (TCA) cycling revealing a decrease in lactate secretion and decreased lipid synthesis compared to wild type (WT) cells. A physical result of decreased TCA cycling is that the KO cells grow ~50% slower than WT cells. Growth rescue experiments reveal that pyruvate and alpha-ketobutyric acid can partially rescue the growth of KO cells. Such experiments suggest that decreased activity of MDH1 has the potential to slow down tumor progression.

Benefits to Science and Society: Joi's studies will increase our understanding about how microenvironmental pH can alter cellular MDH1 activity, the effects of amplifying and decreasing MDH1 levels on cell behavior, and how changes in MDH1 activity can lead to the eradication of squamous NSCLC cells. It is her hope that once she demonstrates that reduced MDH1 activity is specifically detrimental to squamous NSCLC cells, future work will be done to create MDH1 inhibitors that will have the potential to be used as anti-tumor therapies for squamous NSCLC patients.

Personal Interests: Joi also enjoys running, reading, making jewelry, gardening and spending time at the beach with her family.

ARCS Award: The ARCS Foundation Award means security and productivity to me. What I mean is that the ARCS Award has allowed me to investigate the activity of MDH1 in squamous NSCLC within the confines of a small research group. This opportunity would not be possible without funding as our research group is young and quickly acquiring undergraduates, so help is greatly needed to support the graduate students. Plus, I acutely felt the impact of a challenging funding climate as my previous lab was forced to eliminate a project and personnel due to a grant ending, requiring me to find a new lab. Since all of my funds are from outside sources such as ARCS, I was able to seamlessly move on to a new research group without the worry of delayed or suspended pay. Now I'm in a new lab that values my biological expertise and seeks to help me grow as a scientist, regardless of the ebb and flow of lab grants. Also, by focusing on science, progress on my new project allowed me the opportunity to present my findings and connect with other scientists at the American Association for Cancer Researchers this April.



# NICHOLAS BENJAMIN WILLIAMS

## San Diego State University / University of California San Diego

College of Sciences

Concentration: Chemistry

Specialization: Inorganic Chemistry

Donor: ARCS Foundation - San Diego / Virginia Lynch Grady Endowment

Currently, Nick is investigating the decomposition of a molecular catalyst-semiconductor hybrid system designed to produce Hydrogen gas. Understanding the mechanism of decomposition has led to the design of better molecular catalysts expected to inhibit degradation during the photoelectrochemical production of Hydrogen. Fundamental studies such as this are necessary for the rational design of better, more efficient and cost-effective solar fuel producing systems in the times to come which we so readily need.

Degrees: B.A. in Chemistry, Washington and Jefferson College; B.A. in Economics, Washington and Jefferson College

Awards and Honors: National Renewable Energy Lab Summer research internship, July 2019; SDSU Dept. Chemistry and Biochemistry Outstanding Masters Research Award, Fall 2017; ARCS Foundation, Inc. - San Diego Award, Fall 2017 to Present

Publications and Posters:

Fang, C.; Li J.; Zhang, Y.; Yang, F.; Lee, J.L.; Lee, M.; Alvarado, J.; Wang, X.; Schroeder, M.; Yang, Y.; **Williams, N.**; Ceja, M.; Yang, L.; Cai, M.; Gu, J.; Xu, K.; Wang, X.; Meng, Y.S. Quantifying inactive lithium in lithium metal batteries. Nature 2019 572, 511-515.

Huang, Y.; Sun, Y.; Zheng, X.; Aoki, T.; Pattengale, B.; Huang, J.; He, X.; Bian, W.; Younan, S.; **Williams, N.**; Hu, J.; Ge, J.; Pu, N.; Yan, X.; Pan, X.; Zhang, L.; Wei, Y.; Gu, J. Atomically engineering activation sites onto metallic 1T-MoS2 catalysts for enhanced electrochemical hydrogen evolution. Nature Communications 2019, 10 (1).

Zhou, Y.-H.; Wang, S.; Zhang, Z.; **Williams, N**.; Cheng, Y.; Gu, J. Hollow nickel-cobalt layered double hydroxide supported palladium catalysts with superior hydrogen evolution activity for hydrolysis of ammonia borane. ChemCatChem 2018, 10 (15), 3206–3213.

Zhou Y.-H.; Zhang, Z.; Wang, S.; **Williams, N.**; Cheng, Y.; Luo, S.; Gu J. rGO supported PdNi-CeO2 nanocomposite as an efficient catalyst for hydrogen evolution from the hydrolysis of $NH_3BH_3$. Int. J. Hydrog. Energy 2018 43, 18745-18753.

Current Research (expanded description): My research initially focused on bonding a monolayer of an organometallic catalyst onto a semiconductor interface for the photoelectrochemical generation of solar fuels. The desired fuel hydrogen gas was produced with a faradaic efficiency of nearly 100% but was produced at a decreasing rate, due to the decomposition of the molecular catalyst. From here I studied the decomposition of the catalyst using surface sensitive techniques. Using methods as complex as X-ray photoelectron spectroscopy and as simple as contact angle measurements, chemical changes can be monitored and observed on material interfaces with the purpose of monitoring catalyst degradation. Additionally, I have been working on developing materials for electrochemical hydrogenation reactions. This work can be utilized in regenerating co-enzymes for cell-free enzyme cascade systems, or recycling sacrificial hydride sources.

Benefits to Science and Society: In catalyst development, the major focus lies in designing better catalysts with understanding the limitation and pitfalls taking a backseat. This work offers insight into the reasons why a very particular and specific system failed. The methodology however can be used on a broader level applied to a wide variety of catalysts. Developing an understanding for why a catalyst fails can aid in the designing of better structures in the future.

Personal Interests: I enjoy camping at places like Death Valley, Yellowstone, and the Black hills. I like to bake my own bread.

ARCS Award: Throughout the last year, whether I was working in lab, reading literature or communicating with scientists and colleagues, I was always learning. Most of the time I was stressed or tired, but thanks to the ARCS Award, the burden of finances was very much alleviated. It gave me the freedom to sit down over the weekends and learn some new fields of sciences related to my work, such as the area of self-assembled monolayers and ion scattering spectroscopy or potential organic liquids for hydrogen storage applications, that I may not have had the time to do. The ARCS Award has been a phenomenal help, and going forward this upcoming year working solely on advancing my PhD, I am truly excited for what I will learn in the year to come.

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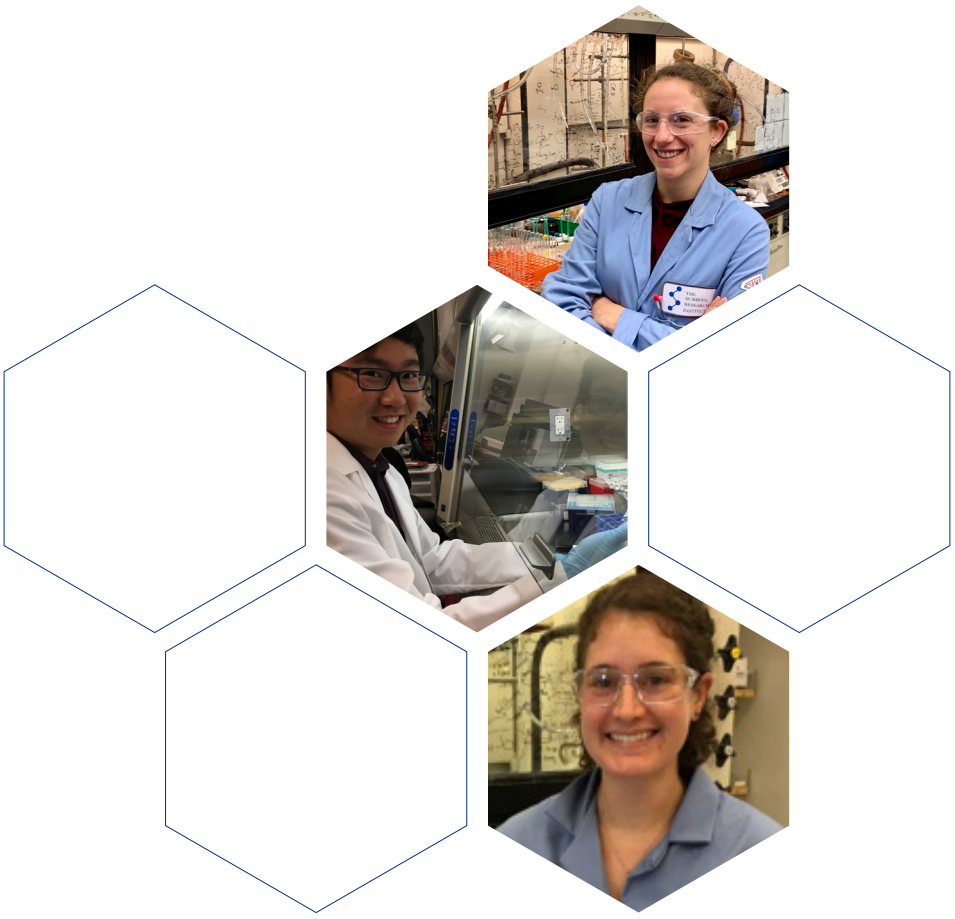


# CARLOS ANDRES AGUIRRE

## Scripps Research

Skaggs Graduate School of Chemical and Biological Sciences

Concentration: Neuroscience

Specialization: Neurodegeneration and Neuroinflammation

Donor: ARCS Foundation - San Diego Chapter

Carlos' research focuses on understanding how inflammation of the brain contributes to Parkinson's disease. Parkinson's disease is primarily characterized by degeneration of dopaminergic neurons, dopamine-producing brain cells, in a specific area of the brain termed the substantia nigra pars compacta. Recently, inflammation has been proposed to contribute to the neuronal loss in Parkinson's disease. Carlos is investigating whether two regulators of immune response interleukin-13 and its receptor alpha-1 (IL-13Rα1) contribute to the neuronal loss characterized in Parkinson's disease. His work may reveal novel targets for treating Parkinson's disease.

Degrees: M.S. in Biology, California State University Los Angeles; B.S. in Pharmaceutical Sciences, University of California Irvine

Awards and Honors: North County San Diego Professional and Interdisciplinary Research Enrichment (NSPIRE) Fellowship; People's Choice Best Poster 2019 Scripps Research Symposium: Engaging the Community; TL1 Translational Research Training Program Fellowship

Publications and Posters:

**Aguirre, C.** Does the IL-13 system contribute to Parkinson's disease? North County San Diego Professional and Interdisciplinary Research Enrichment (NSPIRE) Symposium, San Marcos, USA. July 25, 2019.

**Aguirre, C**. Does allergy contribute to Parkinson's disease? Scripps Research Symposium: Engaging the Community, La Jolla, U.S.A., March 4, 2019.

Current Research (expanded description): My research is focused on understanding how neuroinflammation can contribute to Parkinson's disease (PD), the second most common neurodegenerative disorder, which is primarily characterized by loss of dopaminergic (DA) neurons of the substantia nigra pars compacta (SNc). Although monogenic forms of PD have been identified, most PD cases are believed to be the result of a combination of

environmental and genetic factors. Recently, inflammation and its mediators have been proposed to contribute to the neuronal loss in PD. Thus, inflammatory regulators could be involved in the loss of DA neurons and play significant roles in the onset and/or progression of PD. I am investigating whether two regulators of immune response, interleukin-13 (IL-13) and its receptor alpha-1 (IL-13Rα1), contribute to the neuronal loss observed in PD. I am using CRISPR/Cas9 for both in vitro and in vivo experiments to determine the biological function of a rare single nucleotide polymorphism (SNP) in the human IL13 gene and a rare SNP in the human IL-13Rα1 gene that we found to be associated with PD (early onset for IL13 SNP). Elucidating the contribution of IL-13 and IL-13Rα1 to DA neuron loss in PD may reveal them as novel targets for the treatment of PD.

Benefits to Science and Society: We identified genetic variants associated with human Parkinson's disease (PD) that upon validation would represent one of the first examples that mutations in genes regulating immune functions can specifically contribute to PD. For regenerative PD medicine it may be necessary to develop IL-13Rα1 depleted dopamine neurons from induced pluripotent stem cells to prevent the same vulnerability as the parental ones. Altogether, our research may reveal novel targets for the treatment of PD and progress the future of personalized PD medicine.

Personal Interests: I enjoy attending art shows and cooking new recipes.

ARCS Award: The ARCS Foundation award is an invigorating opportunity that will spearhead me into many scientific and personal growth trajectories. It is exciting to know that through the ARCS Scholars network I will be able to foster relationships with various scientists. Thus, through this award I will be able to develop not only as a scientist in a professional sense, but personally as well. Ultimately, this award will be a crucial aid in my journey of becoming a scientific leader in Parkinson's disease research.



# LISA MARIE BARTON

## Scripps Research

Skaggs Graduate School of Chemical and Biological Sciences

Concentration: Chemistry

Specialization: Organic Chemistry

Donor: Larry and Marti Showley / ARCS Foundation - San Diego

As a graduate student in the lab of Professor Phil Baran, Lisa's research focuses on the development of novel chemical transformations that aid in the synthesis of highly strained molecules. Rapid access to these motifs is useful to many different areas of organic chemistry, including the synthesis of pharmaceuticals, natural products and energetic molecules. The ability to access novel strained scaffolds, that would otherwise be very challenging to synthesize, will aid other chemists in their own research.

Degree: B.S. in both Biology and Chemistry, Northeastern University

Awards and Honors: Bristol-Myers Squibb Graduate Fellowship, 2019-2020; ARCS Scholar, 2019-present; NSF Graduate Research Fellowship, 2018-Present

Publications and Posters:

**Barton, L. M**.; Edwards, J. T.; Johnson, E. C.; Bukowski, E. J.; Sausa, R. C.; Byrd, E. F.; Orlicki, J. A.; Sabatini, J. J.; Baran, P. S. Impact of stereo- and regiochemistry on energetic materials. J. Am. Chem. Soc. 2019, 141, 12531-12535.

Shang, M*; Feu, K. S.*; Vantourout, J. C.; **Barton, L. M**.; Osswald, H. L.; Kato, N.; Gagaring, K.; McNamara, C. W.; Chen, G.; Hu, L.; Ni, S.; Fernandez-Canelas, P.; Chen, M.; Merchant, R. R.; Qin, T.; Schreiber, S. L.; Melillo, B.; Yu, J. Q.; Baran, P. S. Modular, stereocontrolled Cb–H/Ca–C activation of alkyl carboxylic acids. PNAS 2019, 116, 8721-8727. * Equal contributions

Chen, T. -C.*; **Barton, L. M.***; Lin, Y.*; Tsien, J.; Kossler, D.; Bastida, I.; Asai, S.; Bi, C.; Chen, J. S.; Shan, M.; Fang, H.; Fang, F. G.; Choi, H.; Hawkins, L.; Qin, T.; Baran, P. S. Building C($sp^3$)-rich complexity by combining cycloaddition and C–C cross–coupling reactions. Nature 2018, 560, 350-354. *Equal contributions

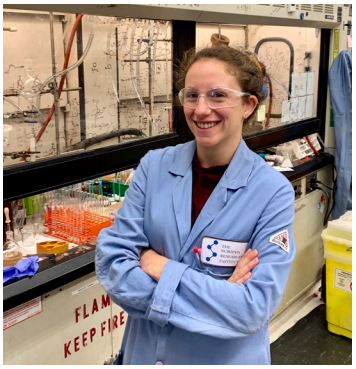
Li, C.*; Wang, J.*; **Barton, L. M.**; Yu, S.; Tian, M.; Peters, D. S.; Kumar, M.; Yu, A. W.; Johnson, K. A.; Chatterjee, A. K.; Yan, M.; Baran, P. S. Decarboxylative borylation. Science 2017, 356, eaam7355. *Equal Contributions

Current Research (expanded description): Development of novel decarboxylative cross-coupling methodologies and strategies, as well as the synthesis of natural products. My initial research involved the discovery of a nickel-catalyzed decarboxylative borylation method for the installation of boronic esters and acids into complex scaffolds. I am currently working to improve this method by the development of a metal free, electrochemical variation of the same transformation. Similarly, a large portion of my research has focused on the synthesis and functionalization of strained ring systems. I coauthored a paper in which we combined the complexity generation of cycloaddition reactions with the modularity of decarboxylation cross-coupling reactions in order to synthesize enantioenriched 1,2-disubstituted cyclopropanes, cyclobutanes, cyclopropanes, and cyclohexanes. Furthermore, in collaboration with the Army Research Laboratory, I systematically studied the effect that stereo- and regiochemistry had on the energetic properties of a series of energetic cyclobutane nitric esters. Finally, the culmination of my research combines my interest in decarboxylative cross-coupling methods with the synthesis and functionalization of strained scaffolds through the ongoing total synthesis of several different polycyclopropane natural products such as jawsamycin.

Benefits to Science and Society: A direct societal benefit of my research is the discovery and rapid synthesis of pharmaceutical candidates. As demonstrated in several of my publications, my work has been directly applied to the synthesis of Velcade, Ninlaro, Saphris, and drug targets currently under investigation at Leo Pharma and Eisai Pharmaceuticals. In addition, several of the cyclobutane nitric esters I discovered in collaboration with the Army Research Laboratory are currently under investigation for their application to both explosives and propellants.

ARCS Award: I am incredibly humbled to have been chosen for the ARCS Foundation award. ARCS has done so much to advance the careers of those in STEM fields, and to be chosen as one of their scholars and therefore represent them is a tremendous honor. Not to mention, as a female scientist myself in a field dominated by men, I feel particularly grateful to be chosen by an organization run entirely by women. In addition to the valuable connections that I am sure to make through the ARCS Foundation, the financial support afforded by this award will go far in helping me complete my studies at Scripps Research. Not only will it help me on a day to day basis, but as I enter the later portion of my Ph.D. studies, I plan to attend several conferences; this will provide me both the opportunity to present my research as well as meet and discuss cutting edge chemistry with my colleagues.





# CHRISTOPHER ANDREW COTTRELL

## Scripps Research

Skaggs Graduate School of Chemical and Biological Sciences

Concentration: Immunology

Specialization: Vaccine Design

Donor: Webster & Helen Kinnaird / Paul Bechtner Foundation / ARCS Foundation - San Diego



Despite over 30 years of effort, an effective HIV vaccine has yet to be developed. Current experimental HIV vaccines are capable of eliciting neutralizing antibodies against the vaccine strain of HIV, but do not produce antibodies capable of neutralizing the diverse strains of HIV circulating throughout the world. Chris's research seeks to combine high-resolution structural biology information with immunological and bioinformatics data to engineer a series of HIV immunogens designed to broaden vaccine-induced neutralizing antibody responses.

Degrees: M.S. in Biotechnology, Johns Hopkins University; B.S. Chemistry, United States Naval Academy

Awards and Honors: 2019 Scripps CHAVI-ID Young Investigator Award; 2017-2020 NIH F31 Predoctoral Fellowship

Publications and Posters:

Turner, H. L.; Pallesen, J.; Lang, S.; Bangaru, S.; Urata, S.; Li, S.; **Cottrell, C. A.**; Bowman, C. A.; Crowe, J. E., Jr.; Wilson, I. A.; Ward, A. B. Potent anti-influenza H7 human monoclonal antibody induces separation of hemagglutinin receptor-binding head domains. PLoS Biol 2019, 17 (2), e3000139.

Pauthner, M. G.; Nkolola, J. P.; Havenar-Daughton, C.; Murrell, B.; Reiss, S. M.; Bastidas, R.; Prevost, J.; Nedellec, R.; von Bredow, B.; Abbink, P.; **Cottrell, C. A.;** Kulp, D. W.; Tokatlian, T.; Nogal, B.; Bianchi, M.; Li, H.; Lee, J. H.; Butera, S. T.; Evans, D. T.; Hangartner, L.; Finzi, A.; Wilson, I. A.; Wyatt, R. T.; Irvine, D. J.; Schief, W. R.; Ward, A. B.; Sanders, R. W.; Crotty, S.; Shaw, G. M.; Barouch, D. H.; Burton, D. R. Vaccine-induced protection from homologous tier 2 SHIV challenge in nonhuman primates depends on serum-neutralizing antibody titers. Immunity 2019, 50 (1), 241-252 e6.

Ringe, R. P.; Pugach, P.; **Cottrell, C. A.**; LaBranche, C. C.; Seabright, G. E.; Ketas, T. J.; Ozorowski, G.; Kumar, S.; Schorcht, A.; van Gils, M. J.; Crispin, M.; Montefiori, D. C.; Wilson, I. A.; Ward, A. B.; Sanders,

R. W.; Klasse, P. J.; Moore, J. P. Closing and opening holes in the glycan shield of HIV-1 envelope glycoprotein SOSIP trimers can redirect the neutralizing antibody response to the newly unmasked epitopes. J Virol 2019, 93 (4).

Cirelli, K. M.; Carnathan, D. G.; Nogal, B.; Martin, J. T.; Rodriguez, O. L.; Upadhyay, A. A.; Enemuo, C. A.; Gebru, E. H.; Choe, Y.; Viviano, F.; Nakao, C.; Pauthner, M. G.; Reiss, S.; **Cottrell, C. A.**; Smith, M. L.; Bastidas, R.; Gibson, W.; Wolabaugh, A. N.; Melo, M. B.; Cossette, B.; Kumar, V.; Patel, N. B.; Tokatlian, T.; Menis, S.; Kulp, D. W.; Burton, D. R.; Murrell, B.; Schief, W. R.; Bosinger, S. E.; Ward, A. B.; Watson, C. T.; Silvestri, G.; Irvine, D. J.; Crotty, S. Slow delivery immunization enhances HIV neutralizing antibody and germinal center responses via modulation of immunodominance. Cell 2019. (forthcoming)

Current Research (expanded description): The HIV envelope glycoprotein is the sole target for antibody-mediated protection from HIV infection. Animal immunizations with first-generation HIV envelope immunogens (SOSIP immunogens) have induced autologous neutralizing antibodies, but failed to induce antibodies with sufficient breadth capable of neutralizing heterologous strains of HIV. Monoclonal antibodies with the ability to neutralize a broad array of HIV strains (broadly neutralizing antibodies) have been isolated from patients infected with HIV and these antibodies are capable of protecting against repeated viral challenge when administered by passive infusion to non-human primates. Broadly neutralizing antibodies generally arise after 2 to 3 years of infection and despite targeting a variety of epitopes on the HIV envelope glycoprotein, most share common characteristics such as high rates of somatic hypermutation. The goal of Chris's research project is to broaden the neutralizing antibody response elicited by first generation SOSIP immunogens. He will use high-resolution structures of SOSIP immunogens in complex with vaccine elicited antibodies to develop a series of immunogens designed to broaden the neutralizing antibody response to specific epitopes. Chris's project will combine structure guided iterative immunogen design with novel immunization strategies to broaden the neutralization specificity of antibodies elicited by current HIV vaccines.

Benefits to Science and Society: Despite significant advances in HIV therapy and prevention, in 2018 an estimated 1.7 million individuals were newly infected with HIV worldwide. An effective HIV vaccine is necessary in order to halt the spread of the epidemic. Chris's research is focused on developing new HIV vaccine candidates and evaluating these vaccine candidates using animal models. Knowledge gained from these experiments will not only contribute to development of an HIV vaccine, but will provide insight into the immune system responses to vaccines.

ARCS Award: The ARCS Foundation award provides an opportunity for me to attend academic conferences specific to my field of research, allowing me to present my results to experts in the field and receive critical feedback to help improve my research.



# JOSEPH MICHAEL MCGRAW

## Scripps Research

Skaggs Graduate School of Chemical and Biological Sciences

Concentration: Biomedical Sciences

Specialization: Immunology

Donor: Reuben H. Fleet Foundation Fund

Cancer immunotherapies direct our immune system to kill tumor cells and can completely cure a subset of patients. However, many patients still do not see any clinical benefit, and additional treatment options are needed. γδ T cells are a subset of immune cells with unique tissue-homing and tumor killing capabilities and are therefore a promising therapeutic target. Joseph's research aims to harness the potential of these cells and develop new cancer diagnostics and immunotherapies to improve clinical outcomes for a wider range of patients.

Degree: B.S. Integrated Degree in Engineering and Arts and Science, Lehigh University

Awards and Honors: AAI Trainee Abstract Award, IMMUNOLOGY 2019 Conference; Best Short Talk, University of San Diego Dermatology Meeting (2019); AAI Travel Award, International Gamma Delta T Cell Conference (2018); AAI Best Poster Award, La Jolla Immunology Conference (2017)

Publications and Posters:

**McGraw, J. M.;** Havran, W. L. gamma delta T cells and IgE team up to prevent tumors. Nature immunology 2018, 19 (8), 793-795. Commentary on article published in the same issue of Nature Immunology

**McGraw, J. M.** In IMMUNOLOGY 2019, San Diego, CA, May 9-13 2019; American Association of Immunologists. Poster and short talk on my thesis project at IMMUNOLOGY 2019 Conference

Current Research (expanded description): As a graduate student, I have focused on studying the immune response within barrier tissues such as skin and gut. These tissues provide a first line of defense against foreign pathogens and environmental toxins by acting as a physical barrier but also contain specialized immune cells that are critical for initiating immune responses and repairing damaged tissue. Specifically, my work has focused on tissue-resident γδ T cells and their role in antitumor immunity. Previous work done in our lab identified novel

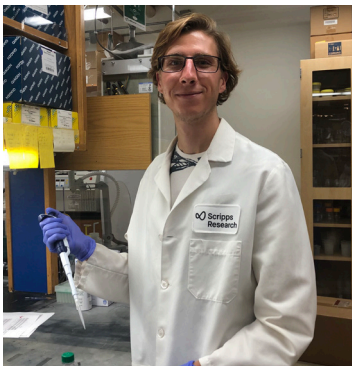
molecules that allow these cells to be activated following tissue damage, and we hope to use this information to develop new cancer immunotherapies. This work has been very exciting, and I plan to continue working on immunology projects to develop new treatments for infection, autoimmune diseases, and cancer after I graduate from Scripps Research.

Benefits to Science and Society: Tissue-resident T cells play critical roles in fighting cancer and infections but can also contribute to autoimmune diseases like psoriasis and inflammatory bowel disease. My hope is that a better understanding of the mechanisms that these cells use to regulate immune responses within tissues will lead to the develop of new diagnostics and treatments for deadly infections, autoimmune disease, and cancer.

Personal Interests: I enjoy reading, cooking, yoga, and spending time at the beach.

ARCS Award: I am grateful to have support from the ARCS Foundation and am happy that others see promise in my work and future as a scientist. This award will support me as I finish my doctoral thesis and move on into the next stage of my career as an immunologist.





# ANTHONY NICHOLAS MILIN

## Scripps Research

Skaggs Graduate School of Chemical and Biological Sciences

Concentration: Biomedical Sciences

Specialization: Phase Separation in Biology

Donor: ARCS Foundation - San Diego Chapter

Each year in America, nearly 1.7 million adults develop sepsis, nearly 270,000 Americans die as a result of sepsis, and 1 in 3 patients who die in hospitals have sepsis. Recent research has identified the growth-arrested state of bacteria as essential to understanding pathogenesis, yet its physiology remains poorly understood. Early investigations point towards liquid-liquid phase separation as one potential starvation protection mechanism for bacteria. By deciphering the physical basis of phase separation and the proteins/molecules that regulate this process, we hope to contribute to the future development of novel antibiotics.

Degree: B.A. in Chemistry, University of California Berkeley

Awards and Honors: The Donald and Delia Baxter Fellowship 2016; The Scripps Research Institute Dean's Fellowship 2016

Publications and Posters:

Onuchic, P. L.*; **Milin, A. N.***; Alshareedah, I.; Deniz, A. A.; Banerjee, P. R. Divalent cations can control a switch-like behavior in heterotypic and homotypic RNA coacervates. Scientific Reports 2019, 9 (1). *Equal contributions

**Milin, A. N.**; Deniz, A. A. Reentrant phase transitions and non-equilibrium dynamics in membraneless organelles. Biochemistry 2018, 57 (17), 2470–2477.

Banerjee, P. R.*; **Milin, A. N.***; Moosa, M. M.*; Onuchic, P. L.; Deniz, A. A. Reentrant phase transition drives dynamic substructure formation in ribonucleoprotein droplets. Angewandte Chemie International Edition 2017, 56 (38), 11354–11359. *Equal contributions

Goldman, D. H.*; Kaiser, C. M.*; **Milin, A**.; Righini, M.; Tinoco, I.; Bustamante, C. Mechanical force releases nascent chain-mediated ribosome arrest in vitro and in vivo. Science 2015, 348 (6233), 457–460. *Equal contributions

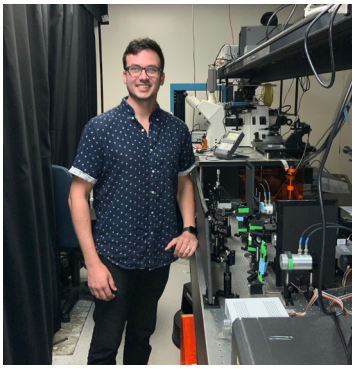
Current Research (expanded description): Over the years, I have covered a broad array of research topics and changed my research focus greatly. Originally trained as a chemist, I transitioned from surface functionalization and catalytic chemistry into biophysics at the single-molecule level by researching the mechanical effects of protein folding on the ribosome exit tunnel using optical tweezers. This research began in the Bustamante lab at UC Berkeley and carried over into my time in the Kaiser lab at Johns Hopkins University. Scripps Research's focus on translational science influenced my decision to pursue my PhD in the Deniz lab, where I currently use single-molecule fluorescence techniques to investigate the mesoscale phenomena of liquid-liquid phase separation. Liquid-liquid phase separation is a universal process that aids in the colocalization of biomolecules and acts as a biomolecular selectivity filter. Numerous recent reports have stressed its essential role in neurodegenerative diseases as well as other health-related processes. Recently, I have transitioned into understanding how this process pertains to the bacterial starvation mechanism. Bacteria are able to colocalize and store their necessary components under various stress responses. This alteration in their cytoplasm leads them to attaining an immunity to common antibiotics and can allow for these bacteria to persist for many years. By understanding the mechanism by which they protect themselves and store their core components, we hope to develop novel therapeutics to treat bacterial infections.

Benefits to Science and Society: Each year in America, nearly 1.7 million adults develop sepsis, nearly 270,000 Americans die as a result of sepsis, and 1 in 3 patients who die in hospitals have sepsis. In order to mitigate sepsis as well as other bacterial-related infections, I am currently investigating the underpinning role of liquid-liquid phase separation in the bacterial starvation mechanism. By understanding the underlying mechanism, we hope to develop novel antibiotics to treat multidrug-resistant bacteria.

Personal Interests: Coming from being raised by an immigrant father, I've always pushed myself to travel outside of my comfort zone. I'm also an avid reader, hiker, and animal lover.

ARCS Award: The ARCS Foundation award presents vital support not only in a monetary sense, but also with the ability to network with fantastically bright and innovative people. Science would not be possible without the generosity of institutions like you, and I hope that you understand just how important this is for breakthrough discoveries and research to take place. I greatly appreciate the honor of receiving the award, and I hope you understand how crucial it is to both my development as a scientist as well as propelling science forward.





# JESSICA DANIELLE ROSARDA

## Scripps Research

Skaggs Graduate School of Chemical and Biological Sciences

Concentration: Chemical Biology

Specialization: Cellular Stress Signaling

Donor: Mike and Laurie Roeder

Strokes are caused by a blood clot that impedes blood flow to the brain. While starved for oxygen and glucose, cells suffer severe stress that can lead to cell death. One way to prevent cell death is to increase the amount of stress a cell can handle by turning on pathways, like ATF6. Jessica's project is to identify protective mechanisms by which pharmacologic ATF6 activation protects neurons against stroke-associated damage. Furthermore, she will investigate the role of ATF6 in dictating the efficacy of other stroke therapeutics currently in development to treat ischemic stroke, such as Activated Protein C (APC).

Degrees: M.S. in Pharmacy conc. Forensic DNA & Serology, University of Florida; B.S. in Biology, Washington and Lee University

Awards and Honors: Donald and Delia Baxter Foundation Fellowship Recipient 2017-2018;

Distinguished Achievement Award - Kelly Government Services 2017; Outstanding Performance and Service Award - American Registry of Pathology 2015

Publications and Posters:

Giadone, R. M.; **Rosarda, J. D.**; Akepati, P. R.; Thomas, A. C.; Boldbaatar, B.; James, M. F.; Wilson, A. A.; Sanchorawala, V.; Connors, L. H.; Berk, J. L.; Wiseman, R. L.; Murphy, G. J. A library of ATTR amyloidosis patient-specific induced pluripotent stem cells for disease modelling and in vitro testing of novel therapeutics. Amyloid : the international journal of experimental and clinical investigation : the official journal of the International Society of Amyloidosis 2018, 25 (3), 148-155.

Glembotski, C. C.; **Rosarda, J. D.**; Wiseman, R. L. Proteostasis and beyond: ATF6 in ischemic disease. Trends Mol Med 2019, 25 (6), 538-550.

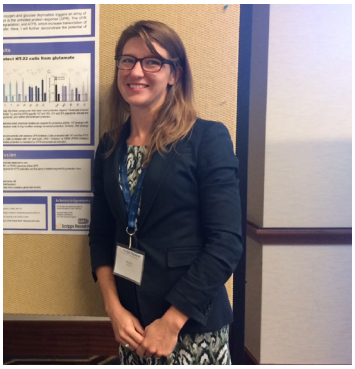
Humston, R.; Bezold, K. A.; Adkins, N. D.; Elsey, R. J.; Huss, J.; Meekins, B. A.; Cabe, P. R.; King, T. L. Consequences of stocking headwater impoundments on native populations of brook trout in tributaries. North American Journal of Fisheries Management 2012, 32 (1), 100-108.

Current Research (expanded description): Ischemic strokes are caused by a clot which occludes a cerebral artery. This reduces blood flow to a portion of the brain and deprives the affected tissue of oxygen and glucose, a condition known as ischemia. Current therapies treat ischemia using mechanical or chemical approaches to remove the clot, reperfusing the affected tissue. Ischemia damages cells by inducing widespread metabolic, oxidative, and protein folding stress. Reperfusion halts progression of this damage, but does not alleviate it, and induces oxidative stress that can cause additional cellular damage. One promising approach to promote neuroprotection following an ischemic stroke is to upregulate endogenous pathways that allow cells to manage additional stress. Previous studies identified one arm of the unfolded protein response (UPR), ATF6, as a critical mediator of cellular fate following I/R injury. However, the mechanism by which ATF6 produces beneficial effects in the brain remains unclear. I will use novel pharmacologic activators of ATF6 to determine the mechanisms by which ATF6 protects neurons against I/R damage, as a standalone treatment and in combination with Activated Protein C, which is currently in phase 2b clinical trials to treat ischemic stroke. Through these aims, I will define the role of ATF6 in ameliorating ischemic stroke associated damage in vitro.

Benefits to Science and Society: Ischemic stroke remains a leading cause of death and adult disability, yet no new stroke therapeutic has been approved by the FDA since 1996. Previously, our laboratory identified pharmacologic ATF6 activators that protect against ischemic stroke damage in vivo. However, the mechanism by which these compounds protect the brain remain unclear. My project will define the therapeutic potential of ATF6 activation to treat ischemic stroke. Furthermore, I will also expand our knowledge of the mechanisms of another stroke therapeutic currently in phase 2 clinical trials.

ARCS Award: When I look at the list of previous ARCS Foundation awardees, I see a host of scientists that I respect and admire. It is an absolute honor to be included in this esteemed group of students. As a non-traditional student with seven years of experience, I took a substantial pay cut to pursue my PhD, which limits my financial flexibility and ability to save for my future during a critical time in my career. The ARCS financial award provides a peace-of-mind that allows me to focus on my research and to plan for my future career moves.





# SOPHIA LOUISE SHEVICK

## Scripps Research

Skaggs Graduate School of Chemical and Biological Sciences

Concentration: Chemistry

Specialization: Organic Chemistry

Donor: Virginia Lynch Grady Endowment

Sophie's current project is the synthesis of a natural product (originally isolated from mushrooms) that targets the kappa opioid receptor (KOR). Sophie plans to make this same natural product in the lab, using commercially available starting materials. A synthetic route to this natural product will provide enough material for biological study, while also allowing for deep-seated changes to be made to the chemical scaffold. In the process, Sophie hopes to learn about chemical reactivity while synthesizing this tool to study opioid pharmacology. There is potential for this molecule to serve as a starting point for a non-addictive pain medication.

Degree: B.Sc. in Chemical Biology, University of California Berkeley

Awards and Honors: Lesly Starr Shelton Award for Excellence in Graduate Studies; TL1 translational NIH training grant; Graduated cum laude from UC Berkeley College of Chemistry

Publications and Posters:

**Shevick, S.L.**; Obradors, C.; Shenvi, R.A. Mechanistic interrogation of Co/Ni-dual catalyzed hydroarylation. J. Am. Chem. Soc., 2018, 140, 12056–12068)

**Shevick, S.L.**; Obradors, C.; Shenvi, R.A. Mechanistic interrogation of Co/Ni-dual catalyzed hydroarylation. Organic Reactions and Processes Gordon Conference, Easton, MA, July 2019 (poster).iodoarenes.

Current Research (expanded description): The Shenvi Lab group utilizes synthetically complex natural product (NP) and NP-like scaffolds as starting points to study challenging biological targets. One target of interest is the kappa opioid receptor (hKOR), a GPCR involved in cognition, mood, nociception (pain perception) and pruritus (itch) that has emerged as an important target for the development of new drugs to manage pain. Previously, our lab explored the synthesis of a modified salvinorin A (SalA) analog - 20-nor-SalA - which exhibited equipotent hKOR agonism to SalA, as well as increased chemical stability under basic conditions. A similar NP

starting point is collybolide, a sesquiterpene isolated from the Collybia maculata mushroom, and a selective hKOR agonist with potent anti-pruritic activity in mice. Both SalA and collybolide share a furyl-delta-lactone motif and are non-nitrogenous agonists of the hKOR, yet exhibit notable differences including; 1) different absolute stereochemistry at the 3-furan; 2) different biological origins; 3) and different core structures. Synthetic access to collybolide will enable us to further probe hKOR pharmacology and biased agonism by providing novel chemical space from which to interrogate small molecule binding at the hKOR.

Benefits to Science and Society: The NIH has called for "all scientific hands on deck" to address the US opioid crisis, including the development of small molecule therapeutics as non-addictive treatments for chronic pain. While pharmaceutical companies typically focus on structural chemotypes that are readily diversifiable, complex scaffolds are frequently passed over due to limited synthetic access to analogs. My research project, aimed at exploring the synthesis of complex natural products, provides access to small molecule tools to understand targeting the hKOR, with important implications for understanding chemical reactivity and human health.

Personal Interests: Sophie enjoys practicing yoga, baking banana bread, and fermenting foods (usually on purpose).

ARCS Award: Throughout my PhD, I have felt simultaneously challenged and rewarded by my work in organic chemistry. It's incredibly motivating when that work is recognized and encouraged by an outside organization. Thank you again for seeing my potential - it means so much!



# MIA SHIN

## Scripps Research

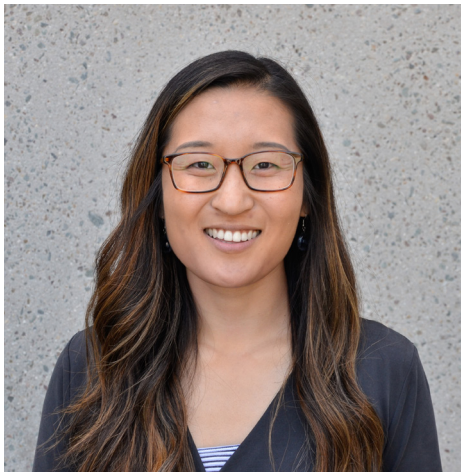
Skaggs Graduate School of Chemical and Biological Sciences

Concentration: Biomedical Sciences

Specialization: Biophysics and Structural Biology

Donor: Peggy Hanley and Hamp Atkinson

For her graduate studies, Mia is using state-of-the-art electron microscopes to solve the structures of proteins that regulate mitochondrial health. By understanding the structure of these essential proteins, she is looking to understand the mechanism of how they work in the cell to maintain health and how they are dysregulated in the context of human disease, as well as to consider potential therapeutic strategies for neurodegenerative diseases such as Alzheimer's and Parkinson's.



Degrees: B.A. in Molecular and Cell Biology, B.A. in Public Health, University of California Berkeley

Awards and Honors: Best Poster Award at the Protein Society Annual Meeting; Graduate Research Fellowship from the National Science Foundation; Fletcher Jones Foundation Fellowship; Dean's Fellowship

Publications and Posters:

**Shin, M.**; Asmita, A.; Puchades, C.; Adjei, E.; Wiseman, R.L.; Karzai, A.W.; Lander, G.C. Distinct structural features of the lon protease drive conserved hand-over-hand substrate translocation. (In Review)

Guinn, E.J.; Tian, P.; **Shin, M.**; Best, R.B.; Marqusee, S. A small single-domain protein folds through the same pathway on and off the ribosome. PNAS 2018, 115, 12206-12211.

Puchades, C.; Rampello, A.J.; **Shin, M.**; Giuliano, C.J.; Wiseman, R.L.; Glynn, S.E.; Lander, G.C. Atomic structure of the mitochondrial inner membrane AAA+ protease YME1 reveals the mechanism of substrate processing. Science 2017, 358.

Current Research (expanded description): For my graduate studies, I am conducting research in the labs of Drs. R. Luke Wiseman and Gabriel Lander where I am investigating how mitochondria employ a complex network of

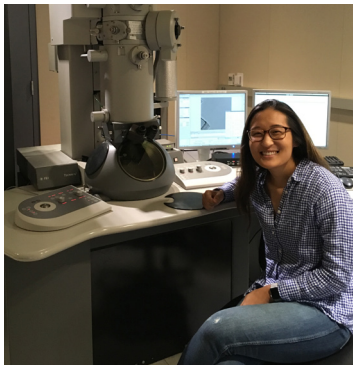
proteases to maintain protein homeostasis, or proteostasis and prevent pathogenesis of aging-related disorders, such as neurodegeneration. For my thesis research, I am interested in combining biophysical techniques, namely cryo-electron microscopy (cryo-EM) and cell biology to understand how ATP-dependent quality control proteases in mitochondria work together to maintain organellar proteostasis, as well as characterizing unique features that allow these proteases to identify diverse substrates and regulate almost all aspects of mitochondrial biology.

Benefits to Science and Society: By elucidating structures of essential mitochondrial quality control proteins, we will understand their mechanism, how they work in the cell, and how they are dysregulated in the context of human disease. Ultimately, we will be able to consider potential therapeutic strategies for aging-related disorders, such as neurodegeneration.

Personal Interests: Volunteering with my church, running, drinking coffee, cooking, and baking.

ARCS Award: Thank you so much for your generosity towards our Graduate Program at Scripps Research and graduate students like myself. I have long since admired the prestige of the ARCS Foundation award and the caliber of scientific achievement that came from named scholars in our program. It is now with great privilege and humility that I receive this magnanimous gift and the title of an ARCS Scholar. This award will indubitably support my lifelong goal of understanding the molecular underpinnings of neurodegenerative diseases, such as Alzheimer's and Parkinson's, with the ultimate goal of discovering potential therapeutic strategies for these debilitating diseases. Thank you, again for making dreams like this become one step closer to a reality.





# LEONARD HEEKYU YOON

## Scripps Research

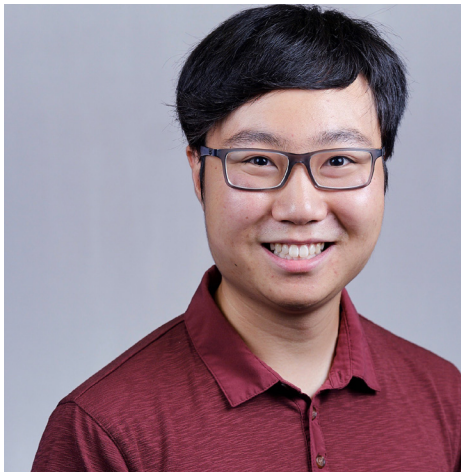
Skaggs Graduate School of Chemical and Biological Sciences

Concentration: Chemical Biology

Specialization: Molecular Medicine

Donor: ARCS Foundation - San Diego Chapter

In the Kelly lab, Leonard is following up on a high-throughput screen that yielded small molecule autophagy activators. After discovering transcriptional and translational targets of these small molecules, he aims to ultimately develop them into neurodegenerative disease therapies. In the Dawson lab, Leonard is working towards synthesizing a D-space Fyn SH2 superbinder for phosphotyrosine-containing substrates. He aims to inhibit overactivated signaling pathways found in various cancers using the superbinder, which will be less susceptible to proteolysis in cells.



Degree: B.A. in Chemistry and Statistics, Amherst College

Awards and Honors: American Chemical Society Division of Inorganic Chemistry Undergraduate Award (Amherst College); Everett H. Pryde Research Award (Amherst College); White Prize (Amherst College)

Publications and Posters:

Flood, D. T.; Asai, S.; Zhang, X.; Wang, J.; **Yoon, L.**; Adams, Z. C.; Dillingham, B. C.; Sanchez, B. B.; Vantourout, J. C.; Flanagan, M. E.; Piotrowski, D. W.; Richardson, P.; Green, S. A.; Shenvi, R. A.; Chen, J. S.; Baran, P. S.; Dawson, P. E. Expanding reactivity in DNA-encoded library synthesis via reversible binding of DNA to an inert quaternary ammonium support. Journal of the American Chemical Society. 2019. 141, 25, 9998-10006.

Chen, W.; Dong, J.; Li, S.; Liu, Y.; Wang, Y.; **Yoon, L.**; Wu, P.; Sharpless, K. B.; Kelly, J. W. Synthesis of sulfotyrosine-containing peptides by incorporating fluorosulfated tyrosine using an Fmoc-based solid-phase strategy, Angewandte Chemie. 2016. 128, 1867-1870.

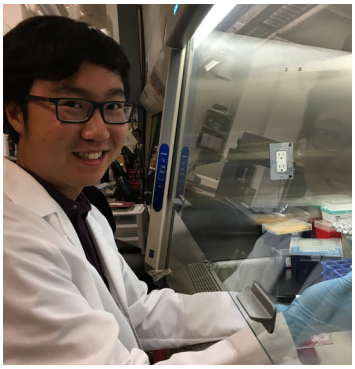
Current Research (expanded description): In the Kelly lab, I am following up on a high-throughput screen that yielded small molecule autophagy activators. After discovering transcriptional and translational targets of these small molecules using RNA-Seq and MS/MS, I aim to synthesize more potent and selective analogs that can ameliorate neurodegenerative disease phenotypes in mammalian cell models. In the Dawson lab, I am attempting to synthesize a D-space Fyn SH2 superbinder for phosphotyrosine-containing substrates. I aim to inhibit overactivated signaling pathways found in various cancers using the superbinder, which will be less susceptible to proteolysis in cells.

Benefits to Science and Society: Development of selective and potent mTOR-independent autophagy activators, which we would openly distribute, would be broadly useful to scientists studying autophagy in diverse biological contexts. One such context could be cancer research, since autophagy promotes cellular senescence and protects against genome instability. Another context could be neurodegenerative disease research, since the pharmacologic activation of autophagy has been shown to clear protein aggregates, lipids and organelles.

Personal Interests: I am a clarinetist in the Coastal Communities Concert Band. I play tennis weekly at UCSD.

ARCS Award: The ARCS Foundation award further motivates me to make meaningful advances in chemical and biological science research. The award also encourages me to share my research with the scientific community.






UC San Diego

# BRYCE ERIC ACKERMANN

## University of California San Diego

Division of Physical Sciences

Concentration: Biochemistry

Specialization: Structural Biology

Donor: Lambert Foundation for Education at Union Bank

Bryce studies the mechanisms of DNA compaction within human cells. He aims to describe the structure of the molecules involved in this process by developing the use of superconducting magnets to harness the innate magnetic properties of atoms. While genome sequencing has been extremely valuable, it is the 3-D structure of the genome that determines how DNA is expressed. The development of this technology will both provide insight into DNA organization and equip researchers with an unparalleled tool to study the molecular details of drugs and disease.

Degrees: M.S. in Chemistry, University of California San Diego; B.S. in Biochemistry and Molecular Biology, University of California Davis

Awards and Honors: 2019 EuroIsmar Conference Travel Award: 2019 Biophysical Society Travel Award; 2018-2020 Molecular Biophysics Training Grant Fellowship; 2016 Schilling Undergraduate Research Award

Publications and Posters:

Lim, B. J.*; **Ackermann, B. E.***; Debelouchina, G. T. Targetable tetrazine-based dynamic nuclear polarization agents for biological systems. bioRxiv 2019. * signifies equal contribution

**Ackermann, B. E.**; Debelouchina, G. T. Heterochromatin protein HP1a gelation dynamics revealed by solid-state NMR spectroscopy. Angewandte Chemie International Edition 2019, 58 (19), 6300–6305.

Monroy, B. Y.; Sawyer, D. L.; **Ackermann, B. E.**; Borden, M. M.; Tan, T. C.; Ori-McKenney, K. M. Competition between microtubule-associated proteins directs motor transport. Nature Communications 2018, 9 (1).

Gutierrez, P. A.; **Ackermann, B. E.**; Vershinin, M.; McKenney, R. J. Differential effects of the dynein-regulatory factor lissencephaly-1 on processive dynein-dynactin motility. Journal of Biological Chemistry 2017, 292 (29), 12245–12255.

Current Research (expanded description): In the Debelouchina Lab at UCSD, our research is focused on elucidating the molecular architecture of heterochromatic regions in the mammalian genome. We focus on heterochromatin protein 1a, a major determinant of heterochromatin which has been proposed to form these regions via liquid-liquid phase separation. We use nuclear magnetic resonance spectroscopy to study these macromolecular complexes because of its unique ability to achieve atomic-scale structural information for heterogenous mixtures. Further, we implement dynamic nuclear polarization to enhance the signal sensitivity, an imperative tool to study these molecules at physiological concentrations within human cells. We aim to identify the molecular interactions of heterochromatin protein 1a, chromatin and additional chromatin effectors, as well as describe the dynamics and function of heterochromatic domains. Our goal is to provide the missing molecular glimpse into this enigmatic region within eukaryotic genomes. These results will set the precedent for structural biology within native environments and help fill the gap formed by the resolution limitations of microscopy.

Benefits to Science and Society: Research in the Debelouchina Lab has the dual benefit of developing new technology to achieve atomic resolution of molecules within cells and elucidating the structure of a genomic feature that is central to biology. Many diseases revolve around the abnormal structuring of macromolecules, and many drugs function by their interaction with these structures. We envision the use of this technology can help facilitate drug discovery and treatments by providing the complete molecular description of the targets in their complex cellular setting.

Personal Interests: I enjoy surfing, music, digital art, coffee, listening, and all things nature.

ARCS Award: I was filled with joy when I learned I received this award from the ARCS Foundation. It feels awesome to be recognized for the work I do and the passion I have for science and the community. It also reminds me to pass on recognition to my peers for years to come, for acknowledgement is a great gift that we can all share.



# MIRIAM KATHLEEN BELL

## University of California San Diego

Jacobs School of Engineering

Concentration: Mechanical Engineering

Specialization: Computational Neuroscience, Computational Biophysics

Donor: Reuben H. Fleet Foundation Fund

Miriam uses computational and mathematical tools to investigate the biophysics behind various biological phenomena in neurons and other cell lines. Most of her current projects focus on the shape-function relationship of dendritic spines, small protrusions on neurons that are centers of synaptic communication. Dendritic spines are known to have different shapes that are characteristic of aging, disease, and learning. Therefore, studying how these various shapes relate to dendritic spine and neuronal function provides valuable insight into underlying neural principles that can help combat various neurological diseases and conditions.

Degrees: M.S. in Mechanical Engineering, University of California San Diego; B.S. in Physics, Harvey Mudd College

Awards and Honors: NDSEG Fellowship 2018-2019; Interfaces Graduate Training Program NIH NIBIB T32 Fellowship 2018-2019; San Diego Match Fellowship 2017-2018; Competitive Edge Fellowship 2016

Publications and Posters:

**Bell, M.**; Bartol, T.; Sejnowski, T.; Rangamani, P. Dendritic spine geometry and spine apparatus organization govern the spatiotemporal dynamics of calcium. J. Gen. Physiol. [Online] 2019, 151.8, 1017-1034 http://jgp.rupress.org/content/151/8/1017 (accessed 26 Sept 2019).

Pearce, K.; **Bell, M.**; Linthicum, W.; Win, Q.; Srinivasan, J.; Rangamani, P.; Scarlata, S. Gaq-mediated calcium dynamics and membrane tension modulate neurite plasticity. 2019. (in review)

**Bell, M.**; Bartol, T.; Sejnowski, T.; Rangamani, P. Dendritic spine geometry and biochemistry couple to alter calcium dynamics, UCSD Research Expo, La Jolla, CA, April 18, 2019.

**Bell, M.**; Bartol, T.; Sejnowski, T.; Rangamani, P. Dendritic spine size, shape, and organization govern calcium dynamics in the volume and AMPAR dynamics on the membrane, Cell Biology of the Neuron Gordon Research Conference, Waterville Valley, NH, June 24-29, 2018.

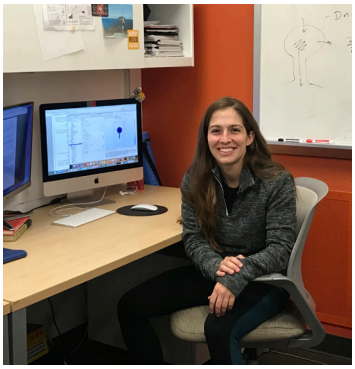
Current Research (expanded description): In my research, I utilize systems of ordinary or partial differential equations (ODEs/PDEs) and mechanical models to consider the effects of biophysical properties on biological systems. The majority of my projects focus on the relationship between shape and function in dendritic spines. Dendritic spines are key centers of synaptic communication, plasticity, and signaling, with dynamics that propagate to determine overall neuronal behavior. Dendritic spines remain morphologically dynamic throughout their lifetimes and are known to have specific shapes characteristic to learning, aging, and disease. Most synapses are found on dendritic spines so the majority of synaptic transmission occurs through the activation of signaling pathways within these small volumes. Second messengers such as $Ca^{2+}$ and $IP_3$ play vital roles in these pathways and their spatiotemporal dynamics determine downstream outcomes. Therefore, it is vital to understand the underlying biophysical properties of spines and how their shape and size influence their signaling networks and function. Overall, I use computational modeling to study multiscale systems or systems that have scales that make experimental observations challenging. I utilize both analytical and numerical approaches to study biological problems in order to offer insight, make predictions, and uncover fundamental principles.

Benefits to Science and Society: With billions of neurons and trillions of synaptic connections, the human brain is an engineering masterpiece. However, this complexity creates a vast number of complications that can arise if the brain malfunctions, which often occurs due to aging or traumatic brain injuries (TBI). Therefore, understanding how learning, memory formation, and decision-making occur in the brain is an important problem from both a scientific and societal point of view. Computational modeling can provide great insight into this complex system.

Personal Interests: Outside of lab, I enjoy playing soccer, bouldering, and hiking.

ARCS Award: Receiving the ARCS Foundation Award is a great privilege and opportunity for me. It allows me to pursue my research and develop as a scientist, with increased financial security and reduced anxiety. I greatly appreciate the ARCS Foundation for its support of and commitment to scientific research and individual scientists.





# LAURA BROWN CHIPMAN

## University of California San Diego

Division of Biological Sciences

Concentration: Biological Sciences

Specialization: Molecular Biology

Donor: Lambert Foundation for Education at Union Bank

Laura's research focuses on how aging is regulated on a molecular level. She studies how a small non-coding RNA molecule that is a fundamental regulator of gene expression, the microRNA, can regulate aging. MicroRNAs act as the traffic cops of genetic information, with the ability to block gene expression. Specifically, she studies how individual microRNAs can either increase or decrease lifespan, and how the pathway can be regulated to effect organismal lifespan.

Degree: B.S. in Biochemistry, University of Washington

Awards and Honors: National Science Foundation Graduate Research Fellowship; NIH Cellular and Molecular Genetics Training Grant Recipient

Publications and Posters:

**Chipman, L. B.**; Pasquinelli, A. E. MiRNA Targeting: Growing beyond the seed. Trends Genet. 2019, 35, 215–222.

Aalto, A. P.; Nicastro, I. A.; Broughton, J. P.; **Chipman, L. B.**; Schreiner, W. P.; Chen, J. S.; Pasquinelli, A. E. Opposing roles of microRNA argonautes during caenorhabditis elegans aging. PLOS Genet. 2018, 14 (6), e1007379.

Lima, S. A.; **Chipman, L. B.**; Nicholson, A. L.; Chen, Y.-H.; Yee, B. A.; Yeo, G. W.; Coller, J.; Pasquinelli, A. E. Short poly(A) tails are a conserved feature of highly expressed genes. Nat. Struct. Mol. Biol. 2017, 24, 1057-1063

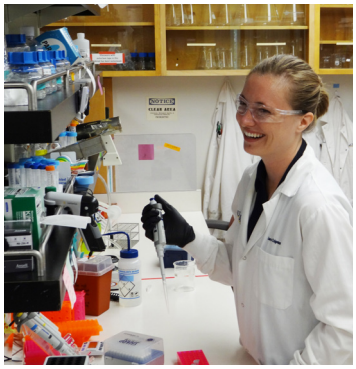
Current Research (expanded description): Argonaute (AGO) proteins partner with microRNAs (miRNAs) to target specific genes for post-transcriptional regulation. During larval development in Caenorhabditis elegans, Argonaute-Like Gene 1 (ALG-1) is the primary mediator of the miRNA pathway, while the related ALG-2 protein is largely dispensable. Our work shows that in adult C. elegans these AGOs are differentially expressed and, surprisingly, work in opposition to each other; alg-1 promotes longevity, whereas alg-2 restricts lifespan. Transcriptional profiling of adult animals revealed that distinct miRNAs and largely non-overlapping sets of protein-coding genes are misregulated in alg-1 and alg-2 mutants. Two miRNAs particularly of interest are lin-4 and miR-71; both of these miRNAs are specifically down-regulated in alg-1 mutant animals, loss of either miRNA results in a shortened lifespan, and potential target genes are up-regulated in alg-1 mutants. These miRNAs and some of the differentially expressed protein-coding genes act within the well-conserved Insulin/IGF-1 Signaling (IIS) pathway. Current studies are aimed at understanding how ALG-1 and ALG-2 associate with specific miRNAs and targets to differentially regulate organismal lifespan. This work establishes an important role for AGO-mediated miRNA gene regulation in aging C. elegans and illustrates that the activity of homologous genes can switch from complementary to antagonistic, depending on the life stage.

Benefits to Science and Society: MicroRNAs are involved in virtually every biological process, unsurprisingly; the mutation of specific microRNAs or the pathway has been implicated in multiple human diseases, from cancer, neurodegenerative diseases, to cardiovascular defects. My research will give deeper understanding of how microRNAs are regulated and regulate gene expression especially in the context of aging. Most diseases onset in aging, so understanding microRNAs in this context is vital for understanding and treating these diseases.

Personal Interests: I enjoy running, swimming, hiking, anything that allows me to enjoy beautiful San Diego!

ARCS Award: This award leaves me honored and alleviated of financial stress, allowing me to happily stay focused on my research!





# GABRIELLE MARIE COLVERT

## University of California San Diego

Jacobs School of Engineering

Concentration: Bioengineering

Specialization: Cardiovascular Imaging

Donor: Ellen Browning Scripps Foundation

The development of minimally invasive transcatheter procedures as alternatives to open-heart surgery demands new imaging techniques. Recent advances in noninvasive imaging have supported the success of these procedures by providing the exact size and location of cardiac pathologies and surrounding anatomy. Using noninvasive imaging, Gabrielle is developing novel methods for evaluating cardiovascular function beyond static anatomical measurements. These tools will improve diagnosis and prevention of cardiac events, enable patient stratification for transcatheter interventions, and yield new understanding of how diseases and implanted cardiac devices alter and restore normal function.

Degrees: M.S. in Bioengineering, University of California San Diego; B.S. in Biomedical Engineering, University of Southern California

Awards and Honors: RFW Best Student Paper Finalist, SPIE Medical Imaging 2019; NIH Integrative Bioengineering of Heart, Vessels, and Blood (T32HL105373) Training Grant Recipient 2017-2019; NAE Grand Challenges Scholar, USC 2016; Global Scholar Prize Winner, USC 2016

Publications and Posters:

**Colvert, G.M.**; Manohar, A.; Colvert, B.; Contijoch, F.; McVeigh, E.R. Measurement of left ventricular longitudinal and circumferential strain on the endocardial surface using 4DCT. 14th Annual Meeting of Society of Cardiovascular Computed Tomography, Baltimore, MD, July 2019

**Colvert G.M.**; Manohar, A.; Colvert, B.; Schluchter, A.; Contijoch, F.; McVeigh, E.R. Novel measurement of LV twist using 4DCT: Quantifying accuracy as a function of image noise. In Medical Imaging 2019: Biomedical Applications in Molecular, Structural, and Functional Imaging, Proceedings of SPIE; San Diego, CA, 16-21 Feb, 2019; doi: 10.1117/12.2512532

**Colvert, G.M.**; Contijoch, F.; McVeigh, E.R. Measurement of LV twist with cine CT. 13th Annual Meeting of Society of Cardiovascular Computed Tomography, Grapevine, TX, July 2018

Current Research (expanded description): The goals of my doctoral work are to leverage the advantages of 4D x-ray computed tomography (CT) to obtain highly reproducible metrics of cardiac function and evaluate their diagnostic and prognostic value in different patient populations. Specifically, I have chosen to focus on patients undergoing transcatheter-based interventions as I believe noninvasive imaging is an integral part of the success of procedures such as transcatheter mitral valve replacement (TMVR) and cardiac resynchronization therapy (CRT). Before entering the catheterization lab, physicians require information regarding both the anatomy and the functional state of their patient. With the tools I am working to develop, 4DCT can provide both anatomical and physiological information to improve the clinical outcomes of these interventions. More specifically, the goals of my research project are to obtain a better understanding of the effect of mitral regurgitation and TMVR on cardiac function and remodeling and to identify prognostic parameters which can be used to stratify patients for the procedure. In addition, we will use the tools I have developed to target the appropriate location for LV lead placement in CRT patients to decrease the number of non-responders (~33%) to the procedure.

Benefit to Science and Society: Through my research I plan to integrate imaging, physiology, biomechanics, and mathematical analyses for development of noninvasive measurements of cardiovascular function. In addition, I hope to make meaningful contributions to imaging science and interventional cardiology that enable a better scientific understanding of cardiovascular disease and improve clinical assessment and treatment of these diseases. Lastly, I would like to promote collaboration of interdisciplinary teams and encourage exchange of data and scientific discoveries to tackle highly complex health-related problems.

Personal Interests: I love travelling, hiking, and supporting my favorite sports teams (from the

USC Trojans, to the Boston Celtics, to the Belgian Red Devils)!

ARCS Award: The ARCS award allows me to fully dedicate my time and effort in advancing my research project as well as my future career as an engineer instead of focusing on financial worries. In addition, this award has connected me to an inspiring, innovative, and supportive community which I am very grateful for.



# BETHANNY PATRICIA DANSKIN

## University of California San Diego

School of Medicine

Concentration: Neurosciences

Specialization: Systems Neuroscience

Donor: Hervey Family Non-Endowment Fund

Making a decision based on internal representation of value is a critical component of animal behavior, from a bee foraging between flower patches to complex human behaviors like economic choice or gambling. In interacting with the world, we need to weigh alternative choices with the expected value of outcomes. Bethanny's research uses cutting-edge neurobiological techniques to characterize the encoding of decision by neurons in the brains of awake, behaving mice.

Degrees: B.S. in Neurobiology, University of Washington; Associate of Arts and Sciences, Bellevue Community College

Awards and Honors: NIH NRSA F31 Individual Predoctoral Fellowship 2018; University of Washington President's Medal 2013; Mary Gates Research Scholarship 2013; Computational Neuroscience Training Grant 2012

Publications and Posters:

Hattori, R.; **Danskin, B.D.**; Babic, Z.; Mlynaryk, N.; Komiyama, T. Area-specificity and plasticity of history-dependent value coding during learning. Cell 2019, 177, 1-15.

Hedrick, T; **Danskin, B.D.**; Larsen, R.S.; Ollerenshaw, D.; Groblewski, P.A.; Valley, M.; Olsen, S.; Waters; J. Characterization of channelrhodopsin and archaearhodopsin in cholinergic neurons of Cre-lox transgenic mice. PLoS One 2016, 11(5)e0156596.

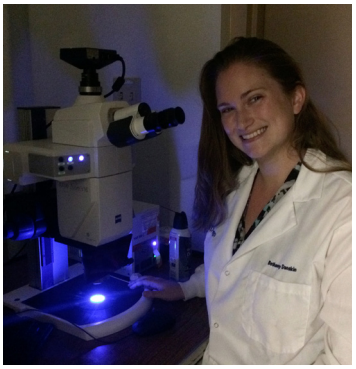
**Danskin, B.D.**; Denman, D.; Valley, M.; Ollerenshaw, D.; Williams, D.; Groblewski, P.A.; Reid, R.C.; Olsen, S.; Waters; J. Optogenetics in mice performing a visual discrimination task: measurement and elimination of retinal activation and the resulting behavioral artifact. PLoS One, 2015, 10(12):e0144760.

Current Research (expanded description): I investigate the neural basis of value-based decision-making, which I study in cortical areas using a combination of calcium imaging, and optogenetic or pharmacological manipulations. I perform my experiments in awake and behaving mice, and model their behavior quantitatively, to better understand how decision information is encoded and used to make adaptive choices in a dynamic environment. Specifically, I have found that by briefly and precisely inactivating part of cortex called the Retrosplenial cortex (RSC) I can measurably degrade the encoding of value and impair the mouse's decision strategy both during and after optogenetic stimulation, which strongly implicates RSC as a repository maintaining value during the behavior.

Benefits to Science and Society: Integrating information to decide between several choices is a universal and critical precursor to animal behavior, one that relies on neural computations. Understanding the mechanisms underlying decision-making, especially the estimation and representation of a choice's value, is critical to effectively diagnosing and treating neuropathologies that affect decision-making. Such pathologies include frontotemporal dementia, Parkinson's disease, Huntington disease, and Alzheimer Disease. This research is also of interest for any field investigating how humans make complex decisions, such as economics or social sciences.

ARCS Award: The ARCS award is peace of mind and a great connection to talented and like-minded colleagues through the ARCS events. The award has lessened the financial burden of graduate school, and is allowing me to pursue my project to completion.





# CAYCE ELIZABETH DORRIER

## University of California San Diego

School of Medicine

Concentration: Biomedical Sciences

Specialization: Neuroscience and Pharmacology

Donor: The Donald C. and Elizabeth M. Dickinson Foundation

Cayce's research focuses on scar tissue buildup that occurs following neuroinflammation such as in multiple sclerosis, where there are few treatment options that aid in tissue repair. She has shown that a fibrotic scar forms in the spinal cord following neuroinflammation and has an impact on how the tissue is able to recover by blocking agents that aid in repair from reaching the inflammation. She hopes to learn more about how scar tissue can be targeted in disease to improve recovery.

Degree: B.S. in Chemistry, University of North Carolina at Chapel Hill

Awards and Honors: NIH F31 Fellowship; Keystone Symposia Travel Scholarship; NSF GRFP Honorable Mention; David Goeddel Fellowship

Publications and Posters:

**Dorrier, C.E.**; Aran, D.; Haenelt, E.A.; Lizama, C.O.; Cautivo, K.M.; Sheehy, R.N.; Weiner, G.A.; Arnold, T.; Daneman, R. CNS fibroblasts form a fibrotic scar in response to neuroinflammation. (submitted).

**Dorrier, C.E.**; Aran, D.; Haenelt, E.A.; Arnold, T.; Daneman, R. Central nervous system fibrosis following neuroinflammation. Keystone Symposia on Neural Environment in Disease: Glial Responses and Neuroinflammation, Keystone, CO, June 16-20, 2019.

Current Research (expanded description): The goal of my research is to understand how fibrotic scar tissue influences recovery from neuroinflammatory diseases. I have identified fibrotic scarring in the central nervous system (CNS) following neuroinflammation in the EAE mouse model of multiple sclerosis that lasts for months after the initial symptom onset. I determined using lineage tracing and single cell sequencing that the scar arises from the proliferation of CNS fibroblasts (and not other cell types) in the CNS turning on the production

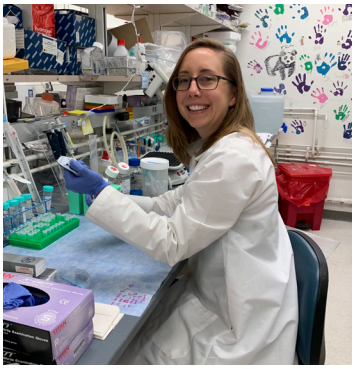
of collagen. I have showed that the scar has an impact on motor recovery by preventing oligodendrocyte lineage cells from entering the lesion to repair damaged axons. Furthermore, using RNA sequencing I have shown that this scar arises in part from interferon gamma signaling in fibroblasts. I hope to expand my research to other CNS disorders with fibrotic scarring such as stroke and spinal cord injury and learn more about the mechanisms regulating scar formation with the hopes of discovering therapeutics that can aid in tissue repair.

Benefits to Science and Society: The outcomes of this project have the potential to lead to new therapeutics that could aid in recovery following neuroinflammatory diseases and other CNS disorders with fibrotic scarring, such as spinal cord and injury and stroke. If I find that a molecular pathway drives scar formation in the CNS and that using therapeutics to target this pathway and decrease scar formation leads to an increase in tissue repair and recovery, then these therapeutics could be tested in a clinical setting.

Personal Interests: Outside of lab I enjoy hiking, yoga, singing and volunteering.

ARCS Award: This award is a great honor and will allow me to continue pursuing my research while maintaining hobbies and activities that I love. I am excited to meet and learn from other scholars and donors.





# MICHELLE T DOW

## University of California San Diego

School of Medicine

Concentration: Bioinformatics and Systems Biology

Specialization: Genetics and Computational Genomics

Donor: Dottie Georgens

Michelle's research focuses on understanding how genetic variation impacts the gene function in anti-cancer drug responses. Translation of cancer genomic data to therapeutic treatment remains challenging. To characterize how these alterations affect therapeutic responses, Michelle analyzes molecular characteristics to see if the changes in the genomic and transcriptomic profiles are associated with the responses. Using these associations, she hopes to capture the mechanisms underlying the tumor-immune interactions and thus better model the functionality impacts on these cancer patients.

Degrees: M.S. in Bioinformatics, Boston University; B.S. in Computer Science and Biology, University of British Columbia

Awards and Honors: NLM Trainee Fellowship 2015-2018; Epstein Trainee Awards for Excellence in Human Genetics Research - finalist 2019; STEM Scholarship, Association for Women in Science (AWIS), USA 2016

Publications and Posters:

Tsui, B.; **Dow, M.**; Skola, D.; Carter, H. Extracting allelic read counts from 250,000 human sequencing runs in Sequence Read Archive. Pac. Symp. Biocomput. 2019, 24, 196–207.

**Dow, M.**; Pyke, R. M.; Tsui, B. Y.; Alexandrov, L. B.; Nakagawa, H.; Taniguchi, K.; Seki, E.; Harismendy, O.; Shalapour, S.; Karin, M.; Carter H.; Font-Burgada, J. Integrative genomic analysis of mouse and human hepatocellular carcinoma. Proceedings of the National Academy of Sciences. 2018, pp E9879–E9888. https://doi.org/10.1073/pnas.1811029115.

Ozturk, K.; **Dow, M.**; Carlin, D. E.; Bejar, R.; Carter, H. The emerging potential for network analysis to inform precision cancer medicine. J. Mol. Biol. 2018, 430 (18 Pt A), 2875–2899.

Zare, F.; **Dow, M.**; Monteleone, N.; Hosny, A.; Nabavi, S. An evaluation of copy number variation detection tools for cancer using whole exome sequencing data. BMC Bioinformatics. 2017. https://doi.org/10.1186/s12859-017-1705-x.

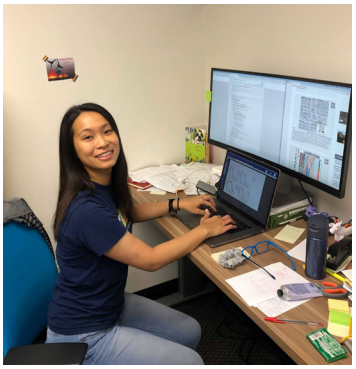
Current Research (expanded description): Cancer genomics has enabled the exhaustive molecular characterization of tumors and has shown hepatocellular carcinoma (HCC) and melanoma as among the most complex cancers. This complexity has triggered the development of mouse models that generate histologically similar tumors but have not been systematically validated at the molecular level. Accurate models of the molecular pathogenesis of cancer patients are essential for biomedical progress, specifically, in understanding the response to anti-cancer therapies such as immune checkpoint blockade (ICB). Immunotherapy has shown promising responses to malignant cancers; however, resistance still occurs in the majority of cases. Therefore, we compared genomic and transcriptomic profiles of separate mouse models with the patients. We have found that the models differed substantially in their mutational burden, affected genes and pathways and transcriptomes. Immune analysis revealed that strain-specific MHC genotype can influence the molecular makeup of murine tumors. We hypothesize that immunogenic mutations can drive HCC or melanoma response to ICB. We hope to develop better preclinical and computational modeling to identify the response-driving alterations and how the models recapitulate the distinct aspects of tumor-immune biology.

Benefits to Science and Society: It is urgent to identify the determinants of responses to anti-cancer drugs and explore how they may serve as therapeutic targets. Research of many heterogeneous cancer types has been hampered by the absence of consensus mouse models with clearly defined molecular features faithfully recapitulating human patients. Michelle's research can tackle this gap by implementing a cross-species comparative analysis between patients and diverse mouse models focused on clinically and therapeutically relevant aspects of genomic and transcriptomic profiles.

Personal Interests: Michelle enjoys trying different snacks, sketching, and re-reading Harry Potter books.

ARCS Award: The ARCS Foundation award helps me focus my energy on wrapping up my research projects instead of looking for additional financial sources to pay for all the expenses for living in an expensive city like San Diego.





# MICKEY FINN III

## University of California San Diego

Jacobs School of Engineering

Concentration: NanoEngineering

Specialization: Organic Haptics

Donor: Reuben H. Fleet Foundation Fund

Current virtual reality environments grant ersatz immersion using display screens and speakers but tend to neglect the sense of touch. Mickey's current project utilizes dense arrays of microfabricated electrodes that are designed to be contacted by the finger pads and safely energized in ways that convey movement and/or surface texture. Previous work in electrotactile haptics employed fewer electrodes that were comparatively large with inadequate explanation of how people perceive them. Mickey intends to provide a more definitive understanding of this through human subject testing and statistical methods common in the biological sciences.

Degrees: M.S. in Nanoengineering, University of California San Diego; B.S. in Nanoengineering, University of California San Diego

Honors and Awards: Illumina iAspire intern 2016; Tau Beta Pi 2014; Warren College Honors Society 2013-2016; UCSD Provost Honors 2013-2016

Publications and Posters:

Keef, C.; Kayser, L.V.; Tronboll, S.; Carpenter, C.W.; **Finn, M.**; Abuhamdieh, S.N.; Davies, D.M.; Meng, S.Y.; Lipomi, D. J. Virtual texture generated using elastomeric conductive block copolymer in wireless multimodal haptic glove. (2019, In Preparation)

**Finn, M.**; Treiber, J.; Issa, M.; Martens, C.J.; Feeney, C.P.; Ngwa, L.; Dhong, C.; Lipomi, D.J. Survival of polymeric microstructures subjected to interrogatory touch. (2019, In Preparation)

Dhong, C.; Kayser, L.V; Arroyo, R.; Shin, A.; **Finn, M.**; Kleinschmidt, A.T.; Lipomi, D.J. Role of fingerprint-inspired relief structures in elastomeric slabs for detecting frictional differences arising from surface monolayers. Soft Matter 2018, 14 (36), 7483–7491.

**Finn, M.**; Martens, C.J.; Zaretski, A.V.; Roth, B.; Søndergaard, R.R.; Krebs, F.C.; Lipomi, D.J. Mechanical stability of roll-to-roll printed solar cells under cyclic bending and torsion. Sol. Energy Mater. Sol. Cells 2018, 174 (August 2017), 7–15.

Current Research (expanded description): For the remainder of graduate school, I plan to leverage my work with electrotactiles in my current project along with my work in micropillars arrays in my previous project. An obvious culmination of these two approaches to haptic actuation would be to fabricate polymeric microstructures with embedded magnetic nanoparticles to make a haptic actuator that can move in response to fields generated by electromagnets. Based on my review of the existing literature and exposure to stimuli-responsive magnetic materials (and other less promising stimuli-responsive materials) at conferences, I have determined that this is the most promising route towards realizing a configurable haptic display surface with the necessary repeatability, response speed and actuation force to convey switchable touch sensations. As time allows, I ultimately wish to integrate such magnetically-enhanced polymer actuators, along with other sensors and actuators developed by colleagues in my research group, into a next generation haptic glove platform such as that which we recently produced for the publication under preparation.

Benefits to Science and Society: The continued commercial development of Virtual Reality and Augmented Reality systems provides sufficient motivation for technologies that can provide a more immersive user experience. Increasingly realistic haptic feedback and actuation, however, can also enable remote surgery and virtual training that would otherwise be either hazardous or cost-prohibitive. Haptic feedback has been shown to be of therapeutic value for both infants born prematurely and victims of stroke. Novel reconfigurable surfaces developed for haptics can also benefit the humanities as tactile art.

Personal Interests: Recreational reading, playing guitar/songwriting, woodworking, 3D printing, hobby electronics, exercise (cycling, swimming, etc.)

ARCS Award: It is a great honor to me because it validates all the hard work and long hours. Additionally, my financial affairs are currently not in the best shape so the monetary disbursement will provide much-needed relief that will allow me to focus more on my work.



# SHEREEN GEORGES GHOSH

## University of California San Diego

School of Medicine

Concentration: Biomedical Sciences

Specialization: Neurogenetics

Donor: Hervey Foundation Non-Endowment Fund

Shereen's research is focused on identifying mechanisms of, and treatments for, rare pediatric brain disease by solving the mysteries of brain development. Her research has identified a group of families with affected children who exhibit early-onset neurodegeneration, seizures, and death. She has been able to identify the causative gene, which has never been implicated in disease before; and has some early hints of potential treatments for this disease through her work in human cells. Shereen is now working to elucidate the mechanism by which loss of this gene's encoded protein is leading to stress-induced seizures and ultimately death in these children

Degrees: M.S. in Biology, University of California San Diego; B.S. in Physiology and Neuroscience, University of California San Diego; B.S. in Cognitive Neuroscience, University of California San Diego

Awards and Honors: Ruth L. Kirschstein National Research Service Award (NRSA) Individual, Predoctoral Fellowship (F31) Recipient; NRSA Institutional Predoctoral Training Grant (T32) Recipient; Association for Women in Science, San Diego Chapter Scholarship Winner

Publications and Posters:

**Ghosh, S.**; Wang, L.; Breuss, M.W.; Green, J.D.; Stanley, V.; Yang, X.; Ross, D.; Traynor, B.J.; Alhashem, A.; Azam, M.; Selim, L.; Bastaki, L.; Elbastawisy, H.I.; Temtamy, S.; Zaki, M.S.; Gleeson, J.G. Recurrent homozygous damaging mutation in TMX2, encoding a protein disulfide isomerase, in four families with microlissencephaly. J Med Genet. 2019. In press.

**Ghosh, S.**; Becker, K.; Huang, H.; Salazar, T.; Chai, G.; Cirak, S.; Gleeson, J.G. Biallelic mutations in ADPRHL2, encoding ADP-ribosylhydrolase 3, lead to a degenerative pediatric stress-induced epileptic ataxia syndrome. Am J Hum Genet. 2018, 103(3): 431-439.

Kerman, B.E.; Kim, H.J.; Padmanabhan, K.; Mei, A.; **Ghosh, S.**; Joens, M.S.; Fitzpatrick, J.A.J.; Jappelli, R.; Chandross, K.J.; August, P.; Gage, F.H. In vitro myelin formation using embryonic stem cells. Development. 2015, 142(12): 2213-225.

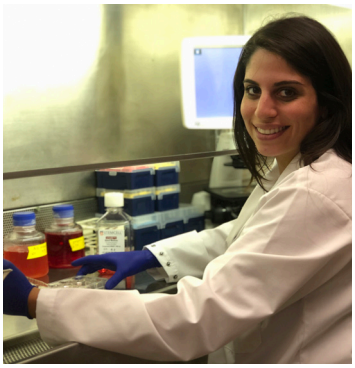
Current Research (expanded description): ADP-ribosylation is a posttranslational modification of proteins characterized by the addition of poly-ADP-ribose (PAR) in response to cellular stressors. The PAR Polymerase (PARP) family catalyzes this reaction, which is reversed by two known factors, PARG and ARH3. Using genome-wide linkage analysis and exome sequencing, inactivating mutations in ARH3 have been identified in several large consanguineous families. The patients exhibit a pediatric onset neurodegenerative disorder with brain atrophy and sudden death from epilepsy. Previous studies have identified ARH3 as the only active glycohydrolase present in mitochondria; however, its importance and role in the mitochondria remain understudied. The goal is to describe this clinical condition as a new syndrome cause of neurodegeneration and study oxidative-stress induced mechanisms by which loss of ARH3 promotes cell death. The generation of iPSCs from patient fibroblasts, which can be further reprogrammed into neurons, offers an exciting and relevant tool to test our model. Further, pharmacological manipulation of the PARP pathway will be used to rescue the phenotypes, in hopes of developing a treatment for this novel pediatric disease. The outcome of this work will not only provide novel insight into normal brain development, but will also identify potential treatments for a new early-onset neurodegenerative disease.

Benefits to Science and Society: Children with neurodevelopmental disease present special challenges to medicine, because physicians and scientists understand so little about how the brain functions. Most conditions are considered untreatable, and most children are left without a specific diagnosis. Shereen's research not only implicates a novel gene in causing a specific type of pediatric brain disease, but is also focused on understanding the mechanism by which this gene functions in normal brain development. These questions will not only provide further understanding of brain function, but will also contribute to a cure for a newly-identified, lethal disease.

Personal Interests: Outside of the lab, Shereen enjoys spending time with her husband and daughter.

ARCS Award: Upon receiving the ARCS award last year, I was also pregnant with my first child. She was born with a very severe congenital heart defect, requiring long hospital stays and multiple open-heart surgeries. This award has helped significantly with her medical bills while I try to complete my Ph.D. degree. This award has allowed me to continue to pursue my education, while also making sure my daughter is able to receive the best care possible.





# JOHN PATRICK GILLIES

**University of California San Diego**

Division of Biological Sciences

Concentration: Biological Sciences

Specialization: Biochemistry and Biophysics

Donor: The Donald C. and Elizabeth M. Dickinson Foundation

Ensuring that cellular components are in the right place at the right time is one of the major jobs a cell must perform. Motor proteins are responsible for transporting these components throughout the cell. John is particularly interested in how the motor protein dynein functions. He uses single-molecule methods to observe individual dynein molecules moving along their tracks to understand how dynein is regulated by a host of interacting proteins.

Degree: B.S. in Biochemistry, University of Oregon

Awards and Honors: NSF Graduate Research Fellowship Program Honorable Mention; Ruth Stern Fellowship; Molecular Biophysics Training Grant

Publications and Posters:

Htet, Z.M.#; **Gillies, J.P**.#; Baker, R.W.; Leschziner, A.E.; DeSantis, M.E*; Reck-Peterson, S.L.* Lis1 promotes the formation of maximally activated cytoplasmic dynein-1 complexes. bioRxiv (2019). doi: 10.1101/683052 #co-first authors *co-corresponding authors

Current Research (expanded description): Cytoplasmic dynein-1 is a molecular motor that drives nearly all minus-end-directed microtubule-based transport in human cells. Activated dynein complexes consist of one or two dynein dimers, the dynactin complex, and an "activating adaptor", with faster velocity seen with two dimers present. The highly conserved dynein binding protein Lis1 is required for nearly all of dynein's known functions. Lis1 increases the binding of mammalian dynein to microtubules and increases the velocity of activated dynein complexes containing the activating adaptor BicD2. How Lis1 exerts these effects is unknown. We uncovered a novel role for Lis1 in the formation of activated dynein/dynactin complexes containing two dynein dimers.

Lis1 is required for increased velocity of complexes activated by proteins representing three different families of activating adaptors: BicD2, Hook3, and Ninl. Once activated dynein complexes have formed, they do not require the presence of Lis1 for sustained increased velocity. In addition, using cryo-electron microscopy we show that human Lis1 binds to dynein at two sites on dynein's motor domain, similar to yeast dynein. We propose that the ability of Lis1 to bind at these sites may function in multiple stages of assembling the motile dynein/ dynactin/ activating adaptor complex.

Benefits to Science and Society: Dynein is an essential component of the cellular trafficking machinery and is responsible for transporting many different cargos in a spatially and temporally regulated manner. Dynein is critically important in every cell of the body, and mutations in dynein and its regulators cause many different neurological diseases. This work will help us to further understand the fundamental problem of dynein regulation, which has important implications for human health.

Personal Interests: When not in lab John enjoys playing board games and going to the San Diego Zoo.

ARCS Award: Being able to complete my training without worrying about my finances is such a blessing. I greatly appreciate the support of the ARCS Foundation.



# MARK KALAJ

## University of California San Diego

Division of Physical Sciences

Concentration: Chemistry

Specialization: Materials and Inorganic Chemistry

Donor: Virginia Lynch Grady Endowment

Mark's work focuses on the design of materials that protect soldiers and civilians from chemical warfare agents. Current materials used to protect soldiers from these harmful chemicals involve porous carbons that function simply as adsorbents. Mark's work is concentrated on designing novel materials that can chemically degrade chemical warfare agents and adsorb them. The materials being used in his research are inherently crystalline solids known as metal-organic frameworks. Mark's work also centers on tailoring these solid materials with flexible polymers for their incorporation in protective textile fibers.

Degrees: M.S. in Chemistry, University of California San Diego; B.S. in Chemistry, The George Washington University

Awards and Honors: 2019 Teddy Traylor Award; 2018 National Defense Science and Engineering Graduate (NDSEG) Fellowship

Publications and Posters:

**Kalaj, M.**; Palomba, J.M.; Bentz, K.C.; Cohen, S.M. Multiple functional groups in UiO-66 improve chemical warfare agent simulant degradation. Chem. Commun. 2019, 55, 5367-5370.

**Kalaj, M.**; Momeni, M.R.; Bentz, K.C.; Barcus, K.S.; Palomba, J.M.; Paesani, F.; Cohen, S.M. Halogen bonding in UiO-66 frameworks display superior ability for chemical warfare agent simulant degradation. Chem. Commun. 2019, 55, 3481-3484.

**Kalaj, M.**; Denny Jr., M.S.; Bentz, K.C.; Palomba, J.M.; Cohen, S.M. Nylon-MOF composites through postsynthetic polymerization. Angew. Chem., Int. Ed. 2019, 58, 2336-2340.

Denny Jr., M.S.; **Kalaj, M.**; Bentz, K.C.; Cohen, S.M. Multicomponent metal-organic framework membranes for advanced functional composites. Chem. Sci. 2018, 9, 8842-8849.

Current Research (expanded description): Mark's research is focused on the use of metal-organic frameworks for the catalytic degradation of organophosphorous chemical warfare agents. Metal-organic frameworks are constructed from inorganic metal nodes, termed secondary building units, joined together by multitopic organic linkers. Mark has incorporated various functional groups (amine, hydroxy, halogen, etc.) on the organic linkers of the metal-organic frameworks to improve their catalytic properties. Metal-organic frameworks, however, are inherently crystalline materials and are synthesized in powder form. Mark's research has also focused on hybridizing these solid frameworks with soft polymers to design a composite material that contains both the catalytic properties of the metal-organic frameworks as well as the flexibly properties of the polymer. This is significant for the incorporation of metal-organic frameworks into a more applicable form factor. To design materials for the protection of soldiers and civilians it is important to select polymers that are commonly used in textiles. With this in mind, Mark designed a flexible metal-organic framework Nylon hybrid material with the ability to degrade CWAs. In this approach, he used interfacial polymerization to covalently tether Nylon polymers to metal-organic framework particles.

Benefits to Science and Society: Despite decades of diplomatic work around the globe for the prohibition of their use, chemical warfare agents remain a danger. Mark's research is concentrated on the synthesis of novel materials that are excellent for the catalytic degradation of chemical warfare agents. Achievement of these materials, at a reasonable cost, would significantly help protect civilians and soldiers who reside in areas where chemical warfare agents are a potential threat.

Personal Interests: In his spare time, Mark enjoys traveling and playing sports. He is also a big Detroit sports fan, go Lions!

ARCS Award: Receiving the ARCS Foundation award is a true honor. I cannot express how grateful I am to receive this recognition from what I imagine is a pool of excellent students. I am also very honored to receive this award from such a commendable foundation with a great mission.



# EMIL MARIO KARSHALEV

## University of California San Diego

Jacobs School of Engineering

Concentration: Materials Science and Engineering

Specialization: Micro/Nano-Robotics

Donor: Beyster Family Foundation Fund IV

Emil's research is in the area of micro/nano-machines. He uses these small-scale objects to deliver a multitude of drugs, nutritional compounds or imaging agents efficiently. The micromotors autonomously propel in biological fluids such as gastric acid and intestinal fluid. This motion translates into embedding or lodging of the micromotors into the mucosal membranes. This leads to an increased residence time and a more efficient absorption of the therapeutic agents. So far results show that the active propulsion outperforms static counterparts in all gastrointestinal scenarios.

Degrees: M.S. in Materials Science and Engineering, University of California Irvine; B.S. in Materials Science and Engineering, University of California Irvine; B.S. in Chemical Engineering, University of California Irvine

Awards and Honors: Best Graduate Presenter for Fall Quarter for the Graduate Student Council Seminar Series 2018; Charles Lee Powell Foundation Fellowship 2015-2018; UROP - Undergraduate Research Opportunity Program Stipend 2014-2015; Undergraduate Research Fellowship Award 2013-2014

Publications and Posters:

**Karshalev, E.** Micromotors as targeted payload delivery platforms. Presented at ACS National Meeting & Exposition Fall 2019, San Diego.

**Karshalev, E.**; Esteban-Fernández de Ávila, B.; Beltrán-Gastélum, M.; Angsantikul, P.; Tang, S.; Mundaca-Uribe, R.; Zhang, F.; Zhao, J.; Zhang, L.; Wang, J. Micromotor pills as a dynamic oral delivery platform. ACS Nano 2018, 12, 8397-8405.

**Karshalev, E.**; Esteban-Fernández de Ávila, B.; Wang, J. Micromotors for "chemistry-on-the-fly". Journal of the American Chemical Society 2018,140, 3810-3820.

Chen, C.; **Karshalev, E.**; Li, J.; Soto, F.; Castillo, R.; Campos, I.; Mou, F.; Guan, J.; Wang, J. Transient micromotors that disappear when no longer needed. ACS Nano 2016, 10, 10389-10396.

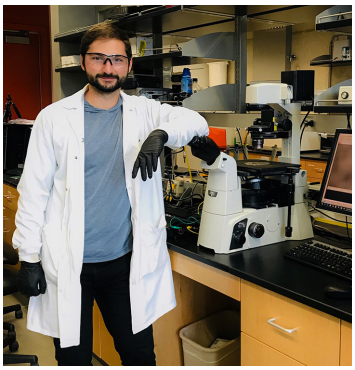
Current Research (expanded description): My research at UCSD has focused on two main thrusts. Firstly, how to design small-scale microstructures which propel by bubble thrust utilizing a chemical reaction where a transient metal is consumed. Transient metals such as magnesium or zinc react with biological fluids producing hydrogen gas and harmless byproducts which can power micromachines. These metals can be fashioned in many geometries depending on the application. With a robust and biocompatible propulsion platform I can focus on the second portion of microrobotics. I then proceed to internalize the biocompatible microrobots into the body in order to actively deliver therapeutic or imaging agents effectively. This is accomplished due to the propulsion of the micromotors. They embed into the mucosal layer of the stomach or intestine which increases the structure's residence time in the body. With increased residence time, absorption of drugs or nutrition is enhanced leading to better therapeutic efficacy. Using smaller amount of drug then leads to reduced side effects. Thus, accessing various parts of the body with actively propelling micromotors has a great potential as the delivery vehicle of the future.

Benefits to Science and Society: The passive delivery strategies of today (drug in a pill) rely on diffusion and absorption despite the constant intestinal motility. Thus, large portions of the active drug are flushed out without being absorbed due to the low residence time. Having actively propelled micromotors which embed into various parts of the intestine, increasing residence time, can provide enhanced absorption and reduced side effects for many therapeutic agents.

Personal Interests: In his free time, Emil enjoys playing soccer, and brewing beer.

ARCS Award: The ARCS Foundation award gives me the financial security to continue to pursue my research goals.





# KEVIN RICHARD KAUFMANN

## University of California San Diego

Jacobs School of Engineering

Concentration: NanoEngineering

Specialization: Machine Learning

Donor: Timkin-Sturgis Foundation

Kevin is researching the application of artificial intelligence to material design, discovery, and analysis. His research efforts are reducing the time and money spent searching for materials with enhanced properties by aiding researchers in selecting the best candidate elemental compositions. After synthesizing these candidates, complete characterization is the next hurdle in material development. Kevin is developing advanced machine learning algorithms capable of characterizing many aspects of the material with little to no a priori knowledge required.

Degrees: M.S. in Nanoengineering, University of California San Diego; B.S. in Nanoengineering, University of California San Diego

Awards and Honors: Abe Hurlich Scholarship - ASM San Diego 2018; National Defense Science and Engineering Graduate (NDSEG) Fellowship 2017 - Present; National Science Foundation (NSF) GRFP Recipient 2017; Jacobs School of Engineering Art Contest 2017

Publications and Posters:

**Kaufmann, K.**; Zhu, C.; Rosengarten, A. S.; Maryanovsky, D.; Harrington, T.; Marin, E.; Vecchio, K. High-throughput identification of crystal structures via machine learning. Microscopy and Microanalysis 2019, 25(S2), 2258-2259.

Zhu, C.; **Kaufmann, K.**; Vecchio, K. Automated reconstruction of spherical Kikuchi maps. Microscopy and Microanalysis 2019, 25, 1-12.

Harrington, T. J.; Gild, J.; Sarker, P.; Toher, C.; Rost, C. M.; Dippo, O. F.; Mcelfresh, C.; **Kaufmann, K.**; Marin, E.; Borowski, L.; Hopkins, P. E.; Luo, J.; Curtarolo, S.; Brenner, D. W.; Vecchio, K.S. Phase stability and mechanical properties of novel high entropy transition metal carbides. Acta Materialia 2019, 166, 271-280.

Singh, V. V.; **Kaufmann, K.**; Esteban-Fernández de Ávila, B.; Karshalev, E.; Wang, J. Molybdenum disulfide-based tubular microengines: Toward Biomedical Applications. Adv. Funct. Mater. 2016, 26, 6270-6278.

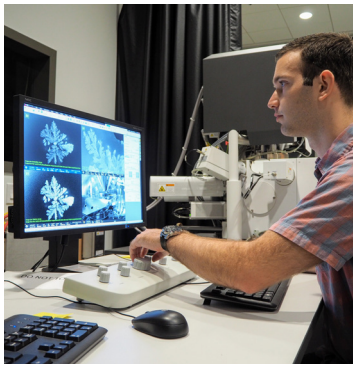
Current Research (expanded description): I am currently leading projects in the field of applied data science and machine learning with a focus on material discovery and sample analysis. The primary goal of the work is to enable computers to 'learn' microstructure data, including phase identification combining chemistry (EDS) and electron backscatter diffraction (EBSD) data, phase fractions, phase location, phase morphology, etc., that enables complete microstructure quantification in an autonomous mode. The secondary goal is to teach the computer to aid in the selection of promising new materials from extremely large computational databases given a set of desired properties and constraints. I am also working to combine these capabilities with our additive manufacturing equipment to create a high-throughput design loop. These machine- learning enabled capabilities represent my unique approach to high-throughput material synthesis and analysis, which would significantly accelerate new material development.

Benefits to Science and Society: Kevin's machine learning endeavors are laying the foundation for autonomous material selection and characterization. If successful, new materials could be designed and evaluated in a fraction of the time it currently takes to investigate one new material. If successfully incorporated into a high-throughput approach, it could open the door to highly automated research facilities.

Personal Interests: Fishing, numismatics.

ARCS Award: The ARCS Foundation Award is both recognition of your accomplishments and an opportunity to share your work with the community.





# ANDREW THOMAS KLEINSCHMIDT

## University of California San Diego

Jacobs School of Engineering

Concentration: Chemical Engineering

Specialization: Polymer Physics

Donor: Lakeside Foundation / Laura Mateo / ARCS Foundation - San Diego

Andrew creates computational models of polymers (plastics) which can be used in making cheap, flexible solar cells. These polymers are long chains of atoms which can create complex folded structures. The conformations these chains take in solution determine the eventual nanostructure of the solar cell. By creating a model to predict these folded structures, he can design new, higher performance materials to help make affordable solar energy a reality.

Degrees: M.S. in Chemical Engineering, University of California San Diego; B.S. in Chemical Engineering, Stanford University

Awards and Honors: Powell Fellowship; Katzin Prize; Firestone Award for Excellence in Undergraduate Research

Publications and Posters:

**Kleinschmidt, A. T.**; Lipomi, D. J. Stretchable conjugated polymers: A case study for new research groups. Acc. Chem. Res., 51, 3134.

Sugiyama, F.; **Kleinschmidt, A. T.**; Kayser, L. V.; Rodriquez, D.; Finn, M.; Alkhandra, M.; Wan, J. M.-H.; Ramirez, J.; Chiang, A. S-C.; Root, S.; Savagatrup, S.; Lipomi, D. J. Effects of flexibility and branching of side chains on the mechanical properties of low-bandgap conjugated polymers. Polym. Chem., 9, 4354.

Sugiyama, F.; **Kleinschmidt, A. T.**; Kayser, L. V.; Alkhandra, M. A.; Wan, J.-H.; Chiang, A. S-C.; Rodriquez, D.; Root, S. E.; Savagatrup, S.; Lipomi, D. J. Stretchable and degrading semiconducting block copolymers. Macromolecules, 51, 5944.

**Kleinschmidt, A. T.**; Root, S. E.; Lipomi, D. J. Poly (3-hexylthiophene) (P3HT): Fruit fly or outlier in organic solar cell research? J. Mater. Chem. A, 5, 11396.

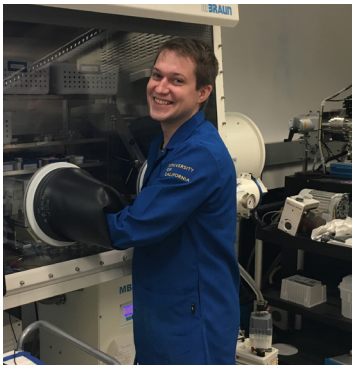
Current Research (expanded description): My research focuses on developing new materials for clean energy applications. In particular, I study solar cells made out of plastic. These special solar cells, referred to as organic photovoltaics, have a number of potential advantages over traditional silicon. They can be printed like newspaper, making them a potentially very cheap alternative. Additionally, we can give these materials special properties like some other plastics, like stretchability, flexibility, and biodegradability. However, it is very difficult to predict the performance of a material just based on its chemical structure. I work to create computational models which can help predict properties of the solar cell, letting experimentalists focus only on the most promising plastics. I hope to continue doing research as a professor after graduation.

Benefits to Science and Society: The goal of my research is to create affordable solar energy by making solar panels out of plastics. In addition, the adaptable properties of plastics such as flexibility and toughness mean that these solar cells could be put in non-conventional places, such as on skin for wearable devices or laminated to the roof of a car. Ultimately, the goal is to provide affordable power for any application.

Personal Interests: I volunteer tutoring high school students in City Heights.

ARCS Award: The ARCS award gives me the financial freedom to attend conferences that are crucial to my development as a young scientist. I have been exposed to many new scientific concepts through attendance at these conferences, and it helps me to network with professors to further my career.





# JENNA JOAQUIN LAWRENCE

## University of California San Diego

Jacobs School of Engineering

Concentration: Mechanical and Aerospace Engineering

Specialization: Biological Fluid Mechanics

Donor: Wally Schirra Memorial Endowment

Jenna studies the flow of cerebrospinal fluid in the central nervous system, both the overall flow characteristics and the small-scale features of the flow. She uses a combination of theoretical fluid mechanics, numerical simulations, and magnetic resonance imaging to investigate these flows. These results help inform her work on intrathecal drug delivery, in which medication is injected to the lumbar region of the spinal canal with the intent of delivering the medication to locations along the spinal canal or to the brain.

Degrees: M.S. in Chemical Engineering, University of California San Diego; B.S. in Chemical Engineering, University of California San Diego

Awards and Honors: Outstanding Teaching Assistant Award, Mechanical and Aerospace Engineering, UC San Diego, June 2019

Publications and Posters:

**Lawrence, J. J.**; Coenen, W.; Sánchez, A. L.; Pawlak, G.; Martínez-Bazán, C.; Haughton, V.; Lasheras, J. C. On the dispersion of a drug delivered intrathecally in the spinal canal. Journal of Fluid Mechanics 2019, 861, 679–720.

Current Research (expanded description): My research thus far has considered the theoretical fluid mechanics of cerebrospinal fluid in the spinal canal. The driving force of this flow is the periodic, pulsatile pressure in the brain due to the heartbeat which induces a small motion at the entrance of the spinal canal. This motion is transmitted throughout the entire spinal canal and the cumulative convective effects over many heartbeats cause a long-term bulk motion. This bulk motion explains the various experimental results which suggest that a tracer injected in the lumbar region reaches the brain in about thirty minutes, and vice versa. We are currently

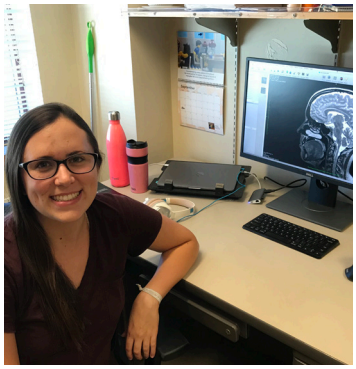
expanding our simple theory in a number of ways by considering more realistic model geometries, the effects of buoyancy, the effects of nonharmonic pressure variation in the brain, and the effects of microanatomy. We are also beginning to use magnetic resonance imaging to gather flowrate data of both cerebrospinal fluid and blood in the brain and along the spinal canal. We hope to use this flowrate data in combination with subject-specific geometry and physiological data to further refine our models.

Benefits to Science and Society: It is currently difficult to predict how a drug administered to the lumbar region will travel through the cerebrospinal fluid. To avoid the negative side effects associated with over-dosing, drugs injected intrathecally are frequently under-dosed, reducing their efficacy. We hope to use patient-specific geometry and physiological information to better predict how a drug will disperse in the cerebrospinal fluid which will improve suggested dosing and therefore improve patient outcomes.

Personal Interests: In her free time, Jenna enjoys yoga, reading, and videogames.

ARCS Award: I am exceptionally grateful for the support of the ARCS Foundation. It is an honor to be part of an organization that so highly values scientific advancement.





# CHI-WEI MAN

## University of California San Diego

Division of Physical Sciences

Concentration: Biochemistry

Specialization: Molecular and Cellular Engineering

Donor: ARCS Foundation - San Diego Chapter

Chi-Wei's research project is to create a cell-based biosensor that can specifically target and report markers of cancer. These cells could be injected into a cancer patient, and if the patient's tumor expresses the specific target protein of the biosensor, the injected cells will glow. This would provide physicians with information about the location of tumors and the proteins they express. Using the information gained from these biosensors, doctors could prescribe the appropriate treatment for the patient's cancer. The adaptability of this system would allow these cells to not only act as diagnostics but therapeutics as well.

Degrees: M.S. in Chemistry and Biochemistry, University of California San Diego; B.A. in Biochemistry, University of Pennsylvania; B.S.E in Chemical Engineering, University of Pennsylvania

Awards and Honors: Columbia Science Honors Program 2010-2011; Merck State Science (Chemistry) Award 2010; Sanofi Aventis Chemistry Scholarship 2011; Molecular Biophysics Training Program and Interfaces Training Program 2017.

Publications and Posters:

Pujari, A.; **Man, C.W.;** Park, J. T-cell manufacture for treatment of acute lymphoblastic leukemia. Undergraduate Research Commons. [Online] 2015, 75, 1-201 http://repository.upenn.edu/cbe_sdr/75 (accessed September 4, 2018).

Limsakul, P.; **Man, C.W.**; Peng, Q.; Lu, S.; Wang, Y. Development of novel cellular imaging tools using protein engineering. Protein Engineering: Tools and Applications. [Online] 2020, https://www.wiley.com/en-us/Protein+Engineering%3A+Tools+and+Applications-p-9783527344703 (accessed September 4, 2018).

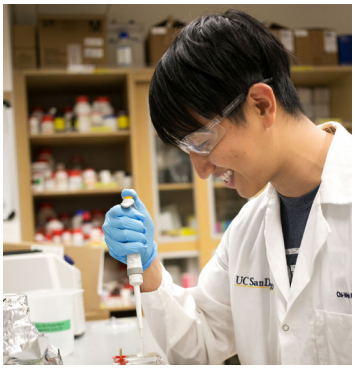
Current Research (expanded description): The aim of my research is to develop Bioluminescence Resonance Energy Transfer and bioluminescence-based whole-cell biosensors to detect cancer-associated antigens. Although this platform will be broadly applicable, I plan to first target Programmed Death-Ligand 1, a protein that causes immune cell exhaustion. Once this system properly targets Programmed Death-Ligand 1-expressing cells, I will incorporate Chimeric Antigen Receptors into my biosensors to allow them not only to recognize tumor cells but eradicate them as well.

Benefits to Science and Society: Patient cancers differ on a case-by-case basis. As such, the effectiveness of cancer therapies varies between patients. My research would provide physicians with a tool to detect the protein composition of patient tumors. My diagnostic cells could be used in conjunction with chimeric-antigen-receptor T-cell immunotherapies to eradicate cancer cells expressing a specific protein of interest. In addition, these biosensor cells can be modified into therapeutics so that they can not only diagnose cancers but treat them as well.

Personal Interests: I enjoy playing tennis, surfing, playing guitar, and playing the piano.

ARCS Award: The ARCS Foundation award means so much to me because it allows me to focus harder on my research with less worry about financial instability. I also really appreciate how it puts me in touch with many other like-minded individuals.





# RYAN JARED MARINA

## University of California San Diego

School of Medicine

Concentration: Biomedical Sciences

Specialization: Genetics and Genomics

Donor: LaVerne and Blaine Briggs

Ryan's research project aims to understand the underlying molecular mechanisms of the neurodegenerative disease Amyotrophic Lateral Sclerosis (ALS). Trained as an RNA biologist, Ryan is seeking to identify how mutations within a particular class of proteins, called RNA-binding proteins (RBPs), contribute to disease susceptibility later in life. His research revolves around using a combination of induced pluripotent stem cell (iPSC) technologies and bioinformatic approaches to determine causative pathways contributing to neuron degeneration.

Degree: B.S. in Cellular and Molecular Biology, University of Michigan

Awards and Honors: Ruth L. Kirschstein Predoctoral Individual National Research Service Award NIGMS Training Grant (T32 GM008666), University of California, San Diego; Graduate Research Fellowship Program Honorable Mention, National Science Foundation

Publications and Posters:

Batra, R; Nelles, D.A.; Pirie, E.; Blue, S.M.; **Marina, R.J.**; Wang, H.; Chaim, I.A.; Thomas, J.D.; Zhang, N.; Nguyen, V.; Aigner, S.; Markmiller, S.; Cooper, T.A.; Xia, G.; Corbett, K.D.; Swanson M.S.; Yeo, G.W. Visualization and elimination of toxic microsatellite expansion RNA by RNA-targeting Cas9. Cell 2017, 170, 899-912.

Diao, Y.; Fang, R.; Li, B.; Meng, Z.; Yu, J.; Qiu, Y; Lin, K.C.; Huang, H.; Liu, T.; **Marina, R.J.**; Jung, I.; Shen, Y.; Guan, K.; Ren, B. A tiling-deletion based genetic screen for cis-regulatory element identification in mammalian cells. Nat Methods 2017, 14, 629-635.

**Marina, R.J.**; Sturgill, D.; Bailly, M.A.; Thenoz, M.; Varma, G.; Prigge, M.F.; Nanan, K.K.; Shukla, S.; Haque, N.; Oberdoerffer, S. TET-catalyzed oxidation of intragenic 5-methylcytosine regulates CTCF-dependent alternative splicing. EMBO J 2016, 35, 335-355.

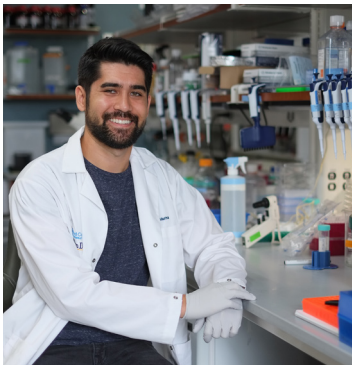
Current Research (expanded description): RNA-binding proteins play integral roles in mediating cellular functions through post-transcriptional gene regulation. RNA-binding protein dysregulation is implicated in several human diseases and is recurrent in neurodegenerative disorders such as amyotrophic lateral sclerosis (ALS). ALS is a paralyzing and incurable disease characterized by upper and lower motor neuron degeneration, progressive muscle wasting and eventual death. Though the causes of ALS are predominantly unknown, with 90% of cases occurring sporadically, patient neurons exhibit distinct hallmarks including aberrant RNA-binding protein biology. My research seeks to understand how a particular RNA binding protein, ataxin-2, contributes to motor neuron degeneration. Ataxin-2 is expressed in every tissue of the human body, yet mutations in this gene specifically manifest in devastating neurodegenerative phenotypes. Using molecular techniques, human stem cell models, and bioinformatic tools, I hope to discern the regulatory pathways downstream of ataxin-2 that are responsible for causing disease state. Moreover, in identifying these pathways, I hope to uncover additional therapeutic avenues or targets that might prove useful in treating all forms of ALS.

Benefits to Science and Society: ALS is the most common motor neuron disease in the adult population that manifests through muscle atrophy, loss of voluntary motor activity, and death in those afflicted. Although pathology of ALS is well characterized, the causative factors responsible for disease onset remain elusive. Through my research I hope to characterize the regulatory roles of RNA-binding proteins in the context of neuronal physiology and disease and strive to use relevant disease modeling strategies to uncover potential therapeutic targets for ALS pathogenesis.

Personal Interests: In my spare time outside of lab, I enjoy cooking, exercising, playing my cello, and hiking with friends.

ARCS Award: I am incredibly grateful to have the continued support of the ARCS Foundation and its members. As a returning scholar, I have been exposed to the generosity and passion of ARCS Foundation, whose members genuinely encourage the continued advancement and success of each of their scholars. This award not only provides me with extremely generous financial support during my graduate training, but also serves as assurance that members of the community truly value the importance of science education and research.





# NICOLE PATRICIA MLYNARYK

## University of California San Diego

School of Medicine

Concentration: Neurosciences

Specialization: Systems Neuroscience

Donor: Kathryn Crippen Hattox Fund

When faced with a decision, we often compare the value of each option and then choose the one that seems most rewarding. Keeping track of value information is very important, but how the brain actually does this remains unclear. To study this, Nicole records the activity of thousands of neurons in a mouse's brain while the animal performs a decision-making task. Using circuit tracing techniques, she can identify the specific neural pathways that encode value, and observe how they communicate with other brain areas to guide our choices.

Degree: B.A. in Cell Biology and Neuroscience, Rutgers University

Awards and Honors: UCSD Quantitative Integrative Biology Fellowship; NIH Intramural Research Training Award; Aresty Undergraduate Research Fellowship; Amgen Scholar Award

Publications and Posters:

Hattori, R.; Danskin, B.; Babic, Z.; **Mlynaryk, N.**; Komiyama, T. Area-specificity and plasticity of history-dependent value coding during learning. Cell. 2019, 177(7), 1858-1872.

McGowan, H.; Mirabella, V.R.; Hamod, A.; Karakhanyan, A.; **Mlynaryk, N.**; Moore, J.C.; Tischfield, J.A.; Hart, R.P.; Pang, Z.P. hsa-let-7c miRNA regulates synaptic and neuronal function in human neurons. Frontiers in Synaptic Neuroscience. 2018, 10, 19.

Zhang, X; **Mlynaryk, N.**; Ahmed, S.; Japee, S.; Ungerleider, L.G. The role of inferior frontal junction in controlling the spatially global effect of feature-based attention in human visual areas. PLOS Biology. 2018, 16, 6.

Zhang, X.; **Mlynaryk, N.**; Japee, S.; Ungerleider, L.G. Attentional selection of multiple objects in the human visual system. NeuroImage. 2017, 163, 231-243.

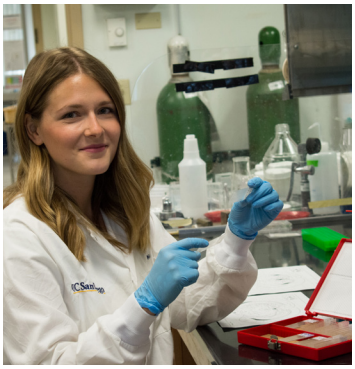
Current Research (expanded description): Value-based decision making is a process in which we assign subjective values to each of our options and then choose the one we believe will be most rewarding. Knowing how the brain computes, stores, and uses this value information is important to understanding both healthy and impaired decision making. Recent work in the Komiyama Lab has identified the retrosplenial cortex (RSC) as a critical brain region where value information is strongly and persistently encoded. My central goals are to identify how these representations of value arise within RSC, and which other brain region(s) RSC then sends this information to. To do this, I use two-photon calcium imaging to record the activity of thousands of neurons in the brain of a mouse while it performs a decision-making task. By combining this technology with computational modeling and advanced circuit tracing techniques, I can track how value information flows throughout the brain and guides an animal's decisions. I will also use optogenetic tools to shut down specific neural pathways and see how that changes the animal's decision-making strategy. This work will reveal the role of RSC within the brain's larger decision-making network, and help us understand the neurobiology of making good choices.

Benefits to Science and Society: Decision making is a fundamental behavior critical to many animal species, and yet much about its neural mechanism remains unknown. By understanding how the brain guides us towards rewarding choices, we can better diagnose and treat disorders in which decision making is impaired, such as Parkinson's disease, Alzheimer's disease, addiction and depression. These insights will also improve theories in the fields of economics, computer science, and social sciences, where decision making is also relevant.

Personal Interests: When not in lab, I also enjoy camping, cooking, gardening, going to concerts, and long road trips.

ARCS Award: Being selected for this award was a wonderful validation of the work I've done so far and gives me the financial stability to take care of myself and focus my energy on my scientific goals.





# COLMAN ARTHUR MOORE

## University of California San Diego

Jacobs School of Engineering

Concentration: NanoEngineering

Specialization: Molecular Imaging

Donor: ARCS Foundation - San Diego Chapter



Colman studies the intersection of nanoengineering and biomedical imaging to develop new diagnostic strategies using photoacoustic imaging. He is primarily focused on applications in oral diseases such as periodontitis (gum disease), which affects nearly half of the adult U.S. population. Photoacoustic imaging is similar to ultrasound but uses optical rather than acoustic excitation to generate signal. This facilitates deeper imaging and higher contrast. The current goal of Colman's work is to build a molecular imaging platform using novel photoacoustic contrast agents to diagnose periodontitis in its earliest stages.

Degrees: M.S. in NanoEngineering, University of California San Diego; B.S. in Biomedical Engineering, University of South Carolina

Awards and Honors: NSF Graduate Research Fellow 2019-present; NIH T32 Training Grant Recipient 2018-2019; UCSD Powell Foundation Fellow 2017-2018; Travel Grant, AIMBE Public Policy Institute 2018

Publications and Posters:

**Moore, C.**; Chen, F.; Wang, J.; Jokerst, J. V. Listening for the therapeutic window: Advances in drug delivery utilizing photoacoustic imaging. Advanced Drug Delivery Reviews 2019, 144, 78-89.

**Moore, C.**; Jokerst, J. V. Strategies for image-guided therapy, surgery, and drug delivery using photoacoustic imaging. Theranostics 2019, 9 (6), 1550-1571.

**Moore, C.**; Bai, Y.; Hariri, A.; Sanchez, J. B.; Lin, C.-Y.; Koka, S.; Sedghizadeh, P.; Chen, C.; Jokerst, J. V. Photoacoustic imaging for monitoring periodontal health: A first human study. Photoacoustics 2018, 12, 67-74.

Wang, J.; Lin, C.-Y.; **Moore, C.**; Jhunjhunwala, A.; Jokerst, J. V. Switchable photoacoustic intensity of methylene blue via sodium dodecyl sulfate micellization. Langmuir 2018, 34 (1), 359-365.

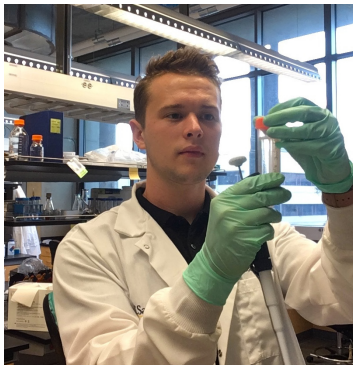
Current Research (expanded description): The current objective of my research is to synthesize an activatable contrast agent to map and measure gingipains expressed by Porphyromonas gingivalis, a pathogenic bacterium, with photoacoustic ultrasound. While P. gingivalis can be quantified in the lab with PCR, it cannot be done so chairside. Molecular imaging with ultrasound offers data that is real-time, chairside, and molecularly specific—it can report the quantity and location of the periodontal pathogen with utility in diagnosis and therapy monitoring. That is the value of this work. We are motivated by studies showing that dental pain dramatically decreases quality of life but that nearly 50% of Americans have some form of periodontitis. Current approaches to monitoring oral health only measure the downstream symptoms of periodontitis (tooth loss, pocket depth, etc.). We contend that by imaging and measuring a molecular marker of disease, new insights will be gained into its basic biology as well as lead to better diagnostic and treatment-monitoring plans. Secondary objectives of this work are to miniaturize photoacoustic hardware for more practical use in the oral cavity, implement reconstruction algorithms for handheld imaging, and harness endogenous contrast mechanisms to also image inflammation and anatomical features of the periodontium using a single platform.

Benefits to Science and Society: Oral health is a critical component of quality of life, but the tools that clinicians use to inspect the oral cavity only monitor the effects and symptoms of periodontitis rather than the underlying cause. The current goal of this work is to build a nanoparticle that generates photoacoustic signal when it encounters dangerous bacteria in the subgingival sulcus. This will identify periodontal disease easily, earlier, and more accurately while giving dentists molecular-level insight into disease to help better direct care and improve quality of life.

Personal Interests: Outside of the lab, I enjoy playing tennis, hiking, and collecting records.

ARCS Award: The ARCS award has reaffirmed my dedication to impactful research and has further motivated me to be as productive as I can during graduate school. I am also grateful for its alleviation of many of the financial pressures associated with Ph.D. training.





# JESSICA YI-JUN NG

**University of California San Diego**

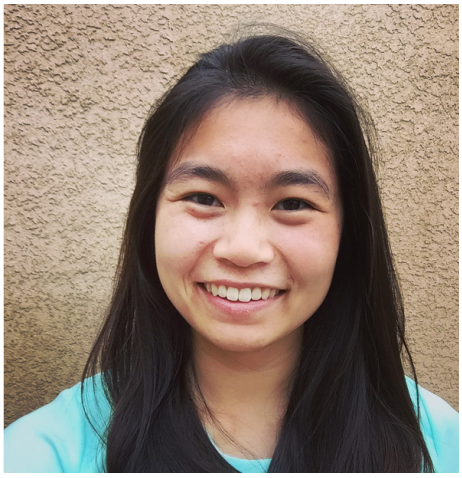
Scripps Institution of Oceanography

Concentration: Geochemistry

Specialization: Noble gas paleoclimatology

Donor: Carlos and Sharon Arbelaez

Jessica's research project is in the Andean Highlands of Chile and Argentina, where lithium mining for electric vehicle batteries and other renewable energy technologies is stressing extremely limited water resources. She measures gases dissolved in the groundwater—water that rained or snowed thousands of years ago and accumulated in closed basins—to understand how the level of groundwater has changed over time, with the goal of quantifying the impact of recent lithium mining.



Degrees: M.S. in Climate Sciences, University of California San Diego; B.A. in Physics, Scripps College

Awards and Honors: National Geographic Explorers Grant; Lal Fellowship (SIO); International Institute Travel Research Grant (UCSD); Center for Iberian and Latin American Studies Travel Grant (UCSD)

Publications and Posters:

Seltzer, A.; **Ng, J.**; Severinghaus, J. Precise determination of Ar, Kr and Xe isotopic fractionation due to diffusion and dissolution in fresh water. Earth and Planetary Science Letters 2019, 514, 156-165.

**Ng. J.**; Severinghaus, J.;Bay, R. Predicting the optical signal in Oldest Ice using marine dust records. POLAR2018, 2018, poster, Davos, CH.

Yan, Y.; Bender, M.; Brook, E.; Clifford, H.; Kemeny, P.; Kurbatov, A.; Mackay, S.; Mayewski, P.; **Ng, J.**; Severinghaus, J.; Higgins, J. 2-million year old climate snapshots from shallow ice cores in the Allan Hills, Antarctica. (In review, Nature)

**Ng, J.**; Williams, B.; Thompson, D. M.; Mayne, C.; Halfar, J.; Edinger, E. N.; Johnson, K. R. Assessing multi-site δ18O-climate calibrations of the coralline alga clathromorphum across the high-latitude Northern Hemisphere. Geochimica et Cosmochimica Acta 2016, 194, 279-290.

Current Research (expanded description): To reconstruct the past mean water table depth, I will measure the stable isotopes of three noble gases: krypton, argon, and xenon. These gases become fractionated in soil air, where gravity causes the heavier isotopes to be enriched linearly with depth. The isotopic composition of these gases dissolved in the groundwater reflects the isotopic composition of the air just above the water table, and thus the depth of the water table, at the time of recharge. I aim to make past-water table measurements for water that was most recently equilibrated with the atmosphere shortly before lithium mining began in the 1980s, but a past-water table depth signal of any age will be of scientific interest to better understand the hydrology of the basin.

Benefits to Science and Society: Understanding the history of groundwater in this region will help assess the impacts of lithium mining on the groundwater and the ecosystem that depends on it -- the basis of life for indigenous communities living throughout the Andean Highlands. This is especially urgent now as electric vehicles, powered by lithium batteries, make gains as a proposed climate solution. Lithium mining impacts and minimal carbon emissions reductions put the benefit of electric vehicles into question and urge us to seek alternative solutions.

Personal Interests: I am involved in activism (in addition to research) around Indigenous resistance to mining exploitation. I also enjoy dancing, writing, and cooking.

ARCS Award: My research took an unexpected turn in the second year of my Ph.D., veering from Antarctic ice to lithium mining impacts on groundwater. Because I developed this new project independently of my advisor and his existing funding, I had very few resources to make it a reality. Receiving the ARCS Foundation award last year empowered me to get the project off the ground -- to build sampling equipment, travel to the field, and continue strengthening my working relationship with local desert communities. I conducted a pilot study in April, 2019, and have been able to successfully measure these samples. This year, the award would go toward a second, more thorough field campaign to collect higher quality samples from more strategic sites of interest, with the intent of providing relevant data for local communities and other interested parties. I am deeply grateful for this award for supporting my passion for community-informed socially-relevant research.



# VICTOR WINGTAI OR


## University of California San Diego

Division of Physical Sciences

Concentration: Chemistry

Specialization: Atmospheric and Environmental Chemistry


Donor: Ellen Browning Scripps Foundation

Humans spend most of their time indoors and there has been an emerging interest in studying the fundamental chemistry influencing the quality of indoor air to which occupants are exposed. Significant effort in indoor chemistry research has been directed towards understanding emissions and their chemical evolution within indoor spaces. Surfaces and their influence on indoor air quality have begun to receive more attention, as surfaces are important for the depositional loss of particulate matter and gases and also serve as reaction sites that can facilitate alternative reactions.

Degrees: M.S. in Chemistry, University of California San Diego; B.S. in Chemistry, University of California Davis

Awards and Honors: San Diego Fellowship 2018 - 2019; ARCS Foundation, Inc. - San Diego Chapter Award 2018–2019, 2019-2020

Publications and Posters:


Farmer, D. K.; Vance, M. E.; Abbatt, J. P. D.; Abeleira, A.; Alves, M. R.; Arata, C.; Boedicker, E.; Bourne, S.; Cardoso-Saldaña, F.; Corsi, R.; Decarlo, P. F.; Goldstein, A. H.; Grassian, V.H.; Hildebrandt Ruiz, L.; Jimenez, J. L.; Kahan, T. F.; Katz, E. M.; Mattila, J. M.; Nazaroff, W. W.; Novoselac, A.; O'Brien, R. E.; **Or, V. W.**; Patel, S.; Sankhyan, S.; Stevens, P. S.; Tian, Y.; Wade, M.; Wang, C.; Shou, S.; Zhou, Y. Overview of HOMEChem: House observations of microbial and environmental chemistry. Environ. Sci. Process. Impacts 2019, 21, 1280-1300.

**Or, V. W.**; Alves, M. R.; Wade, M.; Schwab, S.; Corsi, R. L.; Grassian, V. H. Crystal clear? Microspectroscopic imaging and physicochemical characterization of indoor depositions on window glass. Environ. Sci. Technol. Lett. 2018, 5 (8), 514–519.

**Or, V. W.**; Estillore, A. D.; Tivanski, A. V.; Grassian, V. H. Lab on a tip: atomic force microscopy–photothermal infrared spectroscopy of atmospherically relevant organic/inorganic aerosol particles in the nanometer to micrometer size range. Analyst. 2018, 143, 2765-2774.

Estillore, A. D.; Morris, H. S.; **Or, V. W.**; Lee, H. D.; Alves, A. R.; Marciano, M. A.; Laskina, O.; Qin, Z.; Tivanski, A. V.; Grassian, V. H. Linking hygroscopicity and the surface microstructure of model inorganic salts, simple and complex carbohydrates, and authentic sea spray aerosol particles. Phys. Chem. Chem. Phys 2017, 19, 21101 - 21111.

Current Research (expanded description): In the United States, humans spend most of their time indoors. However, the predominant fraction of environmental chemistry is focused towards atmospheric chemistry. There has been a recent uptick in the number of research groups studying the fundamental chemistry relevant to the indoor environment, and there has been a strong push towards characterizing the composition, behavior, and fates of gaseous and particulate matter components of indoor air. However, a large gap exists in the understanding of the role surfaces play in regulating indoor air quality. Surfaces are significantly more prominent and diverse in the indoor environment and play a large role in regulating concentrations of compounds in the indoor space. For indoor surfaces, nanoscale microscopic and spectroscopic techniques are utilized to probe how surface location and human activity influence the types and state of depositions. In addition, surfaces are monitored as they evolve under varying environmental conditions. The goal of this research is to untangle the influence surface deposition and reactions have on indoor air quality by providing direct insight into the chemical composition and morphological features of indoor surfaces and depositions. These results will be fed into laboratory and modeling studies to produce a molecular-level understanding of relevant surface reactions in the indoor environment.

Benefits to Science and Society: Understanding the role of surfaces indoors is necessary to develop a comprehensive understanding of surface reactions indoors. These findings are integrated into modeling simulations that can provide more generalized descriptions regarding the fates of indoor emissions. More broadly, the findings from indoor chemistry will provide the necessary information for policy makers, manufacturers and occupants to make decisions that minimize exposure to harmful compounds and low indoor-air quality.

ARCS Award: The ARCS Foundation award not only provides me with financial support and stability, but more importantly, serves as a reminder that research and discoveries in STEM are of interest to more than just the scientific community. I am deeply grateful to all those that support education and research in any way, shape, or form.



# JASON ALEXANDER PLATT

## University of California San Diego

Division of Physical Sciences

Concentration: Biophysics

Specialization: Neuroscience/Artificial Intelligence

Donor: Legler Benbough Foundation

Jason is exploring the boundaries between physics, neuroscience and computer science in order to build more biologically-realistic neural networks. He is taking as his model system the insect—specifically the locust—olfactory pathway, a network which has evolved to identify chemical constituents in odors rapidly and accurately, and for which there is enough known biologically to use as a basis for machine learning. Biologically based artificial intelligence programs hold the promise of being able to learn much faster than current systems, while being robust to noise and adversarial attacks.

Degrees: M.S in Applied Physics and Engineering, Stanford University; B.S in Physics, Stanford University

Awards and Honors: UCSD Physics Excellence Award; Departmental Honors, Stanford University Department of Physics

Publications and Posters:

**Platt, J.**; Miller, A.; Abarbanel, H. Machine learning classification informed by a functional biophysical system. Physical Review Letters (Submitted), 2019.

**Platt, J.**; Moehle, N.; Fox, J.; Dally, W. Optimal operation of a plug-in hybrid vehicle. IEEE Transactions on Vehicular Technology, 2018.

Miller, A.; Li, D.; **Platt, J.**; Margoliash, D.; Abarbanel, H. Statistical data assimilation: Formulation and examples from neurobiology. Frontiers in Applied Mathematics and Statistics–Dynamical Systems, 2018.

**Platt, J.**; Hofle, W.; Pollok, K.; Fox, J. Equalizer design techniques for dispersive cables with application to the SPS Wideband Kicker. Nuclear Instruments and Methods in Physics Research Section A: Accelerators, Spectrometers, Detectors and Associated Equipment, vol. 868, 2017, pp. 93–97.

Current Research (expanded description): Computational neuroscience employs theoretical analysis to understand the principles that underlie the structure, function and abilities of the central nervous system. Fundamentally, we are exploring nature's own solutions to interesting functional questions— e.g. how to classify the information content of images, how olfactory systems learn to classify odors, how songbirds learn to sing. Inspired by these biological solutions we seek to construct silicon-based networks to solve equivalent problems that are key to machine intelligence. We are taking as our model system the insect—specifically the locust—olfactory pathway, a network which has evolved to identify chemical constituents in odors rapidly and accurately, and for which there is enough known biologically to use as a basis for machine learning.

The insect olfactory system consists of a feedforward network, with mutual inhibition within each layer. Much of the processing takes place in a layer called the antennal lobe which can be described by a network architecture called winnerless competition (WLC). WLC separates out the input into spatio-temporal signals, giving us a clear way to discriminate between different kinds of input. We are proposing to use this WLC paradigm as the basis for a neural network composed of biophysically realistic neurons.

Benefits to Science and Society: Artificial intelligence is revolutionizing almost every aspect of our society. Current artificial networks, built around oversimplified neurons and synapses, are brittle and susceptible to sophisticated attacks. By basing themselves on nature's own solutions to functional problems, biological-based neural networks hold the promise of solving these issues and allowing us to have more confidence in the networks we build. Bringing together neuroscience, computer science and physics, my work will help bring AI research back to its roots in biophysics in order to build the next generation of neural networks.

Personal Interests: I am an avid backpacker and just finished 200 miles of the John Muir Trail. Musically I play trumpet. Also play sports such as soccer/tennis. Surf when the weather is good.

ARCS Award: The ARCS Foundation award lets me concentrate on research and allows me to travel to conferences and collaborators in the summer instead of having to teach. This is a significant boost to my ability to further my career as well as scientific progress and collaboration across institutions.



# HOMA RAHNAMOUN

## University of California San Diego

Division of Biological Sciences

Concentration: Biological Sciences

Specialization: Cancer Biology and Gene Regulation

Donor: ARCS Foundation - San Diego Chapter / Helga Moore

Only about 2% of the human genome encodes for proteins that carry out functions in a cell. While it has been well-established that some of the noncoding DNA is used as template to generate functional RNA molecules that support different cellular processes, large numbers of noncoding RNAs are still thought to lack function. In a recent study, Homa and her colleagues revealed that several thousand noncoding enhancer RNAs (eRNAs) are produced in colon cancer cells following chronic immune signaling, and the primary focus of her research is understanding how these RNAs regulate oncogenic gene networks.

Degree: B.S. in Bioengineering: Biotechnology, University of California San Diego

Awards and Honors: UC San Diego Biology Founding Faculty Award for Graduate Excellence; NSF Graduate Research Fellowship Program; NIH Cellular and Molecular Genetics Training Grant; Undergraduate San Diego Center for Systems Biology Fellowship

Publications and Posters:

**Rahnamoun, H.**; Orozco, P; Lauberth, S. M. The role of enhancer RNAs in epigenetic regulation of gene expression. Transcription, in press.

**Rahnamoun, H.**; Lee, J.; Sun, Z.; Lu, H.; Ramsey, K. M.; Komives, E. A.; Lauberth, S. M. RNAs interact with BRD4 to promote enhanced chromatin engagement and transcription activation. Nat Struct Mol Biol 2018, 25 (8), 687-697.

**Rahnamoun, H.**; Hong, J.; Sun, Z.; Lee, J.; Lu, H.; Lauberth, S. M. Mutant p53 regulates enhancer-associated H3K4 monomethylation through interactions with the methyltransferase MLL4. J Biol Chem 2018, 293 (34), 13234-13246.

**Rahnamoun, H.**; Lu, H.; Duttke, S. H.; Benner, C.; Glass, C. K.; Lauberth, S. M. Mutant p53 shapes the enhancer landscape of cancer cells in response to chronic immune signaling. Nat Commun 2017, 8 (1), 754.

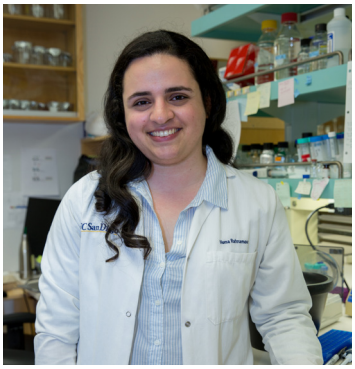
Current Research (expanded description): My primary research focus is to obtain new insights into enhancer-derived RNAs (eRNAs) and their functions. Towards this goal and as shown in a recent study published in Nature Structural & Molecular Biology, I provided evidence that these noncoding RNAs exhibit a direct role in gene-specific activation. This was an important finding since it is among the few studies to date that have identified functional roles for eRNAs and not dismissed them as byproducts of enhancer transcription (transcriptional noise). I also found new evidence that eRNAs enhance the binding of the bromodomain and extra-terminal motif (BET) protein BRD4 to acetylated lysines at active enhancers to promote enhanced BRD4 coactivator activities. This unexpected mechanism of eRNA function could be widespread given the conservation of bromodomains (BDs) which I mapped as the eRNA interacting domain of BRD4 and could have important implications since BD proteins are implicated in a variety of diseases.

Benefits to Science and Society: Understanding the significance of eRNAs as a class of noncoding RNAs that are relatively abundant in our cells provides mechanistic insights into how functional molecules other than proteins regulate or alter various gene networks. Importantly, gaining this knowledge will allow for the development of more targeted therapeutic strategies given that the expression of distinct classes of eRNAs is misregulated in multiple cancers and developmental disorders.

Personal Interests: I love traveling to new places and also enjoy listening to all kinds of podcasts.

ARCS Award: Being chosen as an ARCS Scholar has a profound impact on my confidence and scientific career as an early-stage researcher. To know that such a prestigious organization recognizes my passion and potential and provides valuable intellectual and financial support further motivates me to continue working hard towards making scientific contributions.





# DIMITRIOUS ADRIAN SCHREIBER

## University of California San Diego

Jacobs School of Engineering

Concentration: Electrical and Computer Engineering

Specialization: Medical Robotics

Donor: ARCS Foundation – San Diego Chapter

Dimitri Schreiber's research is focused on the design and control of Magnetic Resonance Imaging (MRI) guided needle-placement robots and their evaluation in a clinical setting. MRI environments are challenging to work inside due to their high magnetic fields and confined working area. Dimitri has developed a highly dexterous CT-compatible biopsy robot which can be modified for use within an MRI scanner with different joint actuators. Currently, he is preparing for clinical tests of his CT-compatible needle-guidance robot and developing novel hydraulic actuators to work within an MRI scanner.

Degree: B.S. in Electrical and Computer Engineering, University of California San Diego

Awards and Honors: Best Poster Runner-up Award, IEEE/RSJ International Conference on Intelligent Robots and Systems; NSF Graduate Research Fellowship; ARCS Foundation Award; Chancellor's Research Excellence Scholarship; Electrical and Computer Engineering Department Fellowship

Publications and Posters:

**Schreiber, D. A.**; Jiang, H.; Li, G.; Yu, J.; Yu, Z.; Zhu, R.; Norbash , A.; Yip, M. CRANE: A highly dexterous needle placement robot for evaluation of interventional radiology procedures. IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS). Workshop on Intelligent Robot Interactions with the Anatomy. 2019.

**Schreiber, D.**; Shak, D.; Norbash, A.; Yip, M. An open-source 7-axis, robotic platform to enable dexterous procedures within CT scanners. Proceedings of IEEE/RSJ Intl. Conference on Intelligent Robots and Systems (IROS). 2019.

**Schreiber, D.**; Norbash, A.; Yip, M. MRI guided hyper-redundant biopsy robot. Proceedings of IEEE/RSJ Intl. Conference on Intelligent Robots and Systems (IROS), Workshop on Continuum Robots in Medicine: Design, Integration. 2017.

**Schreiber, D.**; Meyer, D.; Rissolo, D.; Kuester, F. Autonomous stereoscopic photosphere system for archaeological site virtualization. Computer Applications and Quantitative Methods in Archaeology. 2016.

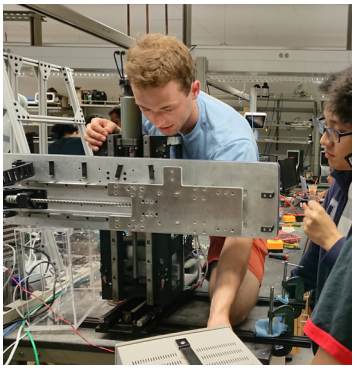
Current Research (expanded description): My research is primarily focused on the design and control of Magnetic Resonance Imaging (MRI) guided needle-placement robots and their evaluation in a clinical setting. MRI environments are challenging to work inside due to their high magnetic fields, sensitivity to Radio Frequency noise, and their confined working area. Prior MRI-compatible robotics works have developed application-specific platforms for prostate biopsy, radiation seed placement, breast biopsy, and bone needle biopsy. The requirements for lung biopsy differ significantly from these procedures as they require a larger working area, have a moving target, and use a substantially longer needle. I have spent the past two years developing a highly dexterous CT-compatible biopsy robot which can be modified for use within an MRI scanner through the use of different joint actuators. For this work, I developed a low-profile cable-driven robotic arm to allow the robot to maintain high accuracy while occupying little space within the imager's bore. I am currently working on control methods to compensate for the cable transmission's flexibility, validating the reachable workspace of the robot within the scanner, and preparing for precursory clinical trials.

Benefits to Science and Society: Lung cancer accounts for over one-quarter of all cancer deaths worldwide. Early detection using image-guided needle biopsy is highly correlated with survival. However, the current CT-guided method provides limited resolution and poor precision. To combat these limitations, I propose to develop an intra-MRI robot for needle lung biopsy. The proposed robotics and controls research will allow for the early diagnosis of lung cancer and improved patient care in addition to expanding the procedures possible within MRI and CT scanners.

Personal Interests: Outside of work, I love rock climbing, surfing, and pottery. When I have time, I also enjoy biking and scuba diving.

ARCS Award: It was a great honor to be granted an ARCS Foundation award. Not only does this award provide me with increased financial security and freedom, but it has also introduced me to an incredible group of people. The financial aspect of the scholarship allows me to focus on my research with far fewer external concerns. It enables me to purchase ancillary items both for my research and home, which would otherwise be financially challenging. My conversations with other Scholars and ARCS members have not only motivated me to work harder in my own research, but have also given me new directions to pursue. It is always interesting to see the other Scholars' fantastic work and the passion with which they pursue their field. I am continually grateful for the difference the ARCS members have made in both my and many other graduate students' quality of life.

dimitrischreiber.weebly.com



# BENJAMIN SHIH

## University of California San Diego

Jacobs School of Engineering

Concentration: Mechanical and Aerospace Engineering

Specialization: Robotics (Soft Robotics)

Donor: ARCS Foundation – San Diego Chapter

Ben studies soft robotics, which is where robots are made from flexible and compliant materials like silicones and rubbers rather than traditionally rigid components such as metals. Their inherently squishy exteriors make them safe for contact with humans or fragile objects and provide them with robustness to uncertainty in their environments and interactions. Ben is developing informative touch for soft robots by embedding dense, high-resolution sensors into their skins and interpreting the tactile information using machine learning. This research enables robots working alongside us in the future to understand actions that are intuitive for humans but difficult for robots to interpret, such as a pat on the back or a handshake.

Degrees: M.S. in Electrical and Computer Engineering, Carnegie Mellon University; B.S. in Electrical and Computer Engineering, Carnegie Mellon University

Awards and Honors: Best Poster Finalist, IEEE-RAS International Conference on Soft Robotics 2018; Outstanding Graduate Student, UC San Diego MAE Department 2017; Jacobs Fellow, UC San Diego Irwin Jacobs School of Engineering Fellowship 2015

Publications and Posters:

Thuruthel T. G.*; **Shih B.***; Laschi C.; Tolley, M. T. Soft robot perception using embedded soft sensors and recurrent neural networks. Science Robotics. 2019, 4:26, eaav1488. *equal contribution

**Shih B.**; Christianson C.; Gillespie K.; Lee S.; Mayeda J.; Huo Z.; Tolley, M. T. Design considerations for 3D printed, soft, multimaterial resistive sensors for soft robotics. Frontiers in Robotics and AI. 2019, 6, 30.

**Shih, B.**; Drotman, D.; Christianson, C.; Huo, Z.; White, R.; Christensen, H.I.; Tolley, M.T. Custom soft robotic gripper sensor skins for haptic object visualization. IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS). 2017.

Kim, Y.-S.; Lu, J.; **Shih, B.**; Gharibans, A.; Zou, Z.; Matsuno, K.; Aguilera, R.; Han, Y.; Meek, A.; Xiao, J.; Tolley, M.T.; Coleman, T.P. Scalable manufacturing of solderable and stretchable physiologic sensing systems. Advanced Materials. 2017.

Current Research (expanded description): Nature is a phenomenal engineer with over four billion years of experience. The biological systems that it has produced can robustly venture into a myriad of unstructured environments. In contrast, many of the bioinspired systems designed by roboticists are currently constrained to well-defined lab environments. My research seeks to bridge the gap between biology and machines by developing biologically-inspired sensing for soft-bodied robots that can safely interact with humans and with uncertainty in their environment. Current work concentrates on design and fabrication of soft robots and sensors and explores how machine learning can enhance soft robot perception. In the future, I plan to focus on deployable, high-resolution sensor skins, algorithms for processing the dense sensor information, and reliable feedback control for soft robots. The long-term vision of my research includes in-home, assistive robots that can sense and understand gestures like a pat on the back and exploratory robots that can work alongside humans out in the unpredictable wild.

Benefits to Science and Society: Robots are growing increasingly prevalent in our everyday lives. As they begin to coexist alongside humans in the work environment and at home, we will require robots that can interact safely with their surroundings. In addition to verbal and visual communication, these collaborative robots should be able to understand how people communicate through the sense of touch, which plays a subtle but crucial role in our daily interactions. Research on informative touch for soft robots will help engineers build robots that can better understand, work with, and help people than the systems that exist today.

Personal Interests: Photography, cycling, basketball, volleyball, cooking, reading

ARCS Award: The ARCS Foundation award is an opportunity to learn about other amazing research in the San Diego region and network with colleagues and peers working on similar topics.

benshih.github.io



# MATTHEW DAVID STONE

## University of California San Diego / San Diego State University

School of Medicine

Concentration: Public Health - Health Behavior

Specialization: Tobacco Regulatory Science

Donor: Kenneth and Marjorie Blanchard

Matthew's research uses choice-based preference tasks, sensor technology and ecologically driven data to investigate the impact that graphic warning labels affixed to cigarette packaging have on consumer health perceptions, thoughts of quitting, and behavioral outcomes among daily smokers. His research also focuses on identifying product characteristics of e-cigarettes that can be altered in order to protect youth and mitigate the harms of vaping. Combined, this high-impact research aids in reducing the global health burden of tobacco-related morbidity and mortality.

Degree: B.S. in Sociology, California State University Long Beach

Awards and Honors: Tobacco-Related Disease Research Program (TRDRP) - Predoctoral Fellowship Award 2018-2021; Travel Award, Society for Research on Nicotine and Tobacco (SRNT) annual meeting

Publications and Posters:

Leventhal, A. M.; Goldenson, N. I.; Cho, J.; Kirkpatrick, M. G.; McConnell, R. S.; **Stone, M. D.**; Pang, R. D.; Audrain-McGovern, J.; Barrington-Trimis, J. L. Flavored e-cigarette use and progression of vaping in adolescents. Pediatrics 2019, 144 (5).

Cho, J.; **Stone, M. D.**; Leventhal, A. M. Anhedonia as a phenotypic marker of familial transmission of polysubstance use trajectories across midadolescence. Psychol. Addict. Behav. 2019, 33 (1), 15.

Pierce, J. P.; Shi, Y.; McMenamin, S. B.; Benmarhnia, T.; Trinidad, D.; Strong, D. R.; White, M. M.; Kealey, S.; Hendrickson, E. M.; **Stone, M. D.** Trends in lung cancer and cigarette smoking: California compared to the rest of the United States. Cancer Prevention Research 2019, 12 (1), 3-12.

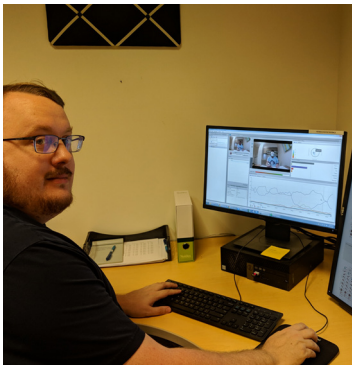
Bello, M.; Khoddam, R.; **Stone, M. D.**; Cho, J.; Yoon, Y.; Lee, J.; Leventhal, A. Poly-product drug use disparities in adolescents of lower socioeconomic status: Emerging trends in nicotine products, marijuana products, and prescription drugs. Behav. Res. Ther. 2019, 115, 103-110.

Current Research (expanded description): Matthew aims to determine how the initial response to graphic warning labels on cigarette packs impacts health perceptions, sensory appeal, quit intentions, and day-to-day smoking consumption over a three-month intervention where participants purchase and smoke their cigarettes from study packs: a) industry packs with marketing intact, b) blank packs with marketing removed, and c) three graphic warning packs. Using facial affective machine learning algorithms, text analytics of verbalized reactions to packs, and marketing techniques in choice-based conjoint, he is seeking to clarify that initial responses to the graphic warnings do not simply reflect provocation but mark impactful processing of health risks of smoking, a precursor to smoking reduction. He is examining whether acute reactions are temporary or diminish after prolonged exposure to graphic packaging. Further, Matthew is investigating what e-cigarette product attributes are most important to users, and which populations (e.g., youth vs. adults) value different attributes. Using an orthogonal discrete choice trade-off task, he is examining the importance of product attributes and corresponding price worth estimates. This research will provide evidence of which FDA regulations may be most effective at reducing youth initiation of e-cigarettes without discouraging adult cigarette smokers from transitioning to e-cigarettes.

Benefits to Science and Society: Matthew's research may provide evidence that mandating graphic warnings on US cigarette packs would induce smoker aversion to these packs and potentially deter cigarette purchasing. Further, his research into youth vaping will provide FDA regulatory authorities with information regarding which e-cigarette attributes (e.g. flavor, nicotine concentrations, etc.) are prime targets for regulation to curb the youth vaping epidemic.

Personal Interests: Aside from research, Matthew enjoys playing board games, solving complex puzzles, and spending time with friends and family.

ARCS Award: As one of this year's ARCS Foundation Scholars, I am grateful for the distinct opportunities this award provides. It is truly a distinguished honor. As an emerging scientist, receiving this award will provide much need research materials, unique and valuable opportunities for collaborative networking, as well as professional trainings. Importantly, the funds associated with the award will help offset living expenses and the economic realities of being a student. This award is directly associated to my scientific productivity as it allows me to focus on my research and professional development – It truly eases a significant burden and contributes greatly to my overall wellbeing. I am beyond elated to receive this award once again! I look forward to seeing everyone and attending this year's wonderful events! Thank you.



# ANTHONY QUOC VU

## University of California San Diego

School of Medicine

Concentration: Biomedical Sciences

Specialization: Genetics and Genomics

Donor: Hervey Family Non-Endowment Fund

Anthony's research focuses on understanding how stress granules may contribute to neurodegenerative diseases. Stress granules are transient clumps of protein and RNA that form inside the cell when exposed to environmental stresses. These assemblies protect their molecules from damage and help the cell survive. Importantly, abnormal formation and clearance of stress granules may impact cell survival and are implicated in the pathogenesis of neurodegeneration. Through experimental methods, his goals are to identify components that contribute to stress granule biology and to determine how misregulation of key genes may contribute to disease progression.

Degrees: M.S. in Biology, University of California San Diego; B.S. in Biochemistry and Cell Biology, University of California San Diego

Awards and Honors: Outstanding Research Poster, CNG Brainstorm Symposium 2018; National Science Foundation (NSF) Graduate Research Fellowship 2016

Publications and Posters:

Fang, M. Y.; Markmiller, S.; **Vu, A. Q.**; Javaherian, A.; Dowdle, W. E.; Jolivet, P.; Bushway, P. J.; Castello, N. A.; Baral, A.; Chan, M. Y.; Linsley, J. W.; Linsley, D.; Mercola, M.; Finkbeiner, S.; Lecuyer, E.; Lewcock, J. W.; Yeo, G. W. Small-molecule modulation of TDP-43 recruitment to stress granules prevents persistent TDP-43 accumulation in ALS/FTD. Neuron 2019, 103 (5), 802-819 e11.

Krach, F.; Batra, R.; Wheeler, E. C.; **Vu, A. Q.**; Wang, R.; Hutt, K.; Rabin, S. J.; Baughn, M. W.; Libby, R. T.; Diaz-Garcia, S.; Stauffer, J.; Pirie, E.; Saberi, S.; Rodriguez, M.; Madrigal, A. A.; Kohl, Z.; Winner, B.; Yeo, G. W.; Ravits, J. Transcriptome-pathology correlation identifies interplay between TDP-43 and the expression of its kinase CK1E in sporadic ALS. Acta Neuropathol 2018, 136 (3), 405-423.

Kapeli, K.; Pratt, G. A.; **Vu, A. Q.**; Hutt, K. R.; Martinez, F. J.; Sundararaman, B.; Batra, R.; Freese, P.; Lambert, N.J.; Huelga, S.C.; Chun, S.J.; Liang, T.Y.; Chang, J.; Donohue, J. P.; Shiue, L.; Zhang, J.; Zhu, H.; Cambi, F.; Kasarskis, E.; Hoon, S.; Ares, M. Jr.; Burge, C. B.; Ravits, J.; Rigo, F.; Yeo, G. W. Distinct and shared functions of ALS-associated proteins TDP-43, FUS and TAF15 revealed by multisystem analyses. Nat Commun. 2016 Jul 5;7:12143.

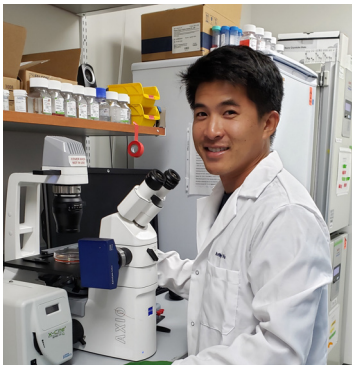
Siddiqi, S.; Nee Foo, J.; **Vu, A.**; Azim Saad; Silver, D. L.; Mansoor, A.; Hong Tay, S. K.; Abbasi, S.; Hashmi, A. H.; Janjua, J.; Khalid, S.; Tai, E.S.; Yeo, G. W.; Khor, C. C. A novel splice-site mutation in ALS2 establishes the diagnosis of juvenile amyotrophic lateral sclerosis in a family with early onset anarthria and generalized dystonias. PLoS One. 2014 Dec 4;9(12):e113258.

Current Research (expanded description): Stress granules (SGs) are dynamic cytoplasmic assemblies of ribonucleoprotein complexes. By stalling mRNA translation and sequestering aggregation-prone proteins, these transient membraneless structures are thought to be a cytoprotective response during cellular stress. Defects in SG assembly and clearance are firmly linked to neurodegenerative disease: stable SG-like inclusions in brain are hallmarks of amyotrophic lateral sclerosis (ALS) and related disorders, and genetic mutations in SG proteins cause familial forms of these diseases. While recent in vitro proteomic studies using biochemical fractionation and protein proximity-labeling techniques have identified over 400 SG components, little remains known about which proteins regulate SGs. It is of great importance to identify components critical to SG formation and disassembly to further our understanding of the basic biology of SGs. Additionally, these findings will reveal novel therapeutic targets to manage disease-associated aberrant SG dynamics. My objective is to take a multidisciplinary approach to evaluate the cellular stress response after protein depletion. Because a majority of identified SG-associated proteins are RNA binding proteins (RBPs) with intrinsically disordered regions that facilitate aggregation and phase separation, my collaborators and I are developing an imaged-based screen using CRISPR/Cas9 to systematically knockout all known RBPs and evaluate stress granule dynamics through high-content imaging.

Benefits to Science and Society: Amyotrophic lateral sclerosis (ALS) is a fatal, incurable disease characterized by degeneration of motor neurons. Abnormal protein aggregates are a central pathological hallmark of ALS; however, the molecular mechanisms that contribute to the disease remain largely unknown. Because tight regulation of stress granule assembly-disassembly is critical for cell viability and dysregulation is linked to neurodegenerative diseases, characterizing key components that regulate stress granules is both necessary to our understanding of protein aggregation and harnesses potential implications for personalized therapeutic intervention.

Personal Interests: I enjoy playing tennis, drawing and painting, rock climbing, working on cars, and snowboarding. I also love automotive racing and often times will compete with friends in indoor go-karting or in our cars at local autocross events.

ARCS Award: Funding from the ARCS Foundation affords me the flexibility to focus on my research training and pursue cross-disciplinary research problems in assay development, disease biology, and therapeutics.



# ALEXANDER JEFFREY WHITEHEAD

## University of California San Diego

Jacobs School of Engineering

Concentration: Bioengineering

Specialization: Regenerative Medicine and Tissue Engineering

Donor: ARCS Foundation – San Diego Chapter

Alex studies how the immune system regulates how the heart heals after a heart attack. He also studies how certain animals can regenerate their hearts, and if we can use similar processes to heal human hearts. He uses large datasets to decipher how protein composition of the heart changes with age and in instances of disease. By combing data-driven approaches and molecular biology techniques, he hopes to identify drug targets to improve outcomes of heart attack patients.

Degree: B.S. in Biomedical Engineering, Virginia Commonwealth University

Awards and Honors: National Science Foundation Graduate Research Fellowship 2018; 2nd Place Young Investigator Award at IADR/AADR 2017; VCU Undergraduate Research Poster Award 2014; Provost Scholarship – Virginia Commonwealth University 2013

Publications and Posters:

Cohen, D. J.; Cheng, A.; Kahn, A.; Aviram, M.; **Whitehead, A. J.**; Hyzy, S. L.; Clohessy, R. M.; Boyan, B. D.; Schwartz, Z. Novel osteogenic Ti-6Al-4V device for restoration of dental function in patients with large bone deficiencies: Design, development and implementation. Sci. Rep. 2016, 6.

Hyzy, S. L.; Cheng, A.; Cohen, D. J.; Yatzkaier, G.; **Whitehead, A. J.**; Clohessy, R. M.; Gittens, R. A.; Boyan, B. D.; Schwartz, Z. Novel hydrophilic nanostructured microtexture on direct metal laser sintered Ti-6Al-4V surfaces enhances osteoblast response in vitro and osseointegration in a rabbit model. J. Biomed. Mater. Res. Part A 2016, 104 (8), 2086–2098.

Current Research (expanded description): Alex is developing an in-vitro co-culture model for cardiac fibroblasts and macrophages that allows for extracellular matrix assays. While he is currently using U937 monocytes and

converting them into macrophages using PMA, he hopes to move to human primary monocytes and convert them using M-CSF and GM-CSF to provide more accurate results. He would also like to investigate how tissue-resident macrophages differ from monocyte-derived cells and how the early healing cascade impacts late-stage fibrosis after myocardial infarction.

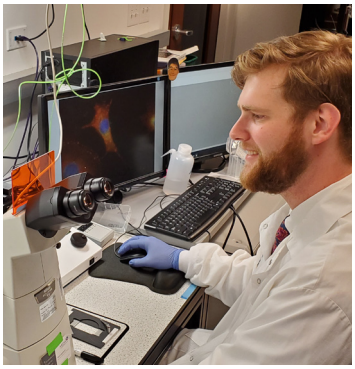
The second half of his project involves investigating how single-nucleotide polymorphisms at the 9p21 locus influence healing outcomes using this in-vitro model. He recently finished generating iPSC-derived cardiac fibroblasts from risk haplotypes and TALEN risk-knockout iPSCs. While the Engler lab has previously shown that p14-16 modulate stress-response for risk haplotype cardiomyocytes, Alex hopes to identify a genetic master regulator for fibrosis that links observed clinical outcomes to risk status.

Benefits to Science and Society: Ischemic heart disease is the leading cause of mortality world-wide, according to the World Health Organization in 2016. Alex has identified a combination of drug targets for post-myocardial infarction treatment that he hopes will lead to improved mortality and cardiac function outcomes. By using regenerative organisms as models for cardiac regeneration, he hopes to coax the adult human heart into a better state of repair.

Personal Interests: In his free time, Alex likes to create music, cook, and snowboard in the winter.

ARCS Award: I am very grateful to receive the ARCS award for my research. It is encouraging to be supported by such a progressive community-focused organization that builds bridges between scientists and the local professionals. This support will help fund my heart regeneration research and demonstrates a commitment to public health and community engagement.





# ANDREW YING

## University of California San Diego

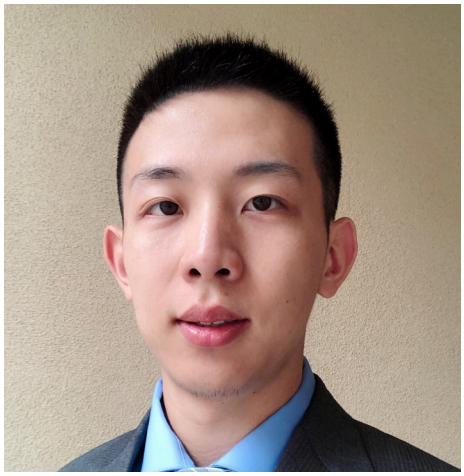
Division of Physical Sciences

Concentration: Statistics

Specialization: Causal Inference

Donor: Reuben H. Fleet Foundation Fund

Causal inference, as a long standing problem in statistics, computer science, epidemiology, and the social sciences, has drawn much attention in recent years due to the explosion of data magnitude and complexity. Andrew's research projects focus on understanding the causal mechanism of certain actions, treatments and others with complex data like time-to-event data. Andrew's current work aims to understand causal effect of etanercept on birth defects for diseased pregnant women.



Degree: B.S. in Mathematics, Zhejiang University

Awards and Honors: Achievement Rewards for College Scientists (ARCS) Scholar 2018-2020; Student Poster Award, Conference on Lifetime Data Science 2019; First Class Scholarship, Zhejiang University 2013-2014; Second Class Scholarship, Zhejiang University 2012-2013; Third Class Scholarship, Zhejiang University 2011-2012

Publications and Posters:

Arias-Castro, E.; **Ying, A.** Detection of sparse mixtures: Higher criticism and scan statistic. Electronic Journal of Statistics, 13(1): 208-230, 2019.

**Ying, A.**; Xu, R.; Murphy, J. Two-stage residual inclusion for survival data and competing risks - An instrumental variable approach with application to SEER-Medicare linked data. Statistics in Medicine, 38(10): 1775-1801, 2019.

Chen, S.; **Ying, A.**; Arias-Castro, E. A scan procedure for multiple testing. arXiv preprint arXiv:1808.00631, 2018.

**Ying, A.**; Zhou, W.X. On the asymptotic distribution of the scan statistic for point clouds. arXiv preprint arXiv:1910.01809, 2019.

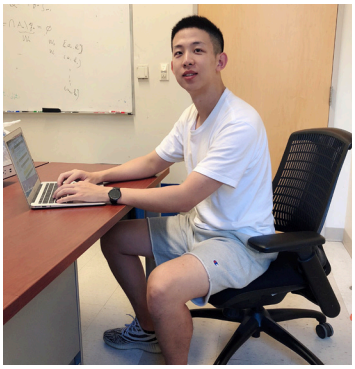
Current Research (expanded description): My co-authors and I are investigating the causal effects of etanercept (trade name Enbrel) on birth defects, a pharmaceutical that treats autoimmune diseases and recently went through US FDA revised labeling for use in pregnancy, since the proportion of liveborn infants with major birth defects was higher for women exposed to etanercept compared to diseased-etanercept-unexposed women. An outstanding problem, which was not addressed in the data analysis leading up to the FDA relabeling, is missing birth defect outcomes due to spontaneous abortion since, in accepted standard practice, an infant or a fetus is assumed not to be malformed unless a defect is found. This led to likely bias because, according to the theory of "terathanasia," a defective fetus is more likely to be spontaneously aborted. In addition, the previous analysis stratified on live birth against spontaneous abortion, which was itself a post-exposure variable showing higher rate of spontaneous abortion in unexposed women, and hence did not lead to causal interpretation of the stratified results. In this paper we aim to estimate and provide inference for the causal parameters of scientific interest, including principal effects, making use of the missing data mechanism informed by terathanasia. During the process we also deal with complications in the data including left truncation, observational nature, and rare events. Our findings not only provide a more in-depth analysis than previously done on etanercept but also shed light on how similar studies on causal effects of medication (or vaccine, other substances etc.) during pregnancy may be analyzed.

Benefits to Science and Society: Our proposed data analysis on the causal effects of etanercept can generalize to work on other medication (or vaccines, other substances etc.) during pregnancy. This analysis can make correct and efficient use of the observational data that are available, which saves budget for conducting more randomized trials. Our analysis results can also help doctors make better decisions when prescribing medicines.

Personal Interests: I love cooking, pulling latte arts and working out.

ARCS Award: I am incredibly grateful to have the continued support of the ARCS Foundation and its members. The award provided me with financial support for attending conferences to learn, network and broadcast my work. In the upcoming academic year, it will continue to support me so that I can focus on my research and career path.





# JIARONG ZHOU

## University of California San Diego

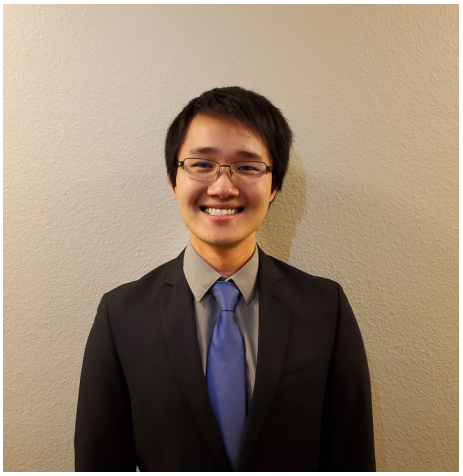
Jacobs School of Engineering

Concentration: NanoEngineering

Specialization: Vaccine Development

Donor: ARCS Foundation, Inc. – San Diego Chapter

Jiarong's research focuses on leveraging tiny particles for the development of vaccines against both infectious diseases and cancer. Vaccines are the safest and most effective means of fighting against infections. By introducing the foreign substances into the immune system in a safe manner, our immune cells can be taught to fight against the pathogens and cancerous cells. Jiarong is currently utilizing cell membrane-coated nanoparticles to create personalized vaccine formulations for individual patients.



Degrees: M.S. in Nanoengineering, University of California San Diego; B.S. in Nanoengineering, University of California San Diego

Awards and Honors: Ford Foundation Predoctoral Fellowship 2019-2022; Institute for Global Entrepreneurs, Technology Management & Entrepreneurism Fellow 2019-2020; National Institute of Health T32 Training Grant 2017-2019; Carbon Neutrality Initiative Student Fellowship 2015-2016

Publications and Posters:

**Zhou, J.**; Kroll, A.; Holay, M.; Fang, R.; Zhang, L. Biomimetic nanotechnology towards personalized vaccines. Advanced Materials 2019, in press.

Wei, X.; Ran, D.; Campeau, A.; Xiao, C.; **Zhou, J.**; Dehaini, D.; Jiang, Y.; Kroll, A.; Zhang, Q.; Gao, W.; Gonzalez, D.; Fang, R.; Zhang, L. Multiantigenic nanotoxoids for antivirulence vaccination against antibiotic-resistant gram-negative bacteria. Nano Letters 2019, 19(7), 4760-4769.

Wei, X.; Beltran-Gastelum, M.; Karshalev, E.; Bsteban-Fernandez de Avila, B.; **Zhou, J.**; Ran, D.; Angsantikul, P.; Fang, R.; Wang, J.; Zhang, L. Biomimetic micromotor enables active delivery of antigens for oral vaccination. Nano Letters 2019, 19(3), 1914-1921.

Kroll, A.; Fang, R.; Jiang, Y.; **Zhou, J.**; Wei, X.; Yu, C. L.; Gao, J.; Luk, B.; Dehaini, D.; Gao, W.; Zhang, L. Nanoparticulate delivery of cancer cell membrane elicits multi-antigenic antitumor immunity. Advanced Materials 2017, 29(47), 1703969.

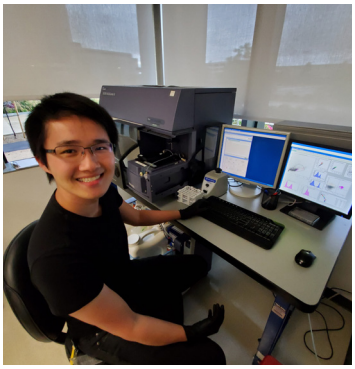
Current Research (expanded description): My research focuses on cell membrane-coating nanotechnology, in which we strip plasma membrane from natural cells and coat them onto the surface of nanoparticles to preserve the surface functionalities. More specifically, I am leveraging the technology to generate new vaccines without the need for in-depth studies of each pathogen. Since our immune systems recognize foreign entities by probing their surface, most of the antigenic markers can be found on the surface. By utilizing cell membrane-coated nanoparticles, we can directly train our immune systems against those surface markers without the need to understand them. Through varying the source cells, such as cancer cells, parasites, and bacteria, different types of vaccines can be generated against specific pathogens. In addition, cell membrane-coated nanoparticles can be used to capture bacterial toxins. A wide variety of toxins secreted by pathogens can disrupt host cells. However, many of these toxins act on the membrane surface. By using the same source cells, the inanimate nanoparticles can capture the toxins in their native form. Vaccination with the toxin-bound nanoparticles can elicit immunity against the toxins and protect patients from the toxicity. In this manner, comprehending the exact mechanism of the toxins is unnecessary.

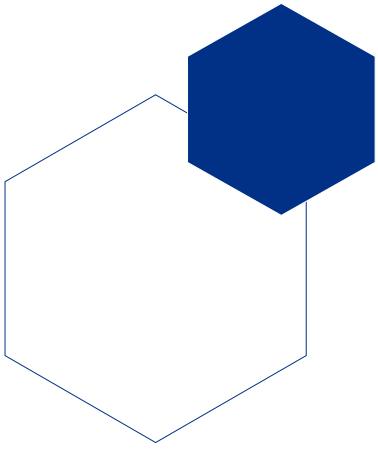
Benefits to Science and Society: Although vaccines have successfully helped prevent several dangerous diseases such as polio and tuberculosis, many bacterial infections rely on antibiotics as treatments. However, the spread of antibiotic resistance has far outpaced their discovery. Thus, by developing vaccines against the pathogens, we can slowly move away from using drugs as a cure-all and ultimately overcome the antibiotics resistance challenge. Furthermore, by advancing personalized formulations, medical decisions can be tailored to individual patients in order to maximize the efficacy of each treatment.

Personal Interests: I enjoy mentoring and teaching other people, programming, immersing in Japanese culture, cooking delicious food, and learning about innovative technologies.

ARCS Award: To me, receiving the ARCS Foundation award is a form of recognition. The award helps reinforce the idea that there are people who recognize that the work and research I am doing have major societal impacts. Furthermore, the funding from the award will allow me to dedicate more of my time towards research rather than stressing about any financial burdens.








University
of San Diego

# BYRON BATZ

## University of San Diego

Hahn School of Nursing and Health Science

Concentration: Nursing

Specialization: Home Based Palliative Care

Donor: Beyster Family Foundation Fund IV

Byron's research project is focused on the palliative care process and end of life preparation. He is seeking how hospitalized patients requiring increased symptom management can have an efficient and smoother transition into either inpatient or home-based palliative care services. In addition, he is researching why most individuals in the United States are not prepared with end of life arrangements or long-term care. His nursing experience as a palliative care nurse, patient educator, case manager, and research nurse has shown him that end of life unpreparedness is causing increased inefficiency in the use of medical resources and time, and unnecessary stress, pain, and suffering to patients and their family members.

Degrees: M.S. in Nurse Executive Leadership, University of San Diego; B.S. in Nursing, California State University Long Beach

Awards and Honors: 2018 ARCS Award presented by Beyster Family Foundation Fund IV; 2013 Daisy Award presented by Riverside Kaiser Permanente; 2012 Notable Nurse Award presented by Kaiser Permanente and the State of California; 2005 Long Beach City College Life Science Scholar's Award

Publications and Posters:

Nguyen, H.Q.; Mularski, R.A.; Edwards, P.E.; Lynn, J.; Machado, M.T.; McBurnie, M.A.; McMullen, C.; Mittman, B.S.; Reinke, L.R.; Shen, E.; Wang, S.E.; Werch, H.S.; . . . **Batz, B.** . . . Protocol for a noninferiority comparative effectiveness trial of home-based palliative care (HomePal). Journal of Palliative Medicine (2019) 22(S1), 20-33. doi:10.1089/jpm.2019.0116.

Current Research (expanded description): Since death is an event all humans will experience, a conversation that facilitates planning and arrangements for one's final days should be important in American society. However, in the US, only 25%-30% of the population has completed an advance directive (AD). Almost 60% of American adults 65 years of age or older do not want to discuss life expectancy with their physicians. Theoretically,

having these conversations increases the potential of lessening the taboo surrounding the topic of death, as well as minimizing the distress of terminal patients and their families at the end of life (EOL). This research will examine the attitude of adults toward death. Can conversations about death and dying help with being better prepared for end of life planning (EOLP)? By answering the question regarding whether a population is ready to start talking about death and dying or not, a program can be developed that can assist individuals reach a state of advanced preparedness. It is proposed that individuals who reach this advanced preparedness can potentially increase their probability of receiving quality of care during the dying process at EOL

Benefits to Science and Society: When elderly patients with serious health conditions or their surrogate caregivers do not prepare for the health care needs at the end of life, and are admitted to a hospital in poor or grim health condition, it potentially increases stress, pain, and suffering for patients, their families, friends, and assigned decision makers, while also potentially increasing health care costs. Finding causes and reasons for the lack of preparedness can help in the development of solutions, which can in turn help decrease stress levels, pain, and suffering, as well as minimize health care costs.

Personal Interests: Byron states that the best way of spending his time is with his wife and two daughters. He also loves taking his Jeep off road, riding his road bike in the mornings, fishing, and nature.

ARCS Award: I am extremely grateful for the ARCS Award. It has and continues to help my family and me in decreasing the financial burden of the ever-rising education costs. This award allows me to use more of my mind power on learning. It provides an opportunity to continue to stay in school without the need to increase my work hours. Thank you!



# NICOLE TAMARA MARTINEZ

## University of San Diego

Hahn School of Nursing and Health Science

Concentration: Nursing

Specialization: Emergency Medicine

Donor: Beyster Family Foundation IV

Nicole's study will describe relationships among social demographics (age, gender, established PCP, race/ethnicity, education level), physical examination findings (i.e. HR> 90 bpm, temperature > 37.7 C), treatment modality (i.e. incision and drainage, oral medication, or parenteral medication), patient disposition (i.e. hospital admission or Emergency Department discharge at initial presentation), and reason for return visit to the ED among patients with non-purulent and purulent skin and soft tissue infections who presented for treatment in a high-volume rural ED. Furthermore, her work will identify factors that increase the odds of hospital admission at initial presentation for patients with skin and soft tissue infections, such as cellulitis and abscesses.

Degrees: M.S. in Nursing, Western University of Health Sciences, Pomona; B.S. in Biology, University of California Los Angeles

Awards and Honors: ARCS Scholar (2017- present); Comite Mexico Scholar, USD PhD Student (2019- 2020); Dean's Research Scholar, USD PhD Student (2019- 2020); Dean's Graduate Merit Scholar, USD PhD student (2018- 2020)

Publications and Posters:

**Martinez, N.**; Arts, S. Herpes Zoster in the Emergency Department. Advanced Emergency Nursing J. 2018, 40, 285-295.

Gadler, T.; **Martinez, N.**; Ogg- Gress, J. Recognizing measles, mumps, and rubella in the Emergency Department. Advanced Emergency Nursing J. 2018, 40, 110-118.

**Martinez, N.** Hammer toe deformity. Guidelines in Primary Care; Hollier, A., Ed.; Advanced Practice Education Associates, Inc.: Lafayette, LA, 2018; p 507- 508.

**Martinez, N.** Gamekeeper's thumb. Guidelines in Primary Care; Hollier, A., Ed.; Advanced Practice Education Associates, Inc.: Lafayette, LA, 2018; p 502- 503.

Current Research (expanded description): The purpose of my study is to describe relationships among social demographics (age, gender, established PCP, race/ethnicity, education level), physical examination findings (i.e. HR> 90 bpm, temperature > 37.7 C), treatment modality (i.e. incision and drainage, oral medication, or parenteral medication), patient disposition (i.e. hospital admission or ED discharge at initial presentation), and reason for return visit to the ED among patients with non-purulent and purulent SSTI who presented for treatment in a high-volume rural ED. Furthermore, I will identify factors that increase the odds of hospital admission at initial presentation for patients with specific social demographics, physical examination findings, treatment, and management modalities among patients with non-purulent and purulent skin and soft tissue infections.

Benefits to Science and Society: My proposed research will greatly improve overall patient management and outcomes via improvements in identification, diagnosis, and treatment of lower extremity skin and soft tissue infections. I believe that identifying the gaps in clinical management versus standardized national guidelines will direct the future of the clinical course for these infections while decreasing the overuse of antibiotics, and ultimately improving patient outcomes while decreasing unnecessary hospitalizations.

ARCS Award: As an ARCS Foundation Scholar, I am honored to represent my university and the organization as a future nurse scientist who will improve the care of our patients who present to the emergency department. The support from the ARCS Foundation has provided me with the means and ability to continue my pursuit of my doctoral degree while maintaining an established career and a growing family.



# ALLISON KATHLEEN PERKINS


## University of San Diego

Hahn School of Nursing and Health Science

Concentration: Nursing


Specialization: Delirium

Donor: Beyster Family Foundation IV

This research study focuses on identifying if there are specific risk factors for developing delirium within the Veteran population. Delirium affects 25% of all elderly adults hospitalized in the US and can have long-term consequences. This study will help identify Veterans at risk for delirium upon hospital admission. If at-risk Veterans can be identified before delirium occurs, then preventive interventions can be implemented to decrease the chance of developing delirium.

Degrees: M.S. in Nursing, University of San Diego; Bachelors of Science in Nursing and Spanish, Niagara University

Awards and Honors: JONAS scholar 2018-2020; Irene Palmer Academic Scholar 2019-2020

Publications and Posters:


**Perkins, A.K.** Veteran specific risk factors for delirium. AMSN National Convention, Chicago, IL, September 26-29th, 2019, Academy of Medical-Surgical Nurses, Chicago, Il, 2019.

**Perkins, A.K.**; Jansen, N.C. Implementing a second victimization support program. AMSN National Convention, Chicago, IL, September 26-29th, 2019. Academy of Medical-Surgical Nurses, Chicago, IL, 2019.

**Perkins, A.K.** Clinical manifestations of delirium in the Veteran population. Western Institute of Nursing Research Conference, San Diego, CA, April 11-13th 2019. Western Institute of Nursing Research, San Diego, 2019.

**Perkins, A.K.** Delirium: A concept analysis. USD Annual Research Day. University of San Diego, San Diego, CA, May 8th 2018. University of San Diego, San Diego, 2018.

Current Research (expanded description): The objectives (aims) of this research study are as follows: 1. To describe the difference in incidence rates of delirium and patient clinical characteristics (PTSD, TBI, anxiety, depression) between combat and non-combat veterans. 2. To describe the relationship between select demographics, combat status, comorbidities, patient clinical characteristics (PTSD, TBI, anxiety, depression), LOS, patient disposition at discharge and the incidence of delirium. 3. To determine whether select demographics, combat status, patient clinical characteristics (PTSD, TBI, anxiety, depression) increase the likelihood of developing delirium in hospitalized veterans.

Benefits to Science and Society: This study will help determine if there is a relationship between certain veteran-specific risk factors (PTSD, TBI, anxiety, depression) and the development of delirium. If a relationship is found, then a risk protocol can be developed and interventions implemented to help decrease the development of delirium in hospitalized veterans.

ARCS Award: The ARCS Foundation award allows me to pursue my dream of obtaining my PhD in Nursing. As a working mother with four young children, receiving this financial award allows me to spend more time with my children instead of picking up extra shifts at the hospital to pay for tuition. Additionally, it has given me the opportunity to network with a variety of professionals from diverse scientific backgrounds.

# BROOKE HALEY RAKES

## University of San Diego

Hahn School of Nursing and Health Science

Concentration: Nursing

Specialization: Neonatal Nursing

Donor: Reuben H. Fleet Foundation Fund

Hypoxic-ischemic encephalopathy (HIE) occurs when there is a lack of oxygenated blood flow to the neonate's brain leading to brain injury. HIE is a significant cause of mortality, morbidity, and long-term disability. Timely recognition of infants with HIE is critical. The standard of care is to initiate treatment within six hours of life to prevent further brain injury. Brooke's proposed research will examine retrospective data extracted from the electronic health records (EHR) of HIE infants receiving therapy, to identify if there is a relationship among the hour of life treatment was initiated and the short-term outcomes.

Degrees: M.S. in Nurse Executive Leadership, University of San Diego; B.S. in Nursing, Point Loma Nazarene University

Awards and Honors: ARCS Scholar 2017-present; Sharp Center of Nursing Excellence (CONE) Education Scholarship 2019; Dean Merit Scholarship, University of San Diego 2017-Present; 2017 Recipient of the Sharp Metro Campus "Nursing Excellence Award" 2017; Clinical Nurse in the Structural Empowerment Category

Current Research (expanded description): I will continue to place infants and families in the center of my research to improve outcomes for our most fragile patients. Infants with suspected HIE require urgent or emergent delivery, resuscitation, and stabilization. Established protocols include initiation of therapeutic hypothermia (TH), transfer to the neonatal intensive care unit (NICU), and if necessary, transfer to a hospital with a higher-level NICU. Nurses play a central role in the identification of HIE infants as well as TH initiation and management. Deeper understanding of timing may optimize TH and infant outcomes. Therefore, the proposed research will examine retrospective data extracted from electronic health records (EHR) of HIE infants receiving TH therapy to identify if there is a relationship among TH initiation time (minutes/hour of life), time to target temperature (minutes/hour of life to 33.5°C), and short-term infant outcomes (seizure activity, MRI result, length of stay, respiratory support at discharge, and feeding support at discharge).

Benefits to Science and Society: As part of the next generation of nursing scientists, I will shape the future of nursing through my program of research. Through my research, I hope to generate new knowledge related to nurses' central role in HIE identification, initiation, and treatment. I will give back through supporting and mentoring future nurses as they further contribute to the art and science of nursing.

Personal Interests: When I am not working as a neonatal intensive care nurse or focusing on my academics, I love spending time with my husband and our wire-haired vizsla.

ARCS Award: The PhD will provide knowledge and skills required to achieve my goals. The USD doctoral curriculum, and support by faculty and ARCS, will facilitate my growth in nursing science, philosophy, policy, research methodology and statistics. Thanks to the ARCS financial award, I am able to reduce my work commitment and focus more on my program, research interests, and family.