ARCS

ADVANCING SCIENCE IN AMERICA®

SAN DIEGO CHAPTER

ACHIEVEMENT REWARDS FOR COLLEGE SCIENTISTS

SCHOLARS' PROFILES
2022-2023

2022-2023 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 enter our 38th anniversary year, we have made awards totaling over $11.8 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, have at least a 3.5 GPA, and they must be enrolled full-time in academic degree programs in science, engineering, and medical research. Awards are $10,000, unrestricted, and renewable for three years. The San Diego chapter focuses on supporting students in doctoral programs, and the ARCS Scholars we have funded have a 98% graduation rate. For the 2022-2023 academic year, the San Diego ARCS chapter has awarded $500,000 to 50 Scholars.

SUMMARY

ARCS Foundation - San Diego Chapter 2022-2023 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

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

JASON LAJOS BAER

San Diego State University / University of California San Diego

College of Sciences

Concentration: Cell and Molecular Biology

Specialization: Microbial Ecology

Donors: Karen and Robert Bowden/ARCS Foundation - San Diego Chapter

Despite major advances in our understanding of coral reefs, we have not yet had much success in rebuilding these highly diverse and inter-connected ecosystems. For his Ph.D., Jason is designing, building, and deploying midwater structures called Coral Reef Arks as tools to pick apart the complexity of coral reefs and to help restore them. Jason is using these "mini-reefs" to create pockets of reef biodiversity that can help reseed the surrounding areas, as well as in-water laboratories to study reef processes and test new conservation tools.

Degree: B.S. in Marine Science and Spanish Language, Eckerd College

Awards and Honors: SDSU Graduate Fellowship, 2022; CSU Program for Education and Research in Biotechnology Grant, 2022; NOAA Hollings Scholarship, 2015-2017; Eckerd College Ford Scholarship, 2015-2017

Publications, Papers, and Posters:

Baer, **J.**; Carilli, J.; Hartmann, A.; Haas, A.; Chadwick, B.; Hatay, M.; Rohwer, F.; et al. Coral Reef Arks: A Standardized In Situ Mesocosm and Potential Reef Restoration Tool. *Journal of Visualized Experiments: JoVE.* (in review, submitted September 2022)

Baer, **J.**; Carilli, J.; Hartmann, A.; Rohwer, F.; et al. Coral Reef Arks: An Innovative Solution for Coral Reef Mitigation. Oral presentation. *International Coral Reef Symposium.* July 2022.

Rojas, M.I.; Little, M.; **Baer**, **J.**; Rohwer, F. et al. Swabbing the Urban Environment - A Pipeline for Sampling and Detection of SARS-CoV-2 From Environmental Reservoirs. *Journal of Visualized Experiments: JoVE.* (170), DOI: 10.3791/62379.

Baer, **J.**; Pennington, P.; Woodley, C. The Effect of Anthropogenic Pollutants on ESA Coral Health. *NOAA National Ocean Service National Centers for Coastal Science Annual Report.* May 2017.

Current Research (expanded description). I have built and deployed several Coral Arks on Caribbean reefs in Curacao and Puerto Rico. We move threatened corals onto these Arks, alongside a diverse community of reef organisms (i.e., sponges, urchins, crabs) that support their health. By moving Arks off the seafloor, we provide the communities with higher flow and sunlight and avoid many of the challenges corals face on the seafloor, like sedimentation and hypoxia. We then study these communities as they grow to determine the optimal conditions needed to assemble and sustain healthy coral reefs and use this knowledge to design better restoration efforts.

Using Arks, we are discovering new ways that the reef's smallest players - viruses and microbes - impact the health of corals, the distribution of resources, and the relationships between organisms on reefs. On unhealthy reefs (i.e., many modern seafloor environments), microbes grow uncontrolled and disrupt the balance on the reef – causing disease, drawing down oxygen, and causing the death of many important reef creatures - a phenomenon called microbialization. Arks are a method to combat - and potentially reverse - microbialization for a coral reef community, providing the field with a tool to directly improve conservation and restoration outcomes.

A major goal of the Coral Arks project is to directly benefit coastal communities by recruiting fish, creating dive sites for tourism, conserving local reef biodiversity, and helping reseed degraded areas, especially after hurricanes or ship groundings. Arks, as midwater structures, can be used to build reef communities in previously unworkable areas. In the process, Arks provide scientists with a new way to study entire coral reef communities as they grow and change on movable underwater laboratories isolated from the seafloor.

Personal Interests: As with research, I prefer to spend most of my time in the field. I am an avid SCUBA and freediver, surfer, photographer, camper, and national park aficionado.

ARCS Award: As a coral reef field scientist, much of my Ph.D. work has been spent abroad in remote - and often, as a function of tourism, expensive - places. I am passionate about this work, and I am incredibly grateful to the ARCS Foundation for providing me with a safety net that enables me to continue pursuing fieldwork without concern of significant financial burden. The financial support of the ARCS Foundation will allow me to complete several more field expeditions to the islands of Curacao and Puerto Rico to continue to deploy and collect data on the artificial reef structures. I am proud to be a part of the ARCS community and, with the support of my ARCS mentors and peers, look forward to contributing important knowledge to both the scientific literature and to the field of coral restoration: a discipline in dire need.

MARICRUZ HENKEL CARRILLO

San Diego State University / University of California San Diego

College of Engineering

Concentration: Mechanical Engineering

Specialization: Material Science and Manufacturing

Donor: Reuben H. Fleet Foundation

Maricruz's research focuses on the additive manufacturing and sintering of ceramic samples to be used as bone implants. Or, as she puts it, she is 3D printing bones. The aim is to manufacture patient specific bone scaffolds that mimic native bone properties by combining 3D printing and sintering technologies. A technology like this will be a crucial advancement in the orthopedic implant field because it will increase implant biocompatibility, decrease healing time, and avoid re-operations, ultimately leading to a better quality of life for orthopedic patients.

Degrees: M.S. in Bioengineering, San Diego State; University; B.S. in Mechanical Engineering, San Diego State University

Awards and Honors: Society of Hispanic Professional Engineers (SHPE) Scholarship, August 2021; National Science Foundation (NSF) Innovation-Corps Grant, August 2020; CSU Chancellor's Doctoral Incentive Program Fellowship, July 2020; CSU Graduate Student Research Symposium (State-wide) First prize; February 2020

Publications, Papers, and Posters:

Carrillo, **M.**; Lee, G.; Manière, C.; Olevsky, E. Additive Manufacturing of Powder Components Based on Subtractive Sintering Approach. *Rapid Prototyping.* 2021

Lee, Geuntak; **Carrillo, M.**; Olevsky. Fabrication of Ceramic Bone Scaffolds by Solvent Jetting 3D Printing and Sintering: Towards Load-bearing Applications. *Additive Manufacturing.* 2020.

Carrillo, M. Fabrication of Ceramic Bone Scaffolds by Solvent jetting 3D Printing and Sintering: Towards Load-bearing Applications. *2020 Minerals, Metals and Materials Society Conference,* San Diego, CA.

Carrillo, M.; Olevsky, E. 3D Printing via Binder Jetting and Consolidation of Nano Alumina Bone Scaffold Prototypes. Montezuma Publishing, San Diego State University. 2018

Current Research (expanded description): Bone is an incredible mechanosensory organ, difficult to recreate. The current gold standard for bone repair scaffolds is using autografts from the patient's iliac crest. Although this technique has been used for years, extraction-site morbidity, limited size/shape availability and need for re-operation are surprisingly common issues. The goal of my research is to provide a scaffold manufacturing solution which produces biocompatible, customizable, and load bearing scaffolds that mimic native bone properties. My research mainly focuses on the biocompatible geometry and compressive strength of the ceramic scaffolds produced. Using a powder-based 3D printing method, I can use Hydroxyapatite (the largest component of bone) to print, obtain micro porosity within the structure for nutrient adsorption, design specific macro porosity for osseointegration and vascularization, and apply surface roughness for cell adhesion. Then, utilizing advanced sintering techniques after printing, I can control the microstructure of the material to obtain an implant with high mechanical strength. Furthermore, a thermo-mechanical model will be developed to predict final scaffold shape and properties using a finite element program. Predicting the final geometry and strength of the scaffolds will be crucial in matching the implant to the injury and patient.

Benefits to Science and Society: By combining innovative 3D printing technologies and advanced sintering techniques, I can leverage the advantages of each to extend the concept of personalized medicine to the orthopedic space which will improve the quality of life for millions of patients worldwide. Personalized medicine is the future, yet it has been limited in orthopedics because there is a missing link between manufacturing and biology. In my research, I close the gap and open the door to improved solutions for orthopedic patients.

Personal Interests: Sustainability and entrepreneurship - I have a small business called Menos Waste. For fun, surfing and salsa dancing are my hobbies!

ARCS Award: Financial burden has been present for the entirety of my educational career which has limited me in many ways before. With this ARCS award, I can stop worrying about my finances this year and focus on what matters most- my life changing research. On a more practical level, this scholarship will allow me to pay for my living expenses without accruing more student loan debt and it allows me to graduate on time too! I am so grateful for the generosity of the donors. Your help allows students like me achieve their dreams and conduct the research that is necessary to truly leave this world better than when we got here.

ASHLEY DANG-NGUYEN

San Diego State University / University of California San Diego

College of Sciences

Concentration: Chemistry

Specialization: Organic Chemistry

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

Electrophilic aromatic substitution is a common methodology used to functionalize pharmaceutical scaffolds and make additional analogues, aiming to synthesize more potent drugs targeting different diseases and cancers. However, the lack of site specificity makes it difficult to attach the functional group of interest at an exact position in high quantities. Ashley is currently designing and developing methodologies to address this issue in producing the target isomer. Her work aims to streamline pharmaceutical synthesis by allowing for direct access to produce analogues of lead compounds.

Degree: B.S. in Chemistry, concentration in Biochemistry, San Jose State University

Awards and Honors: University Graduate Fellowship 2020-2022, Harry E. Hamber Memorial Scholarship 2020-2022, Tom Ragan Memorial Scholarship 2020-2021

Publications, Papers, and Posters:

Nguyen, **A.D.**; McCarty, C.T.; Legaspi, K.C.; Smith, D K.; Gustafson, J.L. *2022 Gordon Research Conference: Stereochemistry,* Newport, RI, July 24-July 29, 2022, Light and Catalyst-promoted Inherent and Regioselective Perfluoroalkylation of Arenes and Heteroarenes. Poster Presentation.

Nguyen, **A.D.**; Zanolini, R.J.; Gustafson, J. Selective Functionalizations of Arenes and Heteroarenes via SEAr and Related Transformations. Wiley. 2021, ISBN: 9783527834242

Cardenas, M.; **Nguyen**, **A. D.**; Brown, Z.; Heydari, B.; Heydari, B.; Vaidya, S.; Gustafson, J. Atropisomerism as an Inspiration for New Chemistry. *Arkivoc Journal*. 2021, i, 20-47

Dinh, A.N.*; **Nguyen**, **A.D.**.*; Millan, E.A.; Albright, S.T.; Cedano, M.; Smith, D.K.; Gustafson, J.L. Photocatalytic Oxidative C-H Thiolation: Synthesis of Benzothiazoles and Sulfenylated Indoles. *Synlett.* 2019, 30, 1648-1655. *signifies equal contribution

Current Research (expanded description): The goal of my research is to develop catalyst-controlled regioselective methodologies for the addition of radicals into pharmaceutically relevant aromatic scaffolds. Particularly, I am interested in directing electrophilic perfluoroalkyl radicals (i.e. CF3) into aromatics and heterocycles. I propose to use a Lewis basic catalyst approach to control the regioselectivity of electrophilic radical additions through a mechanism that is analogous to electrophilic aromatic substitution (SEAr). Bifunctional catalysts that contain Lewis bases and a H-bonding handle have been shown to form non-covalent interactions with the substrate via hydrogen bonding, allowing for the directed activation of the electrophile and subsequent coordination to the substrate. My preliminary data suggests that different Lewis basic catalysts can yield different constitutional isomers and mechanistic studies for this project will be able to reveal key features of the inner-workings of Lewis basic catalyst control to develop more specialized catalysts for a variety of reaction systems.

Benefits to Science and Society: The goal of my research is to make more potent analogs of pharmaceuticals in an efficient way. Current, common methods to do so involve pre-functionalizing materials and more synthetic work rather than making the base compound and selectively adding functional groups to it. My research aims to empower late-stage functionalization as a tool in pharmaceutical synthesis for electrophilic additions.

Personal Interests: Rock climbing, video games, and playing with my pug, Oliver.

ARCS Award: It is incredibly humbling and motivating to be honored for the work I am doing for my Ph.D.in organic chemistry. The ARCS Foundation award is a prestige that I am truly grateful for receiving in recognition of scientific achievement for early career scientists. I thank the ARCS Foundation for seeing my potential and alleviating a financial burden which will allow me to focus on my research.
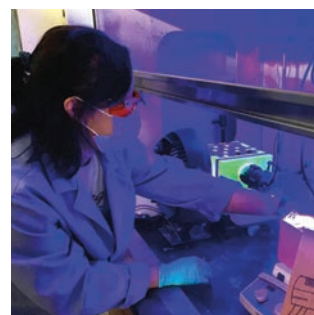
JESSICA EILEEN GRIFFIN

San Diego State University / University of California Davis

College of Sciences

Concentration: Marine Ecology

Specialization: Coastal Marine Community Dynamics

Donor: The Heller Foundation of San Diego

Jessica is a marine ecologist whose research focuses on the conservation of coastal marine ecosystems, which are rapidly degrading due to climate change, invasive species and pollution. Jessica studies California seagrass beds, which perform vitally important ecosystem services, such as carbon sequestration and providing habitat for many fishes and invertebrates. Jessica's research addresses three threats to eelgrass survival: invasive species, eutrophication (addition of nutrients to the water), and climate change, and will provide insight on how to preserve these ecosystems under the stress of global change.

Degrees: B.S. in Environmental Sciences, University of Connecticut; B.S. in Ecology and Evolutionary Biology, University of Connecticut

Awards and Honors: Dr. Susan Lynn Williams Memorial Graduate Award (2021); Council on Ocean Affairs, Science and Technology (COAST) Graduate Student Research Award (2021); NSF Graduate Research Fellowship (2019), Phi Beta Kappa Honor Society, Epsilon of Connecticut Chapter (2017)

Publication, Papers, and Posters:

Becker, D.M.; **Griffin, J.E.**; Miller, C. Identifying factors that contribute to positive and negative student experiences at field-based institutions. In *Women of the Wild: Challenging Gender Disparities at Field Stations and Marine Laboratories*. Lexington Books, 2022

Griffin, J.E.; O'Malley, B.P.; Stockwell, J.D. The Freshwater Mysid Mysis Diluviana (Audzijonyte & Väinölä, 2005) (Mysida: Mysidae) Consumes Detritus in the Presence of Daphnia (Cladocera: Daphniidae). *Journal of Crustacean Biology.* 2020, 40(5), 520 – 525

Griffin, J.E.; Park, G.; Dam, H.G. Relative Importance of Nitrogen Sources, Algal Alarm Cues and Grazer Exposure on Toxin Production of the Marine Dinoflagellate Alexandrium catenella. *Harmful Algae.* 2019, 84, 181–187

Griffin, J.E.; Hovel, K.A. Interactive effects of habitat disturbance and Asian mussel invasion on seagrass infauna communities. Poster presentation. *Western Society of Naturalists*. October 2019. Ensenada, MX

Current Research (expanded description): My dissertation focuses on species interactions in California eelgrass beds, and understanding how they are altered by anthropogenic forces like climate change and eutrophication. For my first chapter, I am investigating interactions between invasive Asian mussels, eelgrass and eelgrass infauna, which are native invertebrates that live among the sediments that eelgrass grow in. While Asian mussels are an invasive species, they may have positive effects on eelgrass infauna under some circumstances, such as when eelgrass is disturbed. When eelgrass is disturbed, diversity of infauna declines (Frost et al. 1999). Under these circumstances, the physical structure provided by Asian mussels, which form dense mats, may be beneficial to eelgrass infauna. In this chapter, I ask whether Asian mussels facilitate eelgrass infauna when the eelgrass is disturbed and have performed field experiments for three summers to address this question.

My second chapter focuses on how environmental context affects bivalve-eelgrass interactions. Eelgrass coexists with bivalves such as clams and oysters, and previous studies have shown that sometimes, bivalves have positive effects on eelgrass, such as by increasing water clarity through filtration. However, sometimes bivalves harm eelgrass, such as by excreting toxic sulphides into the sediment. In my research, I investigate whether these disparities are due to environmental context, such as temperature or light conditions. Understanding how temperature and light affect eelgrass dynamics will be important as climate change alters temperature and eutrophication alters water clarity.

Benefits to Science and Society: Seagrasses form the basis of an important nursery habitat for many species and perform many ecosystem services, such as carbon sequestration. Due to human activities, seagrass beds are rapidly degrading, threatening the animal residents of these beds and the benefits they provide to society. My research addresses three threats to eelgrass survival: invasive species, eutrophication, and climate change, and will provide insight on how to preserve these vital ecosystems. When restored effectively, eelgrass beds may boost local fisheries and benefit California's economy.

Personal Interests: In my free time I enjoy hiking, traveling, and reading.

ARCS Award: I'm honored to receive this award and greatly appreciate the recognition of my work and potential as a marine ecologist. I am grateful for the opportunity to join a community of scholars motivated to produce excellent work that serves society's needs. Additionally, the support this award affords me helps me to focus on my graduate school work without undue financial stress. This award is helping to support me professionally and financially, and will surely contribute to my development as a scientist.
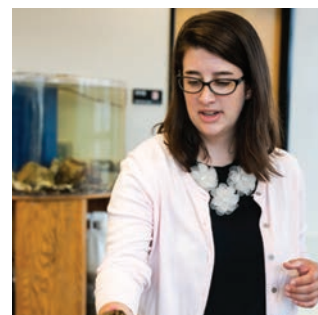
TIFFANY LUONG

San Diego State University / University of California San Diego

College of Sciences

Concentration: Cell and Molecular Biology

Specialization: Bacteriophage Biology

Donor: Hervey Family Fund

Antibiotic-resistant bacterial infections are a growing concern worldwide. Due to their ability to infect and kill bacteria, there has been renewed interest in harnessing bacteriophages, phages for short, as an alternative treatment against antibiotic resistance. Currently, phage therapy can only be approved by the FDA as an emergency treatment. During Tiffany's PhD research, she developed a method to produce high-quantity clinically safe phage preparations for personalized emergency patient treatment. Her ongoing research will focus on the tripartite interactions between bacteria, phages, and the mammalian host.
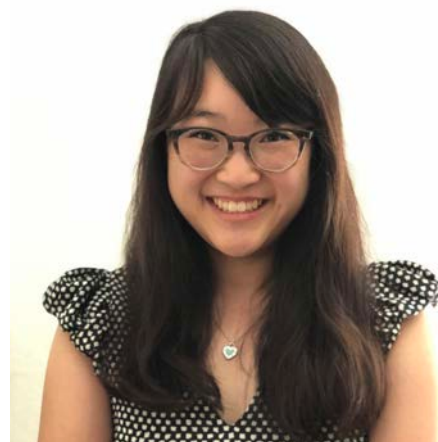
Degree: B.S. in Molecular, Cell, and Developmental Biology, University of California Los Angeles

Awards and Honors: SDSU Cell and Molecular Biology Research Achievement Award 2021, San Diego State University Graduate Fellowship 2021, Rees-Stealy Research Foundation Fellowship 2021, ARCS Foundation Scholarship 2020 – 2021

Publications, Papers, and Posters:

Luong T.; Schumann A.; Conrad D.; Roach D.R. Draft Genome Sequence of the Multidrug-resistant Pseudomonas Aeruginosa Strain PA291 Isolated from Cystic Fibrosis Sputum. *Microbiology Resource Announcements.* 2021, 10 (36), e00572-21.

Luong, T.; Salabarria, A.C.; Roach, D.R. Phage therapy in the resistance era: Where Do We Stand and Where Are We Going? *Clinical Therapeutics.* 2020, 42(9):1659-1680

Luong, T.; Salabarria, A.; Edwards, R. A.; Roach, D.R. Standardized Bacteriophage Purification for Personalized Phage Therapy. *Nature Protocols.* 2020, 15 (9), 2867-2890

Mizuno, C.M.; **Luong, T.**; Cederstrom, R.; Krupovic, M.; Debarbieux, L.; and Roach, D.R. Isolation and Characterization of Bacteriophages That Infect Citrobacter rodentium, a Model Pathogen for Intestinal Diseases. *Viruses.* 2020, 12, 737

Current Research (expanded description): Bacteriophages, or "phages", are viruses that infect, replicate within, and kill bacteria. This makes them an attractive alternative antimicrobial for drug-resistant bacterial infections. For my thesis work, I am studying the tripartite interactions between phages, bacteria, and the mammalian host. Currently, how best to formulate phages therapeutically remains unknown. Thus, I am investigating phage-bacteria interactions to decipher how to mix different phages in combination (cocktail) and how to dose phage treatments against both planktonic (free-living) and biofilm (complex structure) modes of bacterial growth.

I have also had the exciting opportunity to participate in translational research during my PhD studies. In January 2022, I used a protocol that I established to produce and formulate a phage cocktail for compassionate use intravenous administration (Luong et al. *Nature Protocols* 2019). The patient, who had a multidrug resistant lung infection, received the phage cocktail and antibiotics and was discharged from the hospital. During treatment, we collected clinical samples to track changes in pathogen abundance, phage abundances, and total bacterial burden. I am currently continuing analysis of clinical metagenomes (collection of all the DNA reads in a sample including human, bacterial, viral, and archaeal) to analyze the effect of phages during treatment.

Benefits to Science and Society: In my PhD studies, I developed a method to highly purify phage formulations for treatment of acute and chronic drug-resistant bacterial infections. For my thesis work I am studying phage-bacteria interactions to better understand the consequences of phage treatment; during emergency phage therapy what type of phages should be used, how many phages, and how frequently should phages be given remain empirically chosen. By finding answers to these questions, I aim to bring phage therapy closer to standardized clinical trials.

Personal Interests: Some of my interests and hobbies include piano, tabletop role-playing games, mahjong, food & travel, video games, science fiction and fantasy literature.

ARCS Award: ARCS has continued to help me grow and develop as an early career scientist. As a graduate student during the pandemic, my avenues to communicate, network, and share my research have been incredibly limited. My involvement with ARCS has allowed me to expand my scientific network virtually (through the ARCS meet and greet event, Scientist of the Year event, and Getting-To-Know-You event) and finally in-person this year (ARCS picnic).

These events have allowed me to gain perspective on a variety of scientific careers, the path to getting a PhD, and share my research passion with senior scientists. Again, with support from strong female mentors including Drs. Steffanie Strathdee and Catherine Atkins, I feel particularly supported in phage research. In a time where so much of our networking has gone virtual, I am also happy that ARCS has provided platforms on Twitter and LinkedIn to shine a light on ARCS scholars, their achievements, and their research projects. The support from ARCS is tangible as a student and I hope to maintain these relationships after obtaining my PhD.

Finally, financial support from ARCS has enabled me to not only obtain equipment that I'm using for my bioinformatics projects and ongoing training, but it has enabled me to travel to my first international scientific conference (Viruses of Microbes 2022, Portugal) where I presented my research project and made meaningful connections with scientists from all over the world! I met with phage scientists and clinicians that I hope will be future mentors for my academic career. Thank you ARCS for your ongoing support.
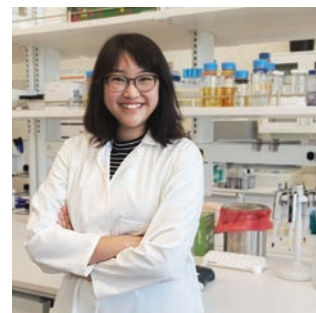
ADRIAN XAVIER RIVERA

San Diego State University / University of California San Diego

College of Engineering

Concentration: Structural Engineering

Specialization: Non-Destructive Evaluation

Donor: ARCS Foundation - San Diego Chapter

Adrian's research is focused on analyzing manufacturing imperfections in aluminum honeycomb sandwich composites. The impact of this research will increase the understanding of how imperfections affect the material performance of aluminum honeycomb cores, allowing engineers to better identify potential failure of future aerospace structural designs. Furthermore, the tools used to construct finite element models of honeycomb core materials can be used for design optimization, improving the reliability and performance of fracture critical structures.

Degree: B.S. in Aerospace Engineering, San Diego State University

Awards and Honors: NASA Fellowship Activity. Aug 2018 - Aug 2021; ABRCMS Presentation Award. Parametric Shell Buckling Analysis Nov 2017; NASA NIFS Summer Internship. Finite Element/Shell Buckling May 2017

Publications, Papers, and Posters:

Rivera, **A.X.**; Venkataraman, S.; Hyonny, K.; Pineda, E.J.; Bergan, A. Characterization and Modeling of Cell Wall Imperfections in Aluminum Honeycomb Cores using X-ray CT Imaging. *AIAA Scitech.* 2021 Forum (p. 1620). DOI: https://doi.org/10.2514/6.2021-1620

Rivera, **A.X.**; Venkataraman, S.; Hyonny, K.; Pineda, E.J.; Bergan, A. Investigation of crushed response of aluminum honeycomb sandwich composites and sensitivity to manufacturing imperfections *NASA Glenn Research Symposium.* 2019

Current Research (expanded description): Aluminum honeycomb core is a common structural component that has been used in a range of industries from automotive to aerospace. The manufacturing of these aluminum honeycomb cores introduces a variety of imperfection sources that can change the expected performance of the initial design. The main focus of my research is to better understand the effect of imperfections on performance of honeycomb core parts. To accomplish this a detailed model was constructed using X-ray computed tomography. CT scans are routinely used to create 3D images of human body parts. In a similar fashion, a much stronger CT scan was used to capture the resultant honeycomb structure after the manufacture of a panel with the same specifications as one used on a space launch system. Results from this research has shown that the aluminum honeycomb core compression behavior is specific to the manufacturing signature within the given sample. Using models with the measured manufacturing imperfections yielded accurate predictions of compression stiffness as well as the compression strength when compared to the experimental results of specimens with the same manufacturing imperfections. This would indicate that to accurately predict the performance of aluminum honeycomb core measured imperfections must be considered.

Benefits to Science and Society: In the aerospace industry the margin of safety, which is the ratio of allowable strength and ultimate strength of the materials, is thin to reduce weight of the overall structure. My research is focused on identifying the imperfections that lead to the largest knockdown in performance and predict performance of a sandwich composite. Being able to predict performance of parts with manufacturing imperfections will help in gauging correctly the life span of critical components, potentially saving lives during commercial airline travel as well as manned space missions.

Personal Interests: I have played tennis at a collegiate level (Division III) and continue to play in local tournaments. I also have a great love of food, especially tacos.

ARCS Award: The current generation of minority students, because of the pandemic, face challenges that may make it more difficult than ever to finish higher education. My experiences as a student mentored in the supportive environment of SDSU and working with students through various outreach programs has resulted in my professional commitment to work to improve the representation and success of underrepresented students in graduate school. As an ARCS Scholar I wish to continue conducting outreach through the networking opportunities that the ARCS Foundation will provide.

JOVAN SAN MARTIN

San Diego State University / University of California San Diego

College of Sciences

Concentration: Chemistry

Specialization: Photocatalysis

Donor: The Hervey Family Fund

Jovan specializes in the design of new perovskite photocatalysts that use renewable energy in the form of visible light to drive chemical reactions. Perovskites are effective materials for solar cell technology and Jovan aims to repurpose such materials for enhanced photochemical reactions. His work has shown perovskites can produce a variety of organic compounds that can be the scaffold for future pharmaceutical drugs. Since perovskites are cheap, quick to produce, recyclable, and powered by renewable energy, Jovan's work can lower both the economic and environmental cost of producing pharmaceutical drugs.

Degree: B.S. in Chemistry, San Diego State University

Awards and Honors: JDP Student Research Award, 2022; Inorganic Chemistry Student Research Award, 2022; University Graduate Fellowship, 2021-2023; Master's Research Scholarship 2020

Publications, Papers, and Posters:

San Martin, J.; Dang, N.; Raulerson, E.; Beard, M. C.; Hartenberger, J.; Yan, Y. Perovskite Photocatalytic CO_2 Reduction or Photoredox Organic Transformation? *Angewandte Chemie International Edition.* 2022, 61 (39), e202205572.

San Martin, J. $CsPbBr_3$ Perovskite Microcrystals for Photocatalytic CO_2 Reduction Studies. Oral presentation at *2022 Spring National ACS Meeting.* San Diego, CA.

San Martin, J.; Zeng, X.; Chen, X.; Miller, C.; Han, C.; Lin, Y.; Yamamoto, N.; Wang, X.; Yazdi, S.; Yan, Y.; Beard, M.C.; Yan, Y. A Nanocrystal Catalyst Incorporating a Surface Bound Transition Metal to Induce Photocatalytic Sequential Electron Transfer Events. *Journal of the American Chemical Society.* 2021, 143 (30), 11361-11369.

Zhu, X.; Lin, Y.; **San Martin**, J.; Sun, Y.; Zhu, D.; Yan, Y. Lead Halide Perovskites for Photocatalytic Organic Synthesis. *Nature Communications.* 2019, 10 (1), 2843.

Current Research (expanded description): The goal of my research is to exploit the tunability of metal halide perovskites towards highly selective and efficient organic photocatalysis. Specifically, I am interested in seeing how transition metal tuning, heterojunction engineering, and chiral ligand modification can modify perovskite's properties toward a variety of organic reactions. My published results have shown that careful tuning of perovskite with a transition metal, copper, can allow perovskite to form nitrogen-nitrogen bonds in diamines via combining photocatalysis with transition metal catalysis. I plan on further investigating the role of transition metal tuning with perovskites by tuning with manganese to take advantage of the magnetic properties of manganese. In the presence of an external magnetic field, such a modification is expected to further enhance the reactions rates of various photocatalytic properties. I also explore various methods of enhancing the stability of perovskites in polar solvents by heterojunction engineering via metal organic framework modifications and zwitterion ligand exchange. One final pillar of my research is synthesizing new forms of chiral perovskites with the end goal of designing a stable chiral perovskite that can proceed in asymmetric photoredox organic transformations, such as asymmetric alpha-alkylation of aldehydes.

Benefits to Science and Society: The goal of my thesis work is to repurpose powerful solar cell materials, perovskites, for enhanced photocatalysis in organic synthesis, such as pharmaceutical drug synthesis. Currently perovskites are underexplored with respect to organic chemical transformations, however, the low cost, ease of synthesis, and recyclability of perovskites make them excellent candidates for photocatalysis. Since such materials are powered by visible light, such as renewable solar energy, perovskites can reduce the cost of synthesizing drugs with a reduced carbon footprint.

Personal Interests: In my free time I like to raid in Destiny 2, lift weights, and make my friends laugh.

ARCS Award: I am humbled and honored to be selected for such a prestigious and highly competitive award. The ARCS Foundation award marks my growth as a young scientist and helps remind me that I am indeed making great progress in my research studies and have grown tremendously over the past years in several ways. I am very grateful to the ARCS Foundation for recognizing my work and giving me the opportunity to further focus more of my efforts towards my research projects while also serving as an example to my students from underrepresented backgrounds. It is my pleasure to join the ARCS community and I look forward to making new discoveries and giving back to the scientific community.
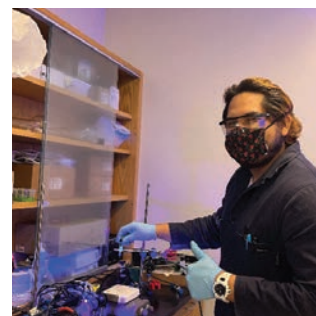
ASHLEY VALENTINA SCHWARTZ

San Diego State University / University of California Irvine

College of Sciences

Concentration: Applied Mathematics

Specialization: Computational Toxicology

Donor: Robin Luby/ARCS Foundation - San Diego Chapter

Environmental contaminants that pose a threat to the health and well-being of society are continually emerging, and high-throughput biological testing helps to characterize that risk. Ashley's research focuses on building mathematical and computational toxicology models to improve chemical safety assessment by leveraging available public data and creating an alternative to extensive animal testing. Ultimately, she hopes to shed light on the way environmental pollutant exposures can impact our health and development.

Degree: B.S. in Applied Mathematics, San Diego State University

Awards and Honors: CSU Student Research Competition First Place, 2021; CSRC Applied Computational Science and Engineering Student Showcase Director's Award, 2021; ACM Computational and Data Science Fellowship, 2020; NSF Funded Academic Support & Scholarships for Interdisciplinary Computational Scientists, 2020.

Publications, Papers, and Posters:

Schwartz, A.V.; Sant, K.E.; Navarrete, J.; George, U.Z. A Developed Complex Network Model for Zebrafish Embryonic Deformity Incidence Following Developmental Exposure to Tris(4-chlorpheynl methanol (TCPMOH). *61st Annual Meeting of the Society of Toxicology*. San Diego, March 27-31, 2022.

Schwartz, A.V.; Sant, K.E.; Navarrete, J.; George, U.Z. Mathematical Modeling of the Interaction between Yolk Utilization and Fish Growth in Zebrafish, Danio Rerio. *Development.* 2021, 148 (9).

Navarrete, J.; Wilson, P.; Allsing, N.; Gordon, C.; Margolis, R.; **Schwartz, A.V.**; Cho, C.; Rogowski, B.; Topps, J.; George, U.Z.; Sant, K.E. The Ecotoxicological Contaminant Tris(4-Chlorophenyl)Methanol (TCPMOH) Impacts Embryonic Development in Zebrafish (Danio Rerio). *Aquatic Toxicology.* 2021, 235, 105815.

Horkowitz, A.P.; **Schwartz**, **A.V.**; Alvarez, C.A.; Herrera, E.B.; Thoman, M.L.; Chatfield, D.A.; Osborn, K.G.; Feuer, R.; George, U.Z.; Phillips, J.A. Acetylcholine Regulates Pulmonary Pathology during Viral Infection and Recovery. *ImmunoTargets and Therapy.* 2020, Volume 9, 333–350.

Current Research (expanded description): Toxic substances make their way into our environment, food, and bodies every day. My work characterizes the toxicity of these chemicals during embryonic development as any perturbations, whether structurally or molecularly, can potentially predispose an individual to disease later in life. I develop computational and mathematical models to answer complex questions about system dynamics, biological processes, and molecular response.

Currently, my work is centered around using network models to investigate the molecular response to a large set of environmental pollutants. Individual studies typically assess a single chemical in the lab, but due to resources, time, and means it is less common for a study to contextualize those changes to mixtures, metabolites, and other chemicals. I combine these embryonic toxicity transcriptomic data sets using developed high-performance computing bioinformatics pipelines and further analyze the data using network machine learning models.

Applying computational power to centralize publicly available data increases the knowledge we can gain from toxicity assessment studies. I am working to build a well-informed machine learning model that can predict the molecular response to a new environmental pollutant in silico, minimizing the need for repeated in vivo testing.

Benefits to Science and Society: The benefits of computational power are evident in the current data-driven world we live in. I am bringing computational and mathematical expertise to the developmental toxicology space, creating high-throughput frameworks for toxicity assessment. I specifically aim to increase data analysis speed using high-performance computing and reach novel predictions using artificial intelligence/machine learning, differential equation modeling, and network analysis. The tools developed elucidate the negative impacts many environmental pollutants have on the health and well-being of society.

Personal Interests: I enjoy spending my free time outside walking my dog and appreciating all that nature has to offer.

ARCS Award: I am honored to be an ARCS scholar and an ARCS Foundation member. Throughout my educational career, I have been greatly impacted by the people I am lucky enough to surround myself with. The amount I have learned about educational and career opportunities through these connections has greatly impacted the trajectory of my future. The ARCS Foundation award represents a door to a new set of incredible scientists from whom I will learn and grow. It is especially exciting for me, coming from a predominately male field, to be a part of a woman-centered STEM organization. The generosity of financial support enables me to spend more time on my research endeavors and share my work at conferences around the country. This award allows me to catapult my career to a new height, for which I am extremely grateful.

LAURA GILMAN SISK-HACKWORTH

San Diego State University / University of California San Diego

College of Sciences

Concentration: Microbiology

Specialization: Microbiome-Host Interactions

Donor: Ellen Browning Scripps Foundation

You probably remember puberty as a time of immense and confusing changes, but you might not know that the microbes in your gut were changing with you. Laura's research focuses on how the physiological changes that we experience during puberty, like soaring hormone levels and metabolic shifts, affect which microbes live in our gut and what they do there. Knowing how puberty shapes the gut microbiome will help us better understand microbiome-related diseases that emerge during puberty, like polycystic ovary syndrome and type I diabetes.

Degree: B.S. in Biological Sciences, California Polytechnic State University, San Luis Obispo

Awards and Honors: 2021-2024 National Institutes of Health F31 Fellowship (Perfect Score); 2021-2022 Scholar, San Diego ARCS Foundation, Inc.; 2021 Rees-Stealy Research Foundation Fellowship; 2020-2021 CMB Joint Doctoral Program Outstanding Research Achievement Award

Publications, Papers, and Posters:

Sisk-Hackworth, L.; Ortiz-Velez, A.; Reed, M.B.; Kelley, S. T. Compositional Data Analysis of Periodontal Disease Microbial Communities. *Frontiers in Microbiology.* 2021, 12 (846)

Sisk-Hackworth, L.; Kelley, S.T. An Application of Compositional Data Analysis to Multiomic Time-Series Data. *NAR Genomics and Bioinformatics.* 2020, 2 (4)

Sisk-Hackworth, L.; Sue, A.; Aslam, S.; Roach, D. Genome Sequence of Clinical Strain Pseudomonas aeruginosa NRD619. *Microbiology Resource Announcements.* 2020, 9 (44), e01013-20

McGhee, J.J.; Rawson, N.; Bailey, B.A.; Fernandez-Guerra, A.; **Sisk-Hackworth, L.**; Kelley, S.T. Meta-SourceTracker: application of Bayesian source tracking to shotgun metagenomics. *PeerJ.* 2020, 8, e8783

Current Research (expanded description): During puberty, sex-specific differences in the gut microbiome emerge and last into adulthood. I performed a preliminary study comparing the gut microbes and gut metabolites (a measure of microbial function) in pre-pubertal and post-pubertal healthy female mice. I found that even though mice are colonized by different microbes during puberty, puberty is associated with the development of specific microbial functions. To determine which microbes and functions of the gut microbiome change due to puberty in a sex-specific manner, I will use the hypogonadotropic mouse model. In this model, mutant mice do not go through puberty, but wild-type mice go through puberty as normal. Thus, changes I observe in the wild-type mice, but not in mutant mice will be due to puberty and not to other factors such as growth or dietary changes. To discern which functional and taxonomic changes in the gut microbiome result from puberty, I will use compositional data analysis methods, which I recently showed better suit microbiome data than standard methods. I am also developing methods to determine how sex steroids change the growth of gut microbes. This will allow me to investigate sex steroids as a mechanism for puberty's impact on the gut microbiome.

Benefits to Science and Society: Puberty is a critical period in human development with lasting health impacts. Links between puberty and microbiome changes during adolescence are important to understand, as some diseases that emerge during puberty, such as polycystic ovary syndrome, type I diabetes, and irritable bowel disease, are strongly linked to the gut microbiome. My research will unravel the links between puberty and the gut microbiome, opening the door for developing microbiome interventions and therapeutics that could treat or prevent these types of diseases.

Personal Interests: I spend my free time reading literature, gardening, and hiking around San Diego.

ARCS Award: I am honored by the support from the ARCS Foundation. Not only is recognition from such a prestigious organization gratifying, but the opportunities to share my research with the membership and meet so many enthusiastic supporters of science are invaluable. The financial aspect of the award relieves a significant amount of stress and allows me to put more of my focus towards my research and community outreach. As a first-generation scientist and doctoral student, I cannot overstate how thankful I am for the ARCS Foundation's support of my scientific and career success.

LILITH ASTETE VASQUEZ

San Diego State University / University of California San Diego

College of Engineering

Concentration: Environmental Engineering

Specialization: Sustainable Onsite Sanitation Systems

Donor: The Hervey Family Fund

Across the globe, 3.6 billion people living in vulnerable and disadvantaged communities lack access to improved facilities for the storage and treatment of fecal waste. To reduce these numbers, sanitation systems that are economically sustainable while minimizing impacts to human and environmental health must be further explored. Lilith's research contributes to these efforts through the study of a user-friendly waterless flushing toilet that treats waste via anaerobic digestion, for applications ranging from short-term encampments of unhoused or displaced people to long-term use at the household scale.

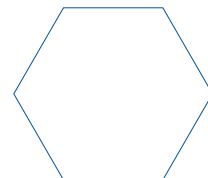Degree: B.S. in Environmental Engineering, San Diego State University

Awards and Honors: National Science Foundation Graduate Research Fellowship, 2021-present; SDSU Student Research Symposium President's Award, 2021; UCSD School of Global Policy & Strategy Science Policy Fellowship, 2020-2022; SDSU University Graduate Fellowship, 2019-2021

Publications, Papers, and Posters:

E. Rivera; N. Mladenov*; **L. Astete Vasquez**; G. McKenzie; V. Gonzalez. Low Maintenance Anammox Enrichment and Nitrogen Removal with an Anaerobic Baffled Reactor. *Bioresource Technology.* 2022, Special Issue on "Advanced biological technologies for removal and recovery of reactive nitrogen from wastewaters."

Astete Vasquez, L.; Mladenov, N. Investigation of Biological and Chemical Properties in Waterless, Recirculating Flushing Toilets as Sustainable Sanitation Alternatives. Poster. *National Onsite Wastewater Recycling Association 2022 Onsite Wastewater Mega-Conference*, Springfield, MO.

Astete Vasquez, L.; Mladenov, N. Biophysicochemical Evolution in Anaerobic Self-flushing Toilets: Varied Waste Introduction Methods and Periods of Operation. Poster. *American Water Works Association CA-NV Section Spring Conference 2022,* Anaheim, CA.

Current Research (expanded description):   According to United Nations surveys, in 2020 3.6 billion people lacked access to 'improved' sanitation systems, which are designed to provide adequate barriers protecting users from fecal pathogens and sufficient removal of harmful contaminants prior to environmental release. The auto-constructed, rudimentary facilities in current use where funds and resources are limited are a known source of pollution and fail to incorporate features that are desirable to their users. My research focuses on sanitation systems designed for practical use in regions facing water scarcity, lack of sewage infrastructure, and socioeconomic constraints. The 'flushing' of circulated, anaerobically-treated wastewater within these systems provides users with a positive interactive experience while providing benefits to the stabilization of organic contents through mixing. For two years, I have compared changes to the tank contents in response to repeat introduction of non-dilute waste under four different introduction schemes, each with unique scientific and cultural relevance. Through this work, I have discerned which introduction method is best for use in real-world applications under different periods of operation, including short term use in unhoused encampments, extended use in disaster relief scenarios and refugee camps, and permanent use in single households.

Benefits to Science and Society: This work extends scientific knowledge on fundamental processes occurring within onsite sanitation systems and can contribute to their improvement through simple design modifications. Access to adequate sanitation is a human right that is pertinent to public and environmental health and has been shown to increase community productivity. Construction of new systems or retrofitting of existing ones could also provide economic benefit through employment of local experts for supplies and labor.

Personal Interests: I enjoy painting, cooking, gardening, singing, dancing, and raising butterflies. I often read about plants, animals, and odd history.

ARCS Award: Based on the achievements of previous awardees, the ARCS Foundation Scholarship seems to be an indicator for success. I am honored to have myself and my work as a researcher recognized as being at the same level of importance as other members of my cohort, and I look forward to sharing the results of our collective advancements in science and engineering.

JENNIFER ANNE WATERS

San Diego State University / University of California San Diego

College of Sciences

Concentration: Biology

Specialization: Cancer Biology

Donor: ARCS Foundation - San Diego Chapter

The way ovarian cancer spreads is heavily influenced by signals from the cells and tissues that surround the tumor, which is collectively referred to as the tumor microenvironment. Jenny is researching how immature fat cells in the tumor microenvironment, called preadipocytes, enhance the ability of ovarian cancer cells to spread and metastasize to the omentum, a fatty tissue that attracts ovarian cancer cells and has the highest tumor burden in patients. She hopes to identify potential drug targets that could reduce the rate of omental metastasis in ovarian cancer.

Degree: B.S. in Biology, San Diego State University

Awards and Honors: ARCS Foundation Award (2021), Rees-Stealy Research Foundation Fellowship (2020), Student Research Symposium President's Award (2020), Cancer Research Foundation Grant (2019)
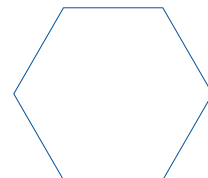
Publications, Papers, and Posters:

Waters J.A.; Robinson M.; Gilbert SF.; Urbano I.; House CD. Omental Preadipocytes Support Ovarian Cancer Tumorigenesis by Mediating Genes Important for Extracellular Matrix Reorganization. Poster presentation. *AACR Annual Meeting*, New Orleans, LA. April 2022.

Robinson M.; Gilbert S.F.; **Waters J.A.**; Lujano-Olazaba O.; Lara J.; Alexander L.J.; Green S.E.; Burkeen G.A.; Patrus O.; Sarwar Z.; Holmberg R.; Wang C.; House C.D. Characterization of SOX2, OCT4 and NANOG in Ovarian Cancer Tumor-Initiating Cells. *Cancers.* Basel, Switzerland, 2021; 13(2), 262.

Waters J.A.; Robinson M.; Gilbert S.F.; and House C.D. Investigation of Insulin-Like Growth Factor Binding Proteins in Supporting Ovarian Cancer Progression. *Moores Cancer Center Annual Cancer Biology & Signaling Retreat*, September 9th 2020. Virtual.

Waters J.A.; House C.D. Overcoming Ovarian Cancer Chemoresistance: Cancer Stem Cells. Book Chapter. Annunziata C and Samimi G. eds. Elsevier, 2020; Vol 11 pp. 56-80.

Current Research (expanded description): Ovarian cancer has a significantly decreased overall survival rate once the cancer begins to invade neighboring tissues. Numerous studies have revealed a predilection for metastasizing to the omentum, which is a large adipose organ that lines the abdominal wall.

While the importance of the mature adipocytes in ovarian cancer progression is well appreciated, little is known about the role of preadipocytes, which are also present in the omentum. Therefore, the goal of my research is to both elucidate what effect preadipocytes exert on ovarian cancer cells, and to use this information to better understand why the omentum provides an optimal environment for tumor initiation and growth.

I have developed several models that ask important questions about the interactions between cancer cells and preadipocytes. My work has revealed that preadipocytes secrete signaling molecules that increase the tumorigenic potential of cells, which translates to increased tumor formation. This results from increased expression of matrix proteins, which is a known phenotype of increased metastatic potential in cancer cells.

My ongoing research seeks to define the impact that increased expression of these matrix proteins is having in the microenvironment, and to determine if these signaling pathways could provide a new therapeutic avenue for patients with advanced metastatic disease.

Benefits to Science and Society: A better understanding of the contributions by the omentum to the tumor microenvironment has the potential to uncover targetable pathways that could be used to develop new cancer therapeutics. Because this work is focused on understanding the influence of preadipocytes on cancer cells, it could potentially have implications for other cancers besides ovarian, such as breast and pancreatic cancers which also develop in close proximity to fatty tissues.

Personal Interests: Outside of the lab, I enjoy rock climbing, baking, trail running and cuddling with my dog.

ARCS Award: Being a recipient of the ARCS Foundation award has been a source of substantial support. By alleviating the financial burdens associated with graduate school, this award has enabled me to focus more on the research I am doing which has heightened my appreciation of the impact that my work could have. Being recognized by the ARCS Foundation has served as an encouraging source of external validation, and it heartens me to know that others see as much potential in this project as I do. It has also provided me with a renewed sense of determination to tackle my upcoming research goals. Lastly, it has supplied resources that will encourage my professional growth and create opportunities for me to network with and learn from established professionals.
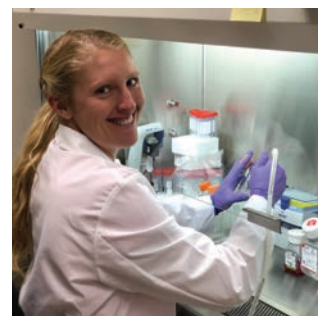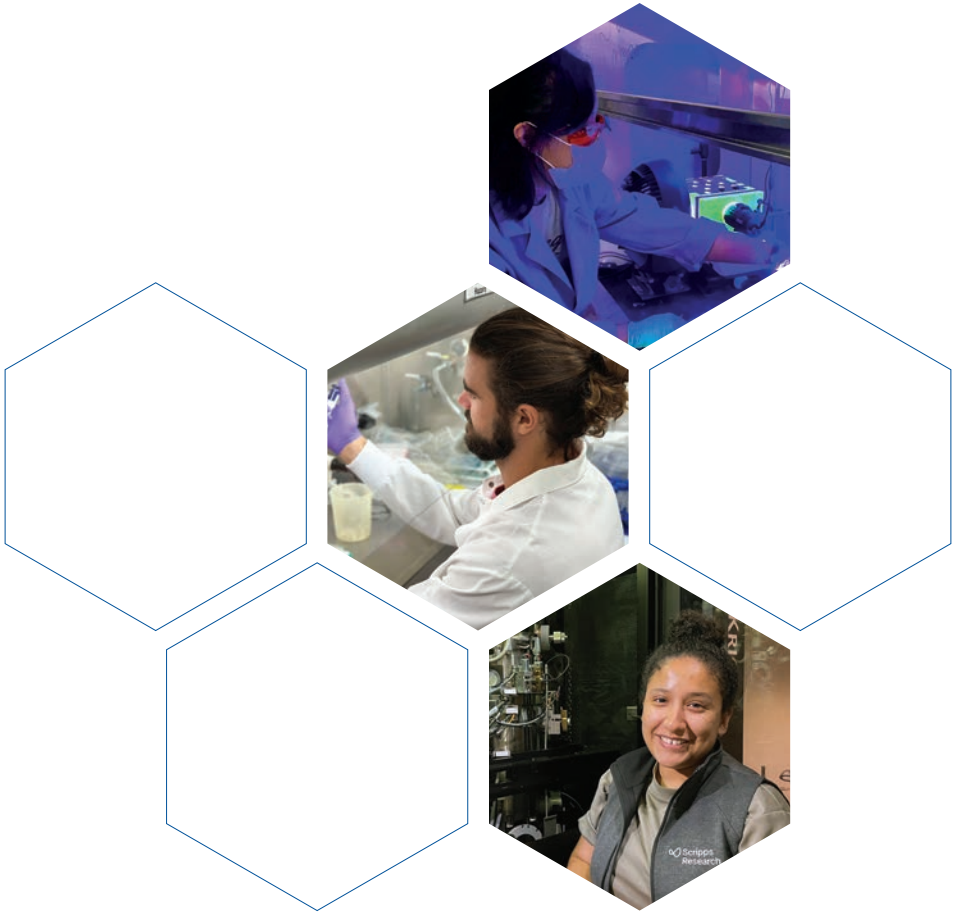
Scripps Research

ROGER JUSTICE FLEISCHMANN III

Scripps Research

Skaggs Graduate School of Chemical and Biological Sciences

Concentration: Immunology

Specialization: Cell Therapy

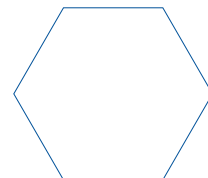Donor: The Paul Bechtner Foundation /ARCS Foundation - San Diego Chapter

Justice investigates the factors which provoke and inhibit immune rejection of cellular transplants. His research revolves around genetically engineering donor-derived white blood cells to eliminate tumors, while also designing them to safely persist inside the patient. By studying the biology of these cells, Justice will produce novel strategies to transplant various types of cells, reduce the economic burden of cell therapy, and improve access to cell therapy.

Degrees: B.S. in Biology, Boston College

Awards and Honors: U.S. Department of Energy, Ames National Laboratory, SULI Research Fellow, 2015

Current Research (expanded description): The human immune system is programmed to reject foreign objects, be that bacteria, fungi, or other cells. There are various molecular mechanisms that the immune system uses to recognize self vs non-self cells, for example, human leukocyte antigen (HLA) is a class of highly polymorphic cell-surface proteins nearly unique to each individual. Without the correct HLA signature, the body mounts an immune response against the foreign cell. By removing this protein, the foreign cell could theoretically evade an immune response. On the other hand, adding certain surface molecules allows cells to remain undetected, or "cloaked." Adding or deleting molecules to the surface of CAR T cells results in a hypoimmunogenic, tumor-eliminating biologic; however, it is also crucial to understand this concept from a broad perspective, taking into consideration the entire immune system. My research as an ARCS Scholar will unearth the biology of various cloaking mechanisms and determine how genetic manipulations to the allogeneic CAR T cell affect its ability to eliminate cancer and persist for long-term efficacy alongside a patient's immune system.

Benefits to Science and Society: Autologous CAR T cell therapies have shown remarkable success in the clinic and there are now multiple products on the market. However, these therapies are limited in scope by their expensive cost, one-patient-one-product model, and risky manufacturing. Allogeneic CAR T cell therapy circumnavigates these issues by providing a cost-effective, ready-to-use solution in which one donor supplies a myriad of patients. This research has the potential to be translated into effective, accessible, and equitable clinical therapies.

Personal Interests: I enjoy surfing, rock climbing, gardening, dance, DEI and STEM education, contemporary art, traveling, cooking, Dungeons and Dragons, interior design, and my dog.

ARCS Award: The ARCS Foundation is an opportunity for me to expand my horizons. It brings me in contact with unique scientists, enthusiastic leaders, and groundbreaking research. I am excited to accept the award and participate in this community.

BRETT MICHAEL GARABEDIAN

Scripps Research

Skaggs Graduate School of Chemical and Biological Sciences

Concentration: Molecular Medicine

Specialization: Glycoimmunology

Donor: ARCS Foundation - San Diego Chapter

Brett uses chemistry and protein engineering to empower our immune system against diseases including chronic infection and cancer. His work focuses on the dense layer of sugars (glycans) that populate the cell-cell synapses formed between white blood cells and diseased cells. By tailoring these interactions using chemical biology tools, Brett is developing novel therapies of disease that will advance the field of "glycoimmunology" and broadly benefit patient outcomes in the clinic.

Degrees: M.S. in Chemistry, University of Basel; B.S. in Chemical Biology, University of California Berkeley; A.A. in Biological Sciences, Santiago Canyon College

Awards and Honors: TL1 Training Grant, 2022; Alfred Werner Scholar at the University of Basel, 2017; SURF Rose Hills Fellow at The University of California at Berkeley, 2015
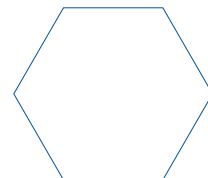
Publications, Papers, and Posters:

Garabedian, B.M.; Meadows, C.W.; Mingardon, F.; Guenther, J.M.; de Rond, T., Abourjeily, R.; Lee, T.S. An Automated Workflow to Screen Alkene Reductases Using High-Throughput Thin Layer Chromatography. *Biotechnol Biofuels.* 13, 184. 2020. PubMed PMID: 33292503

Garabedian, B.M.; Rebelein, J.G.; Lohzkin, B.; Ward, T.R. Artificial Metalloenzyme Directed Prodrug Activation on Tumor Cells. in *CHIMIA.* Vol. 73. 2019.

Heinisch, T.; Schwizer, F.; **Garabedian, B.M.**; Csibra, E.; Jeschek, M.; Vallapurackal, J.; Pinheiro, V.B.; Marliere, P.; Panke, S; Ward, T.R. E. Coli Surface Display of Streptavidin for Directed Evolution of an Allylic Deallylase. *Chem Sci.* 2018, 9, 5383-5388. PubMed PMID: 30079176

Meadows, C.W.; Mingardon, F.; **Garabedian, B.M.**; Baidoo, E.E.K.; Benites, V.T.; Rodrigues, A.V.; Abourjeily, R.; Chanal, A.; Lee, T.S. Discovery of Novel Geranylgeranyl Reductases and Characterization of Their Substrate Promiscuity. *Biotechnol Biofuels* 2018, 11, 340. PubMed PMID: 30607175

Current Research (expanded description): The surface of all healthy cells is covered in "don't eat me" signals encoded as densely packed carbohydrates called glycans. These signals are decoded by immune receptors on white blood cells called inhibitory Siglecs that together, constitute "glyco-immune checkpoints" that prevent killing of healthy cells. A nefarious ploy of cancer cells is their ability to hijack this carbohydrate camouflage and evade the immune response. Exciting reports suggest that by interrupting inhibitory interactions it is possible to reinvigorate the immune response in a manner resembling Nobel Prize-winning therapies targeting the immune checkpoints PD1 and CTLA-4. My research as an ARCS Scholar will expand on this strategy to chemically remodel the immunological synapse and elicit a potent immune response that could benefit patients beyond current best therapies.

Benefits to Science and Society: We live in a time where first-in-class chemical tools are coming online faster than ever, and we are using them to elucidate the importance of glycans in health and disease. My project seeks to define the mechanisms underpinning glyco-immune checkpoints and in doing so, contribute knowledge to the emerging fields of Glycobiology and Glycoimmunology. I am excited by the wealth of therapeutic opportunities within this space, and by their potential to benefit patients afflicted by incurable diseases like cancer.

Personal Interests: SciComm, cooking, guitar, gardening, and prospecting for minerals.

ARCS Award: My beautiful wife and I are recently married, and the ARCS Foundation award provides us the financial security to focus more of our attention on family and life outside the workplace.

NATHALIA ROMANIO GAZANIGA

Scripps Research

Skaggs Graduate School of Chemical and Biological Sciences

Concentration: Biomedical Sciences

Specialization: Immunology

Donor: ARCS Foundation – San Diego

Nathalia utilizes high throughput drug screening methods to identify small molecule immunomodulators in the context of tumors. By being a part of both a chemical biology and an immunology lab, she can screen for small molecules and subsequently work to understand their mechanism in vitro and in vivo. Her project focuses on applying these small molecules to alter the balance of immune cell populations in the tumor microenvironment.

Degree: B.S. in Biological Sciences, Florida Atlantic University

Awards and Honors: Undergraduate Researcher of the Year for 2015, College of Medicine, Florida Atlantic University 2016; 1st place Oral Presentation, Undergraduate Research Symposium, Florida Atlantic University 2016; 1st place Oral Presentation, Undergraduate Research Symposium, Florida Atlantic University 2015
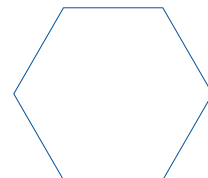
Publications, Papers, and Posters:

Tsai, W. L.; Vian, L.; Giudice, V.; Kieltyka, J.; Liu, C.; Fonseca, V.; **Gazaniga, N**.; Gao, S.; Kajigaya, S.; Young, N.S.; Biancotto, A.; & Gadina, M. High Throughput Pstat Signaling Profiling by Fluorescent Cell Barcoding and Computational Analysis. *Journal of Immunological Methods*. 2020, 477, 112667

Vian, L.; Le, M. T.; **Gazaniga**, N.; Kieltyka, J.; Liu, C.; Pietropaolo, G.; Dell'Orso, S.; Brooks, S. R.; Furumoto, Y.; Thomas, C. J.; O'Shea, J. J.; Sciumè, G.; & Gadina, M. JAK Inhibition Differentially Affects NK Cell and ILC1 Homeostasis. *Frontiers in Immunology*. 2019, 10, 2972

Gadina M.; **Gazaniga N**.; Vian L.; Furumoto Y. Small Molecules to the Rescue: Inhibition of Cytokine Signaling in Immune-Mediated Diseases. *J Autoimmun*. 2017, 85:20-31

Libreros S.; Garcia-Areas R.; Keating P.; et al. Allergen Induced Pulmonary Inflammation Enhances Mammary Tumor Growth and Metastasis: Role of CHI3L1. *J Leukoc Biol*. 2015, 97(5):929-940

Current Research (expanded description): In the Lairson and Teijaro laboratories, my project focuses on understanding the mechanism of previously identified compounds by our lab that alters regulatory T cell differentiation. Additionally, I have also conducted high throughput flow cytometry screens to identify small molecules with effects on different T cell populations. By understanding these small molecules' specific targets in these cells, we aim to determine their downstream pathways. Additionally, our goal is to utilize these small molecules to change the balance of immune cell populations in the tumor microenvironment with the hope of contributing to cancer therapy.

Benefits to Science and Society: T cells are composed of different subsets that are capable of either suppressing or enhancing tumor clearance. Two examples are regulatory T cells that have been correlated with increased tumor progression and effector T cells that aid in controlling tumor growth. Therefore, it is essential to identify new modes of inhibiting or augmenting these cell populations' presence in the tumor microenvironment that can be potentially utilized as cancer therapies.

ARCS Award: The ARCS Foundation award allows me to continue to conduct research in areas I am passionate about and to contribute to the scientific field. Thank you so much once again.

SERGIO RODRIGUEZ LABRA

Scripps Research

Skaggs Graduate School of Chemical and Biological Sciences

Concentration: Biomedical Sciences

Specialization: Translational Neuroscience

Donor: Toby Eisenberg

Alzheimer's disease is the most common form of dementia worldwide and is growing at an alarming rate without a cure. Sergio's research seeks to address a critical need in the field, that is, the lack of adequate pre-clinical models. By innovating stem cell-derived human brain organoid-based models to better reproduce the progression of Alzheimer's disease, Sergio's efforts focus on uncovering new disease mechanisms and more reliably testing promising new drugs in development as potential treatments for the disease.
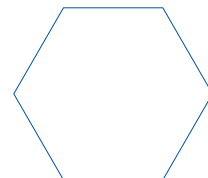
Degrees: M.S. in Biotechnology, University of Pennsylvania; B.S.E. in Chemical and Biomolecular Engineering, University of Pennsylvania

Awards and Honors: NIH Clinical & Translational Science TL1 training grant 2021; Dean's Fellowship, Scripps Research 2018; Graduate Research Fellowship Program Honorable Mention, National Science Foundation 2018; Outstanding Young Investigator Award, Alzheimer's Drug Discovery Foundation 2018.

Publications, Papers, and Posters:

Yoon, L.; Botham, R.C.; Verhelle, A.; Cole, C.; Tan, E.P.; Wu, Y.; Sanz-Martinez, P.; Xu, J.; Cuoco, C.A.; Chou, C.C.; **Labra, S**. mTOR Inhibitor-independent Autophagy Activator Ameliorates Cellular Tauopathy and Prionopathy Neurodegeneration Phenotypes. *bioRxiv*. 2022.

Labra S.R.; Cole C.; Ghatak S.; Piña-Sanz J.; Cedeño C.; Dolatabadi N.; Yoon L.; Lin W.; Lipton S.A.; Kelly J.W. Cerebral Organoids as an Alzheimer´s Disease Human Model. Presented at the *Proteostasis Consortium Retreat,* San Francisco, CA; May 22-23. 2022.

Prokop, S.; Miller, K.R.; **Labra, S.R.**; Pitkin, R.M.; Hoxha, K.; Rosenbloom, A.; Lee, V.M.Y.; Trojanowsk, J.Q. Impact of TREM2 Risk Variants on Brain Region-specific Immune Activation and Plaque Microenvironment in Alzheimer's Disease Patient Brain Samples. *Acta Neuropathologica.* 2019, 138(4), 613-630

Oner, B.S.; **Labra, S.R.**; Fehr, S. FDA Drug Regulation: Investigational New Drug Applications. In *Academic Entrepreneurship for Medical and Health Scientists.* 2019, 1(3), Article 7. DOI: 10.21428/b2e239dc.784553dd.

Current Research (expanded description): I am using a set of isogenic induced pluripotent stem cell lines with different familial Alzheimer's disease (AD) mutations and the complexity afforded by their differentiation into cerebral organoids as a novel system to model and study the progression and potential treatment of AD. By coordinating the expertise of multiple collaborator labs within and outside Scripps Research, I am ascertaining the extent to which my system faithfully recapitulates known functional and biochemical disease signatures while thoroughly characterizing the proteomic and lipidomic changes stemming from AD-associated mechanisms. In parallel to dissecting uncovered disease mechanisms, I am also interrogating the prevention and reversibility of the characterized pathology in the cerebral organoids by functionally and multi-omically testing promising pharmacologic agents for therapeutic and prophylactic effects and determining the feasibility of the model strategy as a higher throughput human drug development platform.

Benefits to Science and Society: Alzheimer's disease (AD) currently affects around 47 million people worldwide and like most other neurodegenerative diseases, still lacks robust disease mechanism descriptions and treatments. My project aims to be one of the most thorough in vitro AD model characterizations, leading not only to the discovery of novel mechanisms underlying the disease, but also enabling the testing of potential new drugs for therapeutic and prophylactic effects; the latter usually obscured in most traditional models, but with incalculable potential benefit in the clinic.

Personal Interests: Volunteer with Cientifico Latino as co-director of a STEM graduate mentorship program for underrepresented minorities.

ARCS Award: The ARCS Foundation award means being welcomed to a community of passionate and unique individuals, ranging from young scientists to generous donors, united by the goal of making a positive impact in the world. I am humbled and immensely grateful for the inspiration and financial support that ARCS provides me to focus my research efforts to contribute to my field and advance my career.

GARRETT LEE LINDSEY

Scripps Research

Skaggs Graduate School of Chemical and Biological Sciences

Concentration: Chemical Biology

Specialization: Chemical Proteomics

Donor: The Reuben H. Fleet Foundation

In the Cravatt lab, Garrett uses the application of Activity-based Protein Profiling (ABPP) to discover and functionally annotate proteins that contribute to human diseases, such as cancer. His research focuses on developing small molecules that target novel proteins to suppress pro-tumorigenic transcriptional networks. Currently, he is studying the mechanism of small molecules that modulate the RNA-binding protein, NONO. Studying these small molecules could provide a way forward for drugging the NONO protein for cancer therapy and more specifically treatment resistant forms of prostate cancer.

Degree: B.S. in Pharmacology, University of California, Santa Barbara

Awards and Honors: Gordon Research Conference, CSURM Fellowship, 2022; Baylor College of Medicine, NIGMS Fellowship for Post-baccalaureate Research Education Program, 2019; National Institute of Health Fellowship for Summer Undergraduate Research, University of Oregon, 2017.
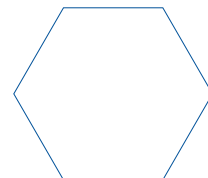
Publications, Papers, and Posters:

Lindsey, **G.L.**; Kathman, S.; Koo, J.; Her, S.; Blue, S.; Li H.; Jaensch, S.; Remsberg, J.; Ahn. K.; Yeo, G.; Cravatt B.F. Remodeling of Oncogenic Transcriptomes by Small Molecules Targeting the RNA-binding Protein NONO. Poster. *Gordon Research Conference 2022*. Andover, NH.

Lindsey, **G.L.**; Kandel, P.; Lyra, C.; Chamakuri, S.; Young, D.W. Targeted TLX Protein Degradation as Novel Therapy for Castration- Resistant Prostate Cancer. Poster. *The Annual Meeting ABRCMS 2019*. Anaheim, CA.

Andresen, R.; Degen, G.; Valois, E.; **Lindsey**, **G.L.**; Kristiansen, K. Siderophore Inspired Molecules to Mediate Collagen Thin Film Adhesion. *APS March Meeting Abstracts*. 2019

Lindsey, **G.L.**; Yasen, A.; Christie, A.D. The Impact of Physical Activity and Sleep on Physiology Following a mTBI. *International Journal of Exercise Science*. 2019, Vol. 12: Iss. 3, Pages 919 – 931.

Current Research (expanded description): A large amount of the human proteome is dedicated to mRNA homeostasis, but most RNA-binding proteins lack chemical probes. Therefore, my specific focus is on developing chemical probes capable of targeting previously reported "undruggable" RNA-binding proteins to suppress pro-tumorigenic transcriptional networks, which would provide great value to the study this class of proteins. Our lab has discovered an electrophilic small molecule that decreased transcripts encoding the androgen receptor and its V-7 splice variant. This phenotypic effect is due to the compound covalently engaging cysteine-145 on the RNA-binding protein NONO. Interestingly, we found that genetic disruption of NONO does not replicate the androgen receptor suppressing effects of the NONO ligands, but instead blocks the activity of these ligands. The effects we observe in targeting NONO with our unique chemical probes correlate with a blockade of cell growth and proliferation of cancer cells from a variety of lineages. I aim to leverage this effect to a more translational application to exploit this mechanism. Additionally, using covalent chemistry, this work can potentially provide a path of using chemical probes to target other RNA-binding proteins that were classified as undruggable and that play vital roles in the landscape of cancer cell biology.

Benefits to Science and Society: RNA binding proteins are implicated in many human diseases and oversee the maturation and quality control of mRNAs that encode key oncogenic proteins. Despite their fundamental roles in human physiology and disease, these proteins remain largely underexplored in terms of chemical probe and drug discovery. The research I am focusing on aims to further contribute this knowledge of this class of proteins for potential therapy of numerous diseases.

Personal Interests: I stay active through weightlifting, hot yoga, or practicing my golf swing at a driving range.

ARCS Award: I am grateful to be a part of the ARCS Foundation of Scholars. Receiving this award is incredibly motivating as it affirms that my efforts toward science are valued. In addition, this generous award allows me to focus on my research by relieving the financial stressors of graduate school. The ARCS Foundation award provides me with another medium in which I can share my research with the scientific community, and I am excited to do so!
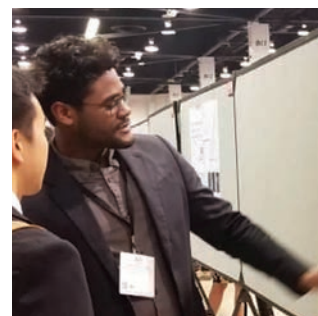
MICHAELA MEDINA

Scripps Research

Skaggs Graduate School of Chemical and Biological Sciences

Concentration: Cell Biology

Specialization: Quantitative Cellular Biology and Biophysics

Donor: The Conrad Prebys Foundation

Michaela uses light microscopy, electron microscopy, and biochemical techniques to investigate how mitochondria sense and adapt to cellular stress. Her work focuses on how mitochondrial membranes remodel in a variety of different cellular contexts to gain a greater understanding for how these processes are regulated. Her goal is to understand of how dysregulation of mitochondrial dynamics results in unhealthy mitochondrial populations that are a hallmark of neurodegenerative diseases, metabolic diseases, and cancer.

Degree: B.S in Cell Biology and Biochemistry, University of California, San Diego

Awards and Honors: Biophysical Society Student Research Achievement Award, 2022; Scripps Research Graduate Symposium poster award, 2021; Southern California Cryo-EM Symposium poster award, 2021; Ford Foundation Predoctoral Fellowship Honorable Mention, 2021.
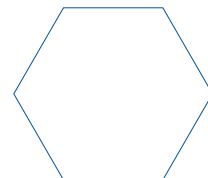
Publications, Papers, and Posters:

Barad, B.A.*; **Medina**, **M.***; Fuentes, D.; Wiseman, R.L.; Grotjahn, D.A. A Surface Morphometrics Toolkit to Quantify Organellar Membrane Ultrastructure Using Cryo-electron Tomography. *bioRxiv*. 2022, 2022.01.23.477440.

Mageswaran, S.K.; Grotjahn, D.A.; Zeng, X.; Barad, B.A.; **Medina**, **M.**; Hoang, M.H.; Dobro, M.J.; Chang, Y.-W.; Xu, M.; Yang, W.Y.; Jensen, G.J. Nanoscale Details of Mitochondrial Fission Revealed by Cryo-electron Tomography. *bioRxiv*. 2021, 2021.12.13.472487.

Gardner, A.; Autin, L.; Fuentes, D.; Maritan, M.; Barad, B.A.; **Medina**, **M.**; Olson, A.J.; Grotjahn, D.A.; Goodsell, D.S. CellPAINT: Turnkey Illustration of Molecular Cell Biology. *Front Bioinform*. 2021, 1, 660936.
* These authors contributed to the work equally

Current Research (expanded description): The ability for mitochondria to sense and adapt to cellular stress is critical for cell survival. While there is a wealth of data characterizing the metabolic outputs of mitochondria in different physiological conditions, what remains unclear is how changes in protein complexes drive large-scale remodeling of important respiratory-machinery-containing membranes of the mitochondrion? To address this, Michaela utilizes cellular cryo-electron tomography (Cryo-ET) to collect high-resolution 3D-volumetric data of mitochondria in their surrounding environment. Recently, Michaela developed new methodologies to quantitatively analyze mitochondrial membranes (ultrastructure) in different physiological contexts. She is applying these methods to understand the complex cellular machinery involved in the dynamic process of mitochondrial division (fission).

Benefits to Science and Society: Dysregulation of mitochondrial fission leads to highly fragmented mitochondrial populations which are hallmarks of neurodegenerative diseases, metabolic disorders, and cancer. By defining the organization of cellular machinery that aid in these large-scale ultrastructural changes, we gain a better understanding of the mechanistic underpinnings of mitochondrial dynamics and begin to explore new avenues for targeting and modulating mitochondrial function. Expanding beyond my biological focus, all ultrastructure analysis tooling will be open source and will aid in the quantitative analysis of organelle ultrastructure in cryo-ET.

Personal Interests: I am an avid music lover especially K-pop and the South Korean band BTS. I enjoy learning languages, reading, hiking, and traveling.

ARCS Award: I am grateful to have been selected as an ARCS scholar and am honored to be welcomed into such a wonderful group of innovative minds. This award will aid in my development as a scientific researcher and serves as an acknowledgment of my efforts thus far. I am enthused to continue my work with the generous support of the ARCS Foundation.

HAILEE ROSE PERRETT

Scripps Research

Skaggs Graduate School of Chemical and Biological Sciences

Concentration: Biophysics and Structural Biology

Specialization: Structural Virology

Donor: Kurt Benirschke Family

For her research, Hailee uses cutting-edge electron microscopy, computational, and biochemical techniques to investigate viral glycoproteins that facilitate host cell attachment. Her work focuses on developing a more robust understanding of arenaviruses, which include the etiologic agents of various hemorrhagic fevers such as Lassa fever. The latter is endemic in West Africa and is recognized by the World Health Organization as a disease with pandemic potential. By defining these proteins' structures and functions, Hailee aims to contribute to the development of next-generation protein tools, therapeutic strategies, and vaccine candidates.
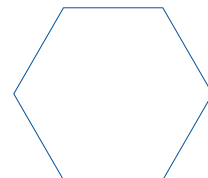
Degrees: B.S. in Chemical Engineering, Michigan State University; B.S. in Biochemistry and Molecular Biology, Michigan State University

Awards and Honors: Ruth L. Kirschstein National Research Service Award (F31), 2022; Excellence in Journalism Award, 2020; David C. Fairchild Endowed Fellowship, 2019-2022; Dean's Research Fellowship, 2019.

Publications, Papers, and Posters:

Perrett, **H.R**.; Brouwer, P.J.M.; Hurtado, J.; Newby, M.L.; Burger, J.A.; Liu, L.; Bouhuijs, J.H.; Gibson, G.; Messmer, T.; Schieffelin, J.S.; Antanasijević, A.; Boons, G.J.; Crispin, M.; Sanders, R.W.; Briney, B.; and Ward, A.B. Structural Conservation of Lassa Virus Glycoproteins and Recognition by Neutralizing Antibodies. *bioRxiv.* 2020. doi.org/10.1101/2022.09.26.509601.

Brouwer, P.J.M.*; Antanasijević, A.*; Ronk, A.R.; Müller-Kräuter, H.; Watanabe, Y.; Claireaux, M.; Lloyd, N.M.; Bijl, T. P. L.; **Perrett**, **H.R**.; Steijaert, T.; Burger, J.A.; van Haaren, M.M.; Sliepen, K.; van Gils, M.J.; Crispin, M.; Strecker, T.; Bukreyev, A.; Ward, A.B. and Sanders; R.W. Lassa. Virus Glycoprotein Nanoparticles Elicit a Neutralizing Antibody that Defines a New Site of Vulnerability. *bioRxiv*. 2020. https://doi.org/10.1101/2022.03.28.486091.

Clausen, T.M.*; Sandoval, D.R.*; Spliid, C.B.; Pihl, J.; **Perrett, H. R.**; Painter, C.D.; Narayanan, A.; Majowicz, S.A.; Kwong, E.M.; McVicar, R.N.; Thacker, B.E.; Glass, C.A.; Yang, Z.; Torres, J.L.; Golden, G.J.; Bartels, P. L.; Porell, R.N.; Garretson, A.F.; Laubach, L.; Feldman, J.; Yin, X.; Pu, Y.; Hauser, B.M.; Caradonna, T.M.; Kellman, B.P.; Martino, C.; Gordts, P.L. S.M.; Chanda, S.K.; Schmidt, A.G.; Godula, K.; Leibel, S.L.; Jose, J.; Corbett, K.D.; Ward, A.B.; Carlin, A.F.; Esko, J.D. SARS-CoV-2 Infection Depends on Cellular Heparan Sulfate and ACE2. *Cell*. 2020. https://doi.org/https://doi. org/10.1016/j.cell.2020.09.033.

Doore, S.M.*; Schrad, J.R.*; **Perrett, H.R.***; Schrad, K. P.; Dean, W. F.; Parent, K.N.A. Cornucopia of Shigella Phages from the Cornhusker State. *Virology*. 2019, 538, 45–52. https://doi.org/https://doi.org/10.1016/j. virol.2019.09.007.

*These authors contributed to the work equally.

Current Research (expanded description): In my work to describe structures of arenaviral glycoproteins, known as GPCs, and develop more stable proteins for scientific and clinical use, I employ single-particle cryo-EM to probe the atomic details of GPC across viral strains. GPC has proved recalcitrant to unbound structural studies and other experiments requiring the proper oligomeric state of the protein in the past; yet, a stable trimer is needed to assess critical interactions such as those between the protein and host antibody responses after vaccination or natural infection. As such, we are working on protein stabilization of the recombinant, soluble GPC. Complementary structural and stabilization efforts will be used in tandem to determine similarities among the viral family that can be exploited during immunogen design and early-stage clinical efforts to encourage effective cross-neutralizing humoral immune responses.

Benefits to Science and Society: By elucidating structures of arenaviral glycoproteins, we can develop a more robust understanding of how these pathogens infect human cells. In doing so, we will develop tools to guide small molecule or antibody therapeutic development for these diseases, for which there is no approved or definitively efficacious treatment available. Importantly, our structural and protein engineering work can be directly applied to vaccine development, much akin to the successful stabilization techniques used with the SARS-CoV-2 vaccines.

Personal Interests: I love the arts and spend a lot of time creating science-related digital illustrations as well as surreal oil paintings. My other hobbies include surfing, cooking, writing, and walking my cat.

ARCS Award: I am honored and deeply humbled to be recognized by the ARCS Foundation and to join such a strong community of like-minded scholars. Receipt of this award alleviates some of the financial stress associated with graduate education but, more importantly, is a clear demonstration that my efforts in what is typically an under-studied field are valuable. I am so grateful for this privilege!
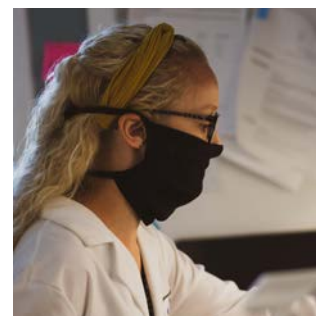
CAROLINE ROSE STANTON

Scripps Research

Skaggs Graduate School of Chemical and Biological Sciences

Concentration: Biomedical Sciences

Specialization: Chemical Biology

Donor: Karen and Robert Bowden

Caroline's graduate research focuses on understanding the regulation of the NLRP3 inflammasome, a protein complex closely tied to sterile inflammation in numerous diseases including gout, rheumatoid arthritis, multiple sclerosis, and stroke. To accomplish this goal, she has performed a high-throughput screen to identify new compounds which inhibit NLRP3 and is determining the mechanism of action of these compounds to establish new ways by which NLRP3 is regulated. This allows her to identify potential new drug targets to reduce NLRP3 activity and inflammation.

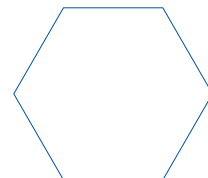Degree: B.S. in Chemistry, University of North Carolina at Chapel Hill

Awards and Honors: Kellogg Fellow in the Skaggs Graduate School of Chemical and Biological Sciences 2019; Phi Beta Kappa 2017; James H. Maguire Memorial Award Recipient for Outstanding Academic Achievement in Chemistry 2017

Publications, Papers, and Posters:

Shalhout, S.Z.; Yang, P.-Y.; Grzelak, E.M.; Nutsch, K.; Shao, S.; Zambaldo, C.; Iaconelli, J.; Ibrahim, L.; **Stanton, C.**; Chadwick, S.R.; Chen, E.; Deran, M.; Li, S.; Hull, M.; Wu, X.; Chatterjee, A.K.; Shen, W.; Camargo, F.D.; Schultz, P.G.; Bollong, M.J. YAP-Dependent Proliferation by a Small Molecule Targeting Annexin A2. *Nature Chemical Biology.* 2021, 17 (7), 767-775

Rosarda, J.D.; Baron, K.R.; Nutsch, K.; Kline, G.M.; **Stanton, C.**; Kelly, J.W.; Bollong, M.J.; Wiseman, R.L. Metabolically Activated Proteostasis Regulators Protect against Glutamate Toxicity by Activating NRF2. *ACS Chemical Biology.* 2021;16(12):2852-63. doi: 10.1021/acschembio.1c00810.

Iannetta, A.A.; Minton, N.E.; Uitenbroek, A.A.; Little, J.L.; **Stanton, C.R.**; Kristich, C.J; Hicks, L.M. IreK-Mediated, Cell Wall-Protective Phosphorylation in Enterococcus faecalis. *Journal of Proteome Research.* 2021. doi: 10.1021/acs.jproteome.1c00635.

Stanton, **C.R.**; Berwanger, J.; Bruening, M.L. In Membrane Exploitation of Antigen/Antibody Interaction for Selective Purification and Quantification of Therapeutic Monoclonal Antibodies. Presented at *American Chemical Society National Meeting*, New Orleans, LA, March, 2018

Current Research (expanded description): Despite the growing recognition of the contribution of NLRP3 in inflammatory disorders, there is still much not understood regarding the activation and regulation NLRP3 inflammasome signaling, limiting our ability to develop pharmacologic approaches to target this important inflammatory complex. Recent identification of covalent molecules which inhibit NLRP3 suggests that NLRP3 may serve as an electrophile sensor within the cells and may be a promising covalent drug target. I am employing a chemical genetic approach to elucidate the biologic and therapeutic potential of covalent cysteine modification of NLRP3 for regulating inflammasome activation and activity. To do this, I developed and implemented a high-throughput screen for inhibitors of NLRP3 inflammasome assembly to identify covalent compounds that inhibit inflammasome assembly and activity. Next, I will define the molecular basis for compound-dependent inhibition of inflammasome assembly with the explicit goal of characterizing a redox sensor mechanism of NLRP3 activation and activity. Further, I will identify compounds with therapeutic potential for protecting against inflammatory disorders through inflammasome inhibition for further translational development.

Benefits to Science and Society: Overactivity of the NLRP3 inflammasome is implicated in numerous inflammatory diseases, yet there are no clinically approved NLRP3 inhibitors. Most of the current clinical candidates work through inhibition of the ATPase activity of NLRP3. However, this research demonstrates an intrinsic electrophile sensing mechanism of regulation of NLRP3 which makes it an ideal covalent drug target. By characterizing this activity, we demonstrate the therapeutic potential of a highly-specific covalent NLRP3 inhibitor for treatment of inflammatory diseases.

Personal Interests: Classical singing including art songs and opera, walking on the beach, reading, and baking.

ARCS Award: I am extremely grateful to be selected as an ARCS Scholar and appreciative of your support of my career as a scientist. It is very gratifying to receive recognition of my efforts and to know that there are people who recognize the importance of training a new generation of scientists.

This scholarship will be pivotal in helping me develop my potential and advance my training. I've always believed that research science is the way I can most impact the world and make a difference in the lives of many. I hope that both during graduate school and afterwards, I can refine my scientific knowledge and apply my talents to the treatment and curing of devastating diseases. When I graduate from this program, I will be ready to contribute my full effort to the development of new therapies and treatments and make a lasting impact on society. Your support will help contribute to my success and I cannot thank you enough for your generosity.
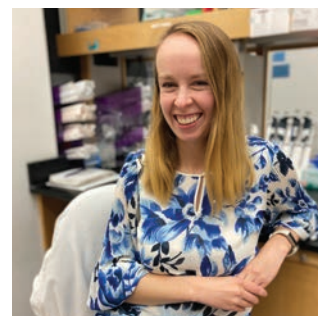
NELSON REN WU

Scripps Research

Skaggs Graduate School of Chemical and Biological Sciences

Concentration: Immunology

Specialization: Vaccine Design

Donor: Laurie and Michael Roeder

Malaria is an ancient tropical disease caused by parasites carried by mosquitoes. While insecticide-treated nets and anti-malarial drugs have largely contributed to a decline in malaria cases, increasing drug resistance by malaria parasites necessitates the development of an effective vaccine. The most advanced vaccine for malaria is the RTS,S/AS01 vaccine approved for use in select African countries, but that is only partially effective. Nelson's research seeks to apply computational modeling to design and screen more effective vaccine candidates.
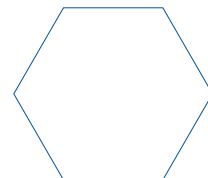
Degree: B.S. in Biomedical Engineering, Washington University in St. Louis

Awards and Honors: WUSTL Dean's List; Byrd Honors Scholarship

Publications, Papers, and Posters:

Saunders, K.O.; Wiehe, K.; Tian, M.; Acharya, P.; Bradley, T.; Alam, S.M.; Go, E.P.; Scearce, R.; Sutherland, L.; Henderson, R.; Hsu, A.L.; Borgnia, M.J.; Chen, H.; Lu, X.; **Wu, N.R.**; Watts, B.; Jiang, C.; Easterhoff, D.; Cheng, H.L.; McGovern, K.; Waddicor, P.; Chapdelaine-Williams, A.; Eaton, A.; Zhang, J.; Rountree, W.; Verkoczy, L.; Tomai, M.; Lewis, M.G.; Desaire, H.R.; Edwards, R.J.; Cain, D.W.; Bonsignori, M.; Montefiori, D.; Alt, F.W.; Haynes, B.F. Targeted Selection of HIV-specific Antibody Mutations by Engineering B Cell Maturation. *Science.* 2019, 366 (6470)

Wu, N.R.; Nicely, N.I.; Lee, E.M.; Reed, R.K.; Watts, B.E.; Cai, F.; Walkowicz, W.E.; Aussedat, B.; Jones, J.A.; Eaton, A.; Trama, A.M.; Alam, S.M.; Montefiori, D.C.; Haynes, B.F.; Saunders, K.O. Cooperation Between Somatic Mutation and Germline-Encoded Residues Enables Antibody Recognition of HIV-1 Envelope Glycans. *PLoS Pathog.* 2019, 15 (12), e1008165

Saunders, K.O.; Nicely, N.I.; Wiehe, K.; Bonsignori, M.; Meyerhoff, R.R.; Parks, R.; Walkowicz, W.E.; Aussedat, B.; **Wu**, **N.R**.; Cai, F.; Vohra, Y.; Park, P.K.; Eaton, A.; Go, E.P.; Sutherland, L.L.; Scearce, R.M.; Barouch, D.H.; Zhang, R.; Von Holle, T.; Overman, R.G.; Anasti, K.; Sanders, R.W.; Moody, M.A.; Kepler, T.B.; Korber, B.; Desaire, H.; Santra, S.; Letvin, N.L.; Nabel, G.J.; Montefiori, D.C.; Tomaras, G.D.; Liao, H.X.; Alam, S.M.; Danishefsky, S.J.; Haynes, B.F. Vaccine Elicitation of High Mannose-Dependent Neutralizing Antibodies Against the V3-Glycan Broadly Neutralizing Epitope in Non human Primates. *Cell Rep.* 2017, 18 (9), 2175-2188

Current Research (expanded description): In the pursuit of a better malaria vaccine, I combine yeast surface display and computational modeling to isolate designs according to novel vaccine strategies, epitope scaffolding, and germline targeting. I begin with Rosetta Design software which identifies low free energy sequences for target proteins in order to design structures that can accommodate artificial substitutions or to increase binding affinities. However, modeling cannot perfectly represent a biological system, and so it is important to take the large library of outputs and display them on the surface of yeast cells for screening against antibodies of interest. With this, one can isolate the optimized immunogens. I use these to accommodate artificial substitutions in epitope scaffolding, the technique of grafting a desired epitope onto another protein in order to generate conformationally stable protein scaffolds that accurately mimic the epitope structure and induce neutralizing antibodies. I also use this process to increase binding affinity in germline targeting, the technique of designing priming immunogens that have appreciable affinity to precursors of neutralizing antibodies in order to initiate antibody induction. Both strategies have shown merit in other vaccine fields, and I hope that this novel application to malaria will sufficiently improve its vaccine.

Benefits to Science and Society: Malaria is a global health risk with an estimated 3.4 billion people in 92 countries at risk of being infected and developing the disease. While the RTS,S vaccine is a major step forward in malaria treatment, its partial effectiveness means it is unable to eradicate malaria in endemic regions. A vaccine made with germline targeting can potentially increase positive response of the immune system while a vaccine made with epitope scaffolding can potentially direct immune response to the most potent epitopes.

Personal Interests: In my spare time, I like performing Chinese-Yoyo, reading fantasy novels, and playing with my Siamese cat.

ARCS Award: The ARCS Foundation award is a great opportunity for me and other scientists to meaningfully engage with others not directly doing research and share our cutting-edge work. More relationships between ground-floor researchers and donors should be fostered in order to better expand science education. I look forward to meeting science philanthropists and learning how to advance STEM interest in my local community.
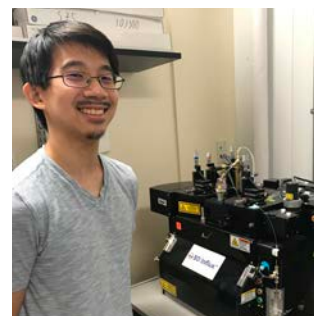
UC San Diego

ANELA KANANI AKIONA

University of California San Diego

Scripps Institution of Oceanography

Concentration: Marine Biology

Specialization: Coral Reef Ecology

Donor: Kenneth and Marjorie Blanchard/ARCS Foundation - San Diego Chapter

Anela studies what determines species distribution on coral reefs, which are under threat from climate change. She uses data from scuba surveys to model how emerging interventions might make reef ecosystems in the Maldives, an island nation which relies heavily on coral-related tourism, more resilient as global temperatures rise. Her research seeks to bridge the gap between conservationists, managers, and scientists as the Maldivian government works to build their national coral conservation strategy.

Degrees: M.S. in Marine Biology, University of Hawaii at Mānoa; B.A. in Marine Science, University of San Diego
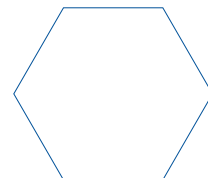
Awards and Honors: Tribal Membership Initiative Fellowship 2021-2023; National Science Foundation Graduate Research Fellowship 2018-2021; Hauoli Mau Loa Graduate Fellowship, University of Hawaii 2016-2018; Kamehameha Schools Imi Naauao Scholarship 2016-2018

Publications, Papers, and Posters:

Akiona, A.K.; B.J.; Popp, B.N.; Toonen, R.J.; Siple, M.C.; Kotubetey, K.; Kawelo, H.; Franklin, E.C. Predatory Fish Diets Shift Towards an Invasive Mullet in a Traditional Hawaiian Aquaculture System. *Aquaculture Fish and Fisheries.* 2022, 1-14

Akiona, A.K.; Zgliczynski, B.J.; Sandin, S.A. Length-weight Relationships for 18 Coral Reef Fish Species from the Central Pacific. *Journal of Applied Ichthyology.* 2021, 00, 1-5

Peyton, K.A.; Sakihara, T.S.; Nishiura, L.K.; Shindo, T.T.; Shimoda, T.E.; Hau, S.; **Akiona**, A.; Lorance, K. Length-weight Relationships for Common Juvenile Fishes and Prey Species in Hawaiian Estuaries. J*ournal of Applied Ichthyology.* 2015, 32, 499-502

Current Research (expanded description): Coral interventions are being developed as tools for scientists and reef managers to mitigate the effects of climate change on coral reefs. Understanding how corals and benthic functional groups may respond to potential interventions should help managers protect and restore coral reefs as the climate effects (particularly bleaching) become more frequent and more severe. I use an empirically grounded, spatially explicit model to assess potential interventions for the Republic of the Maldives, an island nation which depends heavily on coral reef related tourism and which has recently embraced reef restoration. My research draws on extensive Maldives survey data from the 100 Island Challenge, a large-scale effort to describe variation in coral reefs from across the globe, to model different intervention scenarios, including business as usual and larval outplanting. This project is part of a larger effort that is one of the first to create decision-making tools for and in collaboration with coral reef managers and stakeholders.

Benefits to Science and Society: Many of the available coral interventions are quite new and have not been implemented widely yet, which makes it difficult for conservation practitioners and managers to know which will be most effective or to switch from what they already have in practice. My research seeks to make the decision-making process more straightforward by simulating interventions in the Maldives, with potential application to other locations.

Personal Interests: I enjoy scuba diving, hiking, going to the beach, cooking, buying plants, fostering dogs, and embroidering.

ARCS Award: I am very grateful and honored for the opportunity to be an ARCS scholar, which will greatly alleviate financial stress while completing my PhD, and allow me to continue my work in outreach and mentorship.

GABRIEL ANTONIO ASCUI-GAC

University of California San Diego

La Jolla Institute for Immunology

Concentration: Biomedical Sciences

Specialization: Immunology

Donor: Legler Benbough Foundation

Lung infections are major killers globally. Pneumonia alone is responsible for the deaths of 11% of children under 5 years old in the world. This makes it important to understand how protective immune responses in the lung are generated. Gabriel's research focuses on Innate T cells and their importance for protection against bacterial infections. These innate T cells have rapid and donor-unrestricted responses making them important targets for vaccine development. He is using cutting-edge CRISPR screen technology to better understand the lung immune response and to describe novel mechanisms for protection and cellular interactions which aims to improve current therapeutic interventions.

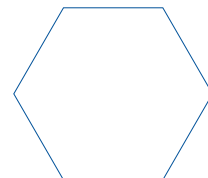Degree: Engineer in Molecular Biotechnology, University of Chile, Chile

Awards and Honors: Best Poster First Annual Meeting of the Chilean Immunology Association (ASOCHIN) 2017.

Publications, Papers, and Posters:

Chandra, S.; Ramirez, C.; **Ascui, G.**; Seumois, G.; Seo, G.-Y.; Simon, H.; Hartmann, N.; Murray, M.P.; Vijayanand, P.; Kronenberg, M. Single Cell Sequence Analysis Reveals Mouse MAIT Cell Diversity at Steady State and after Infection. *J. Immunol.* 2020, 204 (1 Supplement), 76.9 LP-76.9.

Ascui, G.; Gálvez-Jirón, F.; Kramm, K.; Schäfer, C.; Siña, J.; Pola, V.; Cristi, F.; Hernández, C.; Garrido-Tapia, M.; Pesce, B.; Bustamante, M.; Fluxá, P.; Molina, M.C.; Ribeiro, C.H. Decreased Invariant Natural Killer T-Cell-Mediated Antitumor Immune Response in Patients with Gastric Cancer. *Immunol. Cell Biol.* 2020, 98 (6), 500–513. https://doi.org/10.1111/imcb.12331.

Schäfer, C.; **Ascui, G.**; Ribeiro, C.H.; López, M.; Prados-Rosales, R.; González, P.A.; Bueno, S.M.; Riedel, C.A.; Baena, A.; Kalergis, A.M.; Carreño, L.J. Innate Immune Cells for Immunotherapy of Autoimmune and Cancer Disorders. *Int. Rev. Immunol.* 2017, 1–23. https://doi.org/10.1080/08830185.2017.1365145

Garrido-Tapia, M.; Hernández, C. J.; **Ascui, G.**; Kramm, K.; Morales, M.; Gárate, V.; Zúñiga, R.; Bustamante, M.; Aguillón, J. C.; Catalán, D.; Ribeiro, C. H.; Molina, M. C. STAT3 Inhibition by STA21 Increases Cell Surface Expression of MICB and the Release of Soluble MICB by Gastric Adenocarcinoma Cells. *Immunobiology.* 2017, 222 (11), 1043–1051. https://doi.org/10.1016/j.imbio.2017.05.009

Current Research (expanded description): Mucosal-associated invariant T (MAIT) cells play an important role fighting lung bacterial infections. Unlike conventional T cells, these cells recognize bacterial riboflavin metabolites. Our lab has detected an unexpected diversity of MAIT cell subtypes in mice as well as the persistence of these cells in lung tissue long term after infection. Using our single cell transcriptomic datasets, we have generated gene targets for an in vivo CRISPR screen designed to understand the dynamic generation of persistent MAIT cells which protect mice against further infections and whether these could be trained to improve protection. Receptor activity-modulator protein 3 (RAMP3) is a chaperon protein that aids in the transport, activity modulation and pharmacological switch of G-protein coupled receptors (GPCR). Many cytokine and chemokine receptors involved in immune cell recruitment and activation are GPCRs. Our lab has found that Ramp3 gene is overexpressed in innate T cells in the lungs of mice, particularly for MAIT cells and invariant Natural Killer T (iNKT) cells. We have observed that RAMP3 KO mice are more susceptible to bacterial infections, and we are currently exploring the mechanisms involved.

Benefits to Science and Society: Innate T cells like MAIT cells and iNKT cells are a growing family of donor-unrestricted T cells that have been proposed as an ideal target for both vaccine development and cancer immunotherapy, as they are recognized antigens that do not cross-react between individuals and could be used for adoptive transfer therapies. Understanding the biology behind these specialized T cells could be groundbreaking in the field of T cell biology, by describing a new type of immunological memory.

Personal Interests: I like hiking around the San Diego area, and I also enjoy reading, playing bass guitar and painting.

ARCS Award: I feel extremely honored to receive the ARCS Foundation Award. This award will be very significant to me as I will be able to remain financially stable while I complete my Ph.D. and will allow me to focus on my research rather than worrying about financial burdens of being a graduate student. It will also allow me to travel to conferences and interact more with collaborators. This award is a statement on how much our community values the advancement of science and education.

KRISTA PATRICE BALTO

University of California San Diego

Department of Chemistry and Biochemistry

Concentration: Chemistry

Specialization: Inorganic Synthesis and Materials Chemistry

Donor: The Conrad Prebys Foundation

Krista's research focuses on the creation of unique, highly reactive metal-based materials. Once created, Krista determines what these materials are capable of; some aid in the creation of organic molecules or polymers, like plastics, while others are capable of gas and liquid separations for industrial purposes.

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

Awards and Honors: Teddy Traylor Award, June 2022; National Science Foundation Graduate Research Fellowship, Honorable Mention, April 2021.
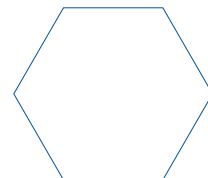
Publications, Papers, and Posters:

Balto, K.P.; Sikma, R.E.; Figueroa, J.S.; Cohen, S. Metal Organic Frameworks with Low Valent Metal Nodes Angew. *Chem. Int. Ed.* 2022, 61 (33), e202206353.

Balto, K. P.; Wang, Y.; Chen, A.; Figueroa, J. S.; Pascal, T.; Tao, A. R. Curvature-Selective Nanocrystal Surface Ligation Using Sterically-Encumbered Metal-Coordinating Ligands. *ACS Nano.* 2022, 16

Balto, K.P.; Gembicky, M.; Rheingold, A. L.; Figueroa, J. S. Crystalline Hydrogen-Bonding Networks and Mixed-Metal Framework Materials Enabled by an Electronically Differentiated Heteroditopic Isocyanide/Carboxylate Linker Group. *Inorganic Chemistry.* 2021, 60 (16), 12545-12554.

Lorzing, G. R.; **Balto, K.P.;** Antonio, A. M.; Trump, B. A.; Brown, C. M.; Bloch, E. D. Elucidating the Structure of the Metal–Organic Framework Ru-HKUST-1. *Chem. Mater.* 2020, 32, 18, 7710–7715. DOI: 10.1021/acs.chemmater.0c01944.

Current Research (expanded description): Krista's research focuses on the synthesis and characterization of m-terphenyl isocyanide based materials. She has synthesized a variety of novel low valent metal-organic framework materials to study their applications in catalysis and small molecule activation. In addition, she collaborates with the Department of NanoEngineering at UCSD on gold and silver nano-particle separations using designer isocyanide ligands.

Benefits to Science and Society: Due to the isolobal nature of isocyanides to carbon monoxide (CO), sterically bulky m-terphenyl isocyanide ligands have allowed for the stabilization and isolation of low-valent transition metal complexes involved in a variety of catalytic cycles. Without the use of such isocyanide ligands, understanding of the electronic structure and reactivity of intermediate metal-carbonyl complexes involved in catalysis would not be possible. Expanding this chemistry to materials has many potential applications in heterogeneous catalysis and reactivity.

Personal Interests: I enjoy weightlifting, surfing, running, trying new restaurants, and traveling.

ARCS Award: The ARCS Foundation award will allow me to continue my studies without worrying about inflation and rent prices in San Diego County. Receiving this award validates my research abilities and increases my confidence as a woman in STEM.
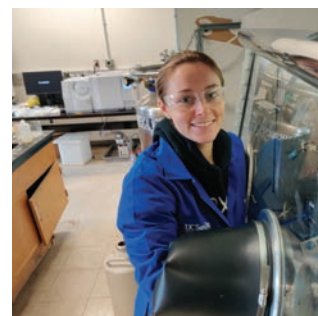
LAURA LYNN BECERRA

University of California San Diego

Jacob School of Engineering

Concentration: NanoEngineering

Specialization: Medical Devices and Systems

Donor: Kevin and Robert Bowden/ARCS Foundation-San Diego Chapter

Laura's research focuses on flexible sensor systems and haptic materials (which convey information via sense of touch) for physiological measurements. Her sensors are used to measure breathing activity in humans, as well as to prevent scar tissue from radiation treatments in the throats of cancer patients. She also investigates materials and their properties to create a desired touch sensation in humans, such as moisture or temperature. This is used for developing realistic technology to be used in surgical training simulations, virtual doctor visits, and virtual reality platforms, among other applications.

Degrees: M.S. in Electrical Engineering, University of California, San Diego; B.S./B.A. in Electrical Engineering, University of San Diego

Awards and Honors: National Science Foundation Graduate Research Fellowship, 2019; Electrical and Computer Engineering Department Fellowship, 2019.
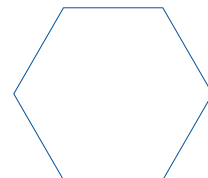
Publications, Papers, and Posters:

Becerra, L.L.; Rafeedi, T.; Ramanarayanan, S.; Frankel, I.; Yalcin, C.; Garudadri, H.; Ng, TN. Bi-directional Venturi Flowmeter with Capacitive Foam Sensing for Spirometry Measurements. Poster. *Materials Research Society Conference*, Honolulu, HI, May 2022.

Blau, R.; Chen, A.X.; Polat, B.; **Becerra, L.L.**; Runser, R.; Zamanimeymian, B.; Choudhary, K.; Lipomi, D.J. Intrinsically Stretchable Block Copolymer Based on PEDOT:PSS for Improved Performance in Bioelectronic Applications. *ACS Applied Materials & Interfaces*. 2022 14(4), 4823-4835 doi: https://doi.org/10.1021/acsami.1c18495

Polat, B.; **Becerra, L.L.**; Hsu, P.; Kaipu, V.; Mercier, P.P.; Cheng, C.; Lipomi, D.J. Epidermal Graphene Sensors and Machine Learning for Estimating Swallowed Volume. *ACS Applied Nano Materials*. 2021 4(8), 8126-8134 DOI: https://doi.org/10.1021/acsanm.1c01378

Becerra, L.L.; Ferrua, J.A.; Drake, M.J.; Kumar, D.; Anders, A.S.; Wang E.N.; Preston, D.J. Active Fume Hood Sash Height Monitoring with Audible Feedback. *Energy Reports*. 2018 4, 399-419 doi: https://doi.org/10.1016/j.egyr.2018.09.010

Current Research (expanded description): The broad objective of my research is to improve medical device technology. I have worked towards this goal in two research areas: flexible sensors and haptic materials. I have fabricated flexible capacitive foam sensors to develop a spirometer device capable of measuring bi-directional airflow from human breath. I have also contributed to a project using graphene strain sensors with metallic nanoislands and electromyography electrodes made of conductive polymer as a wearable device. This wearable sensor device is placed on the throats of human subjects to predict swallowed liquid volumes by the subjects with the use of machine learning. We also used these sensors on the throats of cancer patients at the MD Anderson Cancer Center to prevent dysphagia development from radiation treatments.

Haptic materials are used in technologies that transmits information through the sense of touch. I have conducted human subject experiments to psychophysically test user tactile perception of certain sensations, such as moisture and temperature. This has been tested with polyacrylamide hydrogels of different stiffnesses soaked in liquids of different thermal conductivities. I am also investigating the use of magnetically actuated ferrofluid for different perceived thermal sensations. Improved haptic materials will contribute to more realistic sensations in haptic technology.

Benefits to Science and Society: Flexible sensors are extremely beneficial for medical technology. In my applications, they can play a key role in preventing and diagnosing respiratory illnesses and in detecting dysphagia development in the throats of cancer patients. Haptic materials (which convey sense of touch) contribute to realistic human-machine interfaces in devices such as surgical training simulations, tele-operations, and remote doctor visits. Both avenues show promise in improving physiological measurements and human-machine interfaces.

Personal Interests: I enjoy salsa and bachata dancing, baking, and spending time with friends and family.

ARCS Award: I am extremely grateful to be selected as an ARCS Scholar. I am eager to have the opportunity to share my research with the ARCS community and network with other enthusiastic Scholars. This award has also relieved a tremendous amount of financial stress and will allow me to focus more of my attention on research. As a woman in a male-dominated field, it is also very inspiring to be a part of a national organization started entirely by women. I hope to create new knowledge in my field with the use of the amazing benefits and tools of this fellowship.
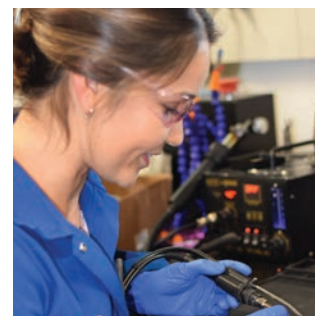
ALEC JOSEPH CALAC

University of California San Diego

Herbert Wertheim School of Public Health and Human Longevity Science

Concentration: Medicine and Public Health

Specialization: Global Health

Donor: Lambert Foundation for Education

Alec is an MD/PhD Candidate at UC San Diego School of Medicine and Herbert Wertheim School of Public Health and Human Longevity Science. He works collaboratively with the Global Health Policy and Data Institute on research projects integrating social media, health technology, health policy, and Tribal public health. He currently serves as the National President of the Association of Native American Medical Students. In 2022, he was named a 40 Under 40 Leader in Minority Health by the National Minority Quality Forum and was also chosen to participate in the White House Leaders in Health Equity Roundtable Series.

Degree: B.S. in Neuroscience and Cognitive Science and Molecular and Cellular Biology, University of Arizona

Awards and Honors: California Area Local Impact Award, National Indian Health Board 2021; Clinton Global Initiative University, Clinton Foundation 2021; Trainee Leadership Award, Building the Next Generation of Academic Physicians 2020; Outstanding Community Leader Award, University of California San Diego Graduate Division 2020.
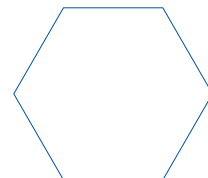
Publications, Papers, and Posters:

Mackey, T.K.; **Calac, A.J.**; Keshava B.S.; Yracheta, J; Tsosie, K.S.; Fox, K. Establishing a Blockchain-enabled Indigenous Data Sovereignty Framework for Genomic Data. *Cell*. 2022;185(15):2626-2631. doi:10.1016/j.cell.2022.06.030

Calac, A.J.; Hoss, A. Vaccine Passports and Indian Country: Nothing Fast About It [published online ahead of print, 2022 Jun 1]. *Public Health Rep*. 2022;333549221094557. doi:10.1177/00333549221094557

Calac, A.J.; Haupt, M.R.; Li, Z.; Mackey, T. Spread of COVID-19 Vaccine Misinformation in the Ninth Inning: Retrospective Observational Infodemic Study. *JMIR Infodemiology*. 2022;2(1):e33587. Published 2022 Mar 16. doi:10.2196/33587

Calac, A.J.; Southwell, BG. How Misinformation Research Can Mask Relationship Gaps that Undermine Public Health Response. *Am J Health Promot*. 2022;36(3):561-563. doi:10.1177/08901171211070951
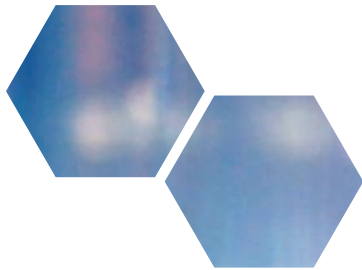
Current Research (expanded description):   There is growing interest in using big data and machine learning approaches to capture and analyze user behaviors in the emerging interdisciplinary field of infoveillance, defined as using sources of Internet data, including via social media platforms, to identify and characterize information about human behavior, particularly in the context of public health. I am particularly interested in the ethical issues that arise when researchers wish to conduct social media research involving Native Americans. I have previously conducted research on how social media users respond to COVID-19 vaccine-related outreach events using vaccine hesitancy frameworks developed by the World Health Organization. I hope to develop and expand on existing frameworks for responsible conduct of research that respects all ethical, legal, and social considerations.

Benefits to Science and Society: Research involving Native American Tribes has long been extractive, with little to no benefit for the communities involved. I am the first from my Tribe to pursue an MD/PhD, hoping to challenge the status quo and ensure that health research involving Native American Tribes is linked to the priorities of their communities. I hope this will minimize potential harm and maximize the potential benefit that such research may yield.

Personal Interests: Homemade ice cream, indoor rock climbing, mentoring youth, exploring craft breweries, and checking out new coffee shops.

ARCS Award: The ARCS Foundation award means everything to me as a Native American scholar. An investment in me is an investment in my community.

AUSTIN JOSEPH CARTER

University of California San Diego

Scripps Institution of Oceanography

Concentration: Geosciences

Specialization: Geochemistry

Donor: The Reuben H. Fleet Foundation

Austin studies the chemistry, shape, and concentration of mineral dust (fine-grained particles of rock) trapped in polar ice. He drills cores of ice on the East Antarctic Ice Sheet, carefully separates the dust, and measures its properties. These small, solid impurities can provide insight into how the conditions on the Earth's surface and the flow of air may have changed through time. By understanding how the environment has changed in the past, his research aims to better project how the environment will change in the future.
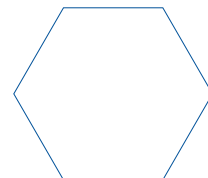
Degrees: M.S. in Earth Sciences, University of California, San Diego; B.S. in Earth and Environmental Sciences, University of Michigan

Awards and Honors: Geological Society of America Graduate Student Geoscience Grant, 2022; Awards for Geochronology Student Research 2, 2021; U.S. Department of Defense: Antarctic Service Medal, 2021; AGU Cryosphere Innovation Award, 2020

Publications, Papers, and Posters:

Wendt, K.A.; Bennett, H.I.; **Carter, A.J.**; Marks-Peterson, J.C. Our Frozen past: Ice Core Insights into Earth's Climate History. *Past Global Changes Magazine* (in press).

Carter, A.; Aarons, S.M.; Higgins, J.A.; Shackleton, S.; Epifanio, J.; Morgan, J.D.; Severinghaus, J.P.; Brook, E.J.; Kurbatov, A.; Gabrielli, P. Characterizing the Source of Mineral Dust in Ice from the Allan Hills, East Antarctica during the Last Interglacial Period. *American Geophysical Union Fall Meeting 2021*.

Current Research (expanded description): During an ice age, Earth's climate is punctuated by periods of cold temperature marked by rapid glacial growth (glacial periods) alternating with periods of warmer climate marked by glacial retreat and/or stagnation (interglacial periods). The concentration, composition, and transport of mineral dust is dependent on the climate-regime, with markedly higher dust fluxes during glacial periods compared to interglacial periods. My research studies the transition from a glacial period into the last interglacial period (145,000-120,000 years ago). Characterizing dust source during the last interglacial period is analytically challenging due to the low quantities of material in the ice. Previous work has indicated that dust deposition during the last interglacial period was distinct with a young volcanic composition characteristic of the West Antarctic Rift System. This distinct dust composition implies a major change in atmospheric dynamics and/or exposure of material. To further constrain the source region, my research probes the mineral dust record contained within high-volume and high-resolution ice from the Allan Hills Blue Ice Area.

Benefits to Science and Society: During the last interglacial period, the climate was 3 degrees Celsius warmer than the pre-industrial era and the sea level was about 5.5-9 meters higher than today. Moreover, it is speculated that the West Antarctic Ice Sheet was severely diminished in size during the last interglacial period. By understanding what happened during the last interglacial period, my goal is to provide information on future possible major changes in the extent of the Antarctic ice sheet.

Personal Interests: I enjoy listening to music, exploring the beach, making paper crafts, and baking some indulgent dessert that I will regret later.

ARCS Award: One day, I hope to become an influential leader in an increasingly vital field of study—the frozen part of our planet. The generous support of the ARCS Foundation provides added motivation and momentum needed toward this career aspiration. Thank you sincerely for supporting my educational pursuits and my path towards a career in science.

KELLEN JAMES CAVAGNERO

University of California San Diego

Department of Dermatology

Concentration: Immunology and Microbiology

Specialization: Inflammation and Infectious Disease

Donor: Dr. Patricia Judd

Kellen's mission is to better understand the immune system in order to more effectively prevent and treat infectious disease, autoimmunity, allergy, and cancer. Specifically, his research focuses on defining what happens after initial exposure to an inflammatory stimulus. Prior to starting his Ph.D., Kellen made significant contributions to the field of allergic airway disease under the mentorship of Dr. Taylor Doherty. Now, as a Ph.D. student under the mentorship of Dr. Richard Gallo, his work is changing how we think about skin and gut infectious and inflammatory diseases.

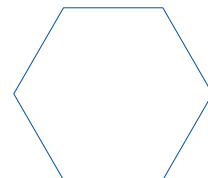Degree: B.S. in Pharmacology, University of California, Santa Barbara

Awards and Honors: National Cancer Institute Outreach Award, 2022; Society for Investigative Dermatology, Future Leaders Retreat Invitation, 2022; National Science Foundation Graduate Research Fellowship, 2021; UCSD Gastroenterology T32 Predoctoral Fellowship, 2020.

Publications, Papers, and Posters:

Marotz, C.; **Cavagnero**, **K.J.**; Song, S.J.; McDonald, D.; Wandro, S.; Humphrey, G.; Bryant, M.; Ackermann, G.; Diaz, E.; Knight, R. Evaluation of the Effect of Storage Methods on Fecal, Saliva, and Skin Microbiome Composition. *mSystems*. 2021, 6 (2). DOI: 10.1128/mSystems.01329-20 (co-first authors)

Cavagnero, **K.J.**; Badrani, J.H.; Naji, L.H.; Amadeo, M.B.; Leng, A.S.; Lacasa, L.D.; Strohm, A.N.; Renusch, S.R.; Gasparian, S.S.; Doherty, T.A. Cyclic-di-GMP Induces STING-Dependent ILC2 to ILC1 Shift During Innate Type 2 Lung Inflammation. *Front Immunol*. 2021, 12, 618807. DOI: 10.3389/fimmu.2021.618807

Cavagnero, **K.J.**; Badrani, J.H.; Naji, L.H.; Amadeo, M.B.; Shah, V.S.; Gasparian, S.; Pham, A.; Wang, A.W.; Seumois, G.; Croft, M.; et al. Unconventional ST2- and CD127-negative Lung ILC2 Populations are Induced by the Fungal Allergen Alternaria alternata. *J Allergy Clin Immunol*. 2019, 144 (5), 1432-1435.e1439. DOI: 10.1016/j.jaci.2019.07.018

Karta, M. R.; **Cavagnero**, **K**.; Miller, M.; Badrani, J.; Naji, L.; Doherty, T. A.; Broide, D. H. Platelets Attach to Lung Type 2 Innate Lymphoid Cells (ILC2s) Expressing P-selectin Glycoprotein Ligand 1 and Influence ILC2 Function. *J Allergy Clin Immunol.* 2019, 144 (4), 1112-1115.e1118. DOI: 10.1016/j.jaci.2019.06.001 (co-first authors)

Current Research (expanded description): The goal of my current research is to uncover novel and critical functions of dermal fibroblasts in skin immune defense. It is now recognized that fibroblasts are a heterogeneous population, not a single cell type only responsible for production of matrix and scar. These spindle-shaped cells take on a variety of distinct functional states that are specific to tissue location and environment. In addition to the classical activity of fibroblasts to produce extracellular matrix, fibroblasts have also been shown to exhibit immune activity. My work suggests that fibroblasts in the skin act directly in innate immune defense by producing antimicrobial peptides and driving neutrophil recruitment, leading me to the hypothesis that fibroblasts serve a previously unappreciated role as central coordinators of cutaneous inflammation and host defense. My thesis work in the Gallo lab focuses on understanding the mechanisms used by fibroblasts to promote neutrophil chemotaxis and antimicrobial activity, uncovering how fibroblasts are activated to initiate host defense functions, and determining the significance of fibroblast activity in vivo.

Benefits to Science and Society: Current improvements in the treatment of skin diseases have come from an increased understanding of how keratinocytes and classical, bone marrow-derived immunocytes participate in the skin immune system. However, many inflammatory and infectious skin diseases with serious impact on human health remain inadequately treated and without cures. An opportunity to advance treatment may come from more research on other cell types in the skin that appear to play important immunological functions.

Personal Interests: I enjoy spending time with friends and family and outdoor activities like surfing, hiking, and scuba diving.

ARCS Award: The cost of living near my university has skyrocketed in recent years, while my stipend has remained the same. The extra financial support provided by the ARCS Foundation will give me the freedom to spend more time thinking about my research rather than my finances. I am grateful and honored to have received the award.
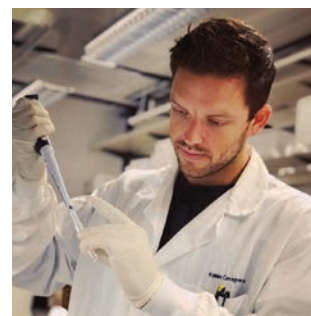
MINERVA CONTRERAS

University of California San Diego

Neurosciences Graduate Program

Concentration: Cellular and Molecular Biology

Specialization: Neurobiology

Donor: Laverne Briggs Family

The brain can modify its connections in response to experience, this is known as plasticity. During development, the brain's ability to respond to experience by making new connections, strengthening, or eliminating old ones, is high. As one gets older, this ability decreases. This explains why learning a new language is easier when one is young, for example. Minerva studies the mechanisms by which astrocytes, a type of non-neuronal cell, regulate plasticity in response to experience. She also hopes to elucidate therapeutic targets for neurodevelopmental diseases where plasticity alterations are hallmarks.
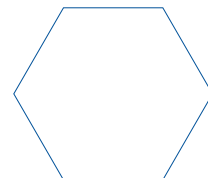
Degree: B.S. in Biotechnology, Universidad Autonoma de Queretaro, Mexico

Awards and Honors: 2022-2025 Predoctoral Fellowship, NASEM, Ford Foundation Fellowship; 2021-2022 Honorable Mention, NSF Graduate Research Fellowship; 2020-2021 Neurosciences Graduate Program T32 Trainee, UC San Diego; 2019-2020 Summer Training Academy for Research Success Graduate Fellowship, UC San Diego

Publications, Papers, and Posters:

Sancho, L.; **Contreras, M.**; Allen, N.J. Glia as Sculptors of Synapti Plasticity. *Neuroscience Research.* 2020 Dec 11:S0168- 0102(20)30488-0. DOI: 10.1016/j.neures.2020.11.005. PMID: 33316304. [https://doi. org/10.1016/j.neures.2020.11.005]

Minata, M.; Audia, A.; Shi, J.; Songjian, L.; Bernstock, J.; Pavlyukov, M.S.; Das, A.; Kim, S.; Shin, Y.J.; Lee Y.; Koo, H.; Snigdha, K.; Waghmare, I.; Guo, X.; Mohyeldin, A.; Gallego-Perez, D.; Wang, J.; Chen, D.; Cheng, P.; Mukhee, F.; **Contreras, M**.; Reyes, J.F.; Vaillant, B.; Sulman, E.P.; Cheng, S.; Markert, J.M.; Tannous, B.A.; Lu, X.; Kango-Shingh, M.; Lee, L.J.; Na, D.; Nakano, I.; Bhat, K.P. Phenotypic Plasticity of Invasive Edge Glioma Stem-Like Cells in Response to Ionizing Radiation. *Cell Reports.* 2019 February. 26(7):1893-1905. https://doi. org/10.1016/j.celrep.2019.01.076

Contreras, M.; Schwartz, J.; Aigner, S.; Yeo, GW. Deletion of CGG Microsatellite Repeat Expansion RNA Characteristic of Fragile-x-associated Tremor/ataxia Syndrome by RNA-targeting Cas Proteins. Poster presentation at the *National Diversity in STEM Conference*, Society for the Advancement of Chicanos/Hispanic and Native Americans in Science (SACNAS), Oct. 2018, San Antonio, TX.

Contreras, M.; Bhat, K.P. Deciphering the Molecular Link of CD109, TAZ, and β-catenin in the Mesenchymal Subtype of Glioma Stem Cells. Poster presentation at the *5to Encuentro de Jovenes Investigadores del Estado de Queretaro*. Queretaro, Mexico, October 2017.

Current Research (expanded description): Astrocytes are a type of glial cell, and an important function of these cells is the regulation of neuronal synaptic plasticity. The period in development when neural circuits are shaped by experience is termed the critical period. During the visual critical period, development of normal vision depends on proper visual input. Monocular deprivation, or the occlusion of sensory input to one eye, when performed during the critical period, leads to ocular dominance plasticity (ODP). ODP occurs when activity from the occluded eye is reduced, thereby allowing the open eye to take over the visual cortex territory of the occluded eye. Interestingly, introduction of juvenile astrocytes to the adult visual cortex reinduces ODP, suggesting a role for astrocytes in regulating critical period plasticity. Thus, ODP offers a reliable way to explore how changes in sensory experience lead to astrocyte regulation of neural circuit plasticity. To investigate this, response to monocular deprivation will be explored in mice where astrocytes undergo genetic manipulation during the critical period and adulthood, in addition to assessing synaptic activity and spine density. The proposed research will investigate the role astrocytes in regulating experience-dependent plasticity during the critical period and adulthood.

Benefits to Science and Society: The results obtained from my research project will lead to further understanding the molecular mechanisms that regulate experience-dependent plasticity. Further, it will identify whether immediate early genes in astrocytes play a regulatory role in response to experience-dependent neuronal activity resulting in an important contribution to understanding the internal molecular mechanisms of astrocytic regulation.

Personal Interests: When not in the lab, you may find me outdoors enjoying this beautiful San Diego weather with my wife and dogs. I love hiking, camping, going to the beach, and snorkeling.

ARCS Award: I am incredibly grateful and honored to be an ARCS Scholar. This recognition motivates me to continue my quest for new knowledge. It reminds me that even though my contribution to science might be a tiny piece of the complicated puzzle that is the brain, it is a piece that gets us closer to understanding the brain as a whole nonetheless.

RUBEN DANIEL ELIAS

University of California San Diego

Department of Chemistry and Biochemistry

Concentration: Biophysics

Specialization: Structural Biology

Donors: Paul and Cleo Schimmel/ARCS Foundation - San Diego Chapter

Ruben's work focuses on understanding how disordered proteins are utilized to orchestrate large scale biological events such as cell division and HIV-1 replication. Protein regions without well-defined, three-dimensional structures are often heavily involved in signal transduction pathways which regulate the timing of cellular processes. Viruses such as HIV-1 take advantage of this by using their own disordered domains to hijack cellular machinery. Ruben develops and applies methods to characterize these disordered proteins, providing valuable insight into their biological significance and towards future drug development.
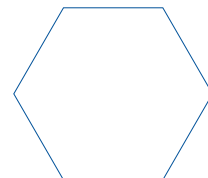
Degrees: M.S. in Chemistry, University of California San Diego; B.S. in Biochemistry, University of California Riverside

Awards and Honors: Bruno Zimm Award, August 2022; University of California San Diego Teddy Traylor Award, July 2021; National Science Foundation Graduate Research Fellowship Program, April 2020; Maximizing Access to Research Careers, Undergraduate Student Training in Academic Research (MARC U-STAR) Trainee, July 2017

Publications, Papers, and Posters:

Elias, R. D.; Ma, W.; Ghirlando, R.; Schwieters, C.D.; Reddy, V.S.; Deshmukh, L. Proline-rich Domain of Human ALIX Contains Multiple TSG101-UEV Interaction Sites and Forms Phosphorylation-mediated Reversible Amyloids. *Proc Natl Acad Sci USA.* 2020, 117 (39), 24274-24284

Elias, R. D.; Ramaraju, B.; Deshmukh, L. Mechanistic Roles of Tyrosine Phosphorylation in Reversible Amyloids, Autoinhibition, and Endosomal Membrane Association of ALIX. *J Biol Chem.* 2021

Current Research (expanded description): Spatiotemporal regulation of cellular machinery is critical in orchestrating the complex and large-scale events in the lifecycle of the cell. This is evident in the endosomal sorting complex required for transport (ESCRT) pathway, an evolutionarily conserved membrane-remodeling system involved in cytokinesis, exosome biogenesis, and the budding of enveloped viruses such as HIV-1 and Ebola, where misregulation is connected to a myriad of cancers. ALIX is a versatile adaptor protein involved in numerous ESCRT-mediated processes. Timed recruitment of ALIX is proposed to be mediated through its disordered proline-rich domain (PRD), which contains multiple proline-rich motifs that bind to different cellular signaling modules such as SH3, UEV, and WW domains. However, a previous lack of in-depth biophysical studies of full-length ALIX or ALIX-PRD has impeded an understanding of the molecular mechanisms by which ALIX regulates the ESCRT pathway. In the Deshmukh lab, Ruben characterizes ALIX and the protein-protein interactions which underly its biological functions using modern biophysical methods, primarily solution NMR. In his work, Ruben has discovered that ALIX and similar proteins are capable of forming amyloid fibrils, structures which are typically considered a pathogenic and a 'dead-end' for a protein, which can be reversibly dissolved mediated by post-translational modifications or certain binding partners. Understanding how these reversible systems function at an atomic level will better elucidate how our cells organize and time critical events in the cell-cycle.

Benefits to Science and Society: Disordered proteins are typically less well-understood than their structured counterparts. I hope my work can provide a general guide for the biochemistry community at large toward the characterization of disordered proteins. More specifically, as ALIX is involved in multiple cancers, the budding of viruses such as HIV-1, and fundamental biological processes like cytokinesis, my work on ALIX will provide further insight to possible avenues of therapeutic intervention.

Personal Interests: I am involved in science outreach and enjoy writing music.

ARCS Award: ARCS Foundation's commitment to supporting the individuals behind the science is entirely refreshing. Receipt of the ARCS Foundation award symbolizes outward recognition that I am working towards something meaningful. Additionally, it provides continued motivation to carry on, and affirms that I can impact the local and scientific community. I am beyond grateful for the ARCS Foundation award.

SONYA RENEE HAUPT

University of California San Diego

Health Sciences

Concentration: Biomedical Sciences

Specialization: Immunology

Donors: Timkin-Sturgis Foundation/ARCS Foundation - San Diego Chapter

Sonya is researching novel technology to be used in HIV (human immunodeficiency virus) vaccines. She evaluates the immune response in model organisms to project what vaccination strategy will create broadly-neutralizing antibodies in humans. Her first project is developing a helper T cell epitope tag that can work across all human HLA types to boost germinal center education of antibody responses. Her second project is modeling how vaccines benefit from different components administered in each dose to progressively coach cells to evolve better neutralizing antibodies. Although HIV vaccines are not effective yet, she hopes that her contribution may help her see an approved HIV vaccine in our lifetime.
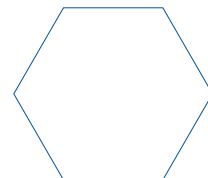
Degrees: M.S in Structural Biology in Molecular and Cellular Biology, University of Connecticut; B.S. in Molecular and Cellular Biology, University of Connecticut

Awards and Honors: University of Connecticut - Outstanding Senior in Molecular and Cellular Biology, 2016; University Scholar (1 of 28 selected) University of Connecticut, 2015; Life Sciences Honors Thesis Award Funding, University of Connecticut, 2014; Daniel Hand High School, Outstanding Achievement in Sciences, 2011

Publications, Papers, and Posters:

Dan, J.M.; Mateus, J.; Kato, Y.; Hastie, K.M.; Yu, E.D.; Faliti, C.E.; Grifoni, A.; Ramirez, S.I.; **Haupt, S**.; Frazier, A.; Nakao, C.; Rayaprolu, V.; Rawlings, S.A.; Peters, B.; Krammer, F.; Simon, V.; Saphire, E.O.; Smith, D.M.; Weiskopf, D.; Sette, A.; Crotty, S. Immunological Memory to SARS-CoV-2 Assessed for up to 8 Months after Infection. *Science.* 2021, 371 (6529), eabf4063. https://doi.org/10.1126/science.abf4063

Dooley, K.; McConnell, R.E.; Xu, K.; Lewis, N.D.; **Haupt, S**.; Youniss, M R.; Martin, S.; Sia, C. L.; McCoy, C.; Moniz, R.J.; Burenkova, O.; Sanchez-Salazar, J.; Jang, S.C.; Choi, B.; Harrison, R.A.; Houde, D.; Burzyn, D.; Leng, C.; Kirwin, K.; Ross, N.L.; Finn, J.D.; Gaidukov, L.; Economides, K.D.; Estes, S.; Thornton, J.E.; Kulman, J.D.; Sathyanarayanan, S.; Williams, D.E. A Versatile Platform for Generating Engineered Extracellular Vesicles with Defined Therapeutic Properties. *Mol Ther.* 2021, 29 (5), 1729–1743. https://doi.org/10.1016/j.ymthe.2021.01.020

Kato, Y.; Abbott, R. K.; Freeman, B. L.; **Haupt**, **S.**; Groschel, B.; Silva, M.; Menis, S.; Irvine, D. J.; Schief, W. R.; Crotty, S. Multifaceted Effects of Antigen Valency on B Cell Response Composition and Differentiation In Vivo. *Immunity.* 2020. https://doi.org/10.1016/j.immuni.2020.08.001

Lewis, N. D.; Sia, C. L.; Kirwin, K.; **Haupt**, **S.**; Mahimkar, G.; Zi, T.; Xu, K.; Dooley, K.; Jang, S. C.; Choi, B.; Boutin, A.; Grube, A.; McCoy, C.; Sanchez-Salazar, J.; Doherty, M.; Gaidukov, L.; Estes, S.; Economides, K. D.; Williams, D. E.; Sathyanarayanan, S. Exosome Surface Display of IL-12 Results in Tumor-Retained Pharmacology with Superior Potency and Limited Systemic Exposure Compared to Recombinant IL-12. *Mol Cancer Ther.* 2020, molcanther.0484.2020. https://doi.org/10.1158/1535-7163.mct-20-0484

Current Research (expanded description):   While working in a biotechnology startup I fell in love with the interdisciplinary nature of making novel therapeutics. It was the first time I realized my academic background could transcend into translational research, where engineering advancements and tenants of biology must be expertly blended to create the next wave of medicines. When I returned to graduate school and the world of academic science, I was drawn to this interface of what we know and what we can do with it in Dr. Shane Crotty's lab. Dr. Crotty and his lab have been large contributors to understanding germinal center dynamics as they relate to the body's adaptive immune response to vaccines. Along with his collaborators, I have joined the effort to engineer and evaluate novel antigens, dosing regimens, delivery systems, and adjuvants as components in an effective HIV vaccine. While the fight to make a HIV vaccine has been ongoing for some time, new hope was ignited in 2009 with the discovery that some long-term infected HIV patients were able to make broadly neutralizing antibodies. How to create this antibody response in unexposed individuals with only a few vaccine doses is what our lab models in mice and non-human primates.

Benefits to Science and Society: Vaccines have proven to be the most effective medical technology for improving global health. As preventative and single use medicines they are easy to administer to populations of all socio-economic levels. In the case of polio, they were so effective as to eradicate the disease entirely. Yet some extremely advanced pathogens overcome common vaccination strategies. Such is the case with HIV (human immunodeficiency virus) which infects 1.5 million people every year and becomes a life long infection, ultimately killing almost 1 million people per year as of 2020.

Personal Interests: I enjoy mentally challenging exercise and connecting with others. I have found such with ultimate frisbee and outdoor rock climbing.

ARCS Award: I am extremely honored to get this award. I am excited to attend events and learn from and about other members. Being an ARCS awardee has made me think about how I can contribute to maintaining a healthy scientific culture in the US along with a healthier global population. Additionally, female leadership and empowerment are topics near to my heart and so I value that this foundation is one more example of that!
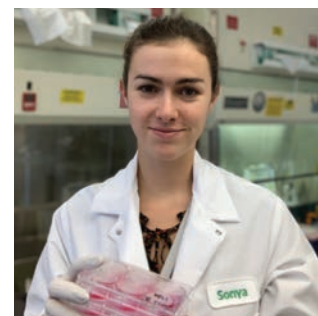
JOHN JAEUN HOLOUBEK

University of California San Diego

Jacobs School of Engineering

Concentration: NanoEngineering

Specialization: Electrochemical Energy Storage

Donor: Ellen Browning Scripps Foundation

John's work aims to understand the energetics and dynamics of various ionic processes at the electrolyte/electrode interphase of electrochemical devices. He currently studies these charge-transfer processes in the context of lithium batteries, which typically fail to provide meaningful power output when operated under significant kinetic strain. He is currently engaged in a long-term effort to develop electrolyte design principles for lithium metal batteries at ultra-low temperatures. These findings aim to convert fundamental electrochemistry principles to application-based technological progress, which will have impact beyond batteries.

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

Awards and Honors: NASA Graduate Research Fellow, 2020-Present; Powell Foundation Fellow, 2018-2019
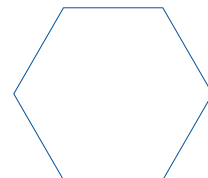
Publications, Papers, and Posters:

Holoubek, J.; Kim, K.; Yin, Y.; Wu, Z.; Liu, H.; Li, M.; Chen, A.; Gao, H.; Cai, G.; Pascal, T. A.; Liu, P.; Chen, Z. Electrolyte Design Implications of Ion-Pairing in Low-Temperature Li Metal Batteries. *Energy Environ. Sci.* 2022, 15 (4), 1647–1658

Holoubek, J.; Baskin, A.; Lawson, J. W.; Khemchandani, H.; Pascal, T. A.; Liu, P.; Chen, Z. Predicting the Ion Desolvation Pathway of Lithium Electrolytes and Their Dependence on Chemistry and Temperature. *J. Phys. Chem. Lett.* 2022, 4426–4433

Holoubek, J.; Liu, H.; Wu, Z.; Yin, Y.; Xing, X.; Cai, G.; Yu, S.; Zhou, H.; Pascal, T. A.; Chen, Z.; Liu, P. Tailoring Electrolyte Solvation for Li Metal Batteries Cycled at Ultra-Low Temperature. *Nature Energy.* 2021, 6 (3), 303–313

Holoubek, J.; Yu, M.; Yu, S.; Li, M.; Wu, Z.; Xia, D.; Bhaladhare, P.; Gonzalez, M. S.; Pascal, T. A.; Liu, P.; Chen, Z. An All-Fluorinated Ester Electrolyte for Stable High-Voltage Li Metal Batteries Capable of Ultra-Low-Temperature Operation. *ACS Energy Lett.* 2020, 1438–1447

Current Research (expanded description): Battery performance is generally understood to be defined by the electrochemical stability of their component parts, as well as the kinetic limitations associated with the bulk liquid electrolyte, bulk solid electrode, and the interphase between them. Though much progress has been made in understanding and improving the kinetics of these processes, the link between interphase chemistry and the kinetics of charge-transfer is relatively fuzzy. Our recent work has established a largely qualitative, but robust relationship between the ionic structure of the electrolyte and the power retention of battery devices at reduced temperature, indicative of superior charge-transfer energetics. My current research aim is to accurately describe the energy penalty associated with Li metal conversion as a function of the Li+ solvation structure in solution. Funded by NASA, this work integrates rigorous theoretical simulations with experimental testing and characterization. We aim to make a worth-while contribution to the fundamental understanding of interphasial ion dynamics in the context of lithium-based secondary batteries while providing engineering strategies applicable to a variety of electrochemical technologies.

Benefits to Science and Society: Improving the performance of high-energy secondary batteries is crucial to the adoption of electric transport and the operation of advanced portable electronics. These technologies currently fail to deliver adequate performance under increased charging speed and reduced temperatures. A significant contributor to these struggles is the poorly understood "charge-transfer" process at the interphase between electrolyte and electrode within the cell. Our work aims to accurately describe the energetic landscape of this process and derive effective design strategies to improve performance.

Personal Interests: In my free time, I enjoy playing basketball, and I am currently learning to surf (with limited success).

ARCS Award: This ARCS award is a tremendous honor that I am humbled to receive. I cannot claim to have ever been considered an elite student, but this award has affirmed to me that my love for research has been recognized in a significant way. I am very grateful to the ARCS Foundation for the support, which I will do my best to live up to.
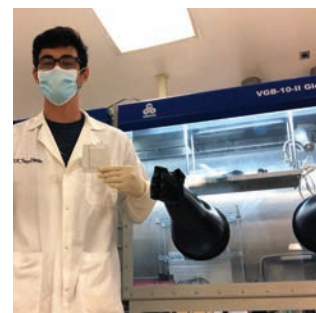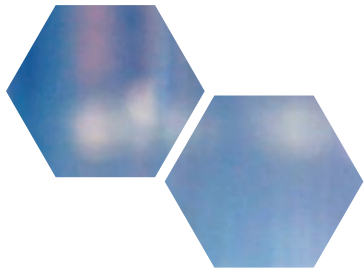
NATHANIEL MAX KLEVIT HOPKINS

University of California San Diego

Jacobs School of Engineering

Concentration: Computer Science/Engineering

Specialization: Theoretical Computer Science

Donor: Kathryn Crippen Hattox Endowment

From measurements of the largest galaxies to the smallest proteins, scientists now record more data in a day than they can possibly handle in a lifetime. This has led to a modern-day scientific revolution, where data-hungry machine learning techniques are used to attack age-old problems like protein folding. These applications, however, require data annotated by people, which is prohibitively expensive for applications like computer-assisted medical diagnosis. Max's research focuses on the theory behind how easily-accessible raw data combined with a few enriched annotations can significantly reduce otherwise infeasible labeling costs.

Degree: B.A. in Mathematics, Harvard University

Awards and Honors: National Science Foundation GRFP Award 2018, JSOE Fellowship 2018, Phi Beta Kappa 2017, United States Presidential Scholar 2014
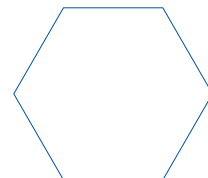
Publications, Papers, and Posters:

Hopkins, M.; Lin, T. Explicit Lower Bounds Against $\Omega(n)$-Rounds of Sum-of-Squares. *2022 Symposium on Foundations of Computer Science*

Bafna M.; **Hopkins, M.**; Kaufman T.; Lovett, S. Hypercontractivity on High Dimensional Expanders: a Local-to-Global Approach for Higher Moments. *2022 Symposium on Theory of Computing*

Bafna M.; **Hopkins, M.**; Kaufman T.; Lovett, S. High Dimensional Expanders: Eigenstripping, Pseudorandomness, and Unique Games. *2022 ACM-SIAM Symposium on Discrete Algorithms*

Hopkins, M.; Kane, D.; Lovett, S. Mahajan G. Point Location and Active Learning: Learning Halfspaces Almost Optimally. *2020 Symposium on Foundations of Computer Science*

Current Research (expanded description): Given a set of n unlabeled data points and query access to an oracle labeling them, how many questions are required to label all n points? This fundamental question lies at the heart of active learning, a field which aims to use adaptivity to exponentially reduce the number of labeled samples required for machine learning. If our n points can be labeled arbitrarily, the answer to this question is of course n—we must query every point. On the other hand, if we are promised the underlying labeling has some structure, one might hope it could be leveraged to use only log(n) adaptive questions.
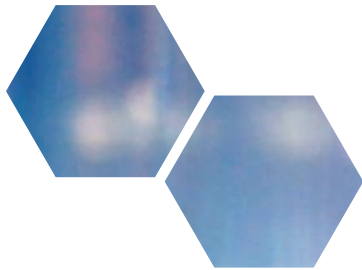
Unfortunately, it turns out that in the standard model this is impossible, even for basic structures. My research focuses on breaking this barrier by asking more informative questions beyond labels (e.g. by comparing points). In a series of works, my collaborators and I have shown optimal algorithms for learning under a number of reasonable structures such as halfspaces, rectangles, decision trees, and polynomial threshold functions via access to natural enriched queries. Applying these results to standard learning paradigms gives query-efficient learners that never make an error (though they may occasionally respond "I don't know").

Benefits to Science and Society: Many important real-world applications of machine learning are hampered by the fact that labeling data is infeasibly expensive. My research suggests that this is not an inherent barrier, and that by developing natural application-specific questions, it may be possible to harness powerful supervised learning techniques without the associated cost. Since our algorithms are additionally more reliable than standard techniques, we hope they can find use in important high-risk applications like preventative medicine and computer-assisted diagnoses.

Personal Interests: In my free time I sing acapella and barbershop music, and enjoy pretty much every form of game.

ARCS Award: I am humbled and thankful for the support of the ARCS Foundation. To me, the award means far more than its financial implications alone. ARCS is the promise of a robust scientific community, and the recognition of years of hard work that could often feel thankless in the face of failure and rejection. I am honored to be counted among its members, and excited to see what the community has in store.
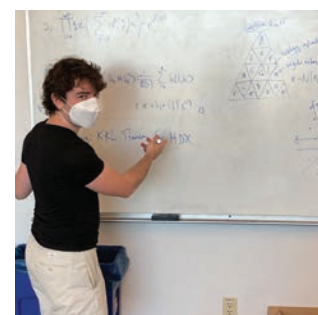
JERVAUGHN DEANTHONY HUNTER

University of California San Diego

Jacobs School of Engineering

Concentration: Bioengineering

Specialization: Tissue Engineering and Regenerative Medicine

Donor: Wally Schirra Memorial Endowment Fund

Jervaughn's research focuses on utilizing injectable therapeutics to treat right ventricular heart failure. After injury, the right ventricle undergoes negative remodeling which can be characterized by cardiac cell death and the healthy tissue being replaced with scar tissue, resulting in heart failure. Currently, there are no treatments on the market that address this remodeling and the only cure would be total organ transplant. By evaluating these therapeutics in pre-clinical models, Jervaughn hopes to demonstrate their efficacy in mitigating this remodeling and ultimately bring these treatments from bench to bedside.

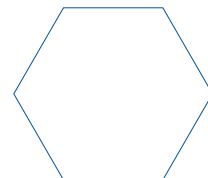Degree: B.S. in Biomedical Engineering, University of Alabama at Birmingham

Awards and Honors: Siebel Scholar Award 2023; UAB Young Alumni Rising Star Award 2022; Ruth L. Kirschstein National Research Service Award Individual Predoctoral Fellowship to Promote Diversity in Health-Related Research 2021; Omega Psi Phi Fraternity, Inc. Graduate Scholarship Grant 2020.

Publications, Papers, and Posters:

Hunter, **J.D.**; Hancko, A.; Shakya, P.; Hill, R.; Hansen, K.; Davis, M.E.; Christman, K.L. Characterization of Decellularized Left and Right Ventricular Myocardial Matrix Hydrogels and Their Effects on Cardiac Progenitor Cells. *Journal of Molecular and Cellular Cardiology*. 2022

Hunter J.D.; Johnson, T.D.; Braden, R.L.; Christman, K.L. Injectable ECM Scaffolds for Cardiac Repair. *Springer Protocols*. 2022.

Bejleri, D.; Robeson, M.T.; Brown, Milton, M.E.; **Hunter**, **J.D.**; Maxwell, J.T.; Christman, K.L.; Davis, M.E. In Vivo Evaluation of Bioprinted Cardiac Patches Composed of Cardiac-Specific Extracellular Matrix and Progenitor Cells in a Model of Pediatric Heart Failure. *Biomaterials Science*. 2022

Spang, M.T.; Middleton, R.; Diaz, M.D.; Wang, R.; **Hunter**, **J.D.**; Mesfin, J.; Lazerson, T.S.; Bhatia, S.; Corbitt, J.; D'Elia, G.; Sandoval Gomez, G.; Kandell, R.; Kato, T.; Igata, S.; Luo, C.; Osborn, K.G.; Cabrales, P.; Kwon, E.; Contijoch, F.; Reeves, R.R.; DeMaria, A.N.; Christman, K.L. Healing Tissues From the Inside Out: Infusible Biomaterial for Targeting and Treating Inflammatory Tissues via Intravascular Administration. *Nature Biomedical Engineering.* 2022 (in review)

Current Research (expanded description): My research entails the fabrication and optimization of therapeutics to treat the failing right ventricle. In my lab, I have developed a right ventricle-derived decellularized porcine myocardial matrix hydrogel that can be injected directly into the right ventricle after injury. Additionally, my collaborators at Georgia Tech/Emory have shown that cardiac progenitor cells can also improve right ventricle function in a small animal model of pediatric right heart failure. Recently, I have shown that my right ventricle-based hydrogel is compositionally and mechanically like the left ventricle-based hydrogel that was previously established in my lab. However, it was also noted that the two materials have distinct protein signatures that might allude to them affecting cell behavior differently. This encouraged my current study of assessing the therapeutic benefit of coupling the hydrogel with cardiac progenitor cells in vitro. It is my goal to show that the right ventricle derived hydrogel can enhance the therapeutic paracrine signaling of my collaborators' progenitor cells. Finally, I will evaluate the efficacy and mechanism of action of my cellular and acellular therapies in a small animal model of right heart failure.

Benefits to Science and Society: Therapies to treat the failing right ventricle have been largely understudied. Single ventricle and pulmonary arterial hypertension are the leading causes of right heart failure in pediatric and adult patients respectively. By studying the right ventricle and therapies to treat it, I will assist in improving the quality of life of these underserved patient populations. Furthermore, my research will also contribute to the field by providing insight into the mechanisms required to promote healing in the right ventricle.

Personal Interests: I love traveling in my spare time. I also enjoy outdoor adventures, movies/video games, and discovering new premium beverages.

ARCS Award: I am truly honored to be selected as an ARCS fellow. Financial hardship can be a wall that impedes progress toward completing graduate studies. ARCS funding will allow me to focus on my research without stressing over financial obligations. The support from this award will also provide me with opportunities to grow my network and advance as a professional. I have always believed that scientists should be more involved in the community outside of their research, so I am elated to see that ARCS emphasizes community engagement. I also look forward to the many opportunities to communicate my science with those outside of my field and in nonacademic spaces. Thank you ARCS Foundation, for supporting me in pursuing my goals as a scientist and as a servant to society.

PRATIBHA JAGANNATHA

University of California San Diego

Jacobs School of Engineering

Concentration: Bioinformatics

Specialization: RNA Biology

Donor: Virginia Lynch Grady Endowment

The central dogma of biology states that RNA converts information stored as DNA sequences, a process called transcription, into proteins, a process called translation. RNA isoforms result from the same DNA sequences being transcribed into different RNA sequences. RNA isoforms are essential for proper functioning of neurons, highly regulated cells of the nervous system, and help support its unique morphology. Using computational and experimental approaches and third generation sequencing, Pratibha studies the relationship between RNA isoforms and translation in the context of normal cellular processes and disease development in neurons.
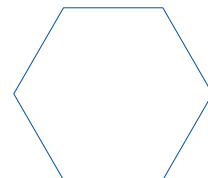
Degree: B.S. in Biomolecular Engineering, University of California Santa Cruz

Awards and Honors: National Science Foundation GRFP Honorable Mention 2020

Publications, Papers, and Posters:

Robinson, E.K.; **Jagannatha, P.**; Covarrubias, S.; Cattle, M.; Smaliy, V.; Safavi, R.; Shapleigh, B.; Abu-Shumays, R.; Jain, M.; Cloonan, S.M.; Akeson, M.; Brooks, A.N.; & Carpenter, S. Inflammation Drives Alternative First Exon Usage to Regulate Immune Genes Includinga Novel Iron-Regulated Isoform of Aim2. *2021, eLife.* 10, e69431. https://doi.org/10.7554/eLife.69431

Brannan, K.W., Chaim; I.A.; Marina, R.J.; Yee, B.A.; Kofman, E.R.; Lorenz, D.A.; **Jagannatha**, **P.**; Dong, K. D.; Madrigal, A.A.; Underwood, J.G.; & Yeo, G.W. Robust Single-Cell Discovery of RNA Targets of RNA-Binding Proteins and Ribosomes. *Nature Methods.* 2021, 18(5), 507–519

Current Research (expanded description): mRNA isoforms of a transcript set can have varying sequence and structural features which may, in turn, lead to complex and differing translational control and ultimately, translation. Isoform diversity is essential for numerous biological processes and has been implicated in multiple pathologies. It is particularly important in the context of the nervous system, with each neuron executing tight spatial and temporal regulation of translation. Variations in 5′ and 3′ untranslated region (UTR) sequences can lead to alterations in translation efficiency, often through cis-regulatory elements that can serve as binding sites for translation initiation factors and RNA binding proteins (RBPs). Additionally, variations to the coding sequence (CDS) can result in different proteins. The relationship between isoform diversity and translation still remains relatively unexplored. My research focuses on using third generation sequencing technologies, high throughput screening, and computational methods to elucidate the relationship between isoform diversity and translation. While my research is focused on understanding this relationship in the cell-type specific context of neuronal activation, my goal is for the methods and analysis pipelines I develop to be applied to studying other conditions and cell types.

Benefits to Science and Society: Isoform diversity is a critical component of many biological processes and has been implicated in multiple pathologies in neurons and other cell types. Understanding the relationship between RNA isoform diversity and translation can not only add to our understanding of relevant biological mechanisms and disease progression, but also help provide an avenue for the development of novel therapeutic strategies.

Personal Interests: I enjoy singing, dancing, painting, and watching documentaries. I also enjoy participating in outreach and mentoring programs.

ARCS Award: I am very grateful to have received the ARCS Foundation award. It has allowed me to focus on pursuing my research endeavors and to dedicate more time towards my outreach and mentoring activities. I am honored to be a part of such an incredible community of scientists and supportive individuals who appreciate science.

NISHTA KRISHNAN

University of California San Diego

Jacobs School of Engineering

Concentration: NanoEngineering

Specialization: Immunology and Drug Delivery

Donor: The Reuben H. Fleet Foundation

Nishta's research focuses on cell membrane-coating nanotechnology, in which cell membrane is derived from live cells and coated onto the surface of synthetic nanoparticulate cores. In particular, Nishta is developing the next generation of these nanoparticles via genetic modification of the source cells. By introducing proteins onto the nanoparticle surface, she can integrate new capabilities and better address challenges in cancer therapy. She uses these genetic engineering approaches to develop nanoparticles with enhanced functionalities including improved targeting to disease sites, enhanced cellular entry, and superior biointerfacing capabilities.

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

Awards and Honors: National Science Foundation Graduate Research Fellowship, 2020-2023; UCSD Gordon Scholars 2019-2020; UCSD Social Innovation Fund 2016-2017
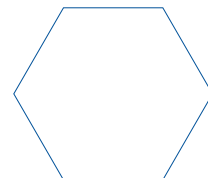
Publications, Papers, and Posters:

Zhou, J.; **Krishnan, N.**; Guo, Z.; Centura, C.; Holay, M.; Zhang, Q.; Wei, X.; Fang, R.; Zhang, L. Nanotoxoid Vaccination Protects Against Opportunistic Bacterial Infections Arising from Immunodeficiency. *Sci. Adv.* 2022, 8, eabq5492

Krishnan, N.; Kubiatowicz, L.; Holay, M.; Zhou, J.; Fang, R.; Zhang, L. Bacterial Membrane Vesicles for Vaccine Applications. *Adv. Drug Deliv. Rev.* 2022, 185, 114294

Krishnan, N.; Fang, R.; Zhang, L. Engineering of Stimuli-responsive Self-assembled Biomimetic Nanoparticles. *Adv. Drug Deliv. Rev.* 2021, 179, 114006

Jiang, Y.; **Krishnan, N.**; Zhou, J.; Chekuri, S.; Wei, X.; Kroll, A.; Yu, C.; Gao, W.; Fang, R.; Zhang, L. Engineered Cell Membrane-coated Nanoparticles Directly Present Tumor Antigens to Promote Anticancer Immunity. *Adv. Mater.* 2020, 32(30), 2001808

Current Research (expanded description): My research focuses on cell membrane-coating nanotechnology, where plasma membrane is derived from cells and coated onto a nanoparticulate core. Through this process, we imbue the resulting formulation with specific capabilities of the source cell, such as long circulation or pathogen binding. Cell membrane coated nanoparticles can also be used as a vaccine by presenting disease-relevant antigens to train the immune system. In my research, I am building the next generation of cell-membrane coated nanoparticles by using genetic engineering to introduce novel capabilities beyond what can be offered by wild-type cell membrane. To that end, we have engineered a co-stimulatory marker onto surface of cancer cells and used the resulting membrane to generate a nanoparticle that can directly engage T cells to enact robust anticancer therapeutic efficacy. In addition, genetic engineering approaches can be used to add active targeting mechanisms to the nanoparticles to improve localization to the disease site, reduce off-target effects and enhance the performance of therapeutic formulations. In my future research, I plan to continue development of these genetically modified cell membrane-coated nanoparticles which can offer enhanced utility across a wide range of biomedical applications.

Benefits to Science and Society: Current cancer treatments oftentimes result in adverse effects, which lead to a lesser quality of life for patients. By leveraging cell-membrane coating nanotechnology, we hope to develop safe and effective formulations that can be used against a variety of cancer types. Imbuing these nanoparticles with additional capabilities through genetic engineering has the potential to generate an incredibly powerful and flexible platform that can accommodate a rapidly changing disease environment.

Personal Interests: I enjoy board games, learning aerial skills and eating otter pops!

ARCS Award: The ARCS Foundation award has given me the opportunity to join a community of researchers from a large set of disciplines. I'm incredibly grateful and honored to be a part of this network of scholars.
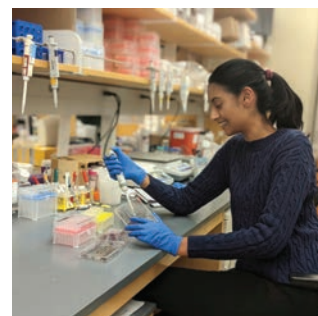
SAHANA KUTHYAR

University of California San Diego

Division of Biological Sciences

Concentration: Ecology, Behavior, and Evolution

Specialization: Microbial Ecology

Donor: The Allen Fund

Sahana studies how ecological and evolutionary factors impact the ability of animal-associated commensal microbes to prevent pathogen colonization. She uses domestication as a framework to explore how genetics and local ecology shape these phenomena. Her research seeks to understand under which contexts the gut microbiome of domestic animals defends against infectious disease. Her work will permit us to develop microbially minded interventions to manage infections and improve the productivity of animal rearing.

Degrees: M.S. in Environmental Sciences, Emory University; B.S. in Environmental Sciences, Emory University

Awards and Honors: Quantitative Integrative Biology Training Grant, 2021-2023; Society for the Study of Evolution, Membership Award, 2021-2023; Jeanne Marie Messier Memorial Award, 2021; Civic Engagement Microgrant, Research America, 2021
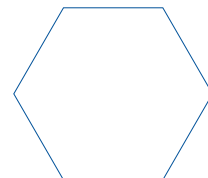
Publications, Papers, and Posters:

Kuthyar, **S.**; Watson, K.; Huang, S.; Brent, L.; Platt, M.; Horvath, J.; Gonzalez, J.; Knight, R.; Dominguez-Bello, M.G.; Amato, K.R. Limited Microbiome Differences in Captive and Semi-wild Primate Populations Consuming Similar Diets. *FEMS Microbiology Ecology.* 2022.

Kuthyar, **S.**; Reese. A.T. Variation in Microbial Exposure at the Human-animal Interface and its Risks for Health. *mSystems.* 2021.

Kuthyar, **S.**; Kowalewski, M.M.; Roellig, D.M.; Mallott, E.K.; Zeng, Y.; Gillespie, T.R.; Amato, K.R. The Effect of Habitat Fragmentation and Giardia Intestinalis Infection on the Alouatta caraya Gut Microbiota. *Ecology and Evolution.* 2021.

Kuthyar, **S.**; Manus, M.; Amato, K.R. Leveraging Non-human Primates for Exploring the Social Transmission of Microbes. *Current Opinion in Microbiology.* 2019.

Current Research (expanded description): Understanding why domestic animals harbor such high burdens of emerging infectious diseases and multidrug resistance is critical not only to promote their performance and health but also to protect human health as domestic animals are amplifiers of emerging pathogens. Traits of individual animals, such as immunity, as well as features of their environment can mediate their likelihood of being infected or spreading infection. Compared to wild animals, the unique environment domestic animals experience, with altered diets and microbial exposures, as well as human interventions through veterinary care and artificial selection is therefore likely to play a critical role in determining their immune state and resulting disease burden. There is mounting evidence that the gut microbiome is a pathway connecting the environment and animal immunity. I use a combinatorial approach of observational data, in vitro experiments, and bioinformatics to 1) evaluate the relative contributions of genetics and local ecology on the gut microbiome and immune state across wild-domestic pairs, 2) test under which animal backgrounds and resident microbial taxa mediate microbiome-mediated colonization resistance, and 3) assay treatments to improve colonization resistance of domestic animal gut microbiomes.

Benefits to Science and Society: Understanding under which environmental contexts the gut microbiome defends against infectious disease can improve animal performance and resilience. Results from my research will provide foundational knowledge about how sub-therapeutic antibiotic use impacts microbiome-mediated colonization resistance, allowing future work to develop safer alternatives to prophylactic antibiotic treatment and growth promotion. More broadly, my research will determine if domestication has consistently altered the way animal-associated microbial communities interact with pathogens, permitting us to develop microbially minded interventions to manage infections and improve the productivity of animal rearing.

Personal Interests: I enjoy running, dancing, and generally being outdoors.

ARCS Award: I am honored and humbled to receive the ARCS Foundation award. Starting my Ph.D. at the beginning of the pandemic has been an incredibly difficult, albeit rewarding, time, and I am excited to be part of the ARCS Foundation community. Importantly, receiving this award is a symbol that my work truly matters, further motivating me to promote solutions to manage infections in both animals and humans.

DAVID AMBROSE MCBRIDE

University of California San Diego

Jacobs School of Engineering

Concentration: Chemical Engineering

Specialization: Immune Engineering and Biomaterials

Donor: ARCS Foundation - San Diego Chapter

Dave's research focuses on the development of biomaterials to improve outcomes in patients with chronic autoimmune diseases. The current medications for autoimmune diseases are designed to systemically inhibit key inflammatory pathways. However, these approaches don't work in all patients, and may have adverse effects on the patient's ability to fight off infection or cancer due to a suppressed immune system. The biomaterials that Dave develops are designed to rebalance important cell subsets in the body's immune system to prevent autoimmune disease while retaining the ability to fight off infection.

Degree: B.S. in Chemical Engineering, University of California Santa Barbara

Awards and Honors: Ruth L. Kirschstein National Research Service Award (F31 AR079921-01), NIAMS, 2021; Graduate Research Fellowship Program Honorable Mention, National Science Foundation, 2020; NIAMS Training Grant (T32 AR064194), University of California San Diego, 2019
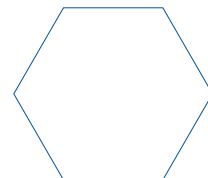
Publications, Papers, and Posters:

McBride, **D.A.**; Kerr, M.D.; Dorn, N.C.; Ogbonna, D.A.; Santos, E.C.; Shah, N.J.; Triggers. Timescales, and Treatments for Cytokine-Mediated Tissue Damage. *EMJ Innov.* 2020, https://doi.org/10.33590/emjinnov/20-00203

McBride, **D.A.**; Kerr, M.D.; Wai, S.L.; Yee, Y.Y.; Ogbonna, D.O.; Shah, N.J. Characterization of Regulatory T-cell Expansion for Manufacturing Cellular Immunotherapies. *Biomater. Sci.* 2020, 8(15), 4186-4198

McBride, **D.A.**; Kerr, M.D.; Wai, S.L.; Shah, N.J. Applications of Molecular Engineering in T-cell Based Immunotherapies. *WIREs Nanomed Nanobiotechnol.* 2019, 11:e1557

McBride, **D.A.**; Petzold, L.R. Model-based Inference of a Directed Network of Circadian Neurons. *J. Biol. Rhythm,* 2018, 33(5), 515 – 522

Current Research (expanded description): Immune tolerance is a key feature of the immune system in which key cellular and molecular mechanisms prevent the targeting and destruction of healthy cells by inflammatory immune cells. The breakdown of this immune tolerance leads to debilitating autoimmune disease, of which rheumatoid arthritis is an example. In many patients, altered signaling results in changes to the balance between pro-inflammatory and anti-inflammatory immune cell subsets, particularly the balance between anti-inflammatory regulatory T cells and the pro-inflammatory Th17 cells. Furthermore, in many patient subsets, regulatory T cells have impaired function in inflammatory environments, making them unable to control autoreactive Th17 cells. Current clinical strategies to treat autoimmune disease do not act on the premise of restoring the balance between disease-associated regulatory T cells and Th17 cells. In contrast, my primary project seeks to provide key molecular signals to joint-infiltrating T cells to selectively promote regulatory T cell function and number at sites of inflammation using a biomaterial depot. By acting specifically at the site of disease, we hypothesize that the regulatory T cells we generate will be disease-specific, fully functional, and able to inhibit disease progression without being broadly immune suppressive.

Benefits to Science and Society: The ability to promote balance between pro- and anti- inflammatory immune cell subsets has broad implications for autoimmune disease. From a scientific perspective, the development of biomaterials to locally influence immune cell fate will provide a valuable tool for determining the mechanistic underpinnings of disease. From a therapeutic perspective, this represents a new approach for autoimmune disease that treats underlying causes, and, due to the non-immunosuppressive nature of this approach, may be used with current strategies to improve patient outcomes.

Personal Interests: I spend the majority of my free time training intensively for beach volleyball, but also enjoy backpacking and painting.

ARCS Award: Receiving the ARCS Foundation award has been an honor and a motivator. The award has been a validation of the work that I am conducting and the time that I have poured into my research. Furthermore, it provides me with the financial security to redouble my focus on research to try to develop my project into something beyond the lab bench that has a real world impact and improves patients' lives.
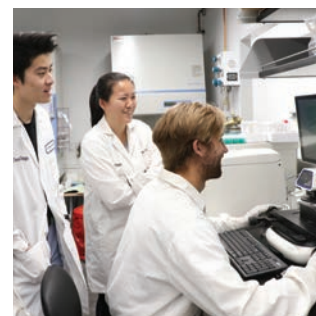
JOSHUA MANALO MESFIN

University of California San Diego

Jacobs School of Engineering

Concentration: Bioengineering

Specialization: Tissue Engineering and Bioinformatics

Donor: The Reuben H. Fleet Foundation

Josh's research focuses on utilizing and understanding the effects of injectable therapeutic biomaterials to treat the heart after a heart attack. After a patient undergoes a heart attack, there are very few treatments to prevent scar tissue that forms around the heart, which can lead to eventual heart failure and death. By using a therapy that can molecularly mediate the heart tissue and prevent scarring, Josh hopes to fully understand how these biomaterials mechanistically work via pre-clinical heart attack models, improve upon these biomaterials, and ultimately bring these treatments to the clinic.

Degree: B.S. in Biological Engineering, Massachusetts Institute of Technology

Awards and Honors: National Science Foundation Graduate Research Fellowship, Honorable Mention, 2021; Ford Foundation Fellowship Honorable Mention, 2021; National Heart, Lung, and Blood Institute Training Grant Award, 2020-2021; Sloan Scholar 2019-2023.
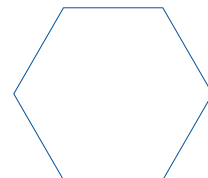
Publications, Papers, and Posters:

Calcagno, D.M.; Taghdiri, N.; Ninh, V.; **Mesfin, J.M.**; Toomu, A.; Sehgal, R.; Lee, J.; Liang, Y.; Duran, J.; Christman, K.L.; Adler, E.; Zhang, K.; Sheikh, F.; Fu, Z.; King, K.R. Single Cell Spatial Transcriptomics Reveal Mechanical Origins of Ischemic Heart Borderzones. *Nat Cardio Res.* 2022, accepted

Spang, M.T.; Middleton, R.; Diaz, M.D.; Hunter, J.D.; **Mesfin, J.M.**; Wang, R.M.; Lazerson, T.S.; Bhatia, S.; Corbitt, J.; D'Elia, G.; Sandoval, G.; Kato, T.; Igata, S.; Osborn, K.G.; Cabrales, P.; Kwon, E.J.; Contijoch, F.; Reeves, R.R.; DeMaria, A.N.; Christman, K.L. Healing Tissues from the Inside Out: Infusible Biomaterial for Targeting and Treating Inflammatory Tissues via Intravascular Administration. *Nat BME.* 2022, accepted

Wang, R.M.; **Mesfin, J.M.**; Cattaneo, P.; Camboa, N.; Braden, R.; Luo, C.L.; Evans, S.; Christman, K.L. Myocardial Matrix Hydrogel Supports a Proliferative Microenvironment for Cardiomyocytes. *Acta Biomater.* 2022, 8227

Stopfer, LE., **Mesfin, JM.**, Joughin, BA., Lauffenburger, DA., White, FM. Multiplexed Relative and Absolute Quantitative Immunopeptidomics Reveals MHC I Repertoire Alterations Induced by CDK4/6 Inhibition. *Nat Comms.* 2020, 11, 2760

Current Research (expanded description): My research entails studying the mechanism behind both natural and synthetic biomaterials to treat the heart post myocardial infarction (MI), otherwise known as a heart attack. Our lab has created a left-ventricle derived myocardial matrix hydrogel that has shown safety in both animal models and within patients. However, we wish to fully characterize this biomaterial and the cells the material interacts with via single cell gene expression studies. In my lab, I currently utilize novel transcriptomic tools to understand our myocardial matrix hydrogel's effect on the heart through cellular gene expression and spatial gene expression when our material is injected into the heart post-MI. In addition, I am using my knowledge uncovered from transcriptomics in the heart to create nanomaterials with the help of the Gianneschi Lab at Northwestern University. These nanomaterials behave like proteins, and can be delivered intravenously, allowing for a minimally invasive approach to treat the heart after MI. Thus, I plan to fully characterize different biomaterials on their therapeutic effect post-MI to thus improve upon the direct treatments for MI.

Benefits to Science and Society: With the exception of organ transplantation, there is no cure for myocardial infarction. Treatments for myocardial infarction also remain severely limited. By studying the effects of novel biomaterials which have demonstrated a therapeutic effect in past publications, we can uncover the direct molecular mechanism behind each biomaterial and thus improve upon these biomaterials to have a more pronounced therapeutic effect for patients suffering from myocardial infarction and cardiovascular disease. Finally, my research is aimed at laying the groundwork for creating a systemically injectable biomaterial that targets and treats the heart as soon as a patient suffers from MI.

Personal Interests: I enjoy traveling, baking, and cooking. I'm also a fan of board/video games and finding things I haven't tried.

ARCS Award: I am incredibly blessed to have been selected to receive an ARCS Foundation award. The support from this award will provide me with opportunities for networking and advancing as a professional. I look forward to the opportunities that I will gain in terms of science communication and community engagement. The ARCS Foundation award will allow me to continue inspiring others to pursue science, knowledge, and clinical impact. I am also honored to be a part of a supportive community that encourages me to think bigger and keep moving forward.

ELEONORA RACHTMAN

University of California San Diego

Jacobs School of Engineering

Concentration: Bioinformatics and Systems Biology

Specialization: Genetics and Phylogenomics

Donor: ARCS Foundation - San Diego Chapter

Eleonora works on the development of computational methods for analysis of large-scale genomic datasets. She focuses on finding efficient ways to derive evolutionary relationships between species to answer questions in areas of biodiversity and ecology. Results of her research can be used for identification of novel or rare species to inform conservation efforts. Eleonora's work can be utilized in tracing bacterial or viral evolution to identify patterns of disease spread and likely sources of transmission. This information is key to finding ways to combat pathogen outbreaks and developing successful vaccines.

Degrees: M.S. in Chemistry/Engineering, San Diego State University; B.S. in Biochemistry, Belarusian State University

Awards and Honors: University of California San Diego Inaugural DT O'Connor Scholarship in Genetics, 2019 and 2020; Illumina Recognition Awards, 2015 and 2016
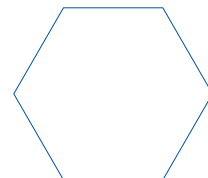
Publications, Papers, and Posters:

Rachtman, E.; Bafna, V.; Mirarab, S. CONSULT: Accurate Contamination Removal Using Locality-Sensitive Hashing. NAR *Genom Bioinform.* 2021, 3 (3), lqab071

Sarmashghi, S.; Balaban, M.; **Rachtman, E.**; Touri, B.; Mirarab, S.; Bafna, V. Estimating Repeat Spectra and Genome Length from Low-Coverage Genome Skims with RESPECT. *bioRxiv*. 2021. https://doi.org/10.1101/2021.01.28.428636. (In press. Accepted for publication in PLOS Computational Biology)

Rachtman, E.; Balaban, M.; Bafna, V.; Mirarab, S. The Impact of Contaminants on the Accuracy of Genome Skimming and the Effectiveness of Exclusion Read Filters. *Mol. Ecol. Resour.* 2020, 20 (3), 649–661

Rachtman, E.; Jung, M.; Johnston-Peck, A.C.; Tracy, J.B.; Kalyuzhny, G. H-1, C-13 and P-31 NMR study of precursor evolution in the synthesis of magic-size II-VI semiconductor nanocrystals. In *Book of Abstracts, 241st ACS National Meeting*, Anaheim, CA; Paper ANYL 243

Current Research (expanded description): I am currently working on development of conventional algorithmic and machine learning solutions for analysis of big genomic datasets. I look for patterns of relatedness between organisms based on their sequencing profiles and translate these patterns into distance estimates to infer accurate phylogenetic relationships. I have previously investigated the effect of the presence of contaminants in sequencing data and developed an algorithm for efficient removal of extraneous reads from sequencing samples. I have also released a workflow for accurate organelle assembly. Our method produced complete or nearly complete assemblies in cases where samples were highly degraded and where other methods failed. I have developed an algorithm for estimating branch length support for phylogenetic trees generated using k-mer based methods. K-mer based approaches are fast and accurate and therefore commonly used for phylogeny reconstruction. However, lack of procedure to assess correctness of generated phylogenies resulted in their limited use in publications. Our method remedies this situation. I am currently developing a machine learning solution to enable phylogenetic placement using a combination of k-mer frequencies and phylogenetic information. Our model allows addition of new species to large phylogenetic trees. This obviates the need to rebuild large phylogenies from scratch every time an update is needed.

Benefits to Science and Society: My work is beneficial in multiple areas where knowing evolutionary relationships helps researchers make informed predictions. Having a reliable phylogeny allows for identification of rare species and for guiding conservation efforts. Tracing bacterial and viral evolution is important for development of vaccines and creation of reliable procedures to combat outbreaks. My methods for contamination removal and filtering can be used to improve quality of forensic samples or characterization of pathogens present in food and water.

ARCS Award: ARCS Foundation award is a very high honor and I am extremely grateful for the opportunity to become a part of this esteemed community of scientists. ARCS fellowship gives me chance to focus on my research without feeling budget pressure. It allows me to explore new ideas that might be just outside of the scope of funded projects that we have in a lab. This truly helps me to expand my expertise, acquire new skills and collaborate in novel directions. Finally, ARCS fellowship gives me a chance to share my work with the brilliant group of like-minded ARCS scientists whose research has potential to inspire my future projects.
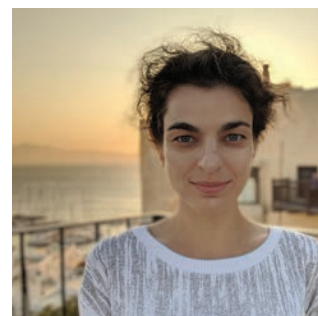
# SANKARAN RAMANARAYANAN

University of California San Diego

Jacobs School of Engineering

Concentration: Mechanical and Aerospace Engineering

Specialization: Fluid Mechanics

Donor: Beyster Family Foundation

Sankaran is interested in problems involving steady streaming – a distinguishing characteristic of non-harmonically pulsating fluid flows. He is currently applying analytical and numerical methods to investigate the physics of bidirectional squeeze-film levitation: a phenomenon wherein a flexible plate vibrating near a parallel wall can generate repulsive and adhesive forces at different vibration frequencies. Advancing the understanding of steady streaming will allow scientists to better leverage its mechanics in applications ranging from soft-robot locomotion to targeted drug delivery.
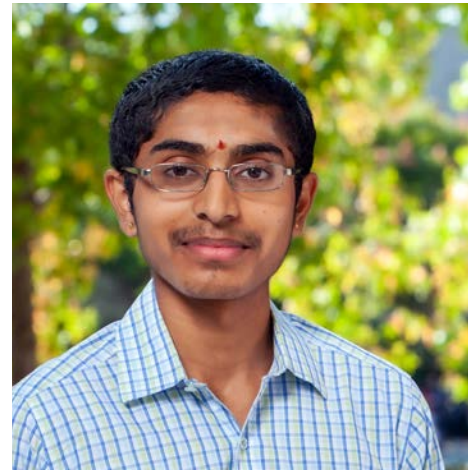
Degrees: M.S. in Engineering Sciences, University of California, San Diego; B.S. in Aerospace Engineering, University of California, San Diego

Awards and Honors: Powell/Bundle Fellowship 2019; John E. Starrett, Jr. Memorial Scholarship 2019; University of California, San Diego Jacobs Scholarship 2015
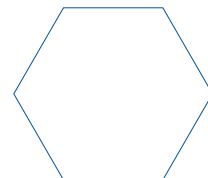
Publications, Papers, and Posters:

Ramanarayanan, S.; Coenen, W.; Sánchez, A.L. Steady Streaming in a Hele-Shaw Cell. *74th Annual Meeting of the Division of Fluid Dynamics, American Physical Society*. 2021

Ramanarayanan, S.; Sánchez, A.L. On the Enhanced Attractive Load Capacity of Resonant Flexural Squeeze-film Levitators. *AIP Advances.* 2022. (accepted)

Ramanarayanan, S.; Coenen, W.; Sánchez, A.L. Viscoacoustic Squeeze Film Force on a Rigid Disk Undergoing Small Axial Oscillations. *Journal of Fluid Mechanics*

Ramanarayanan, S.; Coenen, W.; Sánchez, A.L. Viscoacoustic Squeeze Film Force on a Rigid Disk Undergoing Small Axial Oscillations. *73rd Annual Meeting of the Division of Fluid Dynamics, American Physical Society.* 2020

Current Research (expanded description): My current research objective is to develop a unifying theoretical formulation that can assist with the design and operation of high-frequency squeeze-film systems. Squeeze-film devices typically involve the generation of steady repulsive pressures inside a thin compressible fluid film confined by parallel solid surfaces that are experiencing relative perpendicular oscillations. Such devices can serve, for example, as gas-lubricated bearings inside high-speed rotary machinery or as levitation devices in the assembly-line transport of sensitive micro-electronic devices. Previous studies of squeeze-film systems largely neglected one of many fluid properties – inertia, viscosity, thermal conductivity, or compressibility – to enable simplification of the Navier-Stokes equations. Recently, we applied the method of matched asymptotic expansions, using as small parameters the inverse Strouhal number and the aspect ratio of the fluid film, to develop a reduced parametric formulation that accounts for each of these effects and allows precise quantification of the physical conditions under which the force generated by a rigid axisymmetric squeeze-film system transitions from repulsion to adhesion. Our hope is to extend this analysis to model the fluid-structure interactions between a gaseous film and flexible oscillating surfaces, thereby developing a coupled formulation that may help to accelerate feedback control of locomotive systems for soft robots.

Benefits to Science and Society: Fluid-structure interactions are ubiquitous in soft robots: devices that are built from compliant materials and often powered by fluidic actuators. Due to their physical flexibility, soft robots have great potential in reducing the human safety risks incurred by involving heavy machinery in manufacturing applications. Advancing our understanding of the physics governing the coupled oscillatory motion of lubricant fluids and deformable solids will motivate formal improvements to the interoperability between such systems and a traditional workforce.

Personal Interests: I spend time building and flying model airplanes, and I love listening to percussive music.

ARCS Award: I am deeply grateful to have received the ARCS scholarship award and the accompanying introduction to a valuable community of motivated scholars. As a graduate student who is deeply passionate about pursuing engineering education as a career, I am very excited to learn from my peers and senior members in the ARCS community. I am confident that interacting with this community of motivated researchers that embodies a diverse spectrum of disciplines will equip me to better tackle the challenge of serving as an educator in a classroom consisting of students from various academic backgrounds.

CHIAKI ISABELA SANTIAGO

University of California San Diego

Division of Biological Sciences

Concentration: Neuroscience

Specialization: Cellular and Molecular Neuroscience

Donor: Elizabeth Taft

Chiaki's thesis project aims to understand the molecular mechanisms that drive experience-dependent circuit plasticity in the mammalian brain. The animal brain extracts salient information from its environment, generating memories and behavioral adaptations that allow it to survive in a complex world. This is done through the activity of excitatory and inhibitory neurons that are organized into synaptically connected circuits. Chiaki studies how experience, through the execution of activity-dependent gene expression, regulates the connections between excitatory and inhibitory neurons, and how these processes relate to animal behavior and disease states.

Degrees: M.S. in Neurosciences, University of California, San Diego; B.S. in Neurosciences, Vanderbilt University
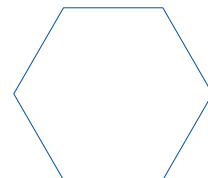
Awards and Honors: Community Leadership Award, 2022; National Science Foundation Graduate Research Fellowship, Honorable Mention, 2021; Ford Foundation Pre-doctoral Fellowship, Honorable Mention 2021; University of California, San Diego Competitive Edge Fellowship, 2019.

Publications, Papers, and Posters:

Sibener, L.J; Kirchgessner, M.A; Steiner, S.; **Santiago, C.I**.; Cassataro, D.; Rossa, M.; Profaci, C.P.; Padilla-Coreano, N. Lessons from the Stories of Women in Neuroscience. *J. Neuroscience.* 2022, 2(24):4769-4773. doi: 10.1523/JNEUROSCI.0536-22.2022

Joffe ,M.E.*; **Santiago, C.I**.*; Engers, J.L.; Lindsley, C.W.; Conn, P.J. Frontal Cortex Genetic Ablation of Metabotropic Glutamate Receptor Subtype 3 (mGlu3) Impairs Postsynaptic Plasticity and Modulates Affective Behaviors. *equal contribution. *Neuropsychopharmacology.* 2021, doi: 10.1038/s41386-021-01041-2

Joffe, M.E.,; **Santiago, C.I**.; Oliver, K.H.; Harris, N.A.; Engers, J.L.; Lindsley, C.W.; Winder, D.G.; Conn, P.J. mGlu2 and mGlu3 Negative Allosteric Modulators Divergently Potentiate Thalamocortical Transmission and Exert Rapid Antidepressant-like Effects. *Neuron.* 2019, doi: 10.1016/j.neuron.2019.09.044

C. Joffe M.E.; **Santiago, C.I.**; Stansley, B.J.; Maksymetz, J.; Gogliotti, R.G.; Engers, J.L.; Nicoletti, F.; Lindsley, C.W.; Conn, P.J. Mechanisms Underlying Deficits in Prelimbic Prefrontal Cortex mGlu3/mGlu5- Dependent Plasticity and Reversal Learning Following Acute Stress. *Neuropharmacology*. 2018, doi: 10.1016/j.neuropharm. 2018.10.013

Current Research (expanded description): The animal brain extracts salient information from its environment, generating memories and behavioral adaptations that allow it to survive a complex world. Immediate early gene transcription factors (IEG-TFs) convert transient electrical and molecular signals into long-lasting changes in function, effecting stimulus specific cellular and circuit plasticity. The IEG-TF NPAS4 is highly and specifically expressed in response to elevated neural activity and mediates input specific programs of gene expression that reorganize the spatial dynamics of synaptic inhibition. Specifically, NPAS4 driven by dendritic excitation results in a reduction in dendritic inhibition, creating a dendritic environment more conducive to plasticity, while NPAS4 driven by action potentials increases somatic inhibition, raising the threshold for future action potential output. Both dendritic and somatic NPAS4 can be driven by exposure to an enriched environment (EE), uniquely linking experience to gene expression to synaptic and circuit function.

While we have shown that NPAS4 alters CA1 PNs output in acute hippocampal slice recordings through changes in inhibition, it is not yet known how it contributes to the spatial coding that characterizes in vivo CA1 PNs, namely place cells. The primary goal of this project is to determine how NPAS4 influences in vivo firing characteristics of CA1 PNs and how this affects place cell regulation.

Benefits to Science and Society: The interplay between excitation and inhibition (E/I) is at the core of healthy brain function, dictating when a neuron will fire action potentials and what information is encoded by that neuron. Dysregulation of E/I coordination has been linked to a broad spectrum of neurological disorders including autism spectrum disorder, schizophrenia, and epilepsy. My thesis project will help bridge the gap between molecular events, where targeted therapeutic interventions can be developed, and a circuit-level understanding of hippocampal function.

Personal Interests: I love spending time in nature - playing volleyball, disc golf, surfing, or exploring our beautiful national parks.

ARCS Award: I am honored to be a recipient of the ARCS Foundation award and feel extremely supported in my scientific career goals. As a first-generation, low-income student, I deeply value the financial support from the ARCS Foundation, as it will allow me to focus more of my attention on my research. Additionally, the ARCS Foundation award has given me the opportunity to make great connections with other amazing graduate students in the UC San Diego community.

SAMANTHA LYLAH SISON

University of California San Diego

Neurosciences Graduate Program

Concentration: Neuroscience

Specialization: Neurodegenerative disease modeling

Donor: Dorothy Georgens/ARCS Foundation - San Diego Chapter

Sammi's research project aims to understand the molecular mechanisms underlying Huntington's disease, a progressive neurodegenerative disorder that leads to motor and cognitive problems and eventually death. With a background in stem cell biology and neuroscience, Sammi uses induced pluripotent stem cells from Huntington's disease patients to study the genetic pathways that may be contributing to neurodegeneration in the brain. By using this system, she hopes to identify therapeutic targets for the potential treatment of Huntington's disease patients.

Degree: B.S. in Neurobiology, University of Wisconsin Madison

Awards and Honors: SfN NSP Fellow 2021; NSF-GRFP 2020; Honorable Mention - Ford Foundation Pre-doctoral Fellowship 2020; Hilldale Undergraduate Research Fellowship 2015
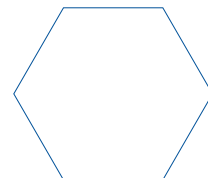
Publications, Papers, and Posters:

Sison, **S.L.**; O'Brien, B.S.; Johnson, A.J.; Seminary, E.R.; Terhune, S.S.; Ebert, A.D. Human Cytomegalovirus Disruption of Calcium Signaling in Neural Progenitor Cells and Organoids. *J. Virol.* 2019, 93 (17). https://doi.org/10.1128/JVI.00954-19

Sison, **S.L.**; Vermilyea, S.C.; Emborg, M.E.; Ebert, A.D. Using Patient-derived Induced Pluripotent Stem Cells to Identify Parkinson's Disease-relevant Phenotypes. *Curr. Neurol. Neurosci. Rep.* 2018, 18 (12), 84. https://doi.org/10.1007/s11910-018-0893-8

Sison, **S.L.**; Ebert, A.D. Decreased NAD+ in Dopaminergic Neurons. *Aging* (Albany NY). 2018, 10 (4), 526–527. https://doi.org/10.18632/aging.101433

Sison, **S.L.**; Patitucci, T.N.; Seminary, E.R.; Villalon, E.; Lorson, C.L.; Ebert, A.D. Astrocyte-produced MiR-146a as a Mediator of Motor Neuron Loss in Spinal Muscular Atrophy. *Hum. Mol. Genet.* 2017, 26 (17), 3409–3420. https://doi.org/10.1093/hmg/ddx230

Current Research (expanded description): As a graduate student, my primary focus is to study the RNA metabolism defects that underly Huntington's disease (HD), while also understanding the basic neurobiology of RNA transport and local translation in human neurons. Recent studies indicate widespread RNA metabolism defects in HD, such as mislocalization and mistranslation of mRNAs, which are suggested to be a main cause of pathology in the disease. One way these defects may be arising is through the binding and sequestration of important RNA binding proteins (RBPs) to mutant HTT CAG repeat RNA. Therefore, my dissertation is aimed at testing and evaluating this hypothesis in human HD patient-derived striatal neurons, the cells most affected by the disease. I will be utilizing novel proximity labeling techniques and cutting-edge STAMP technology developed in our lab to study the binding partners of CAG repeat RNA that may be leading to mRNA transport and translation problems in human neurons from HD patients.

Benefits to Science and Society: My project aims to elucidate two different aspects of RNA metabolism that are disrupted in Huntington's disease and repeat expansion diseases. Specifically, this work may identify hundreds of candidate cell-type-relevant proteins and transcripts that could be targeted for the treatment of these diseases. Additionally, this research will aid in our understanding of how RNA metabolism is regulated in neurons, fundamental knowledge that is broadly applicable to many diseases that affect the nervous system.

Personal Interests: I volunteer for a student-led non-profit organization, called Nucleate, that is aimed at breaking down the barriers to life science entrepreneurship. Besides volunteering, I love to hike, rock climb, and spend time with my two dogs Ash and Rex.

ARCS Award: I feel very honored to be a recipient of the ARCS Foundation award and feel supported in my scientific career goals. Coming from a low-income background, I deeply value the generous financial support from the ARCS Foundation, as this allows me to focus more of my attention on my research and academics rather than worrying about financial burdens that come along with being a graduate student. Additionally, the ARCS Foundation award is an amazing reminder that our community values scientific research and the advancement of students in STEM.
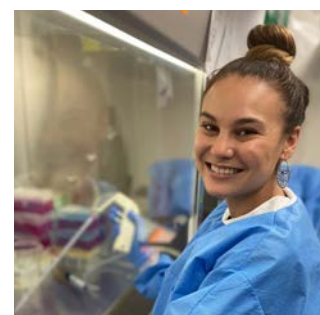
ANGUS BLACKLAW THIES

University of California San Diego

Scripps Institution of Oceanography

Concentration: Marine Biology/Physiology

Specialization: Photosymbiosis

Donor: Carlos and Sharon Arbelaez

Angus studies the physiology of corals, the animals responsible for building coral reef ecosystems. These habitats support thousands of species, provide food for millions of humans, drive global tourism, and protect coastlines from storm damage and erosion. Alarmingly, coral populations are declining rapidly due to climate change not only threatening ecological biodiversity but endangering the food supply and livelihoods of local communities. Angus' research focuses on (1) understanding why coral populations are declining and (2) identifying coral species suitable for conservation and propagation efforts to rebuild degraded coral reef ecosystems.

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

Awards and Honors: Best Student Research Presentation - 4th International Cassiopea Workshop 2021; National Science Foundation Graduate Research Fellowship 2019; Scripps Oceanography 1st-Year Fellowship 2019
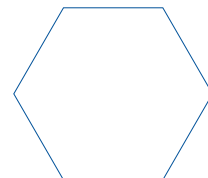
Publications, Papers, and Posters:

Thies, **A.B.**; Quijada-Rodriguez, A.R.; Zhouyao, H.; Weihrauch, D.; Tresguerres, M.A Rhesus Channel in the Coral Symbiosome Membrane Suggests a Novel Mechanism to Regulate NH_3 and CO_2 Delivery to Algal Symbionts. *Sci. Adv.* 2022, 8 (10). https://doi.org/10.1126/sciadv.abm0303.

Barott, K.L.; **Thies**, **A.B.**; Tresguerres, M. V-Type H^+-ATPase in the Symbiosome Membrane Is a Conserved Mechanism for Host Control of Photosynthesis in Anthozoan Photosymbioses. *R. Soc. Open Sci.* 2022, 9 (1). https://doi.org/10.1098/rsos.211449.

Thies, **A.**; Tresguerres, M. Conserved Carbon and Nitrogen Delivery Mechanisms in Cnidarian Photosymbioses. Oral presentation, *4th International Cassiopea Workshop*, Virtual, 2021

Barott, K.L.; Venn, A.A.; **Thies**, **A.B.**; Tambutté, S.; Tresguerres, M. Regulation of Coral Calcification by the Acid-Base Sensing Enzyme Soluble Adenylyl Cyclase. *Biochem. Biophys. Res. Commun.* 2020, 525 (3), 576–580. https://doi.org/10.1016/j.bbrc.2020.02.115.

Current Research (expanded description): Coral reefs support thousands of species and human communities worldwide yet, despite their global importance, we lack a coherent understanding of how these symbiotic partners interact at the molecular level to maintain healthy symbiosis. Alarmingly, the coral-algal photosymbiosis degenerates under elevated ocean temperatures (a result of anthropogenic CO2 emissions) leading to termination of the symbiosis (coral bleaching), and often, mass coral mortality. Global mass mortality events now occur annually yet we still lack a molecular explanation for why the symbiosis breaks down. My research has four focuses: (1) to identify the proteins responsible for nutrient-exchange in healthy coral-algal symbioses, (2) to characterize how these mechanisms compensate for normal environmental challenges, (3) to compare the physiology of healthy vs. bleached corals, and (4) to explore if these mechanisms are conserved in animals where photosymbiosis evolved independently. I work with numerous photosymbiotic model systems to address these questions including corals, anemones, jellyfish, and sea slugs. So far, I have identified a novel nitrogen delivery mechanism in the coral-alga symbiosis that relies on a coral Rhesus channel (Rhp1). Surprisingly, Rhp1 functions akin to human Rh proteins in the kidney collecting duct serving as a mechanism to deliver NH3/NH4+ to algal symbionts.

Benefits to Science and Society: My fundamental research is closing the knowledge gap concerning how healthy corals function. These findings can be applied to predict the effects of climate change on coral species, design effective conservation policies, or genetically manipulate organisms for conservation or biotechnology purposes. Furthermore, fundamental research is inherently valuable as it lays the groundwork to address nuanced problems like coral bleaching. For example, sophisticated cancer treatments are only possible after a century of research established how healthy cells divide and make ATP.

Personal Interests: I love to rock climb, cook, spearfish, explore national parks, start (and maybe finish) DIY projects, and maintain close friendships.

ARCS Award: As a Ph.D. student who conducts sparsely-funded basic physiological research on a non-model organism, it can be a real challenge to address straightforward research questions and overcome experimental problems that are routine for labs working with well-characterized model systems. Receiving this award means a great deal to me: it motivates me to continue this challenging project, it reaffirms my belief that this work is important, and it makes me thankful to see that non-coral physiologists can recognize the potential of this work to mitigate ecological damage caused by humans. You have my deepest gratitude.
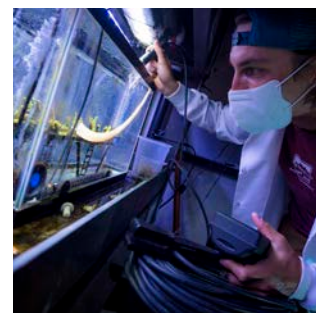
BRIAN KHA TRAN

University of California San Diego

Department of Mathematics

Concentration: Computational Mathematics

Specialization: Geometric Integration

Donor: ARCS Foundation - San Diego Chapter

Brian investigates computational techniques for applications to problems in mathematical, theoretical, and computational physics. Specifically, he focuses on constructing structure-preserving and geometric discretizations of field theories in physics which provide a means of computationally modeling complex physical phenomena, such as electromagnetism and fluid flow. Such structure-preserving discretizations are characterized by the fact that they preserve, at the discrete and computational level, the geometric structures inherent to the physical phenomena of interest. This allows for robust and faithful modelling with applications throughout science and engineering.
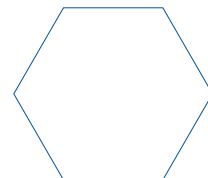
Degrees: C. Phil. in Mathematics, University of California San Diego; M.A. in Applied Mathematics, University of California San Diego; B.S. in Mathematics, University of California San Diego; B.S. in Physics, University of California San Diego

Awards and Honors: NSF Graduate Research Fellowship October 2018; Shang-Keng Ma Memorial Award, UCSD Physics June 2018; Errett Bishop Scholarship, UCSD Mathematics September 2017;. Selma and Robert Silagi Award for Undergraduate Excellence, UCSD Mathematics May 2017

Publications, Papers, and Posters:

Tran, B.; Leok, M. Variational Structures in Cochain Projection Based Variational Discretizations of Lagrangian PDEs. *Foundations of Computational Mathematics.* Submitted, 2021.

Tran, B.; Leok, M. Multisymplectic Hamiltonian Variational Integrators. *International Journal of Computer Mathematics.* Special Issue on Geometric Numerical Integration, Twenty-Five Years Later, submitted, 2021.

Current Research (expanded description): My research focuses on investigating the geometric structures associated with structure-preserving discretizations of physical field theories, such as Hamiltonian and Lagrangian partial differential equations. The goal of my research is developing a geometric framework for understanding and analyzing the computational modelling of complex physical phenomena, which will provide insight on how to develop good algorithms to accurately model physical phenomena. I am particularly interested in variational integrators, which are a class of computational methods constructed by mimicking the variational principle (used throughout physics to describe the dynamics of a physical system as being the stationarity point of some functional) at the discrete level.

Benefits to Science and Society: My research is expected to benefit applications in science and engineering, by providing computational techniques to accurately and robustly model physical phenomena. Increasingly in science and engineering, there is a need for being able to robustly simulate physical phenomena in order to make predictions and guide experimentation concerning the physical world. By developing and analyzing such computational techniques, I hope to assist in the scientific endeavor to better understand the physical world.

Personal Interests: I enjoy playing the guitar and the piano, I love to surf, and I am an avid gamer.

ARCS Award: The ARCS Foundation Award connects me to a network and community which supports and recognizes my research. Being accepted into this community has motivated me to work even harder in achieving my academic and career goals. The award will allow me to focus on my research through the completion of my doctoral degree. I am extremely grateful to the ARCS Foundation for this award.

ALISHA ANISH UKANI

University of California San Diego

Jacobs School of Engineering

Concentration: Computer Science

Specialization: Internet Measurement

Donor: ARCS Foundation - San Diego Chapter

Alisha's research focuses on using Internet traffic data to improve the performance and reliability of critical infrastructure like large-scale data centers, which power vital web services in healthcare and education. She has created a method to identify network outages at Google using network availability data. Alisha plans to build and leverage large-scale measurement systems to make web service infrastructure more reliable and thus better serve the public.
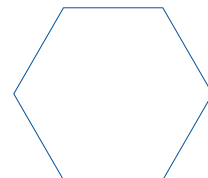
Degree: A.B. in Computer Science, Harvard University

Awards and Honors: NSF Graduate Research Fellowship 2022; Google research internship, summer 2021; Harvard University Certificate of Distinction and Excellence in Teaching, 2020; Charles J. Paine Scholarship Award 2017-2019

Publications, Papers, and Posters:

Randall, A.; Snyder, P.; **Ukani A.**; Snoeren, A.C.; Voelker, G.M.; Savage, S.; Schulman, A. Measuring UID Smuggling in the Wild. *Proceedings of the ACM Internet Measurement Conference*, 2022.

Ukani, A.; Mirian, A.; Snoeren, A.C. Locked-In during Lock-Down: Undergraduate Life on the Internet in a Pandemic. *Proceedings of the ACM Internet Measurement Conference*, 2021.

Current Research (expanded description): The Internet has quickly become a fundamental aspect of modern life, but we cannot truly understand its impact until we measure and analyze Internet traffic patterns from users around the world. My research analyzes network traffic and reliability data to understand 1) how to improve the performance of critical infrastructure like large--scale data centers, allowing us to make services faster and more reliable, and 2) the perspectives of users, allowing us to create better services tailored to their actual needs.

For the first goal, I completed a research internship at Google analyzing network availability data to understand and detect network outages. This analysis can help reduce the time to resolve outages, and is being incorporated into a new anomaly detection tool.

For the second goal, I analyzed how undergraduates' Internet traffic changed because of COVID-19. These results give researchers insight into a unique population.

Benefits to Science and Society: My work leverages network availability data to increase the performance and reliability of large-scale systems, which ensures that critical web applications—like healthcare, education, and banking—are always available. This work also challenges conventional wisdom and finds areas of improvement for existing networking protocols by analyzing how these protocols perform in practice.

Personal Interests: I enjoy reading fiction, interior design, and spending time with my dog. I also like to play tennis and play acoustic guitar.

ARCS Award: The ARCS Award has allowed me to join a strong community of scholars passionate about research in a variety of disciplines. I'm honored to be a part of this network and have it become a strong support system throughout my graduate studies.

ALICIA ANN VAN ENOO

University of California San Diego

Neurosciences Graduate Program

Concentration: Neuroscience

Specialization: Developmental Neuroscience, Stem Cell Biology

Donor: ARCS Foundation - San Diego Chapter

Alicia's research is aimed at understanding the molecular mechanisms underlying abnormal neurodevelopment in autism spectrum disorders (ASD). She uses patient-derived and CRISPR engineered stem cells to create 3-D cortical organoids, nicknamed "mini brains". By studying how these mini brains develop in a dish, Alicia hopes to gain a better understanding of what goes wrong during fetal brain development in ASD patients. These studies will provide the much-needed groundwork necessary to identify novel therapeutic targets for the potential treatment of ASD.

ARCS FOUNDATION, INC. | SAN DIEGO CHAPTER | SCHOLARS 2022-2023

Degrees: M.S. in Neuroscience, University of California San Diego; B.A. in Neuroscience, minor in Public Health, Boston University
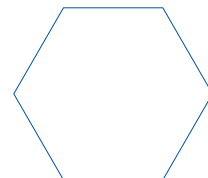
Awards and Honors: Dean's list, Boston University; Undergraduate Research Fellowship

Publications, Papers, and Posters:

Brifault, C.; Romero, H.; **Van Enoo, A.**; Pizzo, D.; Azmoon, P.; Kwon, H.; Nasamran, C.; Gonias, S. L.; Campana, W. M. Deletion of the Gene Encoding the NMDA Receptor GluN1 Subunit in Schwann Cells Causes Ultrastructural Changes in Remak Bundles and Hypersensitivity in Pain Processing. *J Neurosci.* 2020, 40 (47), 9121–9136. https://doi.org/10.1523/JNEUROSCI.0663-20.2020

Clayton, K.A.; **Van Enoo, A.**; Ikezu, T. Alzheimer's Disease: The Role of Microglia in Brain Homeostasis and Proteopathy. *Front. Neurosci.* 2017, 11. https://doi.org/10.3389/fnins.2017.00680

Ikezu, S.; Yeh, H.; Delpech, J.C.; Woodbury, M.E.; **Van Enoo, A.**; Ruan, Z.; Sivakumaran, S.; You, Y.; Holland, C.; Guillamon-Vivancos, T.; Yoshii-Kitahara, A.; Botros, M.B.; Madore, C.; Chao, P.H.; Desani, A.; Manimaran, S.; Kalavai, S.V.; Johnson, W. E.; Butovsky, O.; Medalla, M.; Luebke, J. I.; Ikezu, T. Inhibition of Colony Stimulating Factor 1 Receptor Corrects Maternal Inflammation-Induced Microglial and Synaptic Dysfunction and Behavioral Abnormalities. *Mol Psychiatry.* 2020, 1–24. https://doi.org/10.1038/s41380-020-0671-2

You, Y.; Botros, M. B.; **Van Enoo**, **A.**; Bockmiller, A.; Herron, S.; Delpech, J. C.; Ikezu, T. Cre-Inducible Adeno Associated Virus-Mediated Expression of P301L Mutant Tau Causes Motor Deficits and Neuronal Degeneration in the Substantia Nigra. *Neuroscience.* 2019, 422, 65–74. https://doi.org/10.1016/j.neuroscience.2019.10.001

Current Research (expanded description): I am currently investigating how 16p11.2, the most well-known copy number variant associated with ASD, affects neural and glial development using 3-D cortical organoids and 2-D stem cell-derived astrocyte and microglial cultures. My preliminary studies suggest that cortical organoids derived from 16p11.2 patients recapitulate patient phenotypes. In the next 2 years, I will continue to comprehensively characterize 3-D cortical organoids by evaluating cell-type specific gene expression changes using single-cell RNA sequencing, changes in activity using calcium imaging and multi-electrode arrays, and glial phenotypes using immunofluorescence and functional glutamate assays. Ultimately, I hope to use this model to identify therapeutic targets and perform drug screenings.

Benefits to Science and Society: Currently, 1 in 54 children are diagnosed with an Autism Spectrum Disorder (ASD). Existing interventions are aimed at managing symptoms, as there is no cure for this disorder. Furthermore, the identification of therapeutic strategies to treat ASD has been hindered by a lack of robust experimental models to study ASD pathogenesis. The use of these 3-D "mini brains" gives us a unique opportunity to study early neurodevelopment using an in-vitro humanized model, which will allow us to identify potential new therapeutic targets and, eventually, treatments.

Personal Interests: In my free time, I enjoy going to the beach, exploring new restaurants, and snowboarding.

ARCS Award: Receiving the ARCS Foundation award is such a privilege and honor. As an "English as a Second Language" student coming from a low-income background, I've encountered numerous hurdles in my path to becoming a neuroscientist. It is thanks to incredibly generous foundations, such as the ARCS Foundation, that over the years, I have been able to continue to work towards my career goals. This funding from the ARCS Foundation allows me to focus on my research and professional development, while easing the financial burdens that come with being a graduate student. I am incredibly grateful for this opportunity.
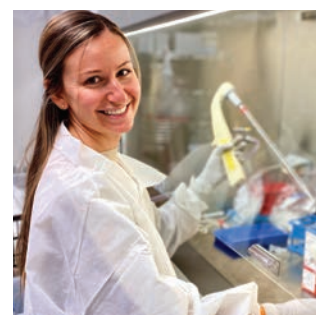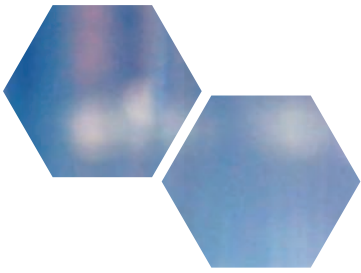
University
of San Diego

ANDREA MARIE CORREIA

University of San Diego

Hahn School of Nursing and Health Science

Concentration: Nursing

Specialization: Pediatrics

Donor: Beyster Family Foundation

Healthcare-related workplace violence perpetrated by patients and caregivers has steadily increased. Numerous studies have been conducted to understand the prevalence and cause. However, few studies have considered adverse childhood experiences or trauma as potential factors. Andrea plans to explore the possible role adverse childhood experiences and trauma have in healthcare-related workplace violence. Such an understanding can eventually lead to improved preventative measures for healthcare organizations.

Degrees: M.S.N. in Nursing, Western University of Health Sciences; B.S. in Athletic Training, Chapman University

Awards and Honors: University of San Diego, Dean's Merit Scholarship, 2022; Children's Health Orange County President's Recognition Award, 2021; Society of Pediatric Nurses, Excellence in Education Award, 2021; Children's Health Orange County, Daisy Nurse Leader Award, 2019.
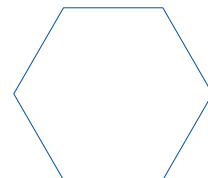
Publications, Papers, and Posters:

Anderson, B.; Birkinshaw, H.; **Correia**, **A.**; Park, S. Addressing Non-iatrogenic Withdrawal in a Pediatric Inpatient Setting. Poster. *32nd Annual Society of Pediatric Nurses (SPN) Conference.* Anaheim, CA, April 2022.

Barrows, J.; Birkinshaw, H.; **Correia**, A. Standardization of Initiation and Weaning of High-flow Nasal Cannula (HFNC) Therapy in a Pediatric Hospital. Poster. *32nd Annual SPN Conference.* Anaheim, CA, April 2022.

Birkinshaw, H.; **Correia A**. Providing Education and Support in Uncertain Times. *31st Annual SPN Conference.* Virtual, April 2021.

Bigani, D.; **Correia**, A. On the Same Page: Nurse, Patient, and Family Perceptions of Change-of-shift Bedside Report. *Journal of Pediatric Nursing.* 2018, 41, 84 – 89

Current Research (expanded description):   Adverse childhood experiences and trauma can potentially lead to the development of maladaptive behaviors. Maladaptive behaviors are often portrayed through verbal and physical acts of violence. Despite this understanding, very few studies have investigated the possible role adverse childhood experiences and trauma have on healthcare-related workplace violence perpetrated by patients and caregivers. My proposed study aims to (1) describe the demographics and past adverse childhood experiences and trauma of patients and caregivers who exhibited violent behaviors and (2) describe the relationship between childhood experiences, past trauma, and exhibited violent behaviors. Current preventative measures related to healthcare-related workplace violence focus heavily on policy development. However, this study can potentially aid in advocating for new preventive measures, such as implementing trauma-informed care within healthcare organizations.

Benefits to Science and Society: One expected benefit of this research is identifying the potential relationship between adverse childhood experiences, trauma, and exhibited acts of violence. If a relationship is found, new insights into workplace violence perpetrated by patients and caregivers will be revealed. Such knowledge can support trauma-informed care to improve a healthcare organization's ability to understand, identify, and respond to patients and caregivers with past traumatic experiences. Furthermore, it can aid in implementing practices and policies that avoid re-traumatization.

Personal Interests: My interests include reading, traveling, and spending time with family and friends.

ARCS Award: It is a true honor to receive the ARCS Foundation award. This award will help me reach my goal of becoming a nurse scientist. Furthermore, this award will allow me to make an impact in the lives of patients and families who have been affected by trauma and nurses who have been affected by workplace violence.
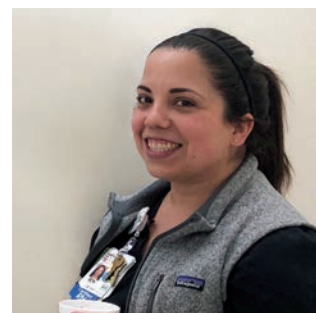
# JENNIE MIKO LEE

University of San Diego

Hahn School of Nursing and Health Science

Concentration: Nursing

Specialization: Maternal Health Disparities

Donor: Beyster Family Foundation

Jennie's research is aimed at improving maternal outcomes with reduced rates of morbidity and mortality due to maternal hemorrhage, the leading cause of maternal morbidity. Her research project is focused on disadvantaged people, exploring the relationship between social determinants of health and maternal mortality by investigating social and economic variables of access to healthcare and health disparities that correlate with maternal mortality.
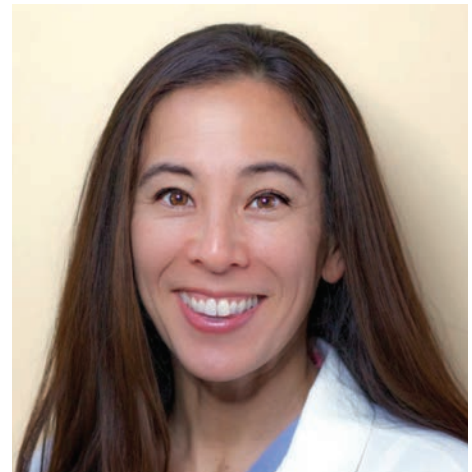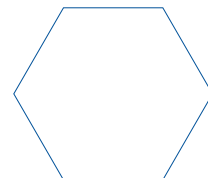
Degrees: M.B.A. in Healthcare Management, Western Governors University, M.S. in Nurse Anesthesiology, University of Southern California, B.S. in Nursing, University of Southern California.

Awards and Honors: University of San Diego, Dean's Merit Scholarship Award 2022-2023; Kaiser Permanente Nurse Anesthetists Association, CRNA Advocate of the Year 2019.

Current Research (expanded description): The leading cause of death among women of childbearing age is maternal mortality, with the leading cause of pregnancy-related death resulting from obstetric hemorrhage. The purpose of my research is to decrease health inequities and improve maternal health outcomes for diverse populations. Prevention science and early intervention with populations experiencing health disparities, with an overall aim to evoke individual, family, community, and social change, is the major goal of my research and clinical practice. I have a broad background in nursing, specifically nurse anesthesiology, with obstetric anesthesia management being the heart of my clinical practice and research interest.

It is known that the high prevalence of severe obstetric hemorrhage is an indicator of poor quality of obstetric care. The non-preventable demographic risk factors associated with maternal death have been identified which include age, socioeconomic status, medical diseases, ethnic and racial variability which requires extra vigilance

in management. The remaining modifiable risk factors related to maternal death provide an opportunity for early identification and intervention to facilitate improved management. The objectives of my research are to examine socio-economic health disparities and their relationship to maternal mortality to improve maternal health outcomes and to identify factors that increase the odds for survival.

Benefits to Science and Society: The expected benefits of this research are to improve maternal healthcare quality and decrease mortality of disadvantaged people. Currently the leading cause of maternal death worldwide is obstetric hemorrhage. My research project is designed to generate supportive evidence for both science and society to improve maternal outcomes that address the social injustice of health inequalities by improving maternal outcomes with reduced rates of morbidity and mortality due to maternal hemorrhage

Personal Interests: I enjoy spending time with family, training Brazilian jiu-jitsu, bodyboarding, running, playing guitar and fishing in Alaska and the Eastern Sierras.

ARCS Award: It is an honor to have been selected as an ARCS Scholar and receive the ARCS Foundation award. As a first-generation college graduate, I have tremendous gratitude for the ARCS Foundation's financial support. It provides encouragement to continue my Ph.D. journey of scientific inquiry and contribute to scientific advancement of nursing research. I am grateful for joining a community of Scholars and look forward to building strong bonds with mentors and Scholars who are collectively working toward scientific advancement. I am grateful for award and appreciate that the ARCS Foundation encourages us to continue generating, synthesizing, and sharing nursing knowledge.
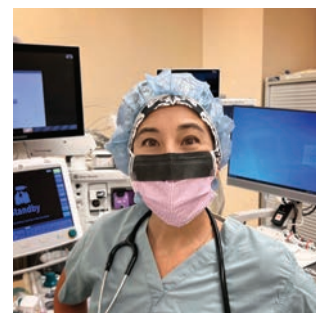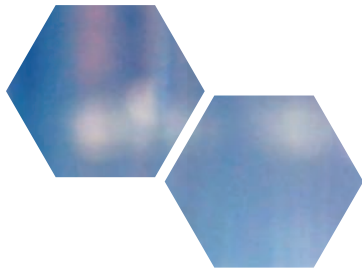
PATRICIA JINHAE MAGDALUYO

University of San Diego

Hahn School of Nursing and Health Science

Concentration: Nursing

Specialization: Oncology Patient Experience

Donor: Beyster Family Foundation

Patty's research interest is to understand the lived experience of oncology patients. She is interested in barriers to care and underserved populations. Results of this research will give nurses firsthand knowledge about oncology patients' daily living and functioning. Patty hopes that through this, we will all be better equipped to communicate with the patient about their quality of life. This will give us the foundation to develop interventions that will improve patient outcomes across the care continuum.

Degrees: M.S. in Nursing, Point Loma Nazarene University; B.S. in Biochemistry/ Cell Biology, University of California San Diego
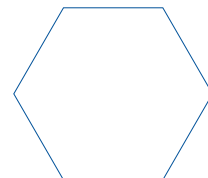
Awards and Honors: Kaye M. Woltman and Melissa R. McGuire Scholarship 2022, Terrence and Barbara Caster Institute for Nursing Excellence Scholarship Recipient, Sharp HealthCare 2021; Deans Graduate Merit Scholar, University of San Diego 2021; Clinical Nurse Specialist Award, Point Loma Nazarene University 2020

Publications, Papers, and Posters:

Magdaluyo, **P.**; Sitzer, V.; Wells, P. Harnessing the Voices of all Staff in Ongoing Improvement, Podium, *Planetree International Conference*, Boston, 2018.

Magdaluyo, **P.** Staff Engagement through Utilization of Virtual Staff Meetings, Poster, *Planetree International Conference*, Baltimore, MD, 2018.

Magdaluyo, **P.** Staff Engagement in Patient Safety, Podium, *Planetree International Conference*, Chicago, IL, 2016.

Current Research (expanded description): A focused effort is needed in training and ongoing education of the healthcare provider to improve communication with patients of all backgrounds. A cancer diagnosis has a significant effect on patients' lives. It can affect every aspect of a patient's life- spiritual, emotional, physical, and social. The understanding of the lived experience of a cancer patient is essential for all healthcare providers, especially nurses. Population based research can reduce disparities related to healthcare. It is extremely valuable for prevention, treatment and education. My research is focused on creating relationships and sustaining partnerships with disadvantaged groups. It will create a means to facilitate and encourage open discussions.

Benefits to Science and Society: Cancer treatment is rapidly advancing and the healthcare environment is continuously changing. It is important to focus on problems that patients experience and the challenges of oncology nursing. My research will create new knowledge to advance nursing practice and improve outcomes for the oncology patient.

Personal Interests: I enjoy indoor cycling, coffee shops and podcasts.

ARCS Award: I am honored and grateful to be an ARCS Scholar. It is an opportunity to continue to focus on my goal of contributing to the future of nursing. It is an inspiration to be a part of a community that values scientific achievement. I will represent the ARCS Foundation and the University of San Diego proudly.
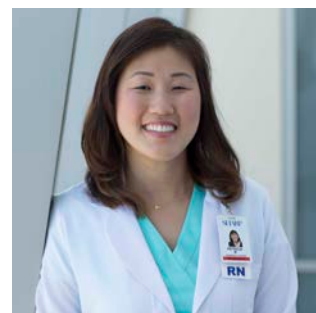
NICOLE RENAE MARCY

University of San Diego

Hahn School of Nursing and Health Science

Concentration: Nursing
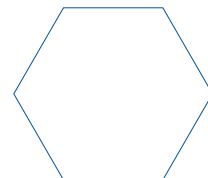
Specialization: Machine Learning

Donor: Reuben H. Fleet Foundation

In 2019, 51.5 million U.S. adults were living with a mental illness. It is estimated 8 million deaths per year globally are attributed to a mental health condition. It is known that over half of mental health cases go untreated. Research shows that mental health issues are on the rise. There are estimates that mental health issues cost several billions of dollars annually globally. Application of artificial intelligence (AI) in mental health could expand access, reduce costs and save lives. Despite the achievements of AI, there is room for improvement. Nicole will investigate the effectiveness of AI in mobile applications used in mental health diagnosis and treatment.

Degrees: M.S.N. in Health Care Informatics, University of San Diego; B.S.N. in Nursing, San Diego State University. B.S. in Health Promotion, University of Minnesota.

Awards and Honors: Daisy Award, 2019; Nurse of the month, 2015; Graduate Nursing Student Academy, American Association of Colleges of Nursing, President's Award, 2005; American Nurses Association of California, Spirit of Nursing Award, Johnson and Johnson, 2005.

Current Research (expanded description): Increase in the use of artificial intelligence (AI) will have radical implications in many realms of healthcare, to list a few: research, healthcare delivery, healthcare professionals' practice, education and policy. It was not long ago that AI became a reality with the evolution of many different technologies. AI is being rapidly adopted broadly in society; however, its utilization in healthcare is relatively new. Although AI holds great promise, there needs to be much more research investigating its impact. Despite what is already known, there is much to be discovered. My research will contribute to existing knowledge. I will investigate the effectiveness of artificial intelligence in clinic decision support systems utilized in mobile health applications interfacing with electronic medical records.

Benefits to Science and Society: It is a goal of many governments to optimize artificial intelligence (AI) utilization to benefit society. One challenge is developing a workforce ready to take on the unique challenges in the optimization of AI. Although AI is already broadly used within society and carries great promise, there is still a long way to go. In healthcare one specific example of the application of AI is to identify medical diagnoses. This is done with surprising accuracy, though accuracy still needs improvement. The need for continued research circles back to having a workforce with the expertise to conduct such work. This AI research contributes to the science of healthcare and to computer science, and draws healthcare closer to true precision medicine.

Personal Interests: Off road rally navigation, overlanding, yoga, meditation, pilates, camping, hiking, reading, art, music, and travel.

ARCS Award: The ARCS Foundation award provides much needed support. Also, this is an honor. This is an incredible gift that cannot be quantified. The benefits of this prestigious award will last a lifetime and cannot be measured.

ARCS Foundation is a national nonprofit organization administered entirely by women.
san-diego.arcsfoundation.org