ARCS ADVANCING SCIENCE IN AMERICA®
SAN DIEGO CHAPTER

ACHIEVEMENT REWARDS FOR COLLEGE SCIENTISTS

SCHOLARS' PROFILES
2021-2022

ARCS ADVANCING SCIENCE IN AMERICA®
SAN DIEGO CHAPTER

2021-2022 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 37th anniversary year, we have made more than 1400 awards totaling well over $11 million. Our academic partners are:

San Diego State University | Scripps Research

University of California San Diego | University of San Diego

ARCS Scholars are selected by their institutions in recognition of their achievements and their exceptional promise to contribute significantly to their fields. Basic requirements have been established by ARCS® Foundation, Inc.: Scholars must be U.S. citizens and have at least a 3.5 GPA; they must be enrolled full-time in academic degree programs in science, engineering, and medical research. Awards are unrestricted and merit-based. The San Diego chapter focuses on supporting students in doctoral programs, and the ARCS Scholars we have funded have a 98% graduation rate, compared with the national rate of 60% for graduate students in the sciences and engineering. Annual awards to Scholars range from $5,000 to $10,000. For the 2021-2022 academic year, the San Diego ARCS chapter has awarded $455,000 to 50 Scholars.


SAN DIEGO STATE UNIVERSITY
Scripps Research
UC San Diego
University of San Diego

SUMMARY

ARCS Foundation - San Diego Chapter 2021-2022 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

Amanda Therese Alker – Cell and Molecular Biology
Maricruz Carrillo - Mechanical Engineering
Ashley Dang-Nguyen - Chemistry
Jessica Eileen Griffin - Marine Ecology
Roslynn Beatrice King – Geophysics
Tiffany Luong – Cell and Molecular Biology
Kyle Evan Malter – Biological Sciences
Adrian Xavier Rivera - Structural Engineering
Laura Gilman Sisk-Hackworth - Microbiology
Kevin James Walsworth - Chemistry
Jennifer Anne Waters - Biology

SCRIPPS RESEARCH

Brett Michael Garabedian - Molecular Medicine
Nathalia Romanio Gazaniga – Biomedical Sciences
Tucker Ryan Huffman - Chemistry
Sergio Rodriguez Labra - Biomedical Science
Lucas James Oxtoby - Chemistry
Hailee Rose Perrett - Biophysics and Structural Biology
Caroline Rose Stanton - Biomedical Sciences
Nelson Ren Wu – Immunology
Leonard Heekyu Yoon - Chemical Biology

UNIVERSITY OF CALIFORNIA SAN DIEGO

Anela Kanani Akiona - Marine Biology
Kyle James Angle - Analytical and Atmospheric Chemistry
Gabriel Antonio Ascui-Gac - Biomedical Sciences
Miriam Kathleen Bell - Mechanical Engineering
Alec Joseph Calac - Medicine and Public Health
Minerva Contreras - Cellular and Molecular Biology
Ruben Daniel Elias - Biophysics
Sonya Renee Haupt - Biomedical Sciences
John Jaeun Holoubek - NanoEngineering
Nathaniel Max Klevit Hopkins - Computer Science/Engineering
Jervaughn DeAnthony Hunter - Bioengineering
Pratibha Jagannatha - Bioinformatics
Andrew Thomas Kleinschmidt - Chemical Engineering
David Ambrose McBride - Chemical Engineering
Colman Arthur Moore -NanoEngineering
Channing Joseph Prend - Physical Oceanography
Eleonora Rachtman - Bioinformatics and Systems Biology
Sankaran Ramanarayanan - Mechanical/Aerospace Engineering
Samantha Lylah Sison - Neuroscience
Angus Blacklaw Thies - Marine Biology/Physiology
Brian Kha Tran - Computational Mathematics
Alisha Anish Ukani - Computer Science
Alicia Ann Van Enoo - Neuroscience
Anthony Quoc Vu - Biomedical Sciences
Alexander Jeffrey Whitehead - Bioengineering
Jiarong Zhou - NanoEngineering

UNIVERSITY OF SAN DIEGO

Pedro Alonso Colio- Nursing
Ann Ozaze Lawani - Nursing
Patricia Jinhae Magdaluyo - Nursing
Nicole Renae Marcy - Nursing

SAN DIEGO STATE UNIVERSITY

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

AMANDA THERESE ALKER

San Diego State University / University of California San Diego

College of Sciences

Concentration: Cell and Molecular Biology

Specialization: Environmental Microbiology

Donor: Reuben H. Fleet Foundation Fund

Many bottom-dwelling marine animals, like corals and tubeworms, release their babies into the water column, where they swim in search of an environmental cue that indicates a suitable place to settle onto the seafloor and develop. Certain bacteria coating submerged surfaces can serve as this environmental cue. Amanda's research investigates a single probiotic marine bacterium, and demonstrates that it can produce multiple different cues that influence the babies to settle down. Harnessing these bacteria as "environmental probiotics" may allow scientists to restore threatened ecosystems like coral reefs in the future.

Degree: B.A. in Biology, Harriet L. Wilkes Honors College at Florida Atlantic University

Awards and Honors: ARCS Foundation, Inc. – San Diego Scholar (August 2020); International Coral Reef Society Student Travel Award (May 2020); National Science Foundation- Graduate Research Internship Award (January 2020); NSF -Graduate Research Fellowship (2017-2022)

Publications, Papers, and Posters:

Alker A.T. et al. Draft genome sequences of ten bacteria from the marine Pseudoalteromonas group. Microbiology Resource Announcements. August 2021, 10 (32) e00404-21 DOI: 10.1128/MRA.00404-21

Alker AT, Jones JE, Dunbar TL, Sneed JM, Paul VJ, Shikuma NJ. A bacterial toolkit to investigate the genetics and function of marine Pseudoalteromonads. Poster presentation. World Microbe Forum (Virtual). June 2021

Alker AT, Sneed JM, Delherbe N, Purdy TN, Demko A, Moore BS, Paul VJ, Shikuma NJ. A marine bacterium produces different factors that stimulate animal metamorphosis. Oral Presentation. International Coral Reef Symposium (Virtual). July 2021

Alker A.T., Delherbe N., Purdy T.N., Moore B.S., Shikuma N.J. Genetic examination of the marine bacterium Pseudoalteromonas luteoviolacea and effects of its metamorphosis-inducing factors. Environmental Microbiology. August 2020; DOI: 10.1111/1462–2920.15211

Current Research (expanded description): My current work investigates different bacterial cues capable of inducing metamorphosis in marine animals and develops genetic tools to elucidate the underlying molecular mechanisms responsible for these transformative cues.

Over the past year, I adapted a broad host range genetic toolkit of modular plasmids for use in diverse marine bacteria. She screened species of host-associated marine bacteria for their candidacy as genetically manipulatable bacteria. To visualize host-microbe associations, I generated fluorescent strains of environmental isolates capable of inducing metamorphosis and imaged them using microscopy. Furthermore, I got CRISPRi gene knockdown technology to work in marine bacteria, opening up the possibility of interrogating gene function in any of the successfully screened marine bacteria. These developments will enable scientists to study the phenomenon not only underscoring metamorphosis, but also for aquaculture and biomedical discovery.

Furthermore, I participated in a two month internship at the Smithsonian Marine Station this past summer, where I was able to test previously characterized bacterial cues for metamorphosis on coral larvae. I found that corals respond to very specific bacterial cues and may be killed by different cues that influence other animals to undergo metamorphosis. The results of this work will inform decisions for futurel coral restoration products.

Benefits to Science and Society: Bottom-dwelling marine animals release their babies into the water, where they swim in search of an environmental cue indicating a suitable place to settle onto the seafloor. Certain bacteria coating submerged surfaces can serve as this cue. My research investigates probiotic marine bacteria and shows how they produce different cues that influence the babies to settle down. Harnessing these bacteria as "environmental probiotics" will allow scientists to restore threatened ecosystems, like coral reefs, in the future.

Personal Interests: Live music- the funkier the better, surfing, backcountry camping, and SCUBA.

ARCS Award: To me, the ARCS Foundation award signifies recognition of both my accomplishments and my potential in academia. I am particularly honored to be recognized by the ARCS Foundation because of its history with female leadership. I wouldn't be where I am today without the support of strong independent women, which makes the support from the ARCS Foundation even more impactful to me. Furthermore, I appreciate the financial support and the investment in my future because they allow me to continue my doctoral research and reach for higher impact projects. The supplementary funds make my salary more sustainable as a graduate student with real-world financial responsibilities.

MARICRUZ CARRILLO

San Diego State University / University of California San Diego

College of Engineering

Concentration: Mechanical Engineering

Specialization: Additive Manufacturing of Bone Implants

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. The Minerals, Metals and Materials Society Conference, San Diego. 2020

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; Zanolini, R. J.; Gustafson, J. Selective functionalizations of arenes and heteroarenes via SEAr and related transformations. Wiley. 2021, (Book chapter in review)

Cardenas, M.; **Nguyen, A. D.**; Brown, Z.; Heydari, B.; Heydari, B.; Vaidya, S.; Gustafson, J. Atropisomerism as an inspiration for new chemistry. Arkivoc. 2021, i, 20-47

Nguyen, A. D.; Millan, E. A; Gustafson, J. L. Photocatalytic Oxidative C-H Thiolation: Synthesis of Benzothiazoles and Sulfenylated Indoles. National Organic Chemistry Symposium (NOS) by American Chemical Society Division of Organic Chemistry, Indiana University, Bloomington, IN, June 23 – June 27, 2019. (Poster)

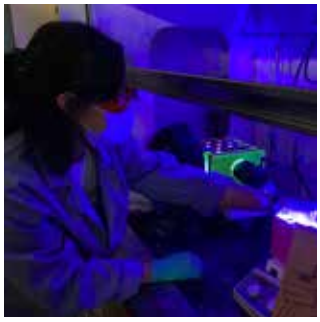
Dinh, A. N*.; **Nguyen, A. D.***; Millan, E. A.; Albright, S. T.; Cedano, M.; Smith, D. K.; Gustafson, J. L. Photocatalytic Oxidative C-H Thiolation: Synthesis of Benzothiazoles and Sulfenylated Indoles. Synlett. 2019, 30, 1648-1655. *signifies equal contribution

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, in press

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.

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 (Wall et al. 2008). However, sometimes bivalves harm eelgrass, such as by excreting toxic sulphides into the sediment (Vinther and Holmer 2008). 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.

ROSLYNN BEATRICE KING

San Diego State University / University of California San Diego

College of Sciences

Concentration: Geophysics

Specialization: Controlled-Source Electromagnetism

Donor: Legler Benbough Foundation

Roslynn is interested in the design, fabrication, and use of controlled-source electromagnetic instruments to study hazards and potential resources that have direct implications for human life located on the continental shelf. More specifically, she is interested in identifying and analyzing marine hydrocarbon seeps, fluid pathways, freshwater resources, and archeological sites so as to reduce ambiguity in current climate models, manage groundwater resources in coastal communities, and aid in the current understanding of human migration pathways.

Degree: B.S. in Geological Engineering, Colorado School of Mines

Awards and Honors: Award of Student Support - NOAA Office of OER 2020; Invited speaker Meeting of Science Advisory Panel of the Coastal Plain of SD Groundwater Sustainability Plan 2020; SCEC Travel Grant Award 2019; Award of Student Support - National Park Service Preservation Technology & Training Grant 2019

Publications, Papers, and Posters:

King, R. B., Constable, S., Maloney, J. M., & Danskin, W. R. CSEM Survey Identifies Fresh Submarine Groundwater: Interim Report. Interim Report for distribution to the United States Geological Survey 2021

Gusick, A. E., Maloney, J., **King, R. B.**, & Braje, T. J. Emerging Technologies in the Search for the Submerged Cultural Landscapes of the Pacific Continental Shelf. In Offshore Technology Conference. Offshore Technology Conference 2019

Duross, C., Hylland, M. D., Hiscock, A., Personius, S., Briggs, R., Gold, R. D., Beukelman, G. S., McDonald, G.N., Erickson, B.A., McLean, A. P., Angster, S. J., **King, R. B**., Crone, A. J., Mahan, S. A. Holocene surface-faulting earthquakes at the Spring Lake and North Creek Sites on the Wasatch Fault Zone: Evidence for complex rupture of the Nephi Segment (Vol. 28, pp. 1-119). Utah Geological Survey 2017

DuRoss, C. B., Hylland, M. D., Hiscock, A., Beukelman, G., McDonald, G. N., Erickson, B., McKean, A., Personius, S. F., Briggs, R., Gold, R., Angster, S., **King, R.**, Crone, A. J., Mahan, S. A. Paleoseismic investigation to determine the mid-Holocene chronology of surface-faulting earthquakes on the Nephi segment of the Wasatch fault zone, Utah and Juab Counties, Utah. US Geological Survey, NEHRP final technical report 2014.

Current Research (expanded description): Sea-level rise following the Last Glacial Maximum (~20 kya) submerged millions of square kilometers of coastal landscape, obscuring multitudes of geologic phenomena, resources, and cultural sites from direct observation. Traditionally, the subseafloor of this region has been investigated using the seismic method, which is a valuable geophysical tool, but is not sensitive to all physical properties. The marine controlled-source electromagnetic (CSEM) method, which has experienced significant development, can be sensitive to geology and features that have little to no seismic signature.

My research explores the use of CSEM to identify and characterize natural and anthropogenic resources on the continental shelf. These targets include shell middens (cultural sites of maritime hunter-gathers), marine hydrocarbon seeps, and submarine fresh water. As shell middens are typically small and difficult to resolve, I am developing a novel bottom-towed CSEM system that is aimed to facilitate their discovery. Additionally, I have used CSEM methods to identify and characterize greenhouse gas emitting marine hydrocarbon seeps and sources. Finally, I have identified a considerable volume of fresh groundwater that extends offshore San Diego. I am determining if this feature is a potential resource or a possible pathway for saltwater encroachment.

Benefits to Science and Society: My research aims to identify phenomenon on the continental shelves that have been obscured from direct observations due to changes in sea level. These features may aid in our understanding of past climates and human histories or may be potential resources such as freshwater. Data regarding the locations and characteristics of these cultural and natural resources will help create robust strategies to protect and manage these targets located just offshore our coastal communities.

Personal Interests: Backpacking, painting, gardening, playing lacrosse, brewing beer, and diving into some solid podcasts.

ARCS Award: The ARCS award has made me feel more confident as a young scientist and has motivated me to produce research that will make this community proud. Additionally, this award has alleviated some of the financial stresses that arise from living in San Diego. With this burden lessened, I feel refreshed and excited to continue to produce high quality work and share my findings with my peers, scientific societies, and this organization.

TIFFANY LUONG

San Diego State University / University of California San Diego

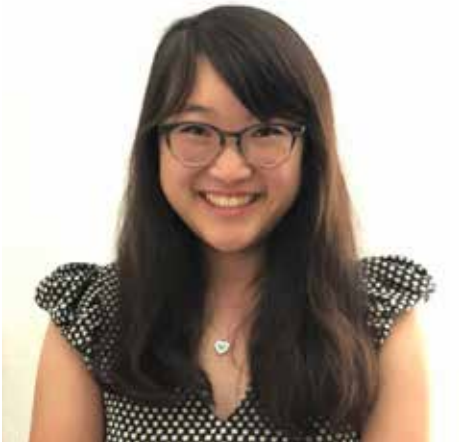
College of Sciences

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.; 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

Flyak, A.I.; Ruiz, S.; Colbert, M.D.; **Luong, T.**; Crowe, J.E., Bailey, J.R., and Bjorkman, P.J. HCV Broadly Neutralizing Antibodies Use CDRH3 Disulfide Motif to Recognize an E2 Glycoprotein Site that Can Be Targeted for Vaccine Design. Cell Host & Microbe 2018, 24, 703–716

Current Research (expanded description): Bacteriophages, phages for short, are viruses that specifically infect bacteria and are currently under investigation for their ability to treat drug-resistant bacteria infections. Phages have been used worldwide to treat a variety of life-threatening drug-resistant bacterial infections. However, despite a century of usage, the production, administration, and treatment of phages remains non-standard, making it difficult to standardize or identify how phages should be formulated for widespread use. Furthermore, as with antibiotics, bacteria can mutate to become phage-resistant.

For my thesis project, I am studying the tripartite interactions between bacteria, phages, and the mammalian host. First, I am deciphering how to select phages that minimize bacterial phage resistance during phage therapy, how to dose for single or dual-phage treatments, and how to best minimize negative bacterial mutations that result from phage treatment.

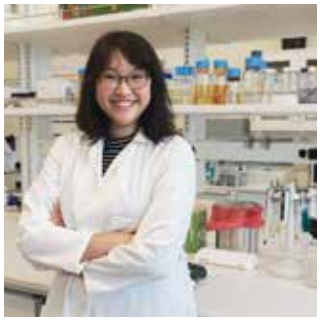
Second, I am studying the interactions between phages and the innate immune system. Phages are naturally present in the mammalian microbiome. However, phage therapy requires the injection of billions of phages into the body. How phages interact with mammalian cells and what type(s) of immune responses they elicit remain unclear. Combined, I hope to identify mechanisms and treatment regimes that will make phage therapy safer in the future.

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 ongoing thesis work, I am studying the nuances of phage-bacteria interactions to understand the microbiological consequences of phage treatment. I am also studying the mechanism of phage sensing by mammalian cells to elucidate the immunological consequences of phage treatment. By gaining a holistic view of these interactions, I hope to optimize the safety of phage therapy.

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 had a profound impact on my development as a scientist and a scientific communicator in the last year. ARCS has connected me with Dr. Steffanie Strathdee, an inspirational female scientist in the phage community, and allowed me to not only share my research with her, but to receive her support and mentorship. Recognition as an ARCS Scholar has allowed me to share my research with my peers as well as other amazing women who support the ARCS community.

Recent ARCS events such as the scholar picnic and scientist of the year event (where Dr. Erica Ollmann Saphire gave an amazing talk about her COVID19 work) have also given me a sense of a female-driven scientific community and reinforced my passion for scientific communication. My strong community of women at ARCS that support my academic successes and who promote me as a young female scientist gives me the confidence to succeed not only during my Ph.D. but in my future endeavors as well.



KYLE EVAN MALTER

San Diego State University / University of California San Diego

College of Sciences

Concentration: Biological Sciences

Specialization: Host-Microbe Biology

Donor: Hervey Family Fund

Kyle's research aims to understand how bacteria directly affect animal development. Identifying the mechanisms that bacteria use to influence animal development could have a wide range of impacts on the scientific community, such as understanding more complex systems, including the human gut microbiome. To study this, Kyle uses a marine tubeworm which requires bacteria for growth and development. This required interaction has allowed him to find key bacterial proteins which control the tubeworm's development. Kyle's future work aims to understand how human gut bacteria contribute to health and development.

Degree: B.S. in Biochemistry, University of California Los Angeles

Awards and Honors: James and Mary Crouch Memorial Scholarship 2018; American Society of Microbiology outstanding abstract award 2017; Graduated magna cum laude 2014, UCLA; UCLA Academic Scholarship 2012-2014

Publications, Papers, and Posters:

Cavalcanti, G.; Alker, A.; Delherbe, N.; **Malter, K.E.**; Shikuma, N.J. The influence of bacteria on animal metamorphosis. Annu. Rev. Microbiol. 2020, 74, in press. https://doi.org/10.1146/annurev-micro-011320-012753

Rocchi, I.; Ericson, C.F.; **Malter, K.E.**; Zargar, S.; Eisenstein, F.; Pilhofer, M.; Beyhan, S.; Shikuma, N.J. A bacterial phage tail-like structure kills eukaryotic cells by injecting a nuclease effector. Cell Rep. 2019, 28 (2), 295-301.e4. https://doi.org/10.1016/j.celrep.2019.06.019

Ericson, C.F.; Eisenstein, F.; Medeiros, J.M.; **Malter, K.E**.; Cavalcanti, G.S.; Zeller, R.W.; Newman, D.K.; Pilhofer, M.; Shikuma, N.J. A contractile injection system stimulates tubeworm metamorphosis by translocating a proteinaceous effector. Elife 2019, 8, 1–19. https://doi.org/10.7554/eLife.46845

Current Research (expanded description): In my research I hope to understand how bacterial communities may influence and contribute to animal development. I have recently made significant progress in understanding how bacterial proteins can be injected into animals and alter certain cellular processes. My work has determined that bacteria can inject proteins via a viral-like injection system directly into animal cells to control their function and behavior. The injection system is a complex array of virus-like tails, similar to T4 bacteriophage, however, protein instead of DNA is transported across the membrane. These tails have the ability to inject proteins into a marine tubeworm and stimulate metamorphosis. I have recently discovered two bacteria-produced proteins, which are injected from the structure into the animal and control two major cellular processes. One protein is a toxin, which is targeted to the animal cell nucleus and degrades DNA. This protein is promiscuous and effects multiple diverse cell lines but not the marine tubeworm. The second bacterial protein can directly initiate the metamorphosis of the marine tubeworm. The work on the second protein sets the foundation for my continued studies, which aims to find the function of this injected protein and determine how it may influence cell signaling.

Benefits to Science and Society: The understanding of animal-bacteria interactions can inform future studies of highly complex microbial ecosystems. We can then begin to use more targeted methods to determine a highly directed role for these microbes in human and animal health. My long-term goal is to understand how a complex mix of microbes associated with human and animal hosts contributes and controls the normal host's development.

Personal Interests: In my free time I am an avid surfer, backpacker and guitar player. I am also an avid builder, shaping my own custom surfboards and handmade instruments.

ARCS Award: The ARCS Foundation awards is an amazing opportunity for me to share my research with the broader community. In this time of false information, community outreach from working scientists has become increasingly more important. Being recognized as an ARCS Scholar is an amazing accomplishment and I am very grateful to be standing shoulder to shoulder with the elite scientists this foundation supports. This award will help springboard my career as a scientist, as the prestige and recognition will aid in increase my networks and affiliations, both of which are very crucial finding new opportunities in science.

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 fous 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. The X-ray images were converted into finite element models which simulated load conditions for compression and pure shear in order to understand the effects that imperfections have on the compression strength and transverse shear respectively. It was found that imperfections through the thickness of the aluminum honeycomb, such as waviness, introduced during the curing process of the composite panels, significantly reduced the compression performance of the aluminum honeycomb core.

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.

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 the beautiful hills of 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.

KEVIN JAMES WALSWORTH

San Diego State University / University of California San Diego

College of Sciences

Concentration: Chemistry

Specialization: Organic Chemistry

Donor: Robin Luby/ARCS Foundation - San Diego Chapter

Kevin's research is focused on the design and synthesis of new drugs to help fight various diseases. He is currently working on two projects; one is the synthesis of a marine natural product that is an active against colon cancer, and the other is the design and synthesis of a new class of hepatitis C drugs. By synthesizing these compounds, he has been able to further optimize new analogues that will be more potent and selective to their targets.

Degree: B.S. in Biochemistry, California State University, Chico

Awards and Honors: Harry E. Hamber Memorial Scholarship, 2020-2022; Tom Ragan Memorial Endowed Scholarship 2020-2021; Organic Chemistry Teaching Assistant Award, 2018-2019

Publications, Papers, and Posters:

Schmit, D., Milewicz, U., Boerneke, M., Burley, S., **Walsworth, K.,** Um, J., Hecht, D., Hermann, T., Bergdahl, BM. Syntheses and Binding Testing of N1-Alkylamino-Substituted 2-Aminobenzimidazole Analogues Targeting the Hepatitis C Virus Internal Ribosome Entry Site. Aust. J. Chem 2020, 73, 212-221

Walsworth, K., Bender, A., Separovic, B., Bergdahl, BM., Metzger, R. The Conformations of Virginiamycin M 1 Diacetate, an Inhibitor of Guinea Pig Brain CCK-B Receptors, in Selected Solvents. Aust. J. Chem 2020, 73, 230-235

Walsworth, K., Simon, A., Nelson-Hall, T., Molina, J., Bender, A., Hermann, T., Bergdahl, BM. Synthesis of New Hepatitis C Virus Translation Inhibitors. American Chemical Society National Meeting, San Diego, CA, August 2019 (poster).

Current Research (expanded description): Palmyramide A is a cyclic depsipeptide consisting of three amino acids and three hydroxy acids; the most notable of these is dimethylhydroxyhexanoic acid (DMHHA). I am using novel chemistry developed in our lab to add a silicon derived directing group with a high degree of stereo control on DMHHA. More recently, I have been focusing on connecting these pieces and thereby completing the total synthesis. Once this is accomplished, my plan is to structurally modify the natural product to determine its molecular target, and then synthesize targeted derivatives with more anti-cancer activity.

Hepatitis C is a single stranded positive-sense RNA virus, which means that its genome is replicated and translated with little to no proof-reading. Current therapies target the viral protein responsible for replication of the virus' genetic material; however, there is a high likelihood of that protein mutating, rendering the drugs ineffective. My research is working on targeting the viral RNA itself, focusing on segment of RNA that is highly conserved (subdomain IIa of the internal ribosome entry site [IRES]). When our compounds bind to the IRES, they make it impossible for ribosomes to bind, rendering the virus unable to replicate. Once I synthesize potential ligands, I work with the Hermann lab at UCSD to test their affinity against the HCV IRES.

Benefits to Science and Society: Natural products and their derivatives make up approximately 35% of the global medicine market and have always been a rich source of therapeutics. Our efficient route to Palmyramide A, along with our designed syntheses of HCV therapeutics, give insight into how these molecules interact with their targets. Even if the specific compounds I have been working on do not turn to be viable drug candidates, what we learn from our mechanism of action and SAR studies can help us to design better therapeutics in the future.

Personal Interests: Watching baseball, playing video games, and binging Netflix.

ARCS Award: I am incredibly grateful to be named an ARCS Scholar. I cannot express enough how honored I am to be recognized by such a great organization. Support from the ARCS Foundation is a reminder that my work is appreciated by the broader community. Thank you for the support, and I hope that my work will continue to do justice to this award.

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 S.F.; House C.D. Role of IGFBP5 in Obesity Related Ovarian Cancer Progression. Research Centers in Minority Institutions (RCMI) Consortium National Conference. March 26th 2021. Virtual.

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) 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.; Robinson M.; Gilbert S.; Alexander L.; and House C.D. Role of Secretory Factors from Obese-Derived Omentum in Supporting Ovarian Cancer Progression. AACR Annual Meeting 2020. April 24-29, 2020, Virtual.

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.

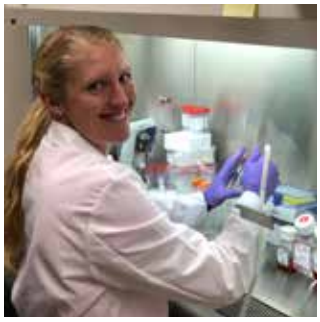
I have developed a co-culture system and a mouse model that enable me to ask important questions about the interactions between ovarian cancer cells and preadipocytes. My work has discovered that preadipocytes secrete specific signaling molecules that increase the tumorigenic potential of cells, which translates to an increase in tumor initiation and growth.

My ongoing research seeks to define the signaling pathways that are being differentially regulated in the cancer cells in response to secreted signals from the preadipocytes, with the hope of preventing preadipocyte-induced increases in tumorigenesis.

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 immense relief. 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

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: ARCS Scholar at Scripps Research, 2021; 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 9, 5383-5388. 2018. 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 11, 340. 2018. 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 remarkably nefarious ploy of cancer cells is their ability to hijack this carbohydrate camouflage and evade the immune response. Exciting reports suggest that by chemically editing these 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: It has been a long year. The ebb and flow of the Coronavirus pandemic has affected us all in unexpected ways, most notably those closest to me. On New Year's Eve 2020 my father passed away from COVID-19, leaving my mother, brothers and me in wholly unfamiliar territory. And sadly, my story is only one of many defined by this pandemic. The ARCS Foundation award represents a major achievement afforded by my hard work, but also represents the unwavering support of my family, friends, colleagues, mentors, and especially of my father, Arthur Garabedian. This ARCS Foundation award is dedicated to my father, that we may remember his glowing kindness, splendor and wit; a fearless innovator who instilled in me values of humility, leadership and a love for discovery and adventure in scientific research and in life. Thank you ARCS, and thank you Dad.

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. (2020). High throughput pSTAT signaling profiling by fluorescent cell barcoding and computational analysis. Journal of immunological methods, 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. (2019). JAK Inhibition Differentially Affects NK Cell and ILC1 Homeostasis. Frontiers in immunology, 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.

TUCKER RYAN HUFFMAN

Scripps Research

Skaggs Graduate School of Chemical and Biological Sciences

Concentration: Chemistry

Specialization: Organic Synthesis

Donor: Reuben H. Fleet Foundation

Tucker's research is currently focused on the chemical synthesis of a biologically active fungal natural product that has exhibited anticancer activity. Access to this material will allow both investigations into its use as a therapeutic agent and studies into how this molecule kills cancer cells. Because of the complexity of the target molecule, Tucker is exploring new reactions that allow the natural product to be made quickly from much simpler, less expensive starting materials.

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

Awards and Honors: NSF Graduate Research Fellowship, June 2019; Departmental Citation in Chemistry, May 2017; University Medal Finalist, May 2017

Publications, Papers, and Posters:

Berdan, C.A.; Ho, R.; Lehtola, H.S.; To, M.; Hu, X.; **Huffman, T.R.**; Petri, Y.; Altobelli, C.R.; Demeulenaere, S.G.; Olzmann, J.A.; Maimone, T.J.; Nomura, D.K. Parthenolide covalently targets and inhibits focal adehesion kinase in breast cancer cells. Cell Chem. Biol. 2019, 26, 1027

Green, S.A.; **Huffman, T.R.**; McCourt, R.O.; van der Puyl, V.; Shenvi, R.A. Hydroalkylation of olefins to form quaternary carbons. J. Am. Chem. Soc. 2019, 141, 7709

Huffman, T.R.; Wu, Y.; Emmerich, A.; Shenvi, R.A. Intermolecular heck coupling with hindered alkenes directed by potassium carboxylates. Angew. Chem. Int. Ed. 2019, 58, 2371

Grossman, E.; Ward, C.C.; Spradlin, J.N.; Bateman, L.A.; **Huffman, T.R.**; Miyamoto, D.K.; Kleinman, J.I.; Nomura, D.K. Covalent ligand discovery against druggable hotspots targeted by anti-cancer natural products. Cell Chem. Biol. 2017, 24, 1

Current Research (expanded description): My current research involves the total synthesis of fusicoccane natural products, particularly cotylenin type diterpenoids. We have devised a highly convergent approach to merge densly functionalized cyclopentane fragments, and have recently discovered a pericyclic reaction cascade that rapidly assembles the 5-8-5 core rapidly. Our current objective is to advance this key building block to access several family members in this important natural product family and produce new analogues with improved biological activity.

Benefits to Science and Society: Access to the chemical matter we are targeting could provide new leads for drug development, particularly in the development of new anticancer agents and strategies.

ARCS Award: The ARCS Foundation award is an affirmation of the work I'm doing as a scientist and a reminder to continue doing quality research that benefits others.

SERGIO RODRIGUEZ LABRA

Scripps Research

Skaggs Graduate School of Chemical and Biological Sciences

Concentration: Biomedical Science

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, lacking 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:

Prokop, S.; Miller, K.R.; **Labra, S.R**.; Pitkin, R.M.; Hoxha, K.; Rosenbloom, A.; Lee, V.M.Y.; Trojanowsk,i 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

Nasir, I.; Onuchic, P.L.; **Labra, S.R.**; Deniz, A.A. Single-molecule fluorescence studies of intrinsically disordered proteins and liquid phase separation. Biochimica et Biophysica Acta (BBA)-Proteins and Proteomics. 2019, 1867(10), 980-987

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.

Rodriguez **Labra S.**; Prokop, S.; Miller, K.R.; Lee, V.M.Y.; Trojanowski, J.Q.; Complement System: Potential Mediators of Synapse Loss in Alzheimer's Disease. Presented at the 12th Drug Discovery for Neurodegeneration Conference of the Alzheimer's Drug Discovery Foundation, Arlington, VA; February 4-6. 2018

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 and novel cell- and non-cell-autonomous 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 finalized project would 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 desire to make a difference in the world. I am humbled to be recognized as an ARCS scholar and I look forward to meeting new interesting scientists with diverse career paths, connecting with the broader community outside the academic bubble, and sharing my research with you and in future scientific conferences. I am immensely grateful for the inspiration and financial support to focus my research efforts to make a difference in my field.

LUCAS JAMES OXTOBY

Scripps Research

Skaggs Graduate School of Chemical and Biological Sciences

Concentration: Chemistry

Specialization: Organometallics

Donor: Lambert Foundation for Education/ARCS Foundation - San Diego Chapter

Luke's research focuses on the development of a novel organometallic methodology using palladium catalysis, specifically through "transient directing group" strategies. Classical metal-coordinating directing groups have seen extensive use in the field of transition metal-catalyzed chemistry; however, their waste-generating installation and removal steps limit the efficiency and practicality of reactions that rely on their use. Using a transient directing group approach circumvents these issues enabling expedient access to structurally complex scaffolds that are otherwise difficult to prepare, including structures present in natural products, agrochemicals, and pharmaceutical agents.

Degree: B.S. in Chemistry, University of Wisconsin-Madison

Awards and Honors: AbbVie Scholars Symposium Presenter 2021; IPMI Johnson Matthey Student Award 2021; NSF Graduate Research Fellowship 2018; UW-Madison Goldwater Scholar 2017

Publications, Papers, and Posters:

Liu, Z.; **Oxtoby, L. J.**; Liu, M.; Li, Z.-Q.; Tran, V. T.; Gao, Y.; Engle, K. M. A Transient Directing Group Strategy Enables Enantioselective Multicomponent Organofluorine Synthesis. J. Am. Chem. Soc. 2021, 143, 8962–8969. DOI: 10.1021/jacs.1c03178

Oxtoby, L. J.; Li, Z.-Q.; Tran, V. T.; Erbay, T. G.; Liu, P.; Engle, K. M. A Transient-Directing-Group Strategy Enables Enantioselective Reductive Heck Hydroarylation of Alkenes. Angew. Chem. In. Ed. 2020, 59, 8885–8890. DOI: 10.1002/anie.202001069

Oxtoby, L. J.; Gurak, J. A., Jr.; Wisniewski, S. R.; Eastgate, M. D.; Engle, K. M. Palladium-Catalyzed Reductive Heck Coupling of Alkenes. Trends Chem. 2019, 1, 572–587. DOI: 10.1016/j.trechm.2019.05.007

Current Research (expanded description): The use of directing groups (DGs), functional motifs containing one or more binding sites capable of facilitating efficient intramolecular delivery of a reagent or catalyst, is a classical strategy in organic synthesis for controlling reactivity and selectivity. In recent years, removable DG strategies have been successfully applied to various alkene functionalization reactions, including classical Mizoroki–Heck alkene arylations. While reactions involving removable DGs are intrinsically valuable, they are limited by the fact that the DG needs to be installed and cleaved, requiring a minimum of two concession steps. Additionally, reactions using DGs are difficult to render enantioselective owing to a lack of available coordination sites on the metal for a chiral ligand.

Taking inspiration from organocatalytic methodologies, we have successfully developed multiple transient directing group (TDG) strategies for transition metal-catalyzed alkene functionalization. In these reactions, a chiral directing moiety (an amino acid or amino amide) condenses with an aldehyde substrate reversibly, promoting the desired reaction via an imine linkage formed and hydrolyzed in situ. This strategy has been applied to both alkene hydroarylation (via a Pd(0)/Pd(II) cycle) and arylfluorination (via a Pd(II)/Pd(IV)) where the TDG was used in catalytic quantities without the need for discrete installation or removal steps.

Benefits to Science and Society: Alkenes are inexpensive, widely available chemical feedstocks that can be sourced from petroleum or renewable resources. Although alkenes are now recognized as fundamental building blocks in organic synthesis, many seemingly straightforward functionalization reactions remain unknown or underdeveloped. The continued development of transient directing group approaches to transition metal-catalyzed alkene functionalization will allow for expedient access to structurally complex scaffolds (such as those present in natural products, agrochemicals, and pharmaceutical agents) that are otherwise difficult to prepare.

Personal Interests: Visiting national and state parks with my fiancée.

ARCS Award: I am honored to have been selected as an ARCS Scholar. The acknowledgement this award brings encourages me both professionally and personally, while the financial support allows me to continue to spend my time focusing on my graduate studies with reduced anxiety. I look forward to the opportunity to discuss research with the ARCS community and hope that in the future I can give back to help students focus on their goals just as the assistance from the ARCS Foundation has done for me.

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: Excellence in Journalism Award, 2020; David C. Fairchild Endowed Fellowship, 2019-2022; Dean's Research Fellowship, 2019; The A. E. Marshall Award for Process Design, 2019

Publications, Papers, and Posters:

Shin, M.; 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.

Antanasijevic, A.; Sewall, L. M.; Cottrell, C. A.; Carnathan, D. G.; Jimenez, L. E.; Ngo, J. T.; Silverman, J. B.; Groschel, B.; Georgeson, E.; Bhiman, J.; Bastidas, R.; LaBranche, C.; Allen, J. D.; Copps, J.; **Perrett, H. R.**; Rantalainen, K.; Cannac, F.; Yang, Y. R.; de la Peña, A. T.; Rocha, R. F.; Berndsen, Z. T.; Baker, D.; King, N. P.;

Sanders, R. W.; Moore, J. P.; Crotty, S.; Crispin, M.; Montefiori, D. C.; Burton, D. R.; Schief, W. R.; Silvestri, G.; Ward, A. B. Polyclonal Antibody Responses to HIV Env Immunogens Resolved Using CryoEM. Nat. Commun. 2021, 12 (1), 4817. https://doi.org/10.1038/s41467-021-25087-4.

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.

Perrett, H. R.; Design of a ranibizumab biosimilar production facility with internal wastewater treatment. American Institute of Chemical Engineers Annual Conference. Orlando, FL, 2019

*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. Our 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: Creating science-related digital illustrations and surreal oil paintings, hiking, 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

Smythers, A. L.; Ford, M. M.; Hawkins, D. G.; Connor, M. C.; Lawrence, K. C.; **Stanton, C. R**.; Gayton, A. C.; Hicks, L. M., Modernizing the Analytical Chemistry Laboratory: The Design and Implementation of a Modular Protein-Centered Course. Journal of Chemical Education 2021, 98 (5), 1645-1652

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: ARCS Scholar; 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

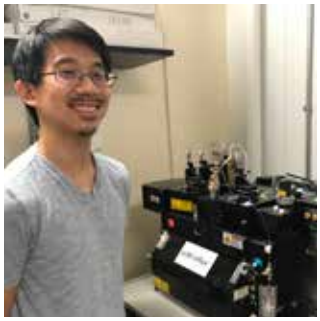
Saunders, K.O.; Nicely, N.I.; Wiehe, K.; Bonsignori, M.; Meyerhoff, R.R.; Parks, R.; Walkowicz, W.E.; Aussedat, B.; **Wu, N.R.**; Cai, F.; Vohra, Y.; Park, P.K.; Eaton, A.; Go, E.P.; Sutherland, L.L.; Scearce, R.M.; Barouch, D.H.; Zhang, R.; Von Holle, T.; Overman, R.G.; Anasti, K.; Sanders, R.W.; Moody, 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 nonhuman 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.



LEONARD HEEKYU YOON

Scripps Research

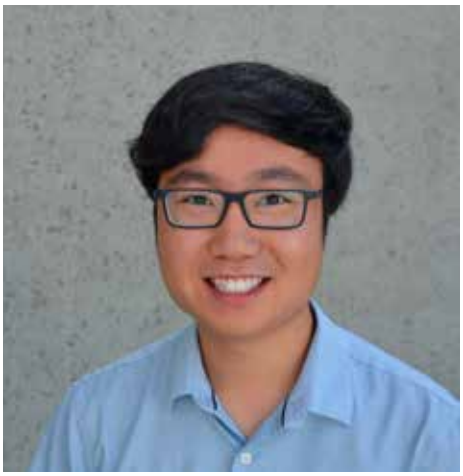
Skaggs Graduate School of Chemical and Biological Sciences

Concentration: Chemical Biology

Specialization: Molecular Medicine

Donor: Karen and Robert Bowden

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



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

Awards and Honors: Shirley and Ralph Shapiro Graduate Fellow Award, Scripps Research (2019); Everett H. Pryde Research Award, Amherst College Chemistry Department (2018); White Prize, Amherst College Chemistry Department (2017)

Publications, Papers, and Posters:

H. O. Leung; M. D. Marshall; A. T. Bozzi; J. R. Horowitz; A. C. Nino; H. K. Tandon; **L. Yoon**. The microwave spectra and molecular structures of (E)-1-chloro-1,2-difluoroethylene and its complex with the argon atom, Journal of Molecular Spectroscopy 2021, 381, 111520

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

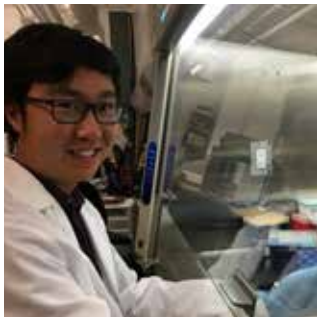
Chen, W.; Dong, J.; Li, S.; Liu, Y.; Wang, Y.; **Yoon, L.**; Wu, P.; Sharpless, K.B.; Kelly, J.W. Synthesis of sulfotyrosine-containing peptides by incorporating fluorosulfated tyrosine using an Fmoc-based solid-phase strategy, Angewandte Chemie. 2016. 128, 1867-1870

Current Research (expanded description): My research is inspired by aggregation of intrinsically-disordered proteins, abnormal lipid droplet accumulation, mitochondrial dysfunction and increased oxidative stress seen in neurodegenerative diseases (ND). We hypothesize that the inability of the cell to clear these potentially harmful cellular components drives ND progression. Autophagy is an important pathway in the degradation of protein aggregates, lipid droplets and organelles. Previously, pharmacologic activation of autophagy has normalized this pathogenic signature, largely through mTOR inhibition. In addition to being a master regulator of autophagy, mTOR is a major signaling hub with roles in growth, metabolism and immune function. So, mTOR-independent autophagy activation would potentially reduce harmful side-effects for ND patients. Development of a selective and potent small molecule mTOR-independent autophagy activator would be broadly useful. To enable my project, we recently executed a lipid droplet-degradation based screen of a million compounds to discover novel autophagy activators utilizing high content imaging. After hit validation, confirmation of dose-dependent activity, elimination of fluorescent artifacts and replication of activity in additional cell lines, approximately twenty-four compounds were prioritized. The objective of my research is to determine the mechanism of action of one mTOR-independent autophagy activator and develop it into a selective and potent compound for use by scientists.

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

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

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




UC San Diego

ANELA KANANI AKIONA

University of California San Diego

Scripps Institution of Oceanography

Concentration: Marine Biology

Specialization: Coral Reef Ecology

Donor: 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.; 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. Journal 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.

KYLE JAMES ANGLE

University of California San Diego

Division of Physical Sciences

Concentration: Analytical and Atmospheric Chemistry

Specialization: Aerosol Chemistry and Kinetics

Donor: Hervey Family Fund

Kyle studies the chemistry of sea spray aerosols. These aerosols are emitted into the air every time ocean waves break and bubbles burst, but their impact on climate change and human health is poorly understood. Kyle has developed new techniques for measuring their acidity, how quickly they can produce chemicals that lead to cloud formation, and how biological building blocks like amino acids change the climate properties of these aerosols. His research shows aerosols rapidly acidify and accelerate key chemical reactions that impact our lung health and atmospheric water uptake.

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

Awards and Honors: Chemistry & Biochemistry Distinguished Graduate Student Fellowship, 2021; Mark Twain Section of the American Chemical Chemical Society Outstanding Graduating Senior, 2018; American Chemical Society Organic Chemistry Award, 2018; Phi Beta Kappa honors fraternity induction, 2017

Publications, Papers, and Posters:

Angle, K.J.; Neal, E.E.; Grassian, V.H. Enhanced Rates of Transition-Metal-Ion-Catalyzed Oxidation of S(IV) in Aqueous Aerosols: Insights into Sulfate Aerosol Formation in the Atmosphere. Environ. Sci. Technol. 2021, 55 (15) 10291–10299.

Angle, K.J.; Crocker, D. R.; Simpson, R.M.; Mayer, K.J.; Garofalo, L.A.; Moore, A.N.; Mora Garcia, S.L; Or, V.W.; Srinivasan, S.; Farhan, M.; Sauer, J.S.; Lee, C.; Pothier; M.A.; Farmer, D.K.; Martz, T.R.; Bertram, T.H.; Cappa, C.D.; Prather, K.A.; Grassian, V.H. Acidity across the interface from the ocean surface to sea spray aerosol. Proc. Nat. Acad. Sci. USA. 2021, 118 (2) e2018397118.

Luo, M.; Wauer, N.A.; **Angle, K.J.**; Dommer, A.C.; Song, M.; Nowak, C.M.; Amaro, R.E.; Grassian, V.H. Insights into the behavior of nonanoic acid and its conjugate base at the air/water interface through a combined experimental and theoretical approach. Chem. Sci. 2020, 11, 10647-10656.

Coddens, E.M.; **Angle, K.J**.; Grassian, V.H. Titration of Aerosol pH through Droplet Coalescence. J. Phys. Chem. Lett. 2019, 10 (15) 4476–4483.

Current Research (expanded description): My research is aimed at developing techniques for measuring the acidity of sea spray aerosols, and then quantifying how acidity impacts chemical equilibria and reaction rates relevant to the marine environment. Aerosol acidity is challenging to measure reliably due to the picoliter volumes and high salt concentrations found in aerosols, but a combination of colorimetric and spectroscopic techniques has enabled me to measure both ensemble and single particle pH. With these tools, I was able to measure the pH-dependent rate of sulfur-IV oxidation in single particles, and found it to be 1-2 orders of magnitude faster in aerosols compared to bulk solutions. My analysis implied that surface effects are highly important for atmospheric chemistry. Recently, I have turned my attention to how the high levels of acidity and salts in marine aerosols can influence the surface activity of important chemicals. By combining surface tension measurements with infrared reflection-absorption spectroscopy and computational potential of mean force calculations, I have found that amino acids that normally reside in aerosol cores can be driven to the surface by low pH and common seawater cations. Next, I plan to expand my work to organic aerosols and improve thermodynamic model calculations of aerosol pH.

Benefits to Science and Society: One of the largest sources of uncertainty in climate change models is the aerosol-cloud interaction. It is believed that aerosol pH and surface coverage impact cloud formation, so by better measuring aerosol pH and surface composition, my research will help improve atmospheric chemistry models. In addition, acidic aerosols have detrimental effects on human lung, brain and tissue cell health. My work uncovers the causes of aerosol acidification and can benefit society by highlighting the chemistry key to improving air quality.

Personal Interests: I enjoy cooking, hiking, composing and playing piano pieces, and writing scenarios for tabletop games.

ARCS Award: The ARCS Foundation award is an incredible encouragement that important scientific research is valued. Lab work can be very challenging and lonely, and validation that my work is seen as important has given me motivation to approach my next project with optimism. The financial component of the award will also help me work toward additional goals I have of finding effective philanthropic solutions to global problems of malnutrition, malaria, and lack of access to clean water.

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 make 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.; Ascui-Gac, 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.

MIRIAM KATHLEEN BELL

University of California San Diego

Jacobs School of Engineering

Concentration: Mechanical Engineering

Specialization: Computational Neuroscience, Computational Biophysics

Donor: Reuben H. Fleet Foundation

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

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

Awards and Honors: NDSEG Fellowship 2019-present; Interfaces Graduate Training Program NIH NIBIB T32Fellowship 2018-2019; San Diego Match Fellowship 2017-2018; Competitive Edge Fellowship 2016

Publications, Papers, and Posters:

Bell, M., Padmini Rangamani. Design decisions for incorporating spatial and mechanical aspects in models of signaling networks. Current Opinion in Systems Biology, 2021

Calizo, R.; **Bell, M.**; Ron, A.; Hu, M.; Bhattacharya, S.; Wong, N.; Janssen, W.; Perumal, G.; Pederson, P.; Scarlata, S.; Hone, J.; Azeloglu, E.; Rangamani, P.; Iyengar, R. Cell shape regulates subcellular organelle location to control early Ca2+ signal dynamics in vascular smooth muscle cells. Scientific Reports, 2020, 10(1), 1-17. equal contribution

Pearce, K. M.; **Bell, M**.; Linthicum, W. H.; Wen, Q.; Srinivasan, J.; Rangamani, P.; Scarlata, S. Gαq-mediated calcium dynamics and membrane tension modulate neurite plasticity. Molecular biology of the cell, 2020, 31(7), 683-694. equal contribution

Bell, M.; Bartol, T.; Sejnowski, T.; Rangamani, P. Dendritic spine geometry and spine apparatus organization govern the spatiotemporal dynamics of calcium. Journal of General Physiology, 2019, 151(8), 1017-1034

Current Research (expanded description): In my research, I utilize systems of ordinary or partial differential equations (ODEs/PDEs) and mechanical models to consider the effects of biophysical properties on biological systems. The majority of my projects focus on the relationship between shape and function in dendritic spines. Dendritic spines are key centers of synaptic communication, plasticity, and signaling, with dynamics that propagate to determine overall neuronal behavior. Dendritic spines remain morphologically dynamic throughout their lifetimes and are known to have specific shapes characteristic to learning, aging, and disease. Most synapses are found on dendritic spines so the majority of synaptic transmission occurs through the activation of signaling pathways within these small volumes. Therefore, it is vital to understand the underlying biophysical properties of spines and how their shape and size influence their signaling networks and function. Overall, I use computational modeling to study multiscale systems or systems that have scales that make experimental observations challenging. I utilize both analytical and numerical approaches to study biological problems to offer insight, make predictions, and uncover fundamental principles. I hope this type of computational modeling can provide insights into complex biological problems which will allow us to tackle neurological diseases and disorders, such as Alzheimer's and Parkinson's Disease.

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

Personal Interests: Outside of the lab, I enjoy playing soccer, training for triathlons but never doing any, and baking.

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

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, a proud descendant from the Pauma Band of Luiseño Indians, works collaboratively with the Global Health Policy and Data Institute on research projects that synthesize public health, global health, social media, and health technology. His research interests are in medical education and workforce development, Tribal public health, vaccine hesitancy and misinformation spread, and social media usage among Native youth. He also works at the state and federal level to identify barriers and facilitators to greater inclusion of Native Americans in medicine and the allied health professions.

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:

Adamson T.; **Calac A.** Addressing inequity requires intentionality [published online ahead of print, 2021 Sep 26]. J Intern Med. 2021, 10.1111/joim.13381. doi:10.1111/joim.13381

Calac A.; Bardier C.; Cai M.; Mackey TK. Examining Facebook Community Reaction to a COVID-19 Vaccine Trial on the Navajo Nation. Am J Public Health. 2021, 111(8):1428-1430. doi:10.2105/AJPH.2021.306202

Pothayee N.;Maric D.; Sharer K.; Tao-Cheng, J.; **Calac, A**.; et al. Neural precursor cells form integrated brain-like tissue when implanted into rat cerebrospinal fluid. Commun Biol. 2018;1:114. Published 2018 Aug 14. doi:10.1038/s42003-018-0113-8

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.

MINERVA CONTRERAS

University of California San Diego

School of Medicine

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

Publications, Papers, and Posters:

Sancho L; **Contreras M;** Allen NJ. Glia as sculptors of synaptic 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, MS; Das, A; Kim, S; Shin, YJ; Le,e Y; Koo, H; Snigdha, K; Waghmare, I; Guo, X; Mohyeldin, A; Gallego-Perez, D; Wang, J; Chen, D; Cheng, P; Mukhee,f F; **Contreras, M**; Reyes, JF; Vaillant, B; Sulman, EP; Cheng, S; Markert, JM; Tannous, BA; Lu, X; Kango-Shingh, M; Lee, LJ; Na, D; Nakano, I; Bhat, KP. 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. October 2018. Poster presentation at the National Diversity in STEM Conference, SACNAS, San Antonio, TX.

Contreras, M; Bhat, KP. Deciphering the molecular link of CD109, TAZ, and β-catenin in the mesenchymal subtype of Glioma Stem Cells. October 2017. Poster presentation at the "5to Encuentro de Jovenes Investigadores del Estado de Queretaro." Queretaro, Mexico.

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: Enjoying this beautiful San Diego weather with my wife and dogs, 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

Donor: 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: 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 U S A 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 (Accepted)

Current Research (expanded description): Spatiotemporal regulation of key factors is crucial in the operation of major cellular processes. 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. ALIX is a versatile adaptor protein involved in numerous ESCRT-mediated processes. 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 occluded an understanding of the molecular mechanisms by which ALIX regulates the ESCRT pathway. In the Deshmukh lab, I was the first to recombinantly express ALIX-PRD, and subsequently characterized the domain in detail using modern biophysical methods. Most notable was the discovery that ALIX-PRD reversibly formed amyloid fibrils based on the phosphorylation status of its conserved tyrosine residues, a completely novel behavior. I then investigated the mechanism of how phosphorylation of ALIX-PRD modulates membrane-binding of the ALIX-Bro1 domain. Currently, I am investigating how recruitment of other ESCRT factors regulates the formation of ALIX assemblies.

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 that I am capable of impacting 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

Donor: 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.; 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.; Yan, Q.; Liu, H.; Wu, Z.; Xing, X.; Zhou, H.; Luo, J.; Chen, Z.; Liu, P. Low-Cost Li||SPAN Batteries Enabled by Sustained Additive Release. ACS Appl. Energy Mater. 2021, 4 (7), 6422–6429

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

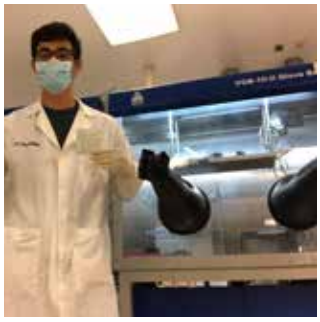
Holoubek, J.; Yin, Y.; Li, M.; Yu, M.; Meng, Y. S.; Liu, P.; Chen, Z. Exploiting Mechanistic Solvation Kinetics for Dual-Graphite Batteries with High Power Output at Extremely Low Temperature. Angewandte Chemie International Edition 2019, 58 (52), 18892–18897

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:

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.; Moshkovitz M. Bounded Memory Active Learning through Enriched Queries. 2021 Conference on Learning Theory

Hopkins, M.; Kane, D.; Lovett, S. The Power of Comparisons for Actively Learning Linear Classifiers. 2020 Conference on Neural Information Processing Systems

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: 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; NSBE BMES Travel Award 2019; Sloan Fellowship 2018

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. 2021. (in review)

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. 2021. (in review)

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. BioRxiv. 2020

Zhu, W.; Zhang, E.; Zhao, M.; Chong, Z.; Fan, C.; Tang, Y.; **Hunter, J.D.**; Borovjagin, A.V.; Walcott, G.P.; Chen, J.Y.; Qin, G.; Zhang, J. Regenerative Potential of Neonatal Porcine Hearts Circulation. 2018

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. (2021). Inflammation drives alternative first exon usage to regulate immune genes including a novel iron-regulated isoform of Aim2. 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. (2021). Robust single-cell discovery of RNA targets of RNA-binding proteins and ribosomes. Nature methods, 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.

ANDREW THOMAS KLEINSCHMIDT

University of California San Diego

Jacobs School of Engineering

Concentration: Chemical Engineering

Specialization: Materials Simulation and Design

Donor: Laura Mateo/Lakeside Foundation

Andrew's research focuses on modeling special types of plastics which can be used for solar cells and other electronic materials. These plastics could be used to create affordable solar cells soft enough to be worn on human skin or hard enough to be embedded into roadways. By modeling these materials, their electronic and mechanical behavior can be predicted before testing, allowing for more rapid technological advances.

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

Awards and Honors: Powell Fellowship at UCSD 2016-2017; Katzin Prize for incoming UCSD graduate students 2016

Publications, Papers, and Posters:

Kleinschmidt, A.T.; Lipomi, D.J. Stretchable conjugated polymers: A case study for new research groups. Acc. Chem. Res. 2018, 51, 3134

Sugiyama, F.; **Kleinschmidt, A.T.**; Kayser, L.V.; Rodriquez, D.; Finn, M.; Alkhandra, M.; Wan, J.M.-H.; Ramirez, J.; Chiang, A.S-C.; Root, S.; Savagatrup, S.; Lipomi, D.J. Effects of flexibility and branching of side chains on the mechanical properties of low-bandgap conjugated polymers. Polym. Chem. 2018, 9, 4354

Sugiyama, F.; **Kleinschmidt, A.T.**; Kayser, L.V.; Alkhandra, M.A.; Wan, J.-H.; Chiang, A.S-C.; Rodriquez, D.; Root, S.E.; Savagatrup, S.; Lipomi, D.J. Stretchable and degrading semiconducting block copolymers. Macromolecules 2018, 51, 5944

Kleinschmidt, A.T.; Root, S.E.; Lipomi, D.J. Poly (3-hexylthiophene) (P3HT): Fruit fly or outlier in organic solar cell research? J. Mater. Chem. A 2017, 5, 11396

Current Research (expanded description): My research focuses on computational molecular-scale modeling of conjugated polymers. I use molecular dynamics simulations to model how polymer chains move past each other to predict their mechanical properties and to model morphologies which could be used to predict electronic properties. My research has two main subprojects. First, I use quantum chemical calculations to properly parameterize my molecular dynamics simulations. In particular, my research includes important corrections to backbone rigidity specific to conjugated polymers. Secondly, I use advanced sampling techniques to "speed up" my molecular dynamics simulations in order to observe and analyze long time-scale events (i.e. chain folding).

Benefits to Science and Society: The main benefit of my research is developing affordable, versatile solar cells that can placed on any surface imaginable. Because the solar cells I develop are made from plastic, they can be made soft and stretchable to provide constant power to wearable devices (such as advanced biosensors). Alternatively, these solar cells could be made tough and durable to act as car paint or window coatings. Finally, because these materials are made of plastic, they can be produced very cheaply and conformally coat a wide variety of surfaces.

Personal Interests: I volunteer with Reality Changers, an afterschool program to tutor at-risk high school students.

ARCS Award: The ARCS Foundation award helps me feel connected to the community and helps me feel like my scientific endeavors are appreciated even on days when the work feels thankless. The enthusiasm of ARCS members for learning about and supporting cutting-edge research helps me feel that my work is of value to the broader community which supports it. Additionally, the financial benefit of ARCS has allowed me to attend more conferences to build out my scholarly network.

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 DA, Kerr MD, Dorn NC, Ogbonna DA, Santos EC, Shah NJ. Triggers, Timescales, and Treatments for Cytokine-Mediated Tissue Damage. EMJ Innov., 2020, https://doi.org/10.33590/emjinnov/20-00203.

McBride DA, Kerr MD, Wai SL, Yee YY, Ogbonna DO, Shah NJ. Characterization of regulatory T-cell expansion for manufacturing cellular immunotherapies. Biomater. Sci., 2020, 8(15), 4186-4198

McBride DA, Kerr MD, Wai SL, Shah NJ. Applications of molecular engineering in T-cell based immunotherapies. WIREs Nanomed Nanobiotechnol., 2019, 11:e1557

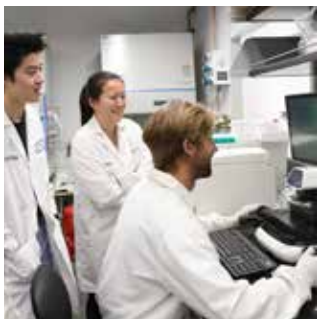
McBride DA, Petzold LR. Model-based Inference of a Directed Network of Circadian Neurons. J. Biol. Rhythms, 2018, 33(5), 515 – 522

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.



COLMAN ARTHUR MOORE

University of California San Diego

Jacobs School of Engineering

Concentration: NanoEngineering

Specialization: Molecular Imaging

Donor: Donald C. and Elizabeth M. Dickinson Foundation

Colman studies the intersection of nanoengineering and biomedical imaging to develop new diagnostic strategies for probing disease. He is currently focused on optical and photoacoustic detection methods for proteases biomarkers. Gingipains are one target, a class of enzymes secreted by certain oral pathogens, with roles in periodontal disease and even Alzheimer's disease. This work is in parallel to ongoing clinical collaborations to validate ultrasound diagnosis of periodontal disease. In the past year, he has also been investigating the feasibility of protease-based COVID-19 diagnostics. Lastly, he recently applied a novel analytical technique for measuring the time-resolved size distributions of aggregating proteins, research with implications for various neurodegenerative disorders.

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

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

Publications, Papers, and Posters:

Moore, C.; Borum, R.M.; Mantri, Y.; Xu, M.; Fajtová, P.; O'Donoghue, A.; Jokerst, J.V. Activatable Carbocyanine Dimers for Photoacoustic and Fluorescent Detection of Protease Activity. ACS Sensors 2021, 6, 6, 2356-2365.

Moore, C.; Wing, R.; Pham, T.; Jokerst, J.V. Multispectral nanoparticle tracking analysis for the real-time and label free characterization of amyloid-β self-assembly in vitro. Analytical Chemistry 2020, 92, 17, 11590-11599.

Moore C., Jokerst J.V. Photoacoustic Ultrasound for Enhanced Contrast in Dental and Periodontal Imaging. In: Chan HL.., Kripfgans O.D. (eds) Dental Ultrasound in Periodontology and Implantology 2020. Springer, Cham.

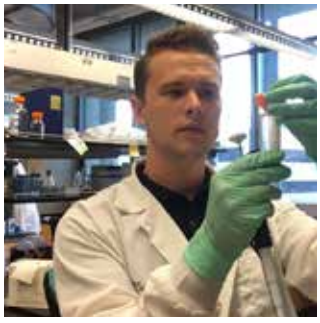
Moore, C.; Chen, F.; Wang, J.; Jokerst, J. V. Listening for the therapeutic window: Advances in drug delivery utilizing photoacoustic imaging. Advanced Drug Delivery Reviews 2019, 144, 78-89.

Current Research (expanded description): The goals of my research are to demonstrate the efficacy of activatable contrast agents for (1) mapping and measuring gingipains expressed by Porphyromonas gingivalis, a pathogenic bacterium, with photoacoustic ultrasound in vivo, and (2) measuring SARS-CoV-2 protease activity in clinically relevant samples. Regarding Goal 1, while P. gingivalis can be quantified in the lab with PCR, it cannot be done so chairside. Molecular imaging with ultrasound offers data that is real-time, chairside, and molecularly specific—it can report the quantity and location of the periodontal pathogen with utility in diagnosis and therapy monitoring. Studies show dental pain dramatically decreases quality of life and that nearly 50% of Americans have some form of periodontitis. Current approaches to monitoring oral health only measure the symptoms of periodontitis (tooth loss, pocket depth, etc.). By imaging and measuring a molecular marker of disease, new insights can be gained into its basic biology as lead to better diagnostic and treatment-monitoring plans. Goal 2 refers to the development of a novel detection strategy for COVID-19. This method targets the machinery of viral replication rather than the virus itself and would offer an alternative diagnostic method at the point of care.

Benefits to Science and Society: Early detection of disease is the thread that ties my research projects together. Improving diagnostic capabilities will improve prognosis in areas such as periodontal disease, Alzheimer's disease, and the ongoing COVID-19 pandemic. For example, oral health is a critical component of quality of life, but the tools that clinicians use to inspect the oral cavity only monitor the anatomical effects of periodontitis rather than the underlying physiology. I am validating a molecular tool to specifically identify oral pathogens. This should enable earlier disease detection more accurately while providing clinicians with deeper insights to help better direct care and improve patient outcomes.

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

ARCS Award: The ARCS award has reaffirmed my dedication to biomedical research and pushed me to maximize my time in graduate school. In addition, I am grateful for its alleviation of the financial pressures associated with Ph.D. training.



CHANNING JOSEPH PREND

University of California San Diego

Scripps Institution of Oceanography

Concentration: Physical Oceanography

Specialization: Air-Sea Interaction

Donor: Toby Eisenberg

Channing studies the exchange of heat and carbon dioxide between the ocean and atmosphere, which regulates the global climate system. He uses measurements from autonomous robotic floats, as well as satellite data and numerical models, to research how ocean circulation contributes to patterns of biological productivity and carbon uptake in the Southern Ocean, which surrounds Antarctica. This region plays an outsized role in the global ocean circulation and carbon cycle, and thus, studying these processes is crucial to improving climate models and future climate projections.

Degree: B.A. in Earth Science and Mathematics, Columbia University

Awards and Honors: Chateaubriand Fellowship (French Embassy to the USA), 2020-21; Geophysical Fluid Dynamics Fellowship (Woods Hole Oceanographic Institution), 2019; National Science Foundation Graduate Research Fellowship, 2017-2020; Walter C. Pitman III Award (Columbia University), 2017

Publications, Papers, and Posters:

Prend, C. J.; Gray, A. R.; Talley, L. D.; Gille, S. T.; Haumann, F. A.; Johnson, K. S.; Riser, S. C.; Rosso, I.; Sauvé, J.; Sarmiento, J. L. Indo-Pacific sector dominates Southern Ocean carbon outgassing. Global Biogeochemical Cycles (submitted).

Prend, C. J.; Flierl, G. R.; Smith, K. M.; Kaminski, A. K. Parameterizing eddy transport of biogeochemical tracers. Geophysical Research Letters (in revision).

Prend, C. J.; Gille, S. T.; Talley, L. D.; Mitchell, B. G.; Rosso, I.; Mazloff, M. R. Physical drivers of phytoplankton bloom initiation in the Southern Ocean's Scotia Sea. Journal of Geophysical Research: Oceans 2019, 124, 5811-5826.

Prend, C. J.; Seo, H.; Weller, R. A.; Farrar, J. T. Impact of freshwater plumes on intraseasonal upper ocean variability in the Bay of Bengal. Deep-Sea Research II 2018, 161, 63-71.

Current Research (expanded description): Physical and biogeochemical processes in the ocean occur over a wide range of spatial and temporal scales. This poses an observational challenge since the ocean is immense and thus, it is impossible to collect measurements at every place and time. The Southern Ocean, which surrounds Antarctica, has particularly few historical measurements since it is such a remote and harsh environment. This region is known to play a disproportionately large role in the oceanic uptake of heat and carbon dioxide, however the spatial and temporal variability is not well constrained due to lack of data. Recent advances in autonomous float technology allow us to observe the Southern Ocean from the comfort of San Diego. This array of more than 200 floats has provided unprecedented spatial and temporal coverage of subsurface biogeochemical measurements in the Antarctic. Using this unique dataset, we are investigating the physical controls on Southern Ocean biological productivity and air-sea carbon fluxes. Characterizing this variability, and the mechanisms that drive it, is necessary to better understand the role of the ocean in the climate system.

Benefits to Science and Society: Autonomous observing systems are changing the way that we see the ocean by providing data in hard-to-reach places like the Antarctic. My research combines this cutting-edge technology with satellite data and numerical model output to help discern the physical mechanisms that control ocean ecosystems and the global carbon cycle. Understanding these drivers is key to improving climate models and predicting the response of the ocean to climate change.

Personal Interests: Science communication and outreach, history and philosophy of science, violin, rowing, swimming, and hiking.

ARCS Award: Receiving an ARCS Foundation Award is a great honor and will alleviate financial stress. My motivation in coming to graduate school was to conduct societally-relevant research and communicate that science to the broader public, so it feels great to be recognized by an organization that has helped advance STEM in the US for decades.

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 mitochondrial and plastid assembly. I showed that our method produced complete or nearly complete assemblies in cases where samples were highly degraded and other methods simply failed. Currently, I am completing a project around the development of an algorithm for estimating branch length support for phylogenetic trees generated using k-mer based methods. K-mer based approaches are common for phylogeny reconstruction because of their speed and accuracy. However, lack of procedure to assess correctness of generated phylogenies resulted in their limited use in publications. Our method has potential to remedy this situation. For my next project I am hoping to apply machine learning methods to construct phylogenies using multiple different sequencing data types for the purpose of reconciling disjointed datasets.

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

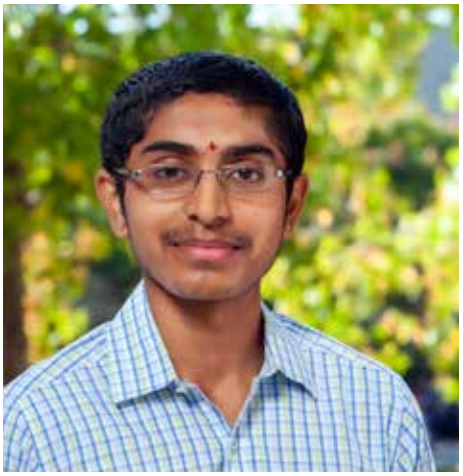
Jacobs School of Engineering

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. Viscoacoustic squeeze film force on a rigid disk undergoing small axial oscillations. Journal of Fluid Mechanics (in review)

Ramanarayanan, S.; Coenen, W.; Sánchez, A.L. Viscoacoustic squeeze film force on a rigid disk undergoing small axial oscillations. American Physical Society 2020 (73rd Annual Meeting of the Division of Fluid Dynamics)

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.

SAMANTHA LYLAH SISON

University of California San Diego

School of Medicine

Concentration: Neuroscience

Specialization: Neurobiology

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

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.; 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.

Barron, M. E.; **Thies, A. B**.; Espinoza, J. A.; Barott, K. L.; Hamdoun, A.; Tresguerres, M. A Vesicular Na+/Ca2+ Exchanger in Coral Calcifying Cells. PLoS One 2018, 13 (10), e0205367. https://doi.org/10.1371/journal.pone.0205367.

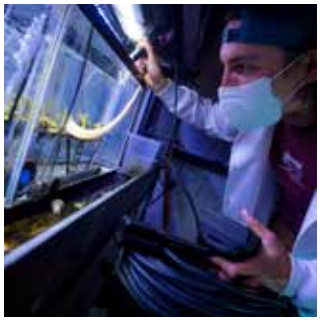
Thies, A.; Barron, M.; Tresguerres, M. Potential Role of a Rh Channel in Delivery of Ammonium from Coral Host Cells to Their Endosymbiotic Algae. Abstract 30.3. Oral presentation, American Physiological Society Intersociety Meeting, New Orleans, Louisiana, 2018.

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: 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:

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 (IMC), 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 cook 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

School of Medicine

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.

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 (ESL) 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.

ANTHONY QUOC VU

University of California San Diego

School of Medicine

Concentration: Biomedical Sciences

Specialization: Genetics and Genomics

Donor: Hervey Family Fund

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

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

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

Publications, Papers, and Posters:

Sanchez, II; Nguyen, T. B.; England, W. E.; Lim, R. G.; **Vu, A. Q.**; Miramontes, R.; Byrne, L. M.; Markmiller, S.; Lau, A. L.; Orellana, I.; Curtis, M. A.; Faull, R. L. M.; Yeo, G. W.; Fowler, C. D.; Reidling, J. C.; Wild, E. J.; Spitale, R. C.; Thompson, L. M., Huntington's disease mice and human brain tissue exhibit increased G3BP1 granules and TDP43 mislocalization. J Clin Invest 2021.

Begovich, K.; **Vu, A.Q.**; Yeo, G.; Wilhelm, J.E., Conserved metabolite regulation of stress granule assembly via AdoMet. J Cell Biol 2020, 219 (8)

Wheeler, E. C.*; **Vu, A. Q.***; Einstein, J. M.; DiSalvo, M.; Ahmed, N.; Van Nostrand, E. L.; Shishkin, A. A.; Jin, W.; Allbritton, N. L.; Yeo, G. W., Pooled CRISPR screens with imaging on microraft arrays reveals stress granule-regulatory factors. Nat Methods 2020, 17 (6), 636-642. *co-first authors

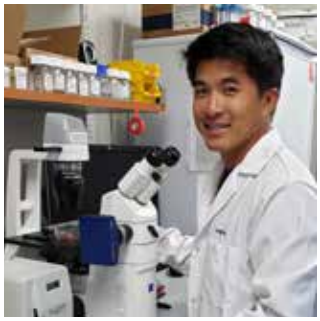
Fang, M.Y.; Markmiller, S.; **Vu, A.Q.**; Javaherian, A.; Dowdle, W.E.; Jolivet, P.; Bushway, P. J.; Castello, N. A.; Baral, A.; Chan, M.Y.; Linsley, J.W.; Linsley, D.; Mercola, M.; Finkbeiner, S.; Lecuyer, E.; Lewcock, J.W.; Yeo, G. W. Small-molecule modulation of TDP-43 recruitment to stress granules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

Current Research (expanded description): Stress granules (SGs) are dynamic cytoplasmic assemblies of ribonucleoprotein complexes. By stalling mRNA translation and sequestering aggregation-prone proteins, these transient membraneless structures are thought to be a cytoprotective response during cellular stress. Defects in SG assembly and clearance are firmly linked to neurodegenerative disease: stable SG-like inclusions in brain are hallmarks of amyotrophic lateral sclerosis (ALS) and related disorders, and genetic mutations in SG proteins cause familial forms of these diseases. While recent in vitro proteomic studies using biochemical fractionation and protein proximity-labeling techniques have identified over 400 SG components, little remains known about which of these proteins regulate SGs. It is of great importance to identify components critical to SG formation and disassembly to further our understanding of the basic biology of SGs. Importantly, therapeutic reduction of known SG components was recently shown to provide neuroprotective effects in animal models of ALS. My objective is to take a multidisciplinary approach to evaluate the cellular stress response after protein depletion. My collaborators and I are developing a cross-paradigm discovery and validation strategy to systematically prioritize these SG components to understand their roles in neuronal function, and if their reduction provides durable, curative effects in ALS models.

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

Personal Interests: I enjoy playing tennis, drawing, cycling, rock climbing, working on cars, competing in automotive racing events, and snowboarding.

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



ALEXANDER JEFFREY WHITEHEAD

University of California San Diego

Jacobs School of Engineering

Concentration: Bioengineering

Specialization: Regenerative Medicine and Tissue Engineering

Donor: Reuben H. Fleet Foundation

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

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

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

Publications, Papers, and Posters:

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

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

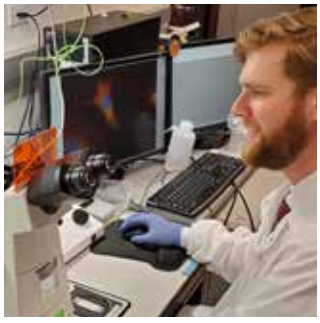
Current Research (expanded description): I am developing an in-vitro co-culture model for cardiac fibroblasts and macrophages that allows for extracellular matrix assays. While I am currently using U937 monocytes and converting them into macrophages using PMA, I hope to move to human primary monocytes and convert them using M-CSF and GM-CSF to provide more accurate results. I would also like to investigate how tissue-resident macrophages differ from monocyte-derived cells and how the early healing cascade impacts late-stage fibrosis after myocardial infarction.

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

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

Personal Interests: In my free time, I like to create music, cook, and snowboard in the winter.

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



JIARONG ZHOU

University of California San Diego

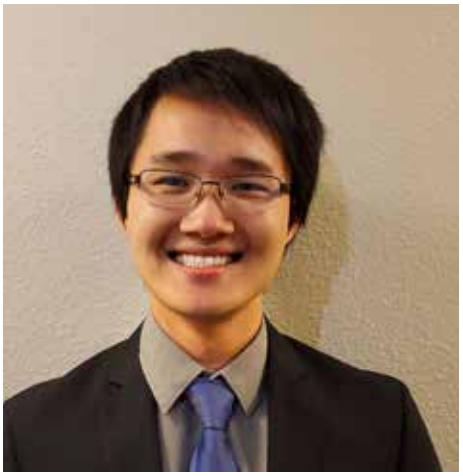
Jacobs School of Engineering

Concentration: NanoEngineering

Specialization: Vaccine Development

Donor: Donald C. and Elizabeth M. Dickinson Foundation

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



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

Awards and Honors: Siebel Scholar, Class of 2022; Ford Foundation Predoctoral Fellowship 2019-2022; National Institute of Health T32 Training Grant 2017-2019; Carbon Neutrality Initiative Student Fellowship 2015-2016

Publications, Papers, and Posters:

Zhou, J.; Karshalev, E.; Mundaca-Uribe, R.; Esteban-Fernandez de Avila, B.; Krishnan, N.; Xiao, C.; Ventura, C. J.; Gong, H.; Zhang, Q.; Gao, W.; Fang, R.; Wang, J.; Zhang, L. "Physical disruption of solid tumors by immunostimulatory microrobots enhances antitumor immunity," Advanced Materials 2021, in press

Johnson, D. T.†; **Zhou, J.†**; Kroll, A.; Fang, R.; Yan, M.; Xiao, C.; Chen, X.; Kline, J.; Zhang, L.; Zhang, D. Acute Myeloid Leukemia Cell Membrane Coated Nanoparticles for Cancer Vaccination Immunotherapy. Leukemia 2021, in press

Zhang, Q.†; Honko, A. N.†; **Zhou, J.†**; Gong, H.; Downs, S. N.; Henao Vasquez, J.; Fang, R.; Gao, W.; Griffiths, A.; Zhang, L. Cellular nanosponges inhibit SARS-CoV-2 infectivity. Nano Letters 2020, 20(7), 5570-5574

Zhou, J.; Kroll, A.; Holay, M.; Fang, R.; Zhang, L. Biomimetic Nanotechnology towards Personalized Vaccines. Advanced Materials 2020, 32(13), 1901255

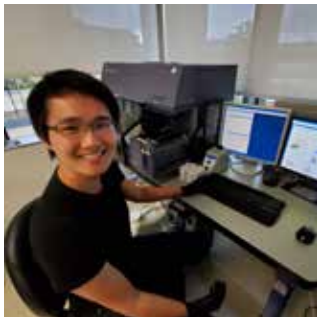
† denotes co-first authorship

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

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

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

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




University
of San Diego

PEDRO ALONSO COLIO

University of San Diego

Hahn School of Nursing and Health Science

Concentration: Nursing

Specialization: Cardiology & Emergency Medicine

Donor: Beyster Family Foundation

Pedro's research project is geared towards identifying the incidence and prevalence of cardiac complications among COVID-19 patients in one of the most underserved counties in Southern California. Pedro hopes to identify any particular trends or determinants of health associated with this condition. If any trends are found, they could potentially be used for early screening and management among certain individuals.

Degrees: D.N.P., University of San Diego; M.S.N. in Primary Care Family Nurse Practitioner, University of San Diego; B.S.N in Nursing Science, San Diego State University; A.S. in Nursing Science, Imperial Valley College

Awards and Honors: CVS Health Foundation Scholarship, 2017 and 2018; Spence Foundation Scholarship, 2016; HRSA Nurse Corps Scholarship, 2013; Pioneer's Memorial Hospital Scholarship, 2010

Publications, Papers, and Posters:

Rapid Assessment of Adults with Traumatic Brain Injuries, 2018 California Association of Nurse Practitioners 41st Annual Educational Conference, San Diego, California. Manuscript has been accepted for publication in the Advanced Emergency Nursing Journal.

Current Research (expanded description): The specific aims of my research are: (1) Identify the occurrence of cardiac complications (myocarditis, pericarditis, STEMI, AFib, and HF) in patients with and without COVID-19 to lay the groundwork for ED (Emergency Department)-based interventions to improve health outcomes in one of the most underserved areas nationally: Imperial County, CA; (2) Compare ED and post-ED management of myocarditis, pericarditis, STEMI, AFib, and HF in patients with and without COVID-19; and, (3) Provide greater insight into health care disparities of ED COVID-19 patients with cardiac diagnoses in an underserved rural health care environment thereby enabling the global health community to improve quality of life.

Benefits to Science and Society: COVID-19 is an emerging, complex, costly, and global public-health problem with potential lifelong sequelae. My research will strengthen clinical science in the identification and treatment of COVID-19 patients who may be susceptible to long-term sequela, specifically cardiac complications, and inform the development of standards of care to improve cardiac/COVID-19-patient outcomes by identifying those at risk of mild-to-severe cardiac complications.

Personal Interests: I love mountain biking, skateboarding, swimming, chess, traveling, grilling in the backyard, and playing baseball with my children.

ARCS Award: The ARCS Foundation award means an opportunity for me to excel as a Ph.D. nursing student. It is an unexpected blessing for me to aim higher than I had originally planned. It is an opportunity for me to give back to my community and improve the quality of care through research and science. Receiving the ARCS Foundation award is a true blessing to me and my family to achieve my dream goal of becoming a nurse scientist. This award will be very helpful to my education and research. I am forever thankful to be an ARCS Scholar. I will work very hard to contribute recognizable research and meet your highest expectations. My ultimate goal is to make a difference and have a positive influence in the world. Your contribution will have made a huge difference in my life and educational journey. Thank you!

ANN OZAZE LAWANI

University of San Diego

Hahn School of Nursing and Health Science

Concentration: Nursing

Specialization: Cardiopulmonary Nursing and Palliative Care

Donor: Beyster Family Foundation

My research stresses the critical need to include Palliative Care in the nursing curriculum to prepare nurses as better patient advocates at the bedside. Given the increase in our patient population with chronic illnesses, Palliative Care education is paramount for patients, families, physicians and the interdisciplinary team of healthcare workers. Patients with advanced cancer and comorbid chronic illnesses need information about the true nature of the disease and prognosis. This will ensure that the right decisions are being made, as it pertains to quality of life, cultural values and beliefs.

Degrees: M.S. in Nursing, University of San Diego; B.S. in Healthcare Administration, California State University Sacramento

Awards and Honors: ARCS Scholar, 2020-present; Sharp Healthcare Caster Institute Education Scholarship, 2020 and 2021; Sharp Healthcare Guardian Angel Award, 2020; Dean Graduate Merit Scholar, University of San Diego, 2019-Present.

Current Research (expanded description): Patients with advanced cancer do not receive early Palliative Care referral. This creates barriers to optimal symptom management, and leads to decreased quality of life, with a lack of psychosocial and spiritual support. Healthcare costs for this cohort are greater due to continuation of aggressive treatment to prolong life, rather than improving quality of life. This research seeks to merge the borders between curative and Palliative Care to help patients, nurses and other healthcare providers become aware of the need for early and continuous discussions about Palliative Care at time of diagnosis and beyond. The purpose of my research is to identify healthcare utilization, cost and outcomes of advanced colon, rectal (colorectal), and lung cancer patients with and without Palliative Care referral; and identify the factors, if any, that account for these outcomes. My research will contribute to the improvement of nursing practice, by ensuring improved quality of life for patients with chronic illnesses, bridging the gap in knowledge about transition and safeguarding accountability of quality care for patients with chronic illnesses. This will ensure early patient education, referral and advocacy, as well as equip nurses to communicate with patients, families and caregivers appropriately providing dignity at the end of life.

Benefits to Science and Society: My research will generate new knowledge for the body of nursing, and identify gaps in Palliative Care research. This will increase awareness among providers about the true cost of aggressive treatment at the end of life for advanced cancer patients and establish a baseline for referral in the case of advance diagnosis to facilitate future measurements of improvement. Dissemination of study results will highlight differences between Palliative Care and Hospice for providers and members of the interdisciplinary team, to clarify optimal selection of services and promote patient-centered care.

Personal Interests: I enjoy cooking, grilling and putting outfits together in my closet.

ARCS Award: Being an ARCS scholar is an honor and inspiration to push on towards achieving my goal of doctoral education in nursing. It acknowledges my hard work and encourages me to continue to focus on my research and ways to become a better nurse scientist to improve patient outcomes. I am both honored and grateful for the opportunity to represent The University of San Diego.

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: 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. (2018), Harnessing the Voices of all Staff in Ongoing Improvement, Podium, Planetree International Conference, Boston

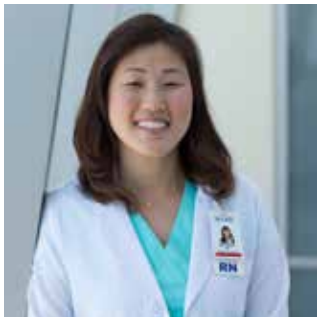
Magdaluyo, P. (2017), Staff Engagement through Utilization of Virtual Staff Meetings, Poster, Planetree International Conference, Baltimore, MD

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

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.

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. 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 compared with other industries. 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.

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SAN DIEGO CHAPTER

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