

22nd Pacific Undergraduate Research & Creativity Conference (PURCC 2022)

Research Day Program

Oral Presentation Sessions

[Oral Presentation Session 1](#)

10:00 AM – 11:40 AM

Sierra Learning Lab, William Knox Holt Memorial Library and Learning Center

[Oral Presentation Session 2](#)

10:00 AM – 12:00 PM

Yosemite Learning Lab, William Knox Holt Memorial Library and Learning Center

[Oral Presentation Session 3](#)

1:00 – 3:40 PM

Yosemite Learning Lab, William Knox Holt Memorial Library and Learning Center

Poster Sessions

[Poster Session 1](#)

10:00 AM – 12:00 PM

Information Commons, William Knox Holt Memorial Library and Learning Center

[Poster Session 2](#)

1:00 – 3:00 PM

Information Commons, William Knox Holt Memorial Library and Learning Center

*Oral Presentation Session 1 – Sierra Learning Lab
April 30, 10:00 AM – 12:00 PM*

10:00 [Quantum chemistry investigation of a ubiquitin-transfer reaction coordinate](#)

Nina Sun, *Pre-Dentistry*

Faculty Mentors: Anthony D. Dutoi and Joseph S. Harrison, *Chemistry*

10:20 [trans-2-Aminocyclohexanols as pH-Triggered Molecular Switches](#)

Gabriella Sonderegger, *Chemistry*

Faculty Mentor: Vyacheslav Samoshin, *Chemistry*

Graduate Student Mentor: Oscar Mendoza, *Chemistry*

10:40 [Creating a video about how to perform a spot western assay to identify successful expression strains of the yeast *Pichia pastoris*](#)

Andrew Lim, *Pre-dentistry and Biological Sciences*, **Priscilla Hu**, *Pre-dentistry and Biological Sciences*, **Kevin Zhang**, *Pre-dentistry and Biological Sciences*, **Eddie Suh**, *Pre-dentistry and Biological Sciences*, **Patrick Delgado**, *Pre-Pharmacy*

Faculty Mentors: Geoff Lin-Cereghino and Joan Lin-Cereghino, *Biological Sciences*

11:00 [Instrumenting Concurrent Applications for Audit Logging](#)

Nicolas Ahn, *Computer Science*

Faculty Mentor: Sepehr Amir-Mohammadian, *Computer Science*

11:20 [Polyhedral Galleries](#)

Matthew Cowen, *Mathematics*

Faculty Mentor: Larry Langley, *Mathematics*

Oral Presentation Session 2 – Yosemite Learning Lab
April 30, 10:00 AM – 12:00 PM

10:00 [**Tiger Strides: A History of Student Leadership at University of the Pacific**](#)

Jamie Chesbrough, *International Relations*, **Kaitlyn Imada**, *Psychology*,
Harleen Kahlon, *Political Science*, **Braydon Ross**, *Music Education*,
Thyphien Son, *Computer Science*, **Lorenzo Spaccarelli**, *History*

Faculty Mentors: Lisa Cooperman, *University Libraries*, Keely Canniff, *University Libraries*,
Niraj Chuadhary, *University Libraries*, Jennifer Helgren, *History*, Robin Imhof, *University*
Libraries, Marie Lee, *Art, Media, Performance & Design*, Edie Sparks, *University Libraries*,
William Swagerty, *History*, Mike Wurtz, *University Libraries*

10:20 **Mestizos Know Why the Earth Eats the Dead**

Giancarlo Lizarraga, *English*

Faculty Mentor: Jeffrey Hole, *English*

10:40 [**The Humanization of Asian Americans: Dispelling the Model Minority Myth in Relation to Higher Education**](#)

Brooke Tran, *English*

Faculty Mentor: Jeffrey Hole, *English*

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11:00 [**Poetic Protest: Defending Nature and BIPOC against Settler Colonialism**](#)

Namorrah Ward, *English*

Faculty Mentor: Xiaojing Zhou, *English*

11:20 [**Musical Nuns of Sixteenth & Seventeenth Century Italy – Who Actually Made their Rules?**](#)

Ainsley Berryhill, *Instrumental Music Education*

Faculty Mentor: Sarah Clemmens Waltz, *Music History*

11:40 [**Black Opera at the Metropolitan Opera House**](#)

Molly Westlake, *Music History*

Faculty Mentor: Sarah Waltz, *Music History*

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*Oral Presentation Session 3 – Yosemite Learning Lab
April 30, 1:00 – 3:40 PM*

1:00 [Thus Spoke the Heretic: Poetry from the liminal state](#)

Guiying (Angel) Zhong, *Psychology and English*

Faculty Mentor: Dr. Amy Smith, *English*

1:20 [Satanic Panic: Moral Turmoil in the United States, 1960-1999](#)

Lyndsey Kell, *History*

Faculty Mentor: Jennifer Helgren, *History*

1:40 [Forecasting Military Conflicts Using Predictive Analytic Models](#)

Areesh Ilyas, *Political Science*

Faculty Mentor: Dari Sylvester Tran, *Political Science*

2:00 [Artificial Politics: The Role of Artificial Intelligence in Shaping Political Action](#)

Arshita Sandhiparthi, *Political Science, Computer Science*

Faculty Mentor: Dari Sylvester Tran, *Political Science*

2:20 [A Look at Canary Mission: Democratic Theory through the Palestinian-American Eye](#)

Malak Haider, *Political Science & International Relations*

Faculty Mentor: Dari Sylvester Tran, *Political Science*

2:40 [Faces of Imperialism: A Survey of the U.S.- Puerto Rican Imperial-Colonial Relationship and the Changing Phases of US Imperialism](#)

Luis Vega Estrada, *International Relations*

Faculty Mentor: Ahmed Kanna, *School of International Studies*

Oral Presentation Session 3 – Yosemite Learning Lab
April 30, 1:00 – 3:40 PM

3:00 [Perception of the LGBTQ+ Films From the Perspective of College Student](#)

Mayu Otsuka, *Media X*

Faculty Mentor: Qingwen Dong, *Communications*

3:20 [ME in VR: Will mere exposure to virtual reality content impact political ideology?](#)

Matthias Lopez, *Political Science & Philosophy*

Faculty Mentor: Dari Sylvester Tran, *Political Science*

*Poster Session 1 – Information Commons
April 30, 10:00 AM– 12:00 PM*

[Widespread use of 3D In-Vitro Models in Viral Diseases](#)

11A

Jef Andrei Pelera, *Bioengineering*

Faculty Mentors: Maria Gencogolu, *Bioengineering*, Shelly Gulati, *Bioengineering*

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[Establishing a proof of concept for the edIncubator: a low-cost tray incubator that minimizes cross contamination and enables monitoring of user-established parameters](#)

11B

Jennifer Moreno, *Bioengineering*

Faculty Mentor: Shadi Othman, *Bioengineering*

[Identifying Important Bacterial Proteins Involved in Synthesis of Spider Silk Protein MaSp1](#)

11C

Douglas Chan, *Biological Sciences*, **Derek Chan**, *Biological Sciences*,
Angela Hung, *Biological Sciences*, **Joochan Koo**, *Biological Sciences*

Faculty Mentor: Craig Vierra, *Biological Sciences*

[Development of Cloning Vehicles for Expression of Gc-MAF in Yeast](#)

12A

Tammy Tran, *Biological Sciences*, **Seohyun Lee**, *Pre-dental (4+3)*,
Jane Yu, *Pre-dental (3+3)*, **Wilson Wu**, *Biological Sciences*

Faculty Mentor: Craig Vierra, *Biological Sciences*

[Effect of Cold Shock Proteins on the Efficiency of Spider Silk Growth in Bacteria](#)

12B

Avery Whipple, *Biology*, **Jillian Lim**, *Biology*

Faculty Mentor: Craig Vierra, *Biological Sciences*

[A Proteomic Analysis to Identify Changes in Bacterial Protein Expression Following Overexpression of a Spider Silk Protein](#)

12C

Jamie (Ju Yeon) Park, *Biological Sciences*, **Jaeyoung (Kate) Lee**, *Biological Sciences*,
David Eum, *Biological Sciences*, **Minji Jung**, *Biological Sciences*,
Sungkyung Lee, *Biological Sciences*

Faculty Mentor: Craig Vierra, *Biological Sciences*

*Poster Session 1 – Information Commons
April 30, 10:00 AM– 12:00 PM*

[Proteomic Analysis of the Expression of MaSp1 Dragline Silk Protein in E. coli](#)

13A **Sophie Pazzo**, *Biological Sciences*, **Rajan Patel**, *Pre-Dentistry*,
Kamrin Athwal, *Pre-Dentistry*, **Edward Kim**, *Pre-Dentistry*

Faculty Mentor: Craig Vierra, *Biological Sciences*

[Overexpression of a Black Widow Dragline Spidroin in Bacterial Protein](#)

13B **Natalie Naseib**, *Biological Sciences*, **Katina Zhu**, *Biological Sciences*,
Jamie (Yu Yeon) Park, *Biological Sciences*, **Daniel Eum**, *Biological Sciences*,
Phuong Phun, *Biological Sciences*

Faculty Mentor: Craig Vierra, *Biological Sciences*

[The role of Npun_F0875 in hormogonium development and motility](#)

13C **Daniel Sepulveda**, *Daniel Sepulveda*, **Austin Wong**, *Austin Wong*

Faculty Mentor: Doug Risser, *Biological Sciences*

[Structure-Function Characterization of Zebrafish GADD34 and CReP](#)

14A **Alice Truong**, *Biological Sciences*, **Ciera Wroten**, *Biological Sciences*,
Jessica Woo, *Biological Sciences*, **Jey Kim**, *Biological Sciences*,
Joshua Tao, *Biological Sciences*, **Kleo Hong**, *Biological Sciences*,
Twisha Patel, *Biological Sciences*

Faculty Mentor: Doug Weiser, *Biological Sciences*

[High Yield Extraction of Clean RNA from Variovorax paradoxus](#)

14B **Joey Kim**, *Pre-Dentistry*, **Narek Manucharyan**, *Pre-Dentistry*,
Kalea Bringas, *Music Therapy*, **Christina Zhang**, *Pre-Dentistry*

Faculty Mentor: Paul Orwin, *Biological Sciences*

[Continuous culture of Variovorax paradoxus biofilms on borosilicate glass](#)

14C **Bringas Kalea**, *Music Therapy*, **Zhang Christina**, *Pre-Dentistry*, **Joey Kim**, *Pre-Dentistry*,
Narek Manucharyan, *Pre-Dentistry*

Faculty Mentor: Paul Orwin, *Biological Sciences*

*Poster Session 1 – Information Commons
April 30, 10:00 AM– 12:00 PM*

[Evaluation of a Tet-On promoter for control of gene expression in *Variovorax paradoxus*](#)

15A **Juna Hwang**, *Pre-Dentistry*, **Naomi Nguyen**, *Biological Sciences*, **Trisha Dinh**, *Biological Sciences*, **Annie Lin**, *Biological Sciences*

Faculty Mentor: Paul Orwin, *Biological Sciences*

[Evaluation of a pBAD based promoter for control of gene expression in *Variovorax paradoxus*](#)

15B **Trisha Dinh**, *Biological Sciences*, **Annie Lin**, *Biological Sciences*, **Juna Hwang**, *Pre-Dentistry*, **Naomi Nguyen**, *Biological Sciences*

Faculty Mentor: Paul Orwin, *Biological Sciences*

[Antimicrobial Resistance Profiling of Alligator Gut Microbiome Isolates](#)

15C **Jenine Dong**, *Pre-Pharmacy*, **Erica Meng**, *Biological Sciences*

Faculty Mentor: Paul Orwin, *Biological Sciences*

Graduate Student Mentor: Julissa Perez-Marron, *Biological Sciences*

[Collaboration in Stage Management](#)

16A **Finley Shields**, *Media X*, **Charlotte Han**, *Violin performance*

Faculty Mentors: James Haffner, *Conservatory*, Lisa Tromovitch, *Media X*

[American Culture](#)

16B **Delilah Freytes**, *Political Science*

Faculty Mentor: Cynthia Dobbs, *English*

[Black Kids are being left to die](#)

17A **TaNiyia Smith**, *Political Science*

Faculty Mentor: Marylou Bagus-Hansen, *Undergraduate Education*

[The Affects of Health Education on Preventable Diseases Spending and a Pharmacists Role in it](#)

17B **Natalie Vasquez**, *3+3 Prepharmacy*

Faculty Mentor: Marylou Bagus-Hansen, *Undergraduate Education*

*Poster Session 1 – Information Commons
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[Mind the gap: Disaggregating mental health data in the AAPI community and establishing mental health equity](#)

17C **Guiying (Angel) Zhong**, *Psychology and English*

Faculty Mentor: Marylou Bagus-Hansen, *Undergraduate Education*

[Evaluating the Effectiveness of Gardening Therapy Across Different Subgroups](#)

18A **Ana Anguiano**, *Psychology*

Faculty Mentor: Marylou Bagus-Hansen, *Undergraduate Education*

[Assessing the Impact of Food Insecurity on Farm Workers' Children Education](#)

18B **Benjamin Guerrero**, *Business Administration*

Faculty Mentor: Marylou Bagus-Hansen, *Undergraduate Education*

[Predictive Indicators of Burnout in Non-profit Workers: An Institutional Examination](#)

18C **Gustavo Garcia**, *Political Science*

Faculty Mentor: Marylou Bagus-Hansen, *Undergraduate Education*

[Minority Mental Health](#)

19A **Brandon Wong**, *Psychology*

Faculty Mentor: Marylou Bagus-Hansen, *Undergraduate Education*

[Supplemental Nutrition Assistance Program \(SNAP\) & Food Insecurity](#)

19B **Linette Santos**, *Political Science & Economics*

Faculty Mentor: Marylou Bagus-Hansen, *Undergraduate Education*

[The Effectiveness of Reentry Programs: The AB 109 Experience](#)

19C **Rolando Garcia-Ceballos**, *Psychology*

Faculty Mentor: Marylou Bagus-Hansen, *Undergraduate Education*

*Poster Session 2 – Information Commons
April 30, 1:00 – 3:00 PM*

[Immature stages clarify systematics in two nymphalid butterflies](#)

11A

Andrea Bui, *Biochemistry*, **Bismanbir Pannu**, *Pre-dental*

Faculty Mentor: Ryan Hill, *Biological Sciences*

[Relationships and immature stage morphology of *Adelpha diocles* and its relatives](#)

11B

Jomel Thomas, *Biological Sciences*, **Jordan Renner**, *Biological Sciences*,
Lu Han, *Biological Sciences*

Faculty Mentor: Ryan Hill, *Biological Sciences*

[Morphological and Protein Composition of the Inner and Outer Layers of Skin and Blubber Tissue](#)

11C

Anna-Marie Nimene, *Biological Sciences*, **Ashley Roberts**, *Biological Sciences*,
Noellemarie Trost, *Biological Sciences*

Faculty Mentor: Jane Khudyakov, *Biological Sciences*

[The effect of auditory stimulation and the day-night cycle on *E. pustulosus* hiding, movements and amplexus behavior](#)

12A

Makaila Gaff, *Biological Sciences*

Faculty Mentor: Marcos Gridi-Papp, *Biological Sciences*

[Signaling Strategies and Competition in Male Tungara Frogs](#)

12B

Alison Kim, *Pre-dentistry*

Faculty Mentor: Marcos Gridi-Papp, *Biological Sciences*

[Medial edge chondrification of the vocal folds of *E. pustulosus* and its function in sexual selection](#)

12C

Helena Czochanski, *Pre-Dentistry*

Faculty Mentor: Marcos Gridi-Papp, *Biological Sciences*

[Eardrum tuning in the tungara frog](#)

13A

Robert Wong, *Biological Sciences*

Faculty Mentor: Marcos Gridi-Papp, *Biological Sciences*

*Poster Session 2 – Information Commons
April 30, 1:00 – 3:00 PM*

[Growth, sexual dimorphism and resource allocation in the túngara frog](#)

13B

Kaitlyn Tonnu, *Pre-dentistry (3+3)*

Faculty Mentor: Marcos Gridi-Papp, *Biological Sciences*

[The effect of age on the mating call of the tungara frog](#)

13C

Zaizhen Xu, *Biological Sciences*

Faculty Mentor: Marcos Gridi-Papp, *Biological Sciences*

[Characterization of Food Calls in Humpback Whales \(*Megaptera novaeangliae*\)](#)

14A

Yasmin Nijjar, *Biological Sciences*, **Aishwarya Ravivarapu**, *Predental*,
Julia Tran, *Predental*, **Ysabella Siangio**, *Predental*, **Tiffany Park**, *Biological Sciences*

Faculty Mentor: Stacie Hooper, *Biological Sciences*

[Whale Feeding: Using Vocalizations to Determine Success](#)

14B

Trisha Dinh, *Biological sciences*, **Hanna Pham**, *Pre-dentistry*, **Karen Situ**, *Biological Sciences*,
Kirollos Semary, *Biological Sciences*

Faculty Mentor: Stacie Hooper, *Biological Sciences*

[What is the prevalence of *Dirofilaria immitis* \(dog heartworm\) in invasive *Aedes* mosquitoes?](#)

14C

Leen Yousef, *Biological Sciences*, **Johan Espinoza Corrales**, *Biological Sciences*, **Daniela Dolar**, *Biological Sciences*, **Taylor Trieu**, *Pre-Pharmacy (3+3)*,
Aisha Popalzai, *Biological Sciences*, **Agamchat Dhami**, *Biological Sciences*

Faculty Mentor: Tara Thiemann, *Biological Sciences*

[The Effects of Male Mating Calls on Flight and Reproduction](#)

15A

William Zhao, *Pre-dentistry 3+3*, **Daniel Bui**, *Pre-dentistry 3+3*,
Jessica Chen, *Pre-dentistry 3+3*

Faculty Mentor: Zachary Stahlschmidt, *Biological Sciences*

*Poster Session 2 – Information Commons
April 30, 1:00 – 3:00 PM*

[Warming– but not herbicide exposure– alters resource acquisition and allocation in an insect](#)

15B **Jacob Whitlock**, *Biological Sciences*, **Justin Choi**, *Biological Sciences*

Faculty Mentor: Zachary Stahlschmidt, *Biological Sciences*

[31P-NMR Spectroscopy of Glucose-6-phosphate, Glucose-1-phosphate and NADH](#)

16A **Austin Thom**, *Biochemistry*

Faculty Mentor: Andreas Franz, *Chemistry*

[The Solution Conformation of Native \$\alpha\$ -1,6-Mannobiose as Determined by NMR Spectroscopy](#)

16B **Hana Rosenblatt**, *Bioengineering*, **Kendall Bromley**, *Biochemistry*

Faculty Mentor: Andreas Franz, *Chemistry*

[NMR Characterization of the Solution Structure of Acarbose and its Interaction with \$\alpha\$ -Amylase](#)

16C **Karissa Acosta**, *Biological Sciences*

Faculty Mentor: Andreas H. Franz, *Chemistry*

Graduate Student Mentor: Cate Simmermaker, *Chemistry*

[Designing a PDZ Chelator for Alzheimer's Peptides Based on the Knob-Socket Model](#)

17A **Colby Vuong**, *Biology, Pre-dentistry 3+3*, **Calvin Vuong**, *Biology, Pre-dentistry 3+3*, **Uyen An**, *Biochemistry*

Faculty Mentors: Jerry Tsai, *Chemistry*, Hyun Joo, *Chemistry*

[Synthesis and Purification of Tripeptides](#)

17B **Erica Meng**, *Biological Sciences*, **Jennifer Sun**, *Chemistry*, **Nancy Vo**

Faculty Mentor: Jianhua Ren, *Chemistry*

Graduate Student Mentor: Ashleigh Ramos, *Chemistry*

*Poster Session 2 – Information Commons
April 30, 1:00 – 3:00 PM*

[Binding of Quercetin Derivatives with DNA Oligonucleotide Triplexes and Duplexes](#)

- 17C** Douglas Chu, *Pre-Pharmacy*, Nicholas Ha, *Pre-Pharmacy*
Faculty Mentor: Liang Xue, *Chemistry*
Graduate Student Mentors: Landy Gu, *Chemistry*, Vanessa Rangel, *Chemistry*

[Significance, Synthesis, and Characterization of HDAC Inhibitors](#)

- 18A** Alaa Al Jawabra, *Biochemistry*, Christine Tran, *Biological Sciences*,
Ashley Wen, *Biological Sciences*, Jayden Stahl, *Chemistry*
Faculty Mentor: Qinliang Zhao, *Chemistry*

[Oral pathogen antimicrobials from a traditional Chinese medicine mushroom: Collaboration between College of the Pacific and Dugoni](#)

- 18B** Taylor Lam, *Biological Sciences*
Faculty Mentor: Skylar Carlson, *Chemistry*
Graduate Student Mentor: Savannah Pierce, *Chemistry*,

[Assessing Infants' Social Evaluations: Virtual Replication and Extension Using Repeated Measures](#)

- 19A** Ashley Bonfoey, *Psychology*, Guiying (Angel) Zhong, *Psychology*,
Ana Anguiano, *Psychology*, Danielle Kitaoka, *Psychology*, Caitlyn Vergara, *Psychology*
Faculty Mentor: Carolynn Kohn, *Psychology*
Graduate Student Mentors: Samantha Crooks, *Psychology*, Mariel Montes, *Psychology*,
Alondra Del Real, *Psychology*

[“The Dog is Feliz” Code-Switching in Emotion Talk with Toddlers](#)

- 19B** Matthew Tineo, *Psychology*, Monica Hernandez-Mendez, *Psychology*
Faculty Mentor: Jessica Grady, *Psychology*

[Perspectives About Neurodiversity-Affirming Practices](#)

- 19C** Kayleigh Guyon, *Speech-Language Pathology*
Faculty Mentor: Madhu Sundarajan, *Speech-Language Pathology*

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Quantum chemistry investigation of a ubiquitin-transfer reaction coordinate

Nina Sun

Faculty Mentors: Anthony D. Dutoi and Joseph S. Harrison

Ubiquitin is a eukaryotic protein that participates in many crucial functions, ranging from the degradation of proteins to the regulation of enzymes. Ubiquitin performs its role by tagging target molecules, where different polyubiquitin chain formations indicate different functions to be carried out. Thus, it is important to investigate and understand the mechanism by which ubiquitin becomes attached to a target molecule. The attachment of ubiquitin is generally facilitated by three families of proteins: E1, E2, and E3. Through crystal structures and computer models, the site of the final ubiquitin transfer is already known to involve the amine end of a lysine on the target protein, and the thioester linkage of a ubiquitin–E2 complex. However, much remains unknown about this process, such as the optimal position for the attacking nucleophile on the lysine and the conformation around the thioester electrophile. We use quantum chemical calculations to evaluate the energy and visualize the molecular orbitals for different arrangements of small-molecule models of the lysine and thioester. Our investigation has found that there are significant changes in the binding energy when the dihedral angle of the methyl group attached to the sulfur on the thioester is changed. Most notable is the enhanced binding at 270° , relative to the carbonyl oxygen. This is a potential indicator for the optimal conformation that the protein must enforce during the process of ubiquitin tagging.

trans-2-Aminocyclohexanols as pH-Triggered Molecular Switches

Gabriella Sonderegger

Faculty Mentor: Vyacheslav Samoshin

Graduate Student Mentor: Oscar Mendoza

Our group studies molecular switches that change their shape dramatically within a specific pH range, making them useful for various applications. One potential application of these switches is targeted drug delivery. Molecular switches can be the lipid-like membrane components for drug-encapsulating

liposomes. When the liposomes encounter an acidic environment, such as cancerous tumors, the molecular switches undergo a conformational change that disrupts the liposomes and releases the drug. This necessitates finding switches that change conformation drastically and within a specific pH range.

Trans-2-aminocyclohexanols act as conformational switches that reversibly change the relative orientation of substituents. We study new 4,5-diacyloxy derivatives that have a different set of substituents compared to previous research. These molecules have two chair conformations in a fast equilibrium. In a neutral environment, the predominant conformer has two acyloxy groups in equatorial positions with an amino group and hydroxyl in axial positions. In presence of acid, the amino group is protonated and forms an intramolecular hydrogen bond with the adjacent hydroxyl, bringing both groups closer together in equatorial positions, and forcing the acyloxy tails into axial positions. We are researching the impact of different amino groups on the acidity required for the conformation switch.

The equilibrium between conformers is gauged by nuclear magnetic resonance ($^1\text{H-NMR}$). The proton-proton coupling constants are strongly dependent on the conformation. When a substituent is axial, the signal of the geminal H is narrow in the range of $\sim 10\text{Hz}$. The equatorial conformation results in a broad signal of $\sim 25\text{Hz}$. Ongoing research involves studying the conformationally locked models to find the extrema of signal width and an estimation of an equilibria position from the observed signal widths for the switches over a range of acidities.

Creating a video about how to perform a spot western assay to identify successful expression strains of the yeast *Pichia pastoris*

Andrew J Lim, Priscilla Hu, Kevin Zhang, Eddie Suh, Patrick Delgado

Faculty Mentors: Geoff Lin-Cereghino and Joan Lin-Cereghino

The yeast *Pichia pastoris* is used as a host to produce valuable recombinant proteins such as insulin and COVID 19 vaccine antigens. One challenge in using this yeast is to identify the strain that expresses the highest amount of the desired protein. Our lab had devised a procedure called the spot western assay which enables a scientist to screen many strains in a

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rapid, efficient manner. Protein samples are spotted onto a membrane and then bound by antibodies to detect the amount of the desired recombinant protein. Up to 60 samples can be screened in less than 2 hours with this procedure. We have created a video which describes how to perform the spot western assay, which we will share through our YouTube channel (Pichia pastoris Saves the World https://www.youtube.com/channel/UCkG51_QRep7aWnis4Fp98Xw). We believe that this technique will encourage scientists to try using this recombinant yeast as well as accelerate the progress of experienced Pichia pastoris users worldwide.

Instrumenting Concurrent Applications for Audit Logging

Nicolas D. Ahn

Faculty Mentor: Sepehr Amir-Mohammadian

Instrumenting legacy code is an effective approach to enforce security policies. Previous work has demonstrated the applicability of instrumentation techniques in the enforcement of audit logging policies for systems with microservices architecture. However, the specified policies suffer from the limited expressivity power as they are confined to Horn clauses being directly used in logic programming engines. In this work, we implemented a tool that rewrites Java-based concurrent applications to support certain audit logging requirements that goes beyond Horn clauses. The rewritten set of microservices are then automatically enabled to generate audit logs that are shown to be formally correct.

Polyhedral Galleries

Matthew Taylor Cowen

Faculty Mentor: Larry Langley

The Art Gallery Problem is one of the most famous problems that has ever been proven in the field of graph theory. The problem asks, “how many cameras are required when placed at the corners of a gallery for that set of cameras to be able to see the entire flooring of the gallery?” Using graph theory, we can answer this problem mathematically. The polygon (the gallery) has n vertices, and that polygon can be triangulated into a set of triangles, from which we can color the vertices through a process of vertex

coloring. After the coloring is completed, we can then place cameras at the set of vertices that use the least amount of colors, and those cameras will be able to see the entire interior of the gallery. From this approach, an upper bound on the number of cameras required to see the interior was found by Chvátal, which is given by the floor function of $n/3$. This problem has been expanded to include other versions, one of which is the gallery with holes (or columns), where Dr. O'Rourke found an upper bound on the number of cameras required given by the floor function of $(n+2h)/3$, where h is the number of holes in the polygon. In my research, I have used O'Rourke's research on galleries with holes as a basis for finding an upper bound of the floor function of $(n+2(h-1))/3$ cameras required to see the surfaces of three dimensional polyhedra. I will discuss the construction required to find this bound, showing how O'Rourke's theorem is used, and then show how this construction works applied to several simple polyhedra, including the cube and the tetrahedron.

Tiger Strides: A History of Student Leadership at University of the Pacific

Jamie Chesbrough, Kaitlyn Imada, Harleen Kahlon, Braydon Ross, Thyphien Son, Lorenzo Spaccarelli

Faculty Mentors: Lisa Cooperman, Keely Canniff, Niraj Chuadhary, Jennifer Helgren, Robin Imhof, Marie Lee, Edie Sparks

In just five weeks, a project based learning fellowship of six students created Tiger Strides, an augmented reality smartphone app which aims to connect the study of local history to a wider audience through technology and placemaking. We explored the question “How has student leadership led to changes in equity, access to higher education, and civic engagement?” We utilized our historical research skills in the University's Special Collections as we searched through primary sources, including the student newspaper, photographs, and promotional material spanning decades. Through this research, we showcased examples of student leaders pushing the boundaries of dialogue at Pacific. Built using Unity game engine, with graphic assets designed on Adobe software, the app was originally developed for Android and then made compatible with iOS devices. We connected our abstract historical research to the digital world using modern technology; the app

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utilizes the smartphone camera, GPS, and audiovisual elements to create an immersive experience. One site on the tour showcases original 3D art that we created using the virtual reality painting application “TiltBrush”. To connect classmates past and present with these findings, the fellows designed, developed and published an app which features an augmented reality walking tour of selected campus sites. Throughout the guided tour of campus, app users stop at notable sites where students demonstrated a commitment to social change and used their leadership abilities. The smartphone app guides users through videos, audio narratives, and images of historical events. Our research showed that this is the first phone application of its kind. With the support of knowledgeable Pacific faculty and staff from a variety of disciplines, we completed and published an accessible phone app that all campus visitors are welcome to experience.

Mestizos Know Why the Earth Eats the Dead

Giancarlo Yzcali Lizarraga

Faculty Mentor: Jeffrey Hole

The suffering of Black and Brown bodies due to environmental destruction has been largely ignored in the white geology of the Anthropocene. As noted in Kathryn Yusoff’s *A Billion Black Anthropocenes or None*, the Anthropocene “neatly erases histories of racism that were incubated through the regulatory structures of geologic relations.” The history of the Anthropocene is a history of Black and Indigenous communities being continually extracted for resources as if they were earthly materials themselves. Being seen as inanimate material means Black and Brown people exist in a subcategory of humanity that I call the Dead. The intersectional identities of the Dead force them to live intimately with their own mortality and the mortality of all life on Earth. Donna Haraway in *Staying with the Trouble: Making Kin in the Chthulucene* calls this state of consciousness compostist, as opposed to post-humanist, wherein all life is understood as being part of the cycle of matter. In this paper, I argue that the Mestizo experience is one of living as the Dead by making kin with the constant exchange of earthly material through death. Leslie Marmon Silko’s *Almanac of the Dead* confronts the history of Mestizos living in the borderlands between Mexico and the United States, whose lives are always in

contrast with their inevitable death. The Dead inhabit a space that is uniquely intimate with the natural world, exhibiting the qualities of Haraway’s compostist theory.

The Humanization of Asian Americans: Dispelling the Model Minority Myth in Relation to Higher Education

Brooke Han Tran

Faculty Mentor: Jeffrey Hole

2021 Summer Undergraduate Research Fellowship Project

As Dr. Kim Tran, Vietnamese American activist and scholar, proposes, “representation affirms that we exist. Liberation ensures that we thrive. Related, [but] not equal.” In dissecting the fallacy of the Model Minority Myth, I aim to explain how it flattens the diversity of Asian American experiences with poverty, immigration and deportation, and, specifically, education. Furthermore, the term Asian American has been weaponized to pit minority groups against one other. It is problematic in that it aligns Asian Americans with whiteness to be proximate to power and privilege, and yet, its positionality is dependent on “othering” other marginalized groups. While I use the term Asian American, I recognize that it contributes to a dangerous notion of homogeneity and grossly simplifies the diverse positionalities and racial traumas of its subgroups.

I chose to analyze case studies, secondary sources, and general history texts in order to have a broader understanding of the way historical policies impact current situations. I found that in order to understand the educational circumstances of Asian Americans, I had to learn about the history of war, colonialism, immigration, poverty, policy, white supremacy, racial stereotypes, and even “bamboo” ceilings in the workplace.

The central questions that guide this research project that I work to address include how and why have Asian Americans been labeled as model minorities. Which group(s) and systems benefit from that myth? How has that label been harmful to the vast number of ethnic subgroups that fall under the category of Asian American? Once data surrounding Asian Americans in education and socioeconomic status is disaggregated, what realities are actually revealed?

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Poetic Protest: Defending Nature and BIPOC against Settler Colonialism

Namorrah Ward

Faculty Mentor: Xiaojing Zhou

In 1982, the state of North Carolina designated the small, predominantly, black Warren County as the dumping ground of hazardous Polychlorinated biphenyl. PCB-infected soil can leak into ecosystems, get absorbed by animals, and make its way up the food chain causing fatal carcinogenic and non-carcinogenic disorders. As a result, the National Association for the Advancement of Colored People (NAACP) organized a large protest, which, while it could not spare Warren County, mobilized the environmental justice movement across the United States. Black, Indigenous, and People of Color (BIPOC) have been victims of and activists against racism and the wanton destruction of the environment by settler colonialism since the seventeenth century.

Underlying the pollution of the environment and the endangerment of BIPOC lives is white supremacy and its attendant settler-colonial ideology which reduces nature to a source of extraction and BIPOC lives to disposable labor. My research focuses on how literature is the site of this contestation over environmental degradation and racism. As critic Cheryll Glotfelty posits in *Literary Studies in an Age of Environmental Crisis*, “we must conclude that literature does not float about the material world in some aesthetic ether, but, rather, plays a part in an immensely complex global system, in which energy, matter, and ideas interact” (19). This paper analyzes how nature poetry by BIPOC writers exposes the exploitation of nature, critiques the colonization of BIPOC, and offers alternative modes of thinking.

Musical Nuns of Sixteenth & Seventeenth Century Italy – Who Actually Made their Rules?

Ainsley R Berryhill

Faculty Mentor: Sarah Waltz

In seeking to determine what the obstacles have been to women composers, I was led to the sixteenth and seventeenth centuries, in which more women composers emerged than in any previous period in Western history. Specifically, women during this time found some remarkable opportunities to learn about music and composition, as nuns in the cloistered communities found in Italy.

By assessing both the work of Craig Monson and Robert Kendrick, who have focused on the musical nuns in Bologna and Milan respectively, this presentation will delineate the parallel circumstances between the convents in these two cities, and evaluate the ways in which women found avenues to performance and composition in many cloistered communities. Even though these spaces seem to have a reputation for providing “safe spaces” for women to pursue an intellectual life, the evidence concerning music points to an intriguing tendency for rebellion on the part of the nuns and their supporters, as they sought to bend or avoid rules in favor of their music-making. The rule breaking was not limited to Bologna and Milan, as illustrated by the compositions of a nun from Novara, whose collection makes her the most prolific woman composer of the seventeenth century. Informed by standard texts on women’s historical involvement in music, this presentation provides a deeper understanding of how Italian convents contributed to women’s entrance into the field of composition, and perhaps points to the barriers which have inhibited the ability of women to enter the music field at large.

Black Opera at the Metropolitan Opera House

Molly C Westlake

Faculty Mentor: Sarah Waltz

2021 Summer Undergraduate Research Fellowship Project

The Metropolitan Opera House in New York has existed since 1880, but until September 2021 had never programmed a black-composed opera (Terence Blanchard/Charles Blow, *Fire Shut Up in My Bones*). Although black opera was composed in those 141 years, for example by William Grant Still and Anthony Davis, the Met declined to perform them in favor of European works, creating a canon that systematically excluded black composers, performers, and artists.

Despite opera’s European façade, black composers and musicians have long been associated with the genre. The recently-founded Black Opera Research Network has identified hundreds of black-composed operas in America; the contributions of singers such as Marian Anderson (first black singer at the Met, 1955), Shirley Verrett, Leontyne Price et al. have, until recently, failed to make significant inroads in the whiteness of opera casts. Black singers were

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typically relegated to stereotyped roles (Ethiopians in *Aida*, the all-black cast of *Porgy and Bess*), and even black-identified lead roles like *Otello* were performed by skin-darkened white performers through 2015.

This paper will examine the road that black opera and particularly *Fire Shut Up in My Bones* has taken. The Met is America's largest and most influential opera company, but has performed almost exclusively European operas. Smaller opera companies (Long Beach, St. Louis, Houston) have been premiering black operas and giving them the success they need to ensure national success. Historically black operas, such as Davis's 1985 *X: The Life and Time of Malcolm X*, had received few performances as critics tore apart numerous facets to justify denial of their artistic value and cultural significance while ignoring popularity with black audiences; incidentally *X* will be revived at the Met in 2022. Opera is slowly emerging from its obsession with European perspectives in order to continue telling universal stories of human experience.

Thus Spoke the Heretic: Poetry from the liminal state

Guiying (Angel) Zhong

Faculty Mentor: Dr. Amy Smith

Saturated by my experiences as a second-generation Chinese American woman, the works in this ongoing collection are unified by the thematic underpinnings of "otherness," displacement, liminality, generational trauma, power(lessness), and filial piety. The disorientation that comes from feeling not quite at home anywhere is a distinct part of diasporic identity that is nested within the core of my poetry. Additionally, ambiguous grief and embodied mourning, derived from inheriting the historical trauma of "Chinese American-ness" (e.g., the 1875 Page Act and the Chinese Exclusion Act), act as the sites at which art and counter-memory collide in this collection. *Thus Spoke the Heretic* represents an important addition to the explosive contemporary literary movement that is being spearheaded by queer, BIPOC writers and thinkers. It calls attention to the intersection of womanhood and race—in the context of growing up Chinese American in a predominantly white environment—with an authentically strained voice shaped by my lived experiences.

Satanic Panic: Moral Turmoil in the United States, 1960-1999

Lyndsey T Kell

Faculty Mentor: Jennifer Helgren,

This research paper is looking at Satanic panic from the 1960's-1990's and moral turmoil in the United States. Satanic panic is a moral panic, where a society experiences a panic fearing their morals are threatened. The purpose is to show the social and cultural impacts, and negative and positive impacts it had on the United States. The research collected for this paper came from online archival resources, digital libraries, history and religion professors at the University of the Pacific, and discussions with a ranking member of a Satanic organization. It answers what fueled satanic panic, which was the popularization of Satanism through prominent satanist Anton LaVey, media coverage, and different art forms. It discusses that anything that went against the conservative culture at the time, like social/political movements or obscene music, were considered Satanic. And it shows that the understanding of Satanism shifted from a practiced religion to the corruption of a "morally correct" nation. The ultimate ramifications of this panic left a divide between those who worry about keeping a "morally correct society" and those who do not fit into that "morally correct" mold.

Forecasting Military Conflicts Using Predictive Analytic Models

Areesh Ilyas

Faculty Mentor: Dari Sylvester Tran

Meticulous analysis of the foreign policy, socioeconomic conditions, and leader's psychology, among numerous other factors, is often performed in order to determine the causal mechanisms of war. All in order to understand war as something more than a random and sporadic event. I question whether war can be predicted. War is defined for the purpose of this research as a military conflict between two parties which results in at least twenty-five battle-related deaths (UCDP). This paper explores the literature around predictive modeling and evaluates existing predictive analytic models of war. I analyze models that use science, statistics, machine-learning techniques, and even literature to predict military conflicts. There have been various forecasts

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established, both for the next few years and decades into the future. As a criterion for analyzing the effectiveness of the models, I use the Russian-Ukrainian war as a case study. Where applicable, if the model accurately predicted the current war, then it is a useful predictive model. I then attempt to build my own model using classification algorithms and machine learning to examine interstate conflicts in the coming years using the UCDP/PRIO dataset of armed conflicts from 1946-2020 and relevant indicators from the World Bank. Predicting wars and understanding them go together, our knowledge of one enhances that of the other. If we can better predict where military conflict might arise next, we can better act proactively rather than respond to the aftermath of war.

Artificial Politics: The Role of Artificial Intelligence in Shaping Political Action

Arshita Sandhiparthi

Faculty Mentor: Dari Sylvester Tran

If the 2016 Presidential elections in the United States served as an example for anything, it is that for better or for worse AI is changing the political landscape. Artificial intelligence (AI) is becoming ubiquitous across disciplines, from medical AI capable of diagnosing breast cancer to text-based AI capable of writing articles about sports, science, and politics. In this research study, we seek to develop and extend our current understanding of AI's effects on political belief formation by focusing on AI-generated news articles and tweets. We have designed two methods for this study: (1) a statistical analysis examining the relationship between AI robots on Twitter and people's political beliefs on Brexit and (2) a survey-based experiment focusing on isolating a relationship between a person's political beliefs and exposure to news articles written by AI. In the first experiment, we found that there is a positive relationship between exposure to AI content about an issue online and human users' beliefs about that issue. The second experiment also indicates that there is a small, positive relationship between exposure to AI-generated political content and changes in an individual's political opinions about the content's subject matter.

A Look at Canary Mission: Democratic Theory through the Palestinian-American Eye

Malak Angel Haider

Faculty Mentor: Dari Sylvester Tran,

There have been many efforts made throughout history that aim to silence individuals who speak out against laws, governments, human rights violations, and other concepts of the sort. Modern day intimidation tactics take on a less physically violent form as they resort to public outings through social media and the internet. In this paper, I seek to hook this idea onto civil rights literature and policies in an attempt to understand the question of intimidation tactics. Further, I hypothesize that these intimidation tactics affect democratic participation. I take on this approach using ethnographic interviews with Palestinian-American college or university students to truly understand the Palestinian-American experience. I hypothesize that these tactics lead to self-censorship, which is subjective in many ways, but ultimately affects one's perception of free speech and willingness to participate in America's democracy.

Faces of Imperialism: A Survey of the U.S.- Puerto Rican Imperial-Colonial Relationship and the Changing Phases of US Imperialism

Luis J Vega Estrada

Faculty Mentor: Ahmed Kanna

The United States has maintained colonial control over Puerto Rico for over a century. Critical explorations of this relationship have revealed that it is rooted in an imperial-colonial project developed at the turn of the 19th century. The U.S. has benefited substantially from the Caribbean possession through the dispossession of Puerto Ricans and the exploitation of labor for the capture of surplus labor value. This article's main intervention is its emphasis on understanding and examining, through a Marxist lens, the changing face of U.S. imperialism on the island and the manners in which value extraction and accumulation have historically manifested themselves. It is an imperialism which has morphed through multiple phases: that of absentee sugar monopoly control; the industrial production of commodities; and more pertinent developments

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within real estate, venture capitalism, debt, and cryptocurrency experiments. Thus, US imperialism is not a monolithic project and must necessarily phase into different manifestations due to changes in the material conditions of global capitalism.

Additionally, I argue that in each successive phase of these imperialist economic arrangements, the ultimate goal is the enrichment of the imperial metropole, thus underscoring the true role of the Puerto Rican colonial state: to provide access for U.S. capital to invest in the island and accelerate capital accumulation and dispossess Puerto Ricans of their lands for gains in the US imperial core. Due to these imperial-colonial investments the island has been left in a perpetual state of underdevelopment as the US imperial core profits. Yet, it is important to highlight that these processes acting at the behest of U.S. capital are not met without resistance, as Puerto Ricans have historically acted and continue to act against imperialist advances. The final portion of this article will reflect on potential revolutionary tactics to combat US imperial-colonialism.

Perception of the LGBTQ+ Films From the Perspective of College Student

Mayu Otsuka

Faculty Mentor: Qingwen Dong

The movement towards inclusion of the film industry when it comes to minorities is quite evident nowadays in comparison to in the past. One of the key group of minorities that is increasingly featured are LGBTQ+ Community. The major challenges that those films that features LGBTQ+ community tends to face is the normalization of sexuality and stigma between self-identification and oppression. To further investigate this phenomenon of film industry focusing on LGbTQ+ community, this research investigates the audience's reaction and their take on 3 different scenes from 3 different films that features LGBTQ+ community. Participants was asked to complete a survey which asks their interpretation of the scene as well as if they would like to watch the whole sequence based on the video clip.

ME in VR: Will mere exposure to virtual reality content impact political ideology?

Matthias Elias Lopez

Faculty Mentor: Dari Sylvester Tran

The following research project aimed at discerning if the mere exposure effect through virtual reality could impact political ideology or a targeted political attitude. To begin, this research project builds on the theory of the mere exposure effect as a means to do initial research on the possible political implications that virtual reality may have on a world that has become more intertwined with technology.

Additionally, paying mind to political science, this long-term research project is focused on how this technology—VR—can be utilized by any yielder of this new technology to propagate a virtual idea for the sake of obtaining, maintaining, or, even, limiting power. Despite a limited sample size, the project was able to discern that depending on the specific virtual reality content, the particular experimental treatment, there was a change in a participant's ideology or attitude towards a targeted idea. Although this preliminary research is a pilot study, it provides a foundation for future political science research to be developed from this model. Thereby, this project serves as political science inquiry for the sake of thinking on behalf of our collective future. Finally, one question remains, how will virtual reality's potential be utilized by future scientists and societies?

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Widespread use of 3D In-Vitro Models in Viral Diseases

Jef Andrei Tabora Pelera

Faculty Mentors: Maria Gencogolu, Shelly Gulati

2021 Summer Undergraduate Research Fellowship Project

This Research provides an overview of the applications and overall challenges of creating 3D-In Vitro models to promote their use in studying viral diseases. 3D models are developed by integrating cells into various types of biomaterials, such as synthetic hydrogels (i.e., polyethylene glycol) and natural hydrogels (i.e, collagen). Some of these models use innovative bioreactors, such as the Rotating Wall Vessel (RWV). Developments in biomaterials have helped researchers solve various challenges when imitating the cellular matrix, polarity, and differentiation of pluripotent cells found in the human body (in-vivo). Structural biomaterials, or scaffolds, provide structural support for cell growth, attachment and migration, mimicking the extracellular environment (ECM) the cell would experience in-vivo. Moreover, growth and signal factors must also be considered to ensure the cells differentiate and proliferate properly. Once the in-vitro model has been created, it is compared with organs/ physiological environments visible in-vivo, then infected with a virus and analyzed through immunohistochemistry. Effective infection and biomimicry indicate successful 3D-models, which can be used to test various drugs/treatments.

Although 3D-models provide information that current 2D-monolayer and animal models cannot, 3D-models should not be an alternative to those methods. This research instead advocates for the widespread use of 3D-models as an additional platform for drug/treatment testing. With more helpful ways of testing, medical professionals may no longer have to settle for developing an effective treatment. Rather, it may encourage and permit pursuit of a more ambitious goal: a revolutionary cure.

Establishing a proof of concept for the edIncubator: a low-cost tray incubator that minimizes cross contamination and enables monitoring of user-established parameters

Jennifer Moreno

Faculty Mentor: Shadi Othman

Current research approaches aim to emulate the microenvironment of living systems by controlling certain parameters, including temperature, carbon dioxide levels, and pH. This can be accomplished by culturing cells in incubators and mimicking homeostatic elements to minimize the risk of apoptosis and contamination. Incubators traditionally support hands-on experimentation and learning processes, although this is easily associated with cross-contamination risks. The *edIncubator* reflects a strong sense of innovation through the implementation of eight individualized trays to minimize cross-contamination and enable multiple users to establish different culturing purposes for each tray. In order to have meticulous control over critical cell culturing parameters, the *edIncubator* integrates electrical components and software designed to store and deliver data relating to user-established parameters.

To establish a proof of concept for Phase 1 of this project, it is important to take into consideration the role carbon dioxide plays in this system since it is a primary parameter associated with tissue microenvironments. The setup of this experiment consists of two simplified chambers with two sets of mechanically operated one-way valves to establish a clear distinction between carbon dioxide flowing in and out of the chambers. Once experimental data proves the foundational idea that carbon dioxide can deviate into two separate chambers, this setup can be expanded to account for eight individual chambers as well as any additional parameters that could be useful to monitor to ensure cell viability.

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Identifying Important Bacterial Proteins Involved in Synthesis of Spider Silk Protein MaSp1

Douglas Chan, Derek Chan, Angela Hung, Joochan Koo

Faculty Mentor: Craig Vierra

Spider silk has been studied extensively due to its unique mechanical properties—tensile strength, extensibility, and toughness, making it approximately five times stronger than steel of an equivalent diameter. These mechanical properties are applicable in a plethora of products including bulletproof vests, medical sutures, fishing lines, ropes, and cords. In order to manufacture these products, spider silk must be obtained in mass quantities. However, spider silk is extremely difficult to harvest and collect in mass quantities from spiders. One promising method that is proposed for the mass production of spider silk is inducing spider silk production in bioengineered *E. coli*. *E. coli* is unequipped to efficiently produce spider silk. In order to efficiently utilize *E. coli* to produce spider silk, this study investigated the proteins and enzymes involved in the production of MaSp1. It has been demonstrated that *E. coli* produces spider silk protein in more abundance when incubated at 16°C. In this study, a 2X construct of the MaSp1 spider silk gene was inserted into a plasmid. *E. coli* was transformed and induced to produce MaSp1. Shotgun proteomics were conducted on the induced bacteria at 16°C and 37°C and uninduced bacteria at 16°C and 37°C to compare the global proteomics. Using a proteomic analysis, necessary proteins and enzymes for the production of MaSp1 in *E. coli* were identified

Development of Cloning Vehicles for Expression of Gc-MAF in Yeast

Tammy Tran, Seohyun Lee, Jane Yu, Wilson Wu,

Faculty Mentor: Craig Vierra

Gc-MAF is a gc-globulin that is naturally found in the human body, and it supports the immune system due to its vitamin D-binding properties. It works by activating macrophages for immune response as well as activating cells responsible for cellular repair. There is emerging biochemical evidence for Gc-MAF as an effective cancer treatment. The long-term goal of this study is to investigate the glycosylation

pattern of Gc-MAF in yeast and compare it to human Gc-MAF, which is known to require specific sugar additions for activity. In order to do this, we first will clone the human Gc-MAF cDNA using PCR. Then, we plan on inserting the Gc-MAF cDNA into a prokaryotic expression vector, followed by subcloning it into a yeast expression vector. Gc-MAF will then be expressed and purified from yeast and its glycosylation pattern investigated using proteomics and mass spectrometry. Since yeast are simple eukaryotes, we hypothesize that yeast may glycosylate Gc-MAF similar to human cells.

Effect of Cold Shock Proteins on the Efficiency of Spider Silk Growth in Bacteria

Avery T Whipple, Jillian Lim

Faculty Mentor: Craig Vierra

Spider dragline silk has attracted the attention of many material scientists due to the fibers' high tensile strength, toughness, and elasticity. On a weight-for-weight basis, dragline silk is several times stronger than steel, and so the ability to synthetically bioengineer it could be revolutionary for manufacturing products ranging from bulletproof vests to medical sutures. Additionally, being a biopolymer made primarily from protein, silk degraders in a nontoxic manner making it a greener material than toxic alternatives. Unfortunately, these fibers cannot be harvested in large quantities through ideas such as spider farming due to the cannibalistic nature of spiders. Additionally, the proteins that make the fibers are so large that scientists have struggled to create them through synthetic means efficiently. Our lab has cloned a specific silk gene called MaSp1, which encodes for a native-sized recombinant silk protein that is about 250-320 kDa long, and we have induced overexpression of this gene in bacteria to try to identify where the bottlenecks are in protein synthesis. Mass spec analysis of the proteins made by bacteria indicated an upregulation of many different proteins. The goal of this experiment was to follow that lead and determine if growing bacterial cultures after induction in a colder environment (16°C) led to more efficient production of the silk protein. If proven successful, this discovery could make the genetic engineering of bacteria to overproduce specific proteins a commonplace to synthetically manufacture spider silk more efficiently.

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A Proteomic Analysis to Identify Changes in Bacterial Protein Expression Following Overexpression of a Spider Silk Protein

Jamie (Ju Yeon) Park, Jaeyoung (Kate) Lee, David Chanyang Eum, Minji Jung, Sungkyung Lee

Faculty Mentors: Craig Vierra, ,

Bullet proof vests, medical sutures, and architectural advancements are potential uses through the versatility of spider silk proteins. Its mechanical and biochemical properties, including exceptional elasticity, strength, and biocompatibility make it a central focus of material scientists and is the reason for many research endeavors targeting artificial spider silk production. Due to the limitations of collecting massive quantities of spider silk by natural methods, strategies to express vast amounts of recombinant spider silk protein in bacteria have been pursued, but also met with technical challenges. These technical challenges have included bacteria running out of critical materials needed for protein synthesis. In order to identify proteins involved in spider silk production in bacteria, we overexpressed a synthetic spider silk gene called Major Ampullate Spidroin 1 (MaSp1) - this spider silk protein contains 16 copies of internal block repeats, along with the N- and C-terminal domains of MaSp1. Overexpression of MaSp1 was confirmed by mass spectrometry and quantitative changes in bacterial protein expression were investigated using proteomics. This provided an enhanced perspective of the bacterial proteome, helping to better identify the characteristics of proteins that may hold the key to mass production of spider silk in bacteria. Here, we reveal our findings of how the bacterial proteome changes in response to overexpression of a spider silk protein in bacteria.

Proteomic Analysis of the Expression of MaSp1 Dragline Silk Protein in E. coli

Sophie Rae Pazzo, Rajan Amit Patel, Kamrin Athwal, Edward Kim

Faculty Mentor: Craig Vierra

This research focuses on understanding the mechanisms of MaSp1 black widow spider silk protein synthesis in bacteria so that it can be used to produce artificial silk in large quantities. The MaSp1-containing silk has extremely high tensile strength, elasticity, and toughness. When equivalent masses

are compared, data suggest that MaSp1-containing silk is five times stronger than steel. If this silk could be manufactured synthetically, it could be used for many industrial applications: bulletproof vests, medical sutures, ropes and chords, as well as nanotechnology. Additionally, mass production of MaSp1 silk has environmental advantages because it is a bipolymer of protein and therefore is non-toxic when degraded.

In order to manufacture MaSp1 silk synthetically, vast quantities of the recombinant protein must be produced. In order to accomplish this task, we cloned a piece of the MaSp1 gene into the prokaryotic expression vector pET24a to create pET-NT4xCT. The natural gene that codes for MaSp1 is extremely long, with nearly 3,000 amino acids. The exact proteins or enzymes that bacteria need to synthesize MaSp1 have not been identified, which makes mass production exceedingly difficult.

In an effort to find a solution, a global analysis of the proteome of E. coli was performed using a mass spectrometer. In order to compare differences in bacterial expression, protein samples were analyzed under two conditions: induced- and non-induced MaSp1 expression. It is hypothesized that the production of MaSp1 puts excessive stress on bacteria, where some bacterial proteins are upregulated under induction that are not upregulated when MaSp1 is not being induced.

Future steps include identifying the bacterial proteins involved in silk production so that we can create a short list of candidate genes that aid in expressing the MaSp1 gene in bacteria.

Overexpression of a Black Widow Dragline Spidroin in Bacterial Protein

Natalie Naseib, Katina Zhu, Jamie (Yu Yeon) Park, Daniel Eum, Phuong Phun

Faculty Mentor: Craig Vierra

<Dragline spider silk uses are various and multifaceted, leading to an increased interest in mass production of recombinant spider silk protein for artificial spider silk production. The mechanical properties of spider silk, including its strength, extensibility, and toughness are responsible for its remarkable properties. In order to acquire ample spider silk protein for mass production, it becomes crucial to develop techniques to express large quantities of recombinant protein. Through the use of prokaryotic expression systems, attempts have been

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made to overexpress spider silk proteins in bacteria. However, to date, only limited amounts of spider silk protein have been obtained. In order to optimize overexpression of recombinant spider silk proteins in bacteria, we overexpressed a minispidroin (short version of a spider silk protein) and performed a proteomic analysis using mass spectrometry to identify bacterial cell proteins that participate in spider silk production. Knowledge from these studies could be used to create new genetically modified strains of bacteria specially designed to produce large quantities of spider silk protein. The potential to yield large quantities of spider silk proteins could allow for commercial use of the spider silk in ways including sutures, bulletproof armor, cords, and much more.

The role of Npun_F0875 in hormogonium development and motility

Daniel Sepulveda, Austin Wong

Faculty Mentor: Doug Risser

Nostoc Punctiforme is a filamentous, nitrogen-fixing cyanobacterium that has the ability to differentiate into three distinct cell types: akinetes, heterocysts, and hormogonia. The cell type of interest in this study is hormogonia, which are motile filaments responsible for gliding, short-distance movement. These filaments allow *N. punctiforme* to establish crucial symbioses with eukaryotes, especially terrestrial plants, for nitrogen-fixation. The motility of these filaments is due to a Type 4 Pilus-like system, which is responsible for the gliding motor and hormogonium polysaccharide secretion (HPS). Through transposon mutagenesis, various non-motile mutants were screened for the location of the transposon insertions, one of them being in the gene Npun_F0875. Thus, the main goal of this project is to identify the role that Npun_F0875 plays in hormogonium development and motility through comparative analysis of the wild type and a Npun_F0875-deletion strain.

Structure-Function Characterization of Zebrafish GADD34 and CReP

Alice Thuc Truong, Ciera Wroten, Jessica Woo, Jey Kim, Joshua Tao, Kleo Hong, Twisha Patel

Faculty Mentor: Doug Weiser

The Unfolded Protein Response (UPR) is a stress response that is activated when the Endoplasmic Reticulum (ER) is overwhelmed with unfolded or misfolded proteins. The UPR consists of three different pathways— PERK, ATF6, and IRE1, which attempt to “resolve” the stress on the ER, by increasing protein folding capacity, clearance of misfolded proteins and reduction in new protein synthesis. If the ER-stress cannot be cleared, the UPR will eventually lead to the cell’s apoptosis. In the PERK pathway, the build-up of unfolded or misfolded proteins will lead to the phosphorylation of Eukaryotic Initiation Factor 2 (eIF2 α), resulting in a reduction in global protein synthesis. This study focuses on two proteins, GADD34 and CReP, which bind to Protein Phosphatase 1 (PP1) and promote the dephosphorylation of eIF2 α , thus working as negative regulators of the PERK pathway. We cloned the zebrafish homologs of GADD34 and CReP and generated N- and C-terminal deletion constructs. Plasmids encoding these deletions can be expressed in HeLa and HEK293T cells, which will allow us to determine which sequences within GADD34 and CReP are required for regulation of eIF2 α dephosphorylation.

High Yield Extraction of Clean RNA from *Variovorax paradoxus*

Joey J Kim, Narek Manucharyan, Kalea E Bringas, Christina Zhang

Faculty Mentor: Paul Orwin

Variovorax paradoxus is a Gram-negative soil proteobacterium that produces biofilms on plant roots and plays a major role in the rhizosphere of *Arabidopsis thaliana*. Our research group is examining the mechanisms of biofilm formation in this organism with a focus on the role of Toxin-Antitoxin (TA) systems. As part of this work, we need to be able to purify RNA from different growth phases to be able to use for transcriptome analysis. This will allow us to identify patterns of gene expression associated with the biofilm lifestyle.

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The work reported here is focused on gathering samples of purified RNA from different *V. paradoxus* strains exponential-phase growth. This RNA will be compared to samples derived from biofilms to identify specific differentially expressed loci. Highly purified RNA is necessary for RNA-seq, the most effective strategy for determining global patterns of gene expression. However, RNase activity and contamination with other nucleic acids are significant obstacles. Here we describe a set of experiments to optimize RNA yield and purity in preparation for that future work.

We have developed a strategy for culture growth and RNA extraction that reliably yields large amounts of high-quality RNA (OD260/280 ratio ~2.0) using a Zymo RNA purification kit. In addition, we present growth data on selected strains in batch culture to facilitate the process of reliably extracting RNA from bacteria in the exponential phase. The purified RNA will be sequenced and compared with biofilm growth to identify TA systems that are differentially regulated.

Continuous culture of *Variovorax paradoxus* biofilms on borosilicate glass

Bringas E Kalea, Zhang Christina, Joey J Kim, Narek Manucharyan

Faculty Mentor: Paul Orwin

Biofilm formation is the irreversible attachment and growth of a population of microorganisms on a surface. This process includes phenotypic adaptations that alter the organism's cell morphology, physiology, and metabolism. A major goal of our research group is to understand the underlying genetic program that leads to this phenotypic shift.

Previous studies from the Orwin lab showed that *Variovorax paradoxus* EPS, a Gram-negative beta proteobacterium, expressed filamentous structures within the biofilm that were not observed when grown in a static liquid medium. Treatment of these biofilms with DNase followed by staining with a mixture of Propidium Iodide and Syto 9 showed that the filaments were eliminated by this treatment, suggesting that extracellular DNA plays an important role in the formation of biofilms. Here we report results of continuous cultures of several strains of *Variovorax* which formed biofilms on glass chips in a chemostat. The morphology and density of the biofilms was observed using DAPI staining on an Echo Revolve epifluorescence microscope. RNA extraction was also attempted on these cultures, and

different nutrient levels were evaluated to determine the optimal growth approach yield high density, phenotypically consistent biofilms.

The overall goal of this is to compare the RNA extracted from the biofilms to similar extractions from exponential growth to identify genes specifically upregulated in these continuous flow systems. Using this strategy we can identify global regulatory systems for controlling this complex developmental process.

Evaluation of a Tet-On promoter for control of gene expression in *Variovorax paradoxus*

Juna Hwang, Naomi C Nguyen, Trisha M Dinh, Annie Lin

Faculty Mentor: Paul Orwin

Toxin-antitoxin (TA) systems are widespread genetic elements in bacteria thought to contribute to many phenotypes. They function by using differential protein stability to control cell lysis during growth. This project is an effort to evaluate a tightly regulated gene expression system using anhydrotetracycline (aTet) as an inducer to study the role of TA systems in strains of *Variovorax paradoxus*, an important soil bacterium. These preliminary studies using a GFPuv reporter assay will provide the necessary foundation for designing our future experiments to evaluate these functional elements in phenotypes such as biofilm formation and horizontal gene transfer.

These experiments were conducted to determine if gene expression can be controlled within different strains of *Variovorax* using the plasmid pBBR2k-GFPuv, which contains a fluorescent reporter under the control of the Tet-On promoter. pBBR2k-GFPuv was purified from *E. coli* and transformed into the different *Variovorax paradoxus* strains using electroporation. The presence of the plasmid was verified by agarose gel electrophoresis. The transformed strains were induced with various concentrations of aTet and gene expression was measured at 4 and 24 hours using SDS PAGE and fluorescence microscopy. These results were compared to similar experiments in the original *E. coli* host strain. The fluorescence microscopy showed a clear induction signal, but the accompanying protein signal in the SDS-PAGE was not as readily detected.

These results will be the basis for further development of this transcriptional control system for use in *Variovorax*, focused on development of tools

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to evaluate the functions of TA systems in this important organism.

Evaluation of a pBAD based promoter for control of gene expression in *Variovorax paradoxus*

Trisha M Dinh, Annie Lin, Juna Hwang, Naomi C Nguyen

Faculty Mentor: Paul Orwin

Toxin-antitoxin (TA) systems are widespread genetic elements in bacteria thought to contribute to many phenotypes. They function by using differential protein stability to control cell lysis during growth. This project is an effort to evaluate a tightly regulated gene expression system using arabinose as an inducer to study the role of TA systems in strains of *Variovorax paradoxus*, an important soil bacterium. These preliminary studies using a GFPuv reporter assay will provide the necessary foundation for designing our future experiments to evaluate these functional elements in phenotypes such as biofilm formation and horizontal gene transfer.

Our project goal was to evaluate the utility of a broad host range vector that uses arabinose to control expression of GFPuv. This plasmid, pBBR8k-GFPuv, was isolated from *Escherichia coli* and transformed into several strains of *Variovorax paradoxus* using electroporation. Transformants were isolated and the plasmid was verified by agarose gel electrophoresis. Reporter gene expression was verified using fluorescence microscopy on cultures at several time points after induction, and SDS-PAGE was also employed to evaluate the expression levels. The expression profile was compared to similar experiments in the original *E. coli* strain.

Fluorescence microscopy on the original *E. coli* strain showed clearly that arabinose could effectively induce GFPuv based fluorescence, but the SDS-PAGE data was much more ambiguous. The plasmids were successfully transformed into *Variovorax paradoxus*, but the induction experiments suggest that either the regulation of the gene is not as tight, or the induction parameters are different. This will be the basis for future experimentation.

Antimicrobial Resistance Profiling of Alligator Gut Microbiome Isolates

Jenine S Dong, Erica Meng

Faculty Mentor: Paul Orwin

Graduate Student Mentor: Julissa Perez-Marron

Antibiotic resistance research has become urgent due to the lack of development of new antibiotics and the increase in multi-drug resistant bacterial infections, which have become a global threat. Due to its large and diverse microbial population, the gut microbiome has been suggested to be a great candidate for antibiotic resistance research. In a recent study, antibiotic resistance gene elements were identified in samples of the gut of an American alligator. The goal of this project is to confirm antibiotic resistance among potential antibiotic-resistant isolated colonies from these previously mentioned alligator gut samples. Bacteria were isolated from this gut microbiota based on the resistance genes identified using a disk diffusion enrichment approach. The isolates were identified based on their 16S rRNA gene sequences, and we have tested some of these isolated strains for antibiotic resistance using a minimal inhibitory concentration (MIC) assay. The MIC assay was performed to determine antibiotic resistance within these selected strains against antibiotics, Ampicillin, Gentamycin, Tetracycline, Rifampin, Chloramphenicol, Kanamycin, and Ciprofloxacin, which are from different classes with different potencies. We found that six of the strains were multi-drug resistant. We found that Ciprofloxacin was mainly inhibitory to all the tested strains, while Ampicillin and Kanamycin were unable to inhibit any of the strains. Moving forward with this project we hope to successfully link the previously identified antibiotic resistance gene elements to resistance seen within the minimal inhibitory assay. This can deepen our understanding of the gut microbiome serving as a potential reservoir of antibiotic resistance elements which can aid in furthering the development of novel antibiotics.

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Collaboration in Stage Management

Finley J Shields, Charlotte Han

Faculty Mentors: James Haffner, Lisa Tromovitch,

This study examines the efficacy of students with different skill sets working as co-leaders in their first opera theatre production, as well as how this dynamic explores the craft of stage management and the potential for distributive leadership in the industry. As first-time stage managers, both students had to learn what the position entailed and how to execute its duties. Furthermore, one specializes in music while the other specializes in theatre. Therefore, working on an opera production required both to collaborate and learn new skills from each other to create a productive, balanced environment.

This research explores the strategies each individual adopted to effectively stage manage an opera. Through a comparative analysis of each student's stage manager book, this presentation will detail the different methods each employed while maintaining an equivalent depiction of the production. As co-leaders, the balance between collaboration and communication were key to understanding the stage manager position both for themselves as well as for the cast and crew. By utilizing their prior knowledge and distinct expertise, they established a co-leadership system that played to both of their strengths and developed new skills in previously unexplored domains. This presentation will analyze the strengths of co-leadership and the applications of two individuals with different specialties collaborating in a new environment.

American Culture

Delilah Freytes

Faculty Mentor: Cynthia Dobbs

Critical Race Theory is a lens that people can use to understand American politics. This lens can help those see that racism is within U.S. History, Policies, and Social Institutions. Within CRT there are 5 core principles that help build upon understanding persistent racial disparities in economic, political, and social experiences and outcomes. Those principles are 1. Racism is ordinary and not a deviation from the norm, 2. Race has been constructed socially, much to the detriment of people of color, 3. Convergence of interest, meaning that black people achieve civil rights victories only when white and black interests converge, 4. A notion that white people are the

beneficiaries of civil rights legislation and lastly, 5. The idea of storytelling and counter-storytelling as a way to magnify the stories, experiences, and narratives of marginalized communities.

With my project, I use CRT as a way of looking at the music industry's history and use this as inspiration for my art piece. In my art piece titled, American Culture, I hope to capture a visual representation of how Black music has become absolutely central to what we consider "American Culture" is. I specifically focus on the music industry's impact of Black musicians and parts of this story that aren't truly shown nor appreciated. In sum, I say, behind every great white voice has been black voices. Some examples include Big Mama Thornton, The Blossoms and Ashanti to name a few. The fifth principle of Critical Race Theory is demonstrated in my project and this is how I will be recognizing and appreciating these artists and culture. Overall, this connects to my course's goal to explore the formal elements and thematic concerns of the blues, jazz, soul, and hip hop that have shaped American literature and culture through time.

Black Kids are being left to die.

TaNiyia O Smith

Faculty Mentor: Marylou Bagus-Hansen

Our current education system is being held together by a band-aid, and the infection that is ignorance is taking its toll on Black Americans. While there have been a plethora of studies discussing the disparities of health issues within Black communities, an important part often missed is the association between primary education and the long term implications. The goal of this research is to provide insight at the ways in which the lack of quality of K-12 education serves as a precursor for an inability to have full control over the decisions impactful to one's health. At its core the work explores the cycle of "intergenerational poverty," initially looking at through the lens of Black children in the current education system and the noticeable disparities in public school education. Then following through with analyzing the implications via the parents of said children attending these high poverty schools. Addressing the unique relationship between Black adults and their pursuit of higher education and the consequences that often follow that become erased in the larger crisis of student loan debt. Lastly, piecing this

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intergenerational poverty all together by looking at the results of a system that perpetuates the impoverished from being able to access the resources in order to remain healthy.

The Affects of Health Education on Preventable Diseases Spending and a Pharmacists Role in it

Natalie L Vasquez

Faculty Mentor: Marylou Bagus-Hansen

American spending on preventable diseases is costing our economy billions in the healthcare spectrum. Preventable diseases can be described as a disease that could've been avoided under certain circumstances. We face an issue in America when it comes to health disparities. A study discussed in this paper found that African Americans spend over \$2 billion per year in excess in out-of-pocket costs. A factor that I've researched as to why this is is because of education. In America there are a lot of factors that go into education, but I will mainly be focusing on racial disparities African Americans face in health education and how this plays a role into how much they spend on preventable diseases. Part one of the study will analyze a project I worked on, the REACH (Racial and Ethnic Approaches to Community Health) toolkit, provided by Public Health Advocates Stockton branch. REACH is a program that focuses on access to healthy foods and increase physical activity opportunities for faith based and community based organizations, which will help further explain how this program helps educate the African American community. The second part to this research question discusses the involvement and role that pharmacists play in health education. Something as simple as teaching health literacy can make a big impact on a patient. By teaching literacy on prescriptions, it can help prevent issues of drug resistance on diseases along with other health issues arising due to not taking the prescription correctly. Along with this, pharmacists can also get involved by doing screening programs. By getting involved, it will allow pharmacists to be able to catch if patients are at increased risk for anything and double down by educating the patients on why they may have an elevated risk for something tying all back to health education.

Mind the gap: Disaggregating mental health data in the AAPI community and establishing mental health equity

Guiying (Angel) Zhong

Faculty Mentor: Marylou Bagus-Hansen

Asian American and Pacific Islander (AAPI) is an identifying umbrella term that encompasses an estimated fifty different ethnic groups speaking over one hundred languages. Nevertheless, research conducted on this broad community often addresses the population monolithically, thereby obscuring the profound heterogeneity and historically-produced unique experiences present within it. As interrelated, emerging concepts, intergenerational and historical trauma are particularly relevant to the invisible heterogeneity of the AAPI community with particular regard to the mental health field. For example, mental health research that assesses the AAPI population does not differentiate between the distinct traumatic psychological legacies of the mass incarceration of Japanese Americans during World War II and U.S. imperialism in the Philippines when attempting to elucidate the state of AAPIs' mental health. As a California Civic Action Fellow serving at Little Manila Rising, a Filipinx-based non-profit organization committed to bringing multi-faceted equity to the historically disenfranchised area of South Stockton, I examined the power of group storytelling as a narrative reclamation device in the context of intergenerational trauma for the AAPI community. How do data and narrative disaggregation empower members of the notably heterogeneous AAPI community? To what extent is mental health equity tied to a paradigm shift towards data disaggregation and community-driven research? Is the widespread implementation of a culturally-informed mental healthcare model possible without the intentional recognition of within-group differences present among AAPIs? Through unstructured interviews with AAPI mental health and research experts and my work with AAPI youth at Little Manila Rising, I hope to shed some light on those aforesaid lines of inquiry.

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Evaluating the Effectiveness of Gardening Therapy Across Different Subgroups

Ana Anguiano

Faculty Mentor: Marylou Bagus-Hansen

As a result of the COVID-19 pandemic and the ensuing economic recession, many people's mental health has been negatively impacted and additional barriers for those who already suffer from mental illness or drug abuse problems have been created, making it harder to receive proper help and treatment. Therapeutic horticulture is a nature-based program that includes a range of outside activities, such as gardening, to promote one's overall well-being by implementing a person-centered approach that can reduce social isolation especially for those with mental health problems. Previous research has shown that horticulture therapy is an effective way of improving one's mental health by reducing participants' levels of depression, stress, and anxiety. Communities that would especially benefit from horticulture therapy according to the existing literature include military veterans, students, and those diagnosed with clinical depression or anxiety. The purpose of this study is to investigate if certain populations are able to benefit more from gardening in general by implementing a survey using a Likert scale to assess participants' affect or emotions after participating in gardening sessions. This survey will focus particularly on seeing if gardening is able to reduce feelings of stress, depression, and anxiety in each population. For if left untreated, mental health issues may have a significant impact on one's physical health and quality of life as well as have societal impacts.

Assessing the Impact of Food Insecurity on Farm Workers' Children Education

Benjamin Guerrero Jr.

Faculty Mentor: Marylou Bagus-Hansen

With California being one of the biggest producers in agricultural output, generating over \$49.1 billion in agricultural cash receipts, the people who make up the workforce in agriculture are predominantly foreign-born as they have immigrated to the United States for better opportunities. It is often, however, that the same people who reap the fruits in the state with the most crops are facing food insecurity

themselves. Children of these farmworkers suffer the consequences of being born into food-insecure homes. Food insecurity impacts not only the health of the children but education as well. The purpose of this study is to determine if there is a correlation between food insecurity and a decline of school performance amongst children of farm workers and those students who are not children of farm workers. The survey conducted will be in a school with a high prevalence of free and price reduced meals and. Currently, there are significant difficulties to reduce the amount of food security such as accessibility to food programs, language, and education. This study would help provide for a way to break down these barriers and help non-profits optimize their reach to the communities to combat food insecurities by implementing communication maneuvers, diminishing stigma around programs, and providing access to food programs that would help contribute to food security in the farmworkers families. If non-profits are able to utilize the proper tools to reach out to the farmworkers, food insecurity would not play such a significant role in the educational performance of children with farmworker caregivers/guardians/parents.

Predictive Indicators of Burnout in Non-profit Workers: An Institutional Examination

Gustavo Garcia

Faculty Mentor: Marylou Bagus-Hansen

In the non-profit sector, the retention of valuable workers is a necessity to ensure that organizational integrity can stay intact. The ability for nonprofits to function properly is reliant on workers continuing their work for the organization and not leaving for a more lucrative position in the private sector and more importantly, not burning out; burnout is typically understood as the physical and emotional stress that a worker experiences during their job for an extended period that culminates in their exhaustion and inability to continue working. While burnout is contested in the literature as being symptomatic of an individual's underlying condition, one thing is certain: the *institutional* forces present in an organization has a monumental influence on the rates of burnout that people experience. The purpose of this research is to answer the question *Are there predictive indicators in an organization that contribute to a worker's burnout?* This study will

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deploy a survey titled “Predictive indicator of burnout survey” (PIBS for short) to analyze a worker’s attitudes to their organization’s structure. The survey will focus on three primary indicators: *wage-to-workload balance, bureaucratic affect, and organizational work culture influence on a worker’s productivity*. Using these three indicators will help nonprofit organizations reduce the rate of burnout and turnover of their most valuable workers by seeing what institutional factors they can change to minimize burnout.

Minority Mental Health

Brandon Wong

Faculty Mentor: Marylou Bagus-Hansen

Mental illness is a lot more common in the United States than we might think. On average, one in six teens ages 12-17 in the United States suffer from a mental illness. This number goes up to 1 in 3 in young adults ages 18-25. There are a myriad of factors and one of which we cannot control—race and ethnicity. Minority groups such as Asian, Black, and Latino seem to be more susceptible and are far less likely to seek treatment compared to their White counterparts. What are the causes of mental health disparities between race and ethnicity and what can we do to bridge the gap and make mental health care more accessible to everyone? So far, there seems to be a limited amount of research in this area. Many factors play a role as to why there hasn't been a clear answer, one of which is the stigma that comes with mental health and mental illness and disabilities. It may be difficult to settle on a correct answer, if there is one. Conducting interviews with healthcare professionals and behavioral health workers in Spanish communities will be the first step in collecting different perspectives of those who work in the field of mental illness who are providing treatments to Spanish speaking communities. The goal is to identify disparities and barriers that may prevent minority groups from receiving the treatment they deserve. As a result, we can look forward to cultivating a more inclusive community-based and individualized treatment options and reach out and help those who may need it the most.

Supplemental Nutrition Assistance Program (SNAP) & Food Insecurity

Linette Santos

Faculty Mentor: Marylou Bagus-Hansen

The purpose of the government funded Supplemental Nutrition Assistance Program (SNAP) is to reduce food insecurity in the United States by improving the levels of nutrition among low-income households and individuals known as CalFresh in California. The project will overview how policies implemented on SNAP have affected who may have access to the service, if there’s been a decrease in food insecurity, and how SNAP and food insecurity was affected during the COVID-19 pandemic. Furthermore, by analyzing the policies and data from SNAP and food insecurity along with a recent survey was conducted at a food distribution event in Stockton, California. As a result, studies have shown SNAP has reduced food insecurity and helped many households and individuals during and after the Covid-19 pandemic. Given so, as of Oct 1, 2021 SNAP has adjusted the benefit amounts to provide 40 cents more per person and per meal.

The Effectiveness of Reentry Programs: The AB 109 Experience

Rolando Anthony Garcia-Ceballos

Faculty Mentor: Marylou Bagus-Hansen

It is assumed that after a convicted criminal is released, no matter how small the crime, they are likely to reoffend. Reentry programs are designed to provide citizens who have recently been released from state prison or county jail with aid to reenter society with hopes in reducing recidivism. The California’s Assembly Bill 109 (commonly referred to as AB 109 or Realignment AB 109) was established after it was ruled that the inmates’ Eighth Amendment Rights were violated because of the inadequate medical and mental health care in the California State Prisons.

So how effective is the California’s Assembly Bill 109? As part of the Pacific College Corps in the Spring 2022 semester, I was able to serve in El Concilio’s AB 109 program. El Concilio is a nonprofit community-based organization dedicated to helping the low income, minority, and marginalized communities in California’s Central Valley. The AB 109 program at El Concilio, Stockton combines

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various services such as case management supervision, counseling referrals, employment referrals, and court advocacy to help its clients. I was able to assess the effectiveness of the AB 109 program at El Concilio through interviews with one of the case managers who work for the program and clients who are a part of the program. Combined with research, I answer the question of how El Concilio's AB 109 program compares to other AB 109 programs in California, particularly to programs established in Los Angeles, and detail some of the universal challenges with the AB 109 program.

Signaling Strategies and Competition in Male Tungara Frogs

Alison S Kim

Faculty Mentor: Marcos Gridi-Papp

The male tungara frog, *Physalaemus pustulosus*, calls to attract a female mate. There are a few notable properties of this call: 1) the male only calls when in water, 2) it is a very energetically expensive task, and 3) it is composed of a whine sometimes followed by a chuck. Calls with chucks are more attractive to females but require more energy. In the presence of competition, the male may add chucks, call louder, or call at a higher rate in an attempt to find a mate. This study aims to determine how the male tungara frog changes his call in terms of chuck number, amplitude, and call rate in response to variation in "competitive" playback. The system consisted of 6 soundproof boxes, each containing one male frog placed inside of a water-filled container with a microphone underneath. Sixty males were split into 10 groups of 6 to be rotated daily to occupy the 6 boxes. The frogs were recorded for 8h per day, from 14:00 to 22:00, in six 10-minute sections per hour. The playback stimulus began at the 5-minute mark of each section. Inside each box, a speaker played synthesized calls with known and measured variables: complexity, duration, call rate, and frequency. For each variable, there were 3 versions of synthesized playback stimulus: a version with the population's average for that variable, greater than the average, and less than the average. Each synthesized call has a single variable altered. The males' responses were recorded and stored as sound files. Calls were then identified, all variables were measured, and the results were saved in a database. This study will advance our knowledge of changes in

signaling strategies of male vertebrates in response to competition.

Immature stages clarify systematics in two nymphalid butterflies

Andrea L Bui, Bismanbir Pannu

Faculty Mentor: Ryan Hill

Central and South America are well-separated geographically and have not always been a contiguous land mass. Many butterfly species show differences between these regions that are recognized at the subspecies and species level. Small differences in adult wing morphology may be interpreted as evidence of differentiation at the subspecies or species level. The number of differences and variability in traits play a crucial role in determining whether or not differentiation at species level has occurred. Considering traits other than adult morphology, such as immature stage morphology and ecology, can help verify subspecies or species hypotheses. Within the species rich family Nymphalidae, with around 6,000 species, there are many species where adults are differentiated by small details of wing morphology. Knowledge of the immature stages and host plant relationships have helped corroborate systematic hypotheses based on subtle differences in wing morphology. Here we examine two nymphalid species, *Catonephele chromis* and *Pycina zamba*, both of which have two subspecies, with one residing in Central America and the other in South America. We describe the immature stage morphology and ecology for the subspecies in South America, and provide the first color images for immatures of each species. Using these data, we tested the hypothesis that the subspecies are two distinct species by assessing differences in adult wing morphology, immature stage morphology, and host plant between regions.

Relationships and immature stage morphology of *Adelpha diocles* and its relatives

Jomel Thomas, Jordan Renner, Lu Han

Faculty Mentor: Ryan Hill

Butterflies in the genus *Adelpha* represent one of the most species-rich genera in the Neotropics with over

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90 species. This adaptive radiation appears to be the result of larval host plant relationships, with speciation associated with color pattern mimicry and/or host plant diversity. Testing hypotheses about diversification requires thorough understanding of Adelpha host relations and diversity. Although much is known, investigations of species relationships and host data are still required, and our group is making significant progress in clarifying cryptic species and species relationships. For example, our recent work on one lineage within Adelpha, the Adelpha serpa group, has clarified understanding of this lineage. However, one species was not included because DNA sequence data were not available. Here we analyze all four species in a subset of the *A. serpa* group from North and Central America: *A. diocles*, *A. bredowii*, *A. eulalia*, and *A. californica*. We estimated their inter-relationships with mitochondrial DNA and used those relationships to evaluate biogeographic history and evolution of immature stage morphology and ecology. We describe the immature stages of *A. diocles*, as well as *A. argentea*, a species from a little-known species group in South America with interesting biogeography. We discuss immature and adult stage morphology and biogeography in *A. diocles* and its relatives, and compare this with *A. argentea* and relatives in the Andes of South America to highlight how immature stages can provide useful insight into biogeography and phylogeny.

Morphological and Protein Composition of the Inner and Outer Layers of Skin and Blubber Tissue

Anna-Marie Erica Nimene, Ashley Hope Roberts, Noellemarie Trost

Faculty Mentor: Jane Khudyakov

Elephant seals undergo an annual catastrophic molting phase during which they shed all of their pelage (skin and fur) within one month. Molting occurs on dry land because blood flow has to be directed towards the surface of the skin for rapid regeneration, whereas it is directed toward internal organs in the water. Since seals cannot forage while they are at the rookery, they fast while molting, during which they rely heavily on fats stored within their blubber, a specialized type of fat tissue, for energy. The outer layer of the blubber is used for thermoregulation, while the inner layer serves to

store energy. While most studies on seal metabolism have been conducted using inner blubber, the blubber layers are not well-defined morphologically. In this study, we characterized rapid hair follicle regeneration during molting in seals using histology. We found that during the early molting phase, most of the hair follicles were in the telogen phase of the hair cycle, while during the late molt phase, most were in anagen phase. We also distinguished inner and outer blubber layers using proteomics. We identified 1,369 proteins in the seal blubber proteome by mass spectrometry and found six proteins that were differentially abundant between the inner and outer blubber layers. The proteins RPL35 and ADH3 were more abundant in inner blubber, while ASPN, GIMAP4, PRKAR2A, and EVPL were more abundant in outer blubber. Our study allows us to gain a more in-depth understanding of the mechanisms regulating extremely rapid skin regeneration, which furthers our understanding of human skin diseases and disorders and their possible treatments. It also provides us with molecular markers to distinguish visibly similar but functionally distinct blubber layers in seals, as well as understand the evolution of blubber in mammals.

The effect of auditory stimulation and the day-night cycle on *E. pustulosus* hiding, movements and amplexus behavior

Makaila Gita Gaff

Faculty Mentor: Marcos Gridi-Papp

Studies on the túngara frog, *Engystomops pustulosus*, have described male calling and its effect on female mate choice, but less is known about the effects of calls on other reproductive behaviors. We studied three behaviors: male amplexus, displacement on a slope, and seeking cover. We used a captive colony with males and females together in tanks where breeding and calling were prevented by the absence of a water pool. A nightly playback of mating calls is alternated with silence every five days. The length of each 10-gallon tank is visually divided by plastic bars on the bedding into 4 zones with equal area but different elevation as tanks are maintained at an inclination of 5.8 degrees. Each night, we determined each frog's position in its tank, the numbers of pairs, and whether the frogs were under cover (plastic huts). These were matched by daytime data collected three times a week. After 50 days of data collection, we

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found that seeking cover predominates during the day, whereas pairing mostly occurs at night. Additionally, more frogs were found in the lowest area of the tank at night, while in the day more were found in higher areas of the tank. The playback resulted in a greatly increased number of pairs, but position and seeking cover were unaffected. The change in number of pairs in response to the beginning or end of playback periods was gradual. This gradation indicates a potential endocrine contribution to the frogs' response to calls. The presence of amplexus behavior even when calling and breeding are blocked illustrates the diversity of ways in which acoustic stimulation can orchestrate breeding behavior in vertebrates.

Medial edge chondrification of the vocal folds of *E. pustulosus* and its function in sexual selection

Helena Soon Czochanski,

Faculty Mentor: Marcos Gridi-Papp

Male túngara frogs attract mates with vocalizations that are uncommonly complex and low pitched in relation to the size of the animal. These features are believed to be driven by sexual selection imposed by female preferences. Our study characterizes aspects of the laryngeal structure that have not been previously described and evaluates their potential function in the production of this mating call. We analyzed serial sections of the larynx prepared in three perpendicular planes and a 3D model reconstructed from a stack of images obtained through microtomography. The vocal cords revealed chondrification along their medial edges. This feature is not continuous throughout the length of the vocal cord, but rather localized at the anteroventral end. This chondrification may increase the density of the vocal fold tissues and result in lower frequency sound. Females have been shown to strongly prefer low frequency calls and their sexual selection may drive the evolution of this structure in the larynges of this species. Alternatively, the chondrification may be a structural reinforcement that could be required to resist the stresses produced by the vibration of the primary fibrous masses. These modify the vibration of the vocal folds to produce the complex call which is also favored by female preference. Chondrification of the vocal cords is rare in small frogs and it may

add an important piece to the puzzle of evolution of complexity in vertebrate communication systems.

Eardrum tuning in the tungara frog

Robert A Wong

Faculty Mentor: Marcos Gridi-Papp

The tungara frogs of Central America and parts of South America rely on their auditory capabilities to engage in reproductive processes. The female tungara frog evaluates many calls produced by multiple males and selects mates with the male that produces the most attractive calls. Frogs in general show a match between the tuning of the ears and that of the calls promoting effective communication. While most of the energy in the call of the tungara frog is found at 700-1000 Hz, researchers in our lab have found that the frog's eardrums are tuned from around 2-3 kHz. This range of auditory tuning was not only unexpected but the results also showed peculiar variability. We are replicating the sensitivity measurements of the eardrums in a new set of frogs while exploring potential sources of variation. Each individual is anesthetized and presented with a series of pure tones ranging from 0.2 to 18 kHz while the vibration responses of the eardrum are characterized using Doppler laser vibrometry. This study will allow us to verify the validity of our existing measurements and test potential sources of variation as a preparation to address the cause of the mismatch between the tuning of the ears and the calls of this species.

Growth, sexual dimorphism and resource allocation in the túngara frog

Kaitlyn D Tonnu

Faculty Mentor: Marcos Gridi-Papp

Unlike humans, most amphibians display indeterminate growth where their growth continues even after becoming adults. Are there differences in growth rate between sexes? At what stage during juvenile development does sexual dimorphism start? What does this tell us about how frogs allocate their energy? Are there tradeoffs between growth and reproduction? We studied a captive colony in which males and females received a constant and equal amount of food and water, and were maintained in the same temperature. Once a month, males were given an opportunity to call for 48 h and females to

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lay eggs. Immediately before and after these events, we measured their body mass and snout-vent length (SVL). Juveniles were measured at various stages in their development. A preliminary analysis of the body mass indicates that male and female growth rates are similar, showing a steep growth during the first year, followed by a plateau. Females are heavier than males. This plateau indicates that both sexes invest energy into growth in the first year and then allocate the energy towards calling (males) or laying eggs (females). SVL data will be used to determine whether females are actually larger in size compared to males or whether the heavier mass is merely due to holding eggs. We expect the mass and SVL graphs to be similar in shape except that mass for females should decrease markedly after egg laying. This study will be complementary to field studies in allowing us to control the feeding and energy expenditure of the frogs to reveal their growth potential and energy allocation strategies.

The effect of age on the mating call of the tungara frog

Zaizhen Xu

Faculty Mentor: Marcos Gridi-Papp

The male tungara frog call consists of a 0.5 s-long harmonic sweep with a downward frequency modulation > 400 Hertz. The sexual attractiveness of the call is influenced by several of these traits and female preference is known to be a major driving factor in the evolution of this signal. Frogs undergo indeterminate growth and their physical characteristics change with age, potentially influencing the parameters of the calls. We investigated the relationship between age and call parameters in 122 adult males in a captive colony. Each day, four to six new male frogs were placed into separate calling boxes and their calls were recorded for 8 h. The calling boxes are made of three layers, each composed of three sublayers of sound-insulating materials. Frequency, rate, duration, and other parameters are being measured in every call identified in the recordings. If any call traits are influenced by age, we will relate them to the extensive literature available on female preferences in this species. This will allow us to better contextualize female mate choice and resource allocation in male vertebrates.

Characterization of Food Calls in Humpback Whales (*Megaptera novaeangliae*)

Yasmin Nijjar, Aishwarya Ravivarapu, Julia Tran, Ysabella Siangio, Tiffany Park

Faculty Mentor: Stacie Hooper

Humpback whales, *Megaptera novaeangliae*, typically use acoustic communication while trying to acquire food or engaging in social interactions. Food calls are powerful vocalizations used by humpback whales as part of a cooperative prey capture effort called bubble-net feeding. Bubble-net feeding happens as humpback whales work together to produce air bubbles in the water, which trap fish, and make it easier for humpbacks to consume them. It is thought that food calls may stun or confuse the fish, making them easier to trap in the bubble net. Although not much is understood about humpback whale communication, there are some key characteristics which can allow us to distinguish a food call from a social call. Food calls typically have a mean duration of 2.6 seconds, a fundamental frequency of 500 Hz, and usually a short frequency modulated portion at the start and end of the call (Cerchio and Dahlheim, 2001). While food calls are generally produced in stereotypical fashion, we noticed that the structure of individual calls in a series can differ. The goal of this project was to investigate whether food call structure changed over the course of a series, and if so, whether it was possible to classify those variations into distinct subtypes. Differences in food calls within a series may indicate changes in motivation, be a response to changes in prey behavior, or may be the result of different callers producing slight variations.

Whale Feeding: Using Vocalizations to Determine Success

Trisha Dinh, Hanna Pham, Karen Situ, Kirollos Semary

Faculty Mentor: Stacie Hooper, ,

Humpback whales (*Megaptera novaeangliae*) are large cetaceans with a complex and varied vocal repertoire, and we are just beginning to understand the variation in humpback whale communication and the function of different types of vocalizations within the social dynamic. On the summer feeding grounds humpback whales can form temporary social groups to perform a cooperative foraging behavior known as

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bubble-net feeding. One whale blows a stream of bubbles while swimming in a circle underneath a school of fish which pushes them to the surface. At the same time, other whales produce loud, low frequency calls known as food calls which likely serve to stun or confuse the fish, making it easier to corral them in the bubble net (Hanser, 2009). Along with food calls, these whales produce a variety of other call types which likely aid in coordinating the group during hunting events. Because their energetic demands are so high, and the feeding season is so brief, there is pressure to perform this behavior successfully. We hypothesized that successful feeding attempts would be accompanied by the loud exhalation of the whales on surfacing (the 'blow') as they swallow a mouthful of fish. Unsuccessful feeding attempts would instead be accompanied by a variety of harsh sounding, low frequency social calls which may serve to release tension or frustration in the group members, or to aid in coordinating another feeding attempt.

What is the prevalence of *Dirofilaria immitis* (dog heartworm) in invasive *Aedes* mosquitoes?

Leen Yousef, Johan Espinoza Corrales, Daniela H Dolar, Taylor K Trieu, Aisha Popalzai, Agamchat Dhami

Faculty Mentor: Tara Thiemann

Aedes aegypti and *Aedes albopictus* are invasive mosquito species introduced to Los Angeles county in 2013 and 2011, respectively. Both are vectors for serious arboviruses such as Dengue and Yellow Fever virus. By 2015, these invasive *Aedes* species were detected within the jurisdiction of 82 cities across southern and central California. Coinciding with the introduction of these species, there has been an increase in the prevalence of *Dirofilaria immitis*, a filarial nematode, in Los Angeles county. *D. immitis* infects over 100,000 dogs in the USA per year, leading to death by obstruction of the pulmonary veins. While the primary vector for *D. immitis* in California is thought to be the native *Aedes sierrensis*, it is unknown whether these invasive *Aedes* species also play a role in transmission. This proposed research aims to determine the current prevalence of *D. immitis* in invasive *Aedes* mosquito pools collected in various study sites across Los Angeles county. Some factors we plan to investigate

include: seasonal variations, habitat differences, and surrounding socioeconomic environment.

The Effects of Male Mating Calls on Flight and Reproduction

William Zhao, Daniel Bui, Jessica Chen

Faculty Mentor: Zachary Stahlschmidt

In nature, organisms face the obstacle of adapting to environmental challenges and reproducing to pass on their genes. However, the allocation of resources towards survival often directly conflicts with reproductive success, so balancing the survival-reproductive tradeoff is critical for organisms. Auditory stimuli can contain information about the quality of an animal's environment and, therefore, influence the decision between reproduction or survival. We used the variable field cricket (*Gryllus lineaticeps*) to study the role of male song in females' investment into survival (dispersal or flight capacity) and reproduction (ovary mass). Throughout early adulthood, each female was exposed to one of two acoustic environments (60-70 decibels)—either white noise (signaling a low quality, mate-free environment) or male cricket mating calls (signaling a high-quality environment with abundant mating opportunities). Flight capacity (investment into flight muscle) and reproductive investment (dry ovary mass) were measured in females to determine whether male song promoted reproduction at the expense of flight capacity. The decision or tradeoff between flight and reproduction may be mediated by resource acquisition so females' food consumption was also determined. Food intake was weighed at the beginning and end of early adulthood. Our results indicated that male mating calls increased body mass and reproductive investment, while reducing investment into flight/dispersal capacity in females. Song-induced differential investment was due to increased food take rather than an increased efficiency by which ingested food was converted into ovary and body mass. Finally, flight-capable females demonstrated higher sensitivity to the acoustic environment. These discoveries shed some light about how the acoustic environment may influence the evolution of flightlessness.

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Warming– but not herbicide exposure– alters resource acquisition and allocation in an insect

Jacob Whitlock, Justin Choi

Faculty Mentor: Zachary Stahlschmidt

Glyphosate (GLY) is the most commonly used herbicide in the U.S. and in California. Although GLY has been marketed as non-toxic to animals, emerging research indicates that many animals may be adversely affected by GLY exposure. However, little work has been done on animals' ability to detect GLY in drinking water sources, whether GLY consumption influences feeding behavior or reproductive investment, or if ongoing global warming influences dynamics among GLY consumption, drinking, feeding, and reproduction. Insects native to California (variable field crickets, *Gryllus lineaticeps*) were given one of two drinking treatments: tap water or Roundup(R) solution (5 mg GLY / L tap water). Crickets were also subjected to one of two temperature treatments: 28±10°C daily cycle (control; current field conditions) cycle or a 32±10°C daily cycle (predicted warming conditions). After 5 days of treatment, crickets' consumption of water and food (dry cat food) were measured to determine resource acquisition. Then, crickets were weighed, euthanized, and dissected to measure dry ovary mass to determine allocation of resources to soma and reproduction. Warming increased feeding, and it promoted reproductive investment at expense to somatic investment. Drinking treatment did not affect any measured variable, including water and food consumption. Thus, crickets were unable to discern herbicide contamination in drinking water. Global environmental change has many facets, and our study indicates that one common feature of global change (warming) has greater effects on an insect than another common feature of global change (pesticide exposure).

31P-NMR Spectroscopy of Glucose-6-phosphate, Glucose-1-phosphate and NADH

Austin Thom

Faculty Mentor: Andreas Franz

The addition of phosphate groups (-OPO₃²⁻) into carbohydrates is one of many central biochemical

processes to regulate the sugar household within the human body. The sugar household contains the body's intake of sugars and starches (carbohydrates) to provide the necessary energy to function properly. Common glycosyl phosphates such as glucose-1-phosphate, glucose-6-phosphate, and NADH were analyzed by magnetic resonance (NMR) spectroscopy at 600 MHz to determine multiple types of coupling constants (¹H-¹³C, ¹H-³¹P, and ¹³C-³¹P) and to draw conclusions about the three-dimensional position of the phosphate group in each case. Through total correlation spectroscopy (TOCSY), correlated spectroscopy (COSY), heteronuclear multiple bond correlation (HMBC), *J*-resolved heteronuclear multiple bond correlation (*J*-HMBC), and heteronuclear single-quantum coherence multiple bond correlation (HSQMBC), the structure of each glycosyl phosphate was further studied to determine coupling constants from the phosphate group to the neighboring carbon and hydrogen atoms. In the analyzed data, it was observed that the phosphate group has a preferred conformation relative to the sugar ring. The so-established NMR experiments were subsequently applied to NADH and allowed us to complete the three-dimensional structure assignment,

The Solution Conformation of Native α-1,6-Mannobiose as Determined by NMR Spectroscopy

Hana Rosenblatt, Kendall Bromley

Faculty Mentors: Andreas Franz

The biochemical functions of oligosaccharides with multiple mannose sugars (high-mannose glycans) are utilized in numerous biological processes. For example, they have been shown to assist in protein folding of the nascent amino acid chain during translation. The first step in exploring how these sugars behave in nature is to elucidate their three-dimensional structure and conformation. Magnetic Resonance (NMR) spectroscopy is a powerful instrumental technique uniquely suited to reveal structural details of molecules. As proof of concept, the solution conformation of 5α-cholestan-3β-ol was studied with NMR spectroscopy. Specifically, the ¹H- and ¹³C-spectra as well as advanced 2D experiments (COSY, HSQC, HMBC, and NOESY/ROESY) were utilized to determine the specific structural identities of all NMR peaks, the coupling constants between

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proton-proton and proton-carbon pairs, and the spatial proximity of protons to each other. The so-established NMR experiments were subsequently applied to α -1,6-mannobiose. Whereas the structure of 5 α -cholestan-3 β -ol was naturally rigid because of multiple fused rings, the structure of α -1,6-mannobiose was surprisingly rigid as well. This was an unexpected finding because the 1,6-glycosidic linkage has potential for significant flexibility. Consequently, structural rigidity of the α -1,6-mannobiose unit in larger natural oligosaccharides may make them reliable templates for protein folding.

NMR Characterization of the Solution Structure of Acarbose and its Interaction with α -Amylase

Karissa Acosta

Faculty Mentor: Andreas H. Franz

Graduate Student Mentor: Cate Simmermaker

Acarbose is a drug used to treat Type II diabetes, a chronic disease indicated by low pancreatic insulin production and poor cellular response to insulin. Acarbose acts as an inhibitor of α -amylase (EC 3.2.1.1), an enzyme involved in the digestion and processing of carbohydrates and starches in the body into the disaccharide maltose, which is further broken down into glucose and used as a source of energy. Treatment with acarbose helps to reduce postprandial hyperglycemia, a symptom of diabetes, by inhibiting the function of α -amylase, effectively decreasing the conversion of starches to sugars and therefore lowering the blood sugar level. In this experiment, the structure of acarbose was assigned by magnetic resonance (NMR) techniques including ^1H NMR, ^{13}C NMR, Total Correlation Spectroscopy (TOCSY), Heteronuclear Multiple Bond Correlation (HMBC), and Rotating frame nuclear Overhauser Enhancement (ROESY). The structural topology of binding to α -amylase was studied by Saturation-Transfer Difference (STD) NMR. Inhibition of α -amylase was measured and quantified by conducting an iodine-starch assay, in which iodine indicator is added to solution to visualize intact starch molecules, which form a dark blue complex with iodide. The percent inhibition was measured through the presence/absence of the starch-iodide complex. The results were quantified by UV-VIS absorbance and converted to percent inhibition by comparing the

results to standard solutions containing starch and α -amylase.

Designing a PDZ Chelator for Alzheimer's Peptides Based on the Knob-Socket Model

Colby Vuong, Calvin Vuong, Uyen An

Faculty Mentors: Jerry Tsai and Hyun Joo,

PDZ domains bind to the C-terminal peptide of other proteins with affinities ranging from mM to high nM. Understanding the basis for peptide specificity to PDZ domains could open possibilities to change the PDZ domain into a chelator of peptides and treatment for Alzheimer's disease. The Knob-Socket model was used to identify the amino acid residues critical for the affinity and specificity to PDZ domains. The PDZ domain structure comprises 5 β -strands and 2 α -helices connected by 6 coil/turn segments. Analyses of 85 PDZ domains uncover a canonical set of interactions with residues in the peptides that determine binding pocket specificity. For consistency with previous works, the peptide positions are numbered backward from P0 at the C-terminal position with negative numbering towards the N-terminus. The P0 residue position packs into sockets formed by the second coil residues in the S0 pocket and into sockets in the longer second α -helix(H2). The P-2 residue also often packs into H2 in conjunction with the P0 residue. Markedly, the peptide extends the β -sheet of PDZ domains as a 6th strand in such a way that the peptide interacts closely with the neighboring β -strands. With this canonical model of peptide binding, the specificity of PDZ domains towards a peptide can be adjusted to bind amyloid- β (A β) peptides: (1) P0 residue should pack into sockets in both coil and H2, (2) peptide should extend the β -sheet by binding S2, (3) peptide residue should pack into the hairpin coil connecting S2 and S3. Based on these findings, a PDZ domain can become an effective chelator of A β -peptides. A β 42 is such an example peptide, containing P0/Ala, P-1/Ile, and P-2/Val. A PDZ chelator for A β 42 should bind with an affinity close to those of known peptides binding PDZ domains.

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Synthesis and Purification of Tripeptides

Erica Meng, Jennifer Sun, Nancy Vo

Faculty Mentor: Jianhua Ren

Graduate Student Mentor: Ashleigh Ramos

Introduction: Peptides are short chains of amino acids and many of them possess critical biological functions. Based on all their natural functionalities, peptides play a significant role in pharmaceutical products and have therapeutic potential for major diseases like cancer, cardiovascular disease, or some neurological disorders. The synthesis and purification of recombinant proteins are essential to understanding protein dysfunction. For example, a target protein containing a side chain of histidine residues is purified by affinity chromatography that causes the His-tagged protein to be isolated. In this study, peptide synthesis was done, and the product's structure and reactivity were analyzed. As an introductory study of peptide synthesis, a simple tripeptide strand, Ac-Cys-Gly-Ala--NH₂, was synthesized with Rink amide resin in the laboratory. In this project, each peptide took approximately 3 weeks to be completely synthesized, purified, and analyzed.

Methods: In solid phase peptide synthesis (SPPS), rink amide resin was used as a structural support to form peptide bonds between amino acids from the C to N terminus. Using 20% Piperidine in dimethylformamide (DMF) as deprotection, fluorenylmethyloxycarbonyl (F-moc) was removed from the N-terminus of an amino acid to allow subsequent amino acids to attach. Washing using methanol (MeOH), dichloromethane (DCM), and DMF to removed unreacted reagents. During coupling, diisopropylethylamine (DIPEA), hexafluorophosphate. benzotriazole tetramethyl uronium (HBTU), and DMF activated the new amino acid, preparing for linkage to another amino acid. The first three steps were repeated until the desired peptide was synthesized. In order to synthesize a tripeptide, coupling was completed three times. The original resin was split into two vessels. In one vessel, only cleavage was done. In the other vessel, N-terminal acetylation was done prior to cleavage. Acetylation replaced the N terminal amine with an acetyl group while cleavage removed the F-moc protecting group and the peptide from the solid support. The product's purity was analyzed by mass spectrometry.

Results: After 3 weeks, the peptide Ac-Cys-Gly-Ala--NH₂ was successfully synthesized in the laboratory, which means that it is a complicated process involving many detailed steps. Also, mass spectroscopy revealed the purification of the peptide.

Binding of Quercetin Derivatives with DNA Oligonucleotide Triplexes and Duplexes

Douglas D Chu, Nicholas K Ha

Faculty Mentor: Liang Xue

Graduate Student Mentors: Landy Gu and Vanessa Rangel

Triplex DNA is an H-form triple-helical structure that is formed through Hoogsteen hydrogen bonding in the major groove of the double-helical DNA. The triplex strand has a more lucrative means of binding onto the DNA sequence via the major groove. The DNA repair and replication enzymes cannot recognize the triplex structure; therefore, triplex formation is an anti-gene therapy target that acts as a repressor of DNA replication and gene expression. The formation of triplex DNA is sequence-specific. The third strand is less likely to bind to other sequences in the human genome except at its specified binding site, minimizing the side effects as a potential drug for different infections and diseases. Despite the sequence specificity that makes triplexes attractive for anti-gene therapy, they have a slower formation rate and, under physiological conditions, are less stable than their duplex counterpart. Small molecules have been used to intercalate or act as groove binders to stabilize triplex formation. The natural product quercetin has antioxidative, anti-inflammatory, antimutagenic, and anticarcinogenic properties. It has been used in many different fields, including the medicinal, cosmetic, and pharmaceutical fields. Its binding to triplex DNA has recently been discovered by our lab. In this study, we further investigate the binding of quercetin derivatives to different DNA oligonucleotide triplexes and duplexes. Based on the data collected, the ligands were successfully bound to and stabilized the triplex DNA complex. The duplex stability remained the same regardless of ligand presence. Results from the thermal denaturation monitored by UV will be presented.

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Significance, Synthesis, and Characterization of HDAC Inhibitors

Alaa Al Jawabra, Christine Tran, Ashley Wen, Jayden Stahl

Faculty Mentor: Qinliang Zhao

Constant development for new medications and therapies is required due to the advancement of tumors and fast-growing resistance to existing anticancer drugs. Histone deacetylase (HDAC), overexpressed in a variety of cancer cells, condenses the chromatin structure of tumor suppressor genes, cell-cycle inhibitor genes, and apoptosis inducer genes. Our innovative approach to these problems is to develop bifunctional platinum (Pt) complexes stabilized by HDAC inhibitors. Each inhibitor comprises of a main scaffold, a zinc-binding group, a protein recognition cap and also a coordination site to metal ions. Several HDAC inhibitors were synthesized through multiple-step synthesis, purified, and characterized by X-ray crystallography, MS, and NMR analysis. The dual function of the Pt complexes will be realized while the DNAs in the cancer cells are relaxed by the HDAC inhibitors and could easily be attached by the Pt cores.

Oral pathogen antimicrobials from a traditional Chinese medicine mushroom: Collaboration between College of the Pacific and Dugoni

Taylor G Lam

Faculty Mentor: Skylar Carlson

Graduate Student Mentor: Savannah Pierce,

Traditional Chinese Medicine (TCM) has been used for thousands of years and remains the only source of treatment for many less developed areas. Although these practices have been used for so long, there is a major deficit identifying the bioactive constituents of herbal medicines. *Ganoderma lucidum*, a well known TCM, is a fungus used in Asian countries thought to increase longevity. Recent studies have shown the numerous health benefits which include modulating the immune system, inhibiting bacteria growth, and controlling blood glucose levels (Wachtel-Gator et al. 2011). Preliminary data from the dental school has shown that the methanol and ethanol crude extracts from the fungus inhibit oral pathogens while also not suppressing commensal organism populations. The

first step in isolating these compounds is to prepare a chemical extract to remove the small molecules from the mushroom to identify the bioactive components responsible for the observed activity. Using Solid Phase Extraction (SPE) column chromatography, three solvent extractions of *G. Lucidum*: 100% EtOH, 50:50 EtOH:MeOH, 100% MeOH were fractionated. These fractions are currently being tested against both Gram-positive and Gram-negative human pathogens. Commensal bacterial testing will take place at the Dugoni School of Dentistry.

Assessing Infants' Social Evaluations: Virtual Replication and Extension Using Repeated Measures

Ashley Bonfoey, Guiying (Angel) Zhong, Ana Anguiano, Danielle Kitaoka, Caitlyn Vergara

Faculty Mentor: Carolynn Kohn

Graduate Student Mentor: Samantha Crooks, Mariel Montes, Alondra Del Real, Mark Matz

Highly cited research on infant social evaluations suggests that infants have innate, or unlearned, morality. Typically, infants' (innate) preferences (for moral others) are evaluated by having them watch a live puppet show of a character who helps another puppet and one who hinders the puppet. Infants are then prompted to make a choice between the helper and hinderer puppets. The first puppet the infant reaches for is measured as their choice. In these studies, more infants (approx. 67%) reach for the helper puppet more than the hinderer puppet, and these data are held up as evidence of infants' unlearned sense of morality. However, these data may not be reliable because infants make only one choice. To address this limitation, other researchers have had infants make several choices after a single puppet show. However, critics of these studies have contended that an infant's first choice is their "true choice" and multiple choices might be confusing for the infant. Our study addressed this limitation and critique. We assessed six infants virtually (via Zoom) due to COVID-19 restrictions. Infants first watched a puppet show video depicting a helper puppet and a hinderer puppet, then were prompted to choose between them; this sequence was repeated three additional times, so that infants always watched puppet shows prior to making a puppet choice. We observed no clear patterns in infant choices and several infants failed to make a choice. Results

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suggest a virtual format may not be suitable to evaluate infants' choices. Given the growing body of failed replications, researchers ought to examine infants' choice stability to understand the conditions, if they exist, under which infants make reliable choices.

“The Dog is Feliz” Code-Switching in Emotion Talk with Toddlers

Matthew Tineo, Monica Hernandez-Mendez

Faculty Mentor: Jessica Grady

Code-switching is when someone switches their speech from one language to another. Parents use code-switching in order to bolster understanding of certain concepts with their children. Considering that parents also teach their children about emotion at a young age, parents can possibly reinforce certain ideas about emotion through code-switching. Previous research has shown that there is a relationship between parents' use of emotion through facial expressions and code-switching. The present study extends beyond previous research through measuring emotion talk in order to see how parents express this dimension of emotion socialization in relation to code-switching. We will examine 13 Spanish-English bilingual parents of 21- to 24-month-old toddlers who were observed code-switching as they read a picture book to their child. During the book reading task only the parent and the child were in the room, so the observation could capture authentic conversations between parent and child. Each session for the 13 parent-child dyads will be transcribed for the English and Spanish spoken by a bilingual transcriber. The transcriptions will then be coded for instances of code-switching and emotion talk spoken by the parent. Code-switching will be divided into two main categories, intrasentential and intersentential, where intrasentential code-switching occurs within utterances while intersentential code-switching occurs between utterances. Emotion talk will be coded as statements parents made that referred to positive and negative emotions in the book characters. We expect results to show that parents use more emotion talk than not in their code switching. We also expect that intrasentential code-switching will occur more frequently in utterances that contain emotion talk than in utterances without emotion talk. In contrast, it is not expected that

intersentential code-switching will vary with emotion talk.

Perspectives About Neurodiversity-Affirming Practices

Kayleigh Guyon

Faculty Mentor: Madhu Sundarrajan

Over the past few years, the neurodiversity movement has become more prominent, with many neurodivergent individuals sharing their lived experiences. Neurodiversity is the concept that recognizes the natural variance within human brains, how they work, and how they interact with their environment (Singer, 1998). This approach to understanding neurology contextualizes the various pathologized conditions (e.g., Autism Spectrum Disorder, Attention Deficit Hyperactivity Disorder, Dyslexia, etc.) and views them along a spectrum of normal brain existence, recognizing that there is no one right type of brain. Neurodiversity-affirming refers to the mindset that respects these differences without pathologizing them or their behavior based on neurotypical standards, validating and supporting the individual's autonomy and lived experiences. The neurodiversity movement has made a tremendous impact on clinical practices within the field of speech-language pathology.

This project aimed to understand current clinical practices and philosophies regarding neurodiversity-affirming practices across health and education professionals (such as speech- language pathologists, occupational therapists, physical therapists, and teachers) serving neurodivergent individuals. Participants responded to a comprehensive anonymous survey exploring their understanding and application of asset- and deficit-based practices through quantitative and qualitative questions about their teaching techniques, reinforcement strategies, and philosophies. Common themes within the survey responses were identified to better understand commonalities within the myriad of perspectives and look for any correlations between the various demographic factors of the clinicians.

Results from this study indicated emerging knowledge and skills of neurodiversity-affirming practices among clinicians, however, a large percentage (46%) remain uninformed. A high percentage of participants (58%) demonstrated a

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disparity between their self-perception and displayed knowledge and application of neurodiversity-affirming practices. Information from this study provides insights into the current practices of clinicians serving neurodivergent individuals and highlights the areas of needed training at the individual, institutional, and literature levels with regards to neurodiversity-affirming practices.