



MULTICULTURAL UNDERGRADUATE RESEARCH  
ART AND LEADERSHIP SYMPOSIUM

**March 25, 2022**  
**LSC Grand Ballroom**



**COLORADO STATE**  
**UNIVERSITY**

# MURALS Schedule

7:45 - 8:30a	Registration and check in with breakfast	LSC Ballroom B
8:45 - 9:00	Welcome	LSC Ballroom C&D
9:15 - 10:15	Presentation <b>GREEN</b>	See page 5
10:30 - 11:30	Presentation <b>GOLD</b>	See page 5
11:45 - 1:00	Official University Welcome/Luncheon Alumnus speaker	LSC Ballroom C&D
1:15 - 2:15	Poster Presentation <b>GREEN</b>	LSC Ballroom A
2:15 - 3:15	Poster Presentation <b>GOLD</b>	LSC Ballroom A
3:15 - 4:15	MURALS Alumni Panel	LSC Ballroom C&D
4:15-5:00	Awards Ceremony	LSC Ballroom C&D



2019 MURALS participants- The last time MURALS was able to be held in person!

# Welcome!

Welcome to the eighth annual Multicultural Undergraduate Research, Art, and Leadership Symposium, we truly appreciate your presence. MURALS exposes students across a variety of disciplines to undergraduate research opportunities.

MURALS, in its 8th year, has become a true student success campus-wide collaborative initiative that is made possible through efforts and dedication across campus. These efforts have demonstrated dedication and measurable outcomes that ensure historically racially marginalized students are affirmed in their educational efforts by providing support to ensure success.

## **MURALS participants will be able to:**

- Increase their interaction and collaboration with students from diverse populations
- Communicate confidently and constructively about their research/scholarly work with their peers, faculty, and staff.
- Independently synthesize and extrapolate information pertaining to their own research/scholarly work, including lessons learned, strengths, and ways to improve.
- Articulate significance of independent research interests as it pertains to their field, community, nation and/or world.
- Increase professional interaction through interpersonal skills with peers, faculty, and staff.
- Understand the fundamental characteristics needed to become a successful multicultural leader.

## **Acknowledgements and Special Thanks to:**

### **MURALS Graduate Coordinators:**

Julian Cassano  
Noelle Dasalla  
Rachel Huff  
India Luxton

### **Additional faculty/student assistance**

Louise Allen, Program Director of the Office for Undergraduate Research & Artistry  
Heidi Klem, Chemistry student in the natural sciences, CIRC graduate assistant.

A sincere thank you to all graduate students who served as Graduate Student Evaluators, and to all faculty guides, evaluators, and day of volunteers!

Bridgette Johnson  
Assistant Vice President  
Office of Inclusive Excellence



## Schedule of Presentations

### Presentation GREEN 9:15-10:15

#### 304

2: M. Tofilo  
4: G. Marrero  
6: M. Armendarez  
8: R. Toum

#### 306

10: J. Firo  
44: C. McHugh  
16: D. Dunlop  
18: M. Paul

#### 308

20: S. Gonzalez  
22: M. Berry  
24: G. Flores Rojas  
14: A. Martin

#### 310

28: K. Umutesi  
30: J. Hauck  
32: Q. Frimpong  
34: C. Fournier

#### 312

38: A. Gonzalez  
40: P. Hurtado Flores  
42: A. Walton, S. Galloway  
& R. Whitaker

#### 322

12: M. Sodani, A. Bui, N. Acosta, G. Kirk, L. Li  
J. Leavitt, M. Swain, S. Mohamed, R. Veazey  
46: M. Carroll  
48: S. Gebru  
50: V. Hurteau

### Presentation GOLD 10:30-11:30

1: A. Sandoval Bravo  
3: M. Siegal  
5: D. Reyes  
7: J. Mckinney

9: N. Mason  
11: A. Freedman  
13: S. Qin  
15: A. Tekeste

17: N. Ahmad, S. Phuepwint, & S. Bronk  
19: J. Ibarra  
21: A. Bui  
23: B. Pate

25: C. Rubin  
27: J. Sherwood  
29: N. DeAtley  
31: A. Puckett, G. Lacy & S. Carles

33: L. Davis  
35: L. Bui  
37: A. Walker  
39: A. Flores

41: T. Herron  
43: M. Kologlu  
45: B. Tefera  
47: B. Barsnick & T. Jacobsen

## Schedule of Presentations (Continued)

**324:**

52: J. Sanchez  
54: E. Revilla  
56: K. Khaykin  
58: H. Gilliard

49: P. Krakker  
59: J. Duenas  
53: R. Mendoza  
55: T. Weiland

**328/330**

60: S. Schaller  
62: R. Gant  
64: J. Arias  
66: M. Weber

57: D. Olmedo  
51: L. Rocha Salazar  
61: R. Workineh

**372/374**

68: A. Galaeva  
70: M. Espinoza Diaz  
72: A. Bushara

65: J. Adenowo  
67: A. Velez  
69: N. Estevez  
71: P. Espinoza

**376/378**

76: L. Moore  
26: M. Porterfield  
74: S. Pinedo  
77: R. Barry

73: I. Park  
75: M. Lee & E. Boviard  
63: P. Meyer, A. Lyde, R. Murray, M. Risch  
& G. Tiberi



***A special thanks to Colorado State University Board of Governors for providing funding for the pilot program MURALS FIRST YEAR SCHOLARS ACADEMY - huge success with promising results***

***A heartfelt thanks to all MURALS donors who give without condition***

***A sincere thanks to the Community for Excellence - COSI CPP Grant***

2021: 1st Place: Alexa Ware & De Von Washington



2021 Winner Alexa Ware & De'Von Washington

**Jevon Mckinney**  
***A Broken Record***

I am the writer and creative director of my short documentary with the Youth Documentary Academy titled, "A Broken Record." It explores the censorship, appropriation, and overall

treatment of Black Musicians in our society. As the creator and director of this project, I am responsible for networking with local Colorado artists and educators such as University of Denver Professor Roger Holland, Singers Kid Astronaut & Jason Martin, national saxophonist and radio host Tony Exum Jr., and soul singer Alpha The Musical to set up interviews where we get their perspectives on the state of Black Music as well as the history of its themes and mistreatment. I direct a crew with camera, lighting, and sound in order to create a film that I hope will contribute to the long-needed discussion about giving Black artists the recognition they deserve.

Here is a link to watch "A Broken Record."

file:///C:/Users/ifyou/Downloads/A%20Broken%20Record%201.17.22.mp4

### **Rothavie Toum**

#### ***The Antithesis of Art History: Khmer Girl with a Gold Earring***

As part of the core curriculum, 3 semesters of fundamental art history courses are necessary to partake in the art program. These courses are essential because they create a foundation for individuals as an artist. There is only one issue when taking these classes... They are predominantly male and overwhelmingly white. I remember eagerly awaiting taking the final art history course as I was told that I would learn more about arts outside of Europe and North America. However, during this class, I only spent 2 weeks learning about arts outside of these regions. Feelings of disappointment and detachment grew as I noticed the lack of representation of other cultures' arts within the curriculum. This piece was created as a revitalization of my relationship with art and art history. This acrylic on canvas piece is a juxtaposition on western art through the insertion of myself as the subject in place of the original subject of Vermeer's classic Girl with a Pearl Earring. This piece is an exploration of self-identity and representation in art history. It is the fulfillment of the lack of diversity and connection that I yearned for taking these foundational art history courses. The attire and accessories included are representative characteristics that allude to my Cambodian heritage. The objective of my piece is to allow viewers to reimagine themselves as the timeless masterpiece to influence them to reconstruct the white and male dominated foundational structure of art history.

### **Malia Berry**

#### ***Dissonance***

The goal of this piece is to express feelings of being trapped within the link between body and mind, mostly relating to body image. My piece is meant to represent this dissonance by

showing strife between two beings, and to bring attention to issues related to body image and expectation.

This work stems from the feeling of being trapped inside one's body because of one's mental space, and how this negativity within the mind ends up destroying itself, but also its vessel. The figure at the top of the piece represents physical existence, while the skeleton bursting from its back represents one's mental being. For me, this piece acts as a way to express intense feelings of frustration. By creating this piece, I am allowing myself to confront my emotions directly, and allow myself to analyze them and their relation to my mind and body.

This piece was painted in Adobe's Photoshop, then printed and adorned with gold leaf. My art consists of both traditional mediums and digital mediums. Because I feel both of these mediums are important to my artmaking process, I wanted to combine the two for this work.

Through my piece I hope to start a conversation within myself. It is not meant to fix the negative feelings I have about my body, but to help me understand better how my mental state affects my opinion on it. I eventually want to restore harmony between my body and mind, and I hope for this piece to be the first stepping stone on that journey.

### **Gerson Flores Rojas**

#### ***First Gen Documentary***

My name is Gerson and I am a junior at Colorado State University majoring in journalism. I am also a first generation student and a Puksta scholar. My time at CSU has brought me to the realization that the experiences of first gen students are often untold. Sure, the schools website states that over 20% of all students are first gen, but what exactly does that mean?

My project aims to answer this question.

This semester I dedicated myself to reaching out to first gen students, initiative directors, counselors, and student parents to paint a much clearer image of what it means to be a first gen student.

I interviewed, researched and documented the experiences of students on campus. And brought it all together to present it in the form of a documentary.

To be completely clear, my MURALS project is a documentary on the lived experiences of first generation students at Colorado State University.

### **Aspen Flores**

#### ***Students Come First – The Journey of CSU's First-Generation Students in the Honors Program***

With my MURALS project, I will highlight first-generation students in the Honors Program at Colorado State University through a documentary. This ten-minute video will highlight the unique challenges of first-generation Honors students, with additional information from CSU

faculty to support the personal claims. My interest in this subject comes from a mix of personal experience and observations around campus. Many first-generation students already defied all odds to get to college, but those in the Honors Program fight additional challenges. Although one in five students at CSU are first-generation students, we do not have much information established specifically on first-generation students in the Honors Program. Creating a documentary opens a somewhat unexplored path and brings attention to a diverse set of students who break academic boundaries. As I film, I will use my interview questions as my “research” questions to find more about first-generation Honors students. This documentary will feature interviews with two students, a CSU research analyst, an Honors professor, and a scholar contact for the Community for Excellence. Everyone involved is a first-generation student. This project will help define what it means to be a first-generation student, what unique challenges these students face, and how it influences their experiences within the Honors Program at CSU. Often being a first-generation student feels isolating, especially without the support of others. As a solution, my documentary will explore the disparities first-generation Honors students endure, create an interest in this under-documented group, and inspire others facing a similar and challenging path.

**Joseph Adenowo**  
***A Cultural Tango***

This piece stemmed from the idea of uniting the diaspora. It’s stemmed from the idea of two cultures, spread around the globe, colliding in the realm of music. With an African background, it’s hard for me not to listen to music like reggaeton and not feel a soul tie. It’s impossible for me to hear the rhythm and not feel the afro influenced percussion and taste the innovation that Hispanic culture has had surrounding that. This piece will be exploring “A Cultural Tango”. This sound had to stem from somewhere. Historically both cultures have had their own turmoil but unite to give birth to something powerful and unique to both sides. The objective is to recognize the beauty within both styles of music and understand the relationship that they have with each other. Through exploring the place afro-beats have in my heart, it led to questioning the influence it had on other cultures, and the way other cultures have adopted it. I want to give power back to the motherland that gives birth to souls around the world. I want to give power back to myself and my ancestors.

# MURALS

## SERVICE LEARNING & LEADERSHIP ABSTRACTS



2019 Winners: Akosua Antobre, Varehya Pratt, Lizeth Arellano and Jennifer Gomez

## 2021 1st Place: Maya Siegel

**SPICE UP** Giving youth a leading voice in the sexual violence prevention movement  
Maya Siegel

### Our Story

Spice to Stop was founded in 2020 as a space dedicated to connecting young survivors and amplifying their voices. We have since become a growing community of survivors and allies, embracing our power and leading together.

Spice to Stop supports and empowers survivors by providing educational guides, campaigns, and an online platform to connect with others. Whether you are a survivor or ally, there is always someone in our community.

Follow Instagram, Facebook, Website

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### Recent Work

**The Survivor Community:**

- Space to Spide offers a safe space for survivors and allies to engage in valuable conversations through our survivor groups.

**Survivor Love Letter Campaign:**

- The Valentine's Day campaign with local B&B, boutique Love Letter, and Candy at 57C in Grand Junction with love letters, by and for survivors (see example below)

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### Meet The Team

**Founders:**

- Maya Siegel, Founder & Executive Director
- Alexa Bunker, Founder & Community Director
- Kendy Roth, Founder & Partnership Director

**Full Team:**

[www.spicetostop.org/team](http://www.spicetostop.org/team)

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### Upcoming Work

**What's Next:**

- Wildfire Campaign
  - First responders are partnering with Spide and survivors to create wildfire safety plans to navigate the landscape safely. The final product will be a series of 100+ guides with medical advice.
- The Survivor Community
  - We will be continuing to develop our community as a resource for young survivors on the high school and college collaborations.

SPICE UP

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### Our Impact

In April 2020, Spice to Stop received alongside Penn State and The National Endowment for the Arts (NEA) to support survivors representing domestic violence during the pandemic. In the span of four months, our budget-size was \$218,000 which directly supported 215+ survivors in Pennsylvania, distributed in counseling fees, groceries, rent/mortgage and other essential needs. In total, the campaign raised over \$200,000.

The work has been featured in Huffpost, MTV News, Daily and TV Times.

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### Problem & Significance

**Sexual Violence:** Sexual violence is small, uncompassionate that often in industries which a person is being treated or manipulated into unwanted sexual activity without their consent. It includes, consensual or non-consensual, sexual assault, sexual contact, sexual exploitation, sexual harassment, rape, sexual coercion, and voyeurism. Sexual violence is a broader term that includes acts not included in law including but not limited to sexual coercion and threats. It can also include non-consensual acts such as catfishing.

**Sexual Violence Statistics:**

Every year, statistics are gathered from the nation's largest anti-sexual violence organization, RAINN. In previous years, sexual violence has a large impact on young people. In fact, young people (between 18-24) are at the highest risk of sexual violence. The majority of sexual violence victims are under the age of 25.

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[NARRATION](#) [ABSTRACT](#) [CONTACT AUTHOR](#) [PRINT](#) [GET POSTER](#)

## **Maya Siegel**

### ***Intersectional Environmentalist, advocating for the protection of people + planet.***

Founded in June of 2020, Intersectional Environmentalist (IE) is a climate justice community and resource hub centering BIPOC and historically under-amplified voices in the environmental space. IE is a 501(c)(3) non-profit organization.

Intersectional environmentalism, a term largely inspired by Professor Kimberlé Crenshaw and her work with intersectional feminism, is an inclusive form of environmentalism that acknowledges the overlap between systemic harm against Black, Indigenous, and people of color (BIPOC) communities and the earth. Furthermore, it recognizes the disproportionate effects of climate change on other marginalized groups, including people with disabilities as well as women and gender minorities. At IE, we bring social justice to the forefront of conversations within environmentalist spaces.

Primarily operating on Instagram, IE shares inclusive content, from educational guides to programmatic offerings, to more than one million people each month. Since our inception, we've published The IE Agenda (print zine), hosted our first season of 'Dismantled' (podcast), created a council of over 20 diverse environmental advocates + educators, engaged in long-term consulting opportunities with select companies like Starbucks and Logitech, held our first annual summit, donated over \$35,000 to environmental justice organizations, and so much more! In 2022 and 2023, we're excited to engage our community more offline through new programming.

## **Melanin Armendariz**

### ***Childhood Development, Generational Trauma and the Pathway to Healing***

Human development occurs throughout the whole lifespan but there are certain periods that are crucial for development, especially in childhood. If something occurs during these formative years it can prevent the child from developing in the way they're supposed to. Adverse childhood experiences can steer the development in a different way. These can be things like living in poverty, experiencing abuse/neglect, parental separation, substance use, etc. These are the things that lead to insecure attachment, higher levels of stress and anxiety, mental illness and even problems with substance use. If these adverse childhood experiences continue repeating for many years, this then turns into transgenerational trauma, which is something that affects many people, especially people of color. The generational trauma is embedded in you way before you even get to experience life. When you are in your mothers womb you are not only exposed to all the emotions and experiences she felt, but also those that your grandmother experienced. Many times this trauma is unresolved which is why it continues through so many generations. This is why it is important to heal and break them. By learning about your attachment style and identifying those traumas, people can begin to understand themselves and heal in order to move forward. Healing and breaking generational patterns is extremely important and it can change the lives of generations to come.

**Abighail Tekeste*****Bridging The Gap***

Through my experience as an English Second Language (ESL) student and working with ESL students in FT Morgan high school, I have noticed the disparities that exist within the education system for ESL students. During my first year at CSU, I worked with students at Fort Morgan high school through the Key Communities with a focus on Education and Diversity, which further developed my interest to continue working with them. Through adversities such as language barriers and legal status, access to higher education is hindered, and my goal is to target this by creating a system of workshops centered around higher education through applications and scholarships for the seniors at Ft Morgan high school.

**Mariela Paul*****Addressing Homelessness in Fort Collins***

As someone who has worked with populations experiencing homelessness, I understand that there are barriers that prevent people from escaping the complications and difficulties of homelessness. Many individuals experiencing homelessness struggle to find support and resources they need to thrive in their environment. In terms of children and young teens who struggle from home insecurities, they often have physical and mental effects like increase in depression and anxiety, low self-esteem, less likely to finish school, etc. Therefore through my project, I strive to create a better environment that allows homeless people to ask for help. My project will focus on providing a helping hand to adults, students, and children in Fort Collins. To lessen the burdens of homelessness, I plan on creating gift bags filled with personal hygiene products, food gift cards, snacks, and a list of resources. In hopes of spreading awareness, I plan on gathering CSU students to assist with passing out gift bags. For my project to succeed, I hope to ease some of the hardships people experiencing homelessness face. I also hope to make people feel cared for, supported, and believed in. In the future, I hope to expand my project and continue exploring the ways homelessness can be addressed. I also hope to work with Rams Against Hunger to alleviate some of the burdens CSU students face on campus. I believe my project has the potential to grow and flourish within the city of Fort Collins.

## **Joel Ibarra**

### ***Construct, Build, Assemble Diversity***

Post-secondary institutions and the professional world lack a diverse representation of individuals who are institutionally minoritized. Amongst first-generation students and students who are people of color, pursuing post-secondary education is a journey with many obstacles. This is true for students of color pursuing a degree in the Construction Management (CM) program. From my personal experience, I'm striving to obtain a degree in the CM program, a very competitive career, and encounter a playing field that presents students like myself with disparities. "Construct, Build, Assemble Diversity" is a project intended to hone down on the opportunities already offered in the industry and the CM program here at CSU to further promote a diverse and inclusive environment. My ultimate goal is to create a scholarship program, but my first steps will consist of fostering a mentorship program for institutionally minority students pursuing a career in the construction industry and studying in the CM program. To help me with my project, I've reached out to Alumni students who studied in the CM program to learn from their lived experience and challenges as a person of color and as first-generation students. From our conversations, there is an imbalance that's deprived first-gen and minority students of skills and resources that cater to their academic and professional success. It's important to me and for my community that this issue is addressed and dismantled. Establishing a mentorship program between alumni students and undergraduate students for the CM program will pave a durable stepping stone for first-generation and minoritized students.

## **Anh Bui**

### ***Education Support for Low-Socioeconomic School***

#### **Faculty Guide: *Sam Desta Senior Coordinator, C4E Scholars Programs***

For many across the nation, inner-city urban schools are failing. The economic inequity is hard-wired into our school-funding systems, and many of these systems have relied largely on local property tax bases. This in turn has caused a noticeable funding gap, highlights the socioeconomic divide found in the flawed process of distributing these funds, and creates a gap for students' access to higher education. My community specifically is in low socioeconomic neighborhoods which lack funding to create extra programs to support their students for college. Being a first-generation college student, minority, and woman has made me uniquely qualified to tackle and help alleviate some of the problems of our community's most disadvantaged and underfunded students. Several times during my journey of applying and learning about college, I had a challenging time finding answers to my questions and I even thought about giving up my dream of college because there was minimal support for me. My goal for this project is to be able to provide mentoring services to students coming from my local high school in Denver. Through this mentoring service, I educated high school students on resources like pre-collegiate programs, internship opportunities, and answered any further questions. Most students are first-generation students like me, so they had little to no guidance on college. I hope to further expand this project to provide students all over the Denver Metro area with resources.

## **Alexandria Walker**

### ***The Intersection of Oral Health and Overall Health***

When my dad was diagnosed with a rare autoimmune disease, it sparked my interest in the dental field due to the disease having a large effect on his oral health. Over the course of my education, I have come to realize that so much of our overall health is affected by what is going on inside of our mouths. According to the CDC, "oral conditions are frequently considered separate from other chronic conditions, but these are actually inter-related. Poor oral health is associated with other chronic diseases such as diabetes and heart disease." As a local volunteer myself, I can say that there is not specific work being done on the issue of dental hygiene in Fort Collins regarding homeless or low-income people and families.

For my project, I have researched nutrition, good oral hygiene practices, chronic diseases, homelessness and all correlations between these topics.

I hope to be able to talk to local dentists and ask for donations for toothbrushes, toothpastes, and floss that people usually get after every hygiene visit. I plan to package and distribute these to the local homeless people that I serve at the Fort Collins Rescue Mission. My plan is to give one bag to every person when they're getting their meal with an informational pamphlet regarding the importance of dental health & overall health. My goals and visions are to fill a void by supplying resources and educating others to help improve dental hygiene and overall health of homeless and low-income people.

### **Estephany Revella**

#### ***Sembrando Oportunidades***

For eight years now I have been a personal assistant to a Spanish Speaking family who has two boys with special needs and disabilities. I saw their fear to seek resources and help due to their legal status, but I also saw how there are very limited resources available to help the Latino community who have children with special needs. There is a language barrier, unfulfilling IEP plans, and among several other issues that don't allow for their children to fully thrive in our communities. Through the family I helped, I was able to become involved with an organization in the Roaring Fork Valley known as La Esperanza de Emily, which main focus is to help Spanish Speaking families with children who have special needs seek those resources that they need in order to be successful. This being said, my intent with this project is to continue to be involved with La Esperanza de Emily and educate communities in ways we can help families who have children with special needs. I hope to be able to start a support group for Latino parents in other communities.

## ***The Panther Coalition***

### **Faculty Guide: *Duan Ruff, Black/African American Cultural Center***

Our objective is to acknowledge Black History in university curriculum in full. This includes sharing accurate information about the Black Panther Party and Rainbow Coalition. We believe that if students in the academic field learn more about the processes and focal points of the BPP, it will empower the modern generation to form a coalition that improves the original efforts of the BPP. If the results of our discussion concur with our hypothesis, it will invite students to create a modern party on CSU campus that includes a diverse, inclusive coalition (similar to the rainbow coalition). If the results are not as expected, then more research and discussion needs to take place to find a better, more efficient coalition effort.

## **Bemnet Tefera**

### ***First-gen Post-grad Mentorship***

As a first-generation college student, I understand the anxiety around graduation and what comes after. Specifically, it is difficult having no guidance regarding the work field. While classes and other opportunities teach vocational skills as well as communication skills. There is little to no information on how to navigate the “real” world. My project aims to partner with the Alumni Center to create a program that will guide/mentor fourth-year students and some third-year students. My hope is to have alumni who are interested in volunteering help guide and answer questions from fourth-year students every month. My focus is to have first-generation students of color come to this program to hear directly from alumni who have graduated and have begun their careers. Many students of color have little knowledge regarding interviewing, resume building, how to look for jobs, and how to network. Furthermore, I think that it is important to hear from someone who has been in that position and succeeded. Therefore I hope that the students who participate in this will have more confidence and knowledge regarding workplace environments, networking, etc. The end goal I hope to achieve through this program is that a good amount of students have plans after graduation and or understand the ins and outs of a job. In the future, I want to see my program expand by having an event at the end of the semester where students network and practice what they have learned as well as celebrate their journey.

## **Dolce Olmedo**

### ***Adverse Childhood Experiences: Examining Beyond The Score***

**Faculty Guide: *Sam Desta, Collaborative For Student Achievement***

Adverse childhood experiences (ACEs) have impacted various individuals from multiple backgrounds and can affect any child. An ACE score is determined by a quiz that consists of ten yes or no questions focused on childhood (under the age of 18) maltreatment and household dysfunction. The higher one's ACE score, the more likely they are to develop both mental and physical health problems. ACEs impact individuals differently as they may have different social locations which include but are not limited to race, class, geographic location, ability, and age. It has recently been found that ACEs can increase physical health problems later on in life. The most prevalent health problems were lung cancer, cardiovascular disease, obesity, and stroke. Unfortunately, populations that are especially susceptible to the health disparities due to ACEs are those who are economically vulnerable racial and ethnic minorities. There are very few studies that examine the impacts of ACEs on racial and ethnic minorities and those who are economically vulnerable. This is quite alarming as many of these marginalized individuals experiencing ACEs are more inclined to develop a physical health problem due to potential mutations caused by intergenerational trauma. To truly understand the impacts ACEs have on a child's mental and physical health, one needs to take a look at all possible risk and protective factors from genetic to systemic.

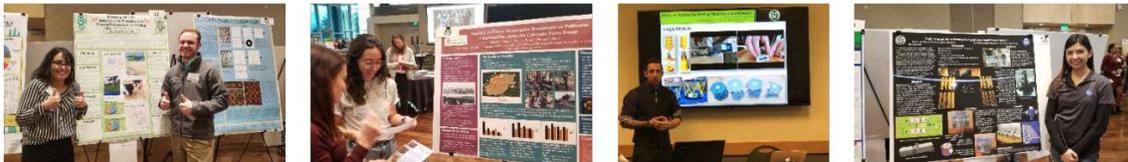
**Jose Duenas**

***El Sueño Inalcanzable: Redefining The Journey to College for Latine and Undocumented Students***

The journey to college can be hard enough for the average individual. For Latine and undocumented students, the journey becomes far more difficult as they attempt to seek help from an education system built to serve white values. Research has shown that Latine students tend to face depravity of information regarding essential steps to take to attain a college education. This systemic push-out is further exacerbated when accounting for the discrimination Latine students face in the education system. With the heap of legal obstacles already faced by the undocumented population, the hope of college can often be subjected to remain a mere dream. Through a collaboration of my identity as a Latine student and my opportunity to deeply study the issue as part of a research team, I will examine the struggles Latine and undocumented students face in the pursuit of higher education. This will be done in an effort to redefine the college journey for Latine students by targeting the core issues that underlie the struggles. Through an evaluation of the results yielded, I will take the next steps in working with local organizations to help the Latine community within Northern Colorado. Local organizations have the power to empower Latine youth who want to pursue a college education. The systems have worked against marginalized communities since their inception and it is time to make a change.

# MURALS

SCIENCE, TECHNOLOGY, ENGINEERING, & MATHEMATICS ABSTRACTS



2019 Winners: Xandria Amash and Reed Featherstone, Ryleigh Gellas, Brandon Tighe, Danelle Lazcano Concelman

2021: 1st Place: Rachel Jackson

### Assessing Physiological Vulnerability to Climate Change in Two Amphibian Species

Rachel Jackson, Anasta Cicchino, W. Chris Funk  
Colorado State University

**Climate Change and Thermal Tolerance**

The critical thermal maximum (CT<sub>max</sub>) is the point at which an animal struggles to perform basic bodily functions. As stream temperatures warm, anurals, especially scaphiurans, will be closer to hitting their CT<sub>max</sub>. A higher CT<sub>max</sub> in an animal could lead to a longer life span, whereas a lower CT<sub>max</sub> could lead to a shorter life span.

**Which species is more vulnerable?**

To answer this question, I will investigate the two following hypotheses.

**Hypothesis 1: Both species have evolved the same CT<sub>max</sub>**

Both of these species inhabit the same streams. If the same selection pressures have been acting on the same trait for both species, then I expect their CT<sub>max</sub> estimates to also be similar.

In this scenario, the CT<sub>max</sub> of the giant coastal salamander (orange) is the same as the CT<sub>max</sub> of the long-toed frog (blue). Over time, as stream temperatures (blue) increase, both species will reach their CT<sub>max</sub> values at the same time. Therefore, they are equally vulnerable.

**Methods**

We will perform CT<sub>max</sub> experiments on ten tadpoles and salamanders from five different populations/streams.

**Species of Interest**

We have chosen to focus on the coastal tailed frog as well as the giant coastal salamander because they are scaphiurans. Scaphiurans regulate their body temperature by utilizing their outside environment. This makes them incredibly sensitive to environmental changes, such as the warming stream temperatures we will be investigating in our experiment. This sensitivity includes the environment having the ability to change how the organisms develop.

**Significance**

This study will allow us to understand whether these two amphibian species' thermal tolerances have been similarly shaped by stream temperatures and whether they have similar vulnerabilities to future warming.

As these two species also represent predator (salamander) and prey (frog tadpole), the physiological vulnerability of both species will ultimately affect the persistence of the other. If both frogs reach their CT<sub>max</sub> first, the salamanders will

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**Miah Tofilo**

***Philodendron's Reactivity to Acidity***

**Faculty Guide: Courtney Ngai|Office of Undergraduate Research**

Objective: To test if Philodendron can grow in acidic conditions.

Hypothesis: The Philodendron that is being watered straight tap water will show the most growth and healthy looking leaves.

In my experiment, I want to be able to find out how damaging, if at all, acidity is to Philodendron. Knowing if Philodendron thrives or struggles with acidity could potentially be used as an indicator for how plants might react to rising acidity levels due to climate change in areas where Philodendron is naturally found. Philodendron is found in South America and the West Indies where acid rain has continued to worsen as climate change proceeds.

I will be watering three Philodendron plants that were all purchased at the same store and are at the same life stage. I plan to water the plants as such: plant 1; tap water (control), plant 2; tap water and smaller amount of lemon juice (5.5pH, to simulate normal rain water), plant 3; tap water and larger amount lemon juice (3pH to simulate acid rain). I plan to water all three plants the same amount of water once a week and they will be stored in the same area in my house with mid exposure to light. Each week, I will also be measuring the Philodendron based off of their new leaf growth (by counting), leaf color and leaf texture.

**Genesis Marrero**

***3D Printing of Structurally Reinforced Calcium Phosphate Scaffolds for Bone Tissue Regeneration.***

Eighty-five percent of all skeletal tumors in dogs are osteosarcomas, most often affecting the proximal humerus and distal radius. Poor healing of these critical-sized bone defects remains one of the biggest challenges in human and veterinary orthopedic surgery, often resulting in limb loss due to a number of complications. Tissue engineering solutions have emerged that use scaffolds, composed of osteogenic biomaterials, that are fabricated to provide structure for new bone development. Hydroxyapatite (HAp), TCP, and numerous other forms of synthesized calcium phosphate alternatives are widely studied for bone regeneration scaffolds. Despite excellent bone regeneration properties, success of these scaffolds is hampered by inadequate structural strength, required for acceptable load-bearing, as well as insufficient promotion of osteoprogenitor cell activity. In our approach, HAp, beta TCP, and biologically derived calcium phosphate materials are 3D-printed into patient-specific endoprosthetics. The 3D-printed device allows for the finely tuned fabrication of complex bone-like geometric patterns. The novelty of our method is that no study to date has used an endoprosthetic sleeve device to protect a fragile but highly osteogenic scaffold and to engage periosteal flow into and from the scaffold in large defect reconstruction. The sleeve enables us to focus on the scaffold design and biomaterial composition. This novel approach shows promise to optimize the mechanical and osteogenic properties of the bone tissue scaffold. Our research approach addresses common failure mechanisms in the treatment of critical defects which has the potential to spare limbs and lives of osteosarcoma patients.

**David Reyes**

***Mechanism of Amyloid Build Up in Alzheimer's Disease***

Alzheimer's disease is a neurodegenerative disease that is characterized by a build up of beta-amyloid proteins producing plaques in neurons. Amyloid precursor protein (APP) is the progenitor protein of the beta-amyloid protein with functions that are still being discovered. One such function of APP may be to act as a receptor protein which becomes a transcription factor. This presentation takes this idea and presents a possible pathway which APP may take in order to become a transcription factor from a receptor protein and how a disruption to this pathway may lead to the build up of beta-amyloid protein.

**Noelle Mason**

***Differential stress experiences in niche-tracking and niche-switching yellow warblers***

**Faculty Guide:: *Kristen Ruegg/Biology***

Conservation of biodiversity is increasingly challenging in the face of climate change. Recent work suggests that avian populations, which have declined by 2.9 billion birds since the 1970s, are able to persist in the face of changing climate conditions based on the extent of climate specialization across the annual cycle. Some migratory birds, called climate specialists, track their climate niche across the annual cycle and specialize in one habitat type. Climate generalists switch their climate niche between seasons and are able to do well in a variety of habitats. In this project, I aim to study the potential implications of climate tracking and climate switching on individuals in the yellow warbler (*Setophaga petechia*), where the extent of climate tracking across the annual cycle has been extensively quantified. Each group likely experiences differential stress, and this study aims to understand whether each group differs in telomere length. Telomeres reflect stress throughout an organism's life and are strongly correlated to relative lifespan and fitness, and shorten with stress. I will measure telomere length using quantitative polymerase chain reaction to understand relative telomere lengths of individuals and the stressors they may have experienced. Understanding stress impacts associated with migration to wintering grounds may help to reveal the selective pressures exerted on yellow warblers outside of their breeding grounds and further conservation efforts.

## **Jimena Firo**

### ***Energy Transfer Spectroscopy in the Field of Nanoscience***

Fluorescence Resonance Energy Transfer (FRET) measurements are often used in biological systems to measure nanometer distances between donor and acceptor molecules. FRET is a powerful “spectroscopic ruler” because it can reveal how and why cells survive just by measuring the distance between proteins. For example, FRET is used in coronavirus research to understand how the main protease replicates the virus. While many FRET applications are biologically focused, our research leverages the powerful FRET technique for potential energy and materials applications. We apply FRET spectroscopy to study defects in nanocrystals. Defects are imperfections in a crystal lattice and play a crucial role in the functional properties of a material, such as its ability to convert solar energy into useful chemical products. Our experiments study energy transfer between ZnO nanocrystals (NCs) donors and AlexaFluor 555 (A555) dye molecule acceptors. We discovered that ZnO NC emission decreases as the A555 concentration increases, which signifies that a highly efficient energy transfer process occurs between the NC donor and molecular acceptors. This work will provide valuable information to understand where the defect sites are in the NCs. This fundamental knowledge will ultimately enable us to leverage ZnO nanocrystals as the active material in environmentally friendly lighting applications.

## **Ashley Freedman**

### ***Bacteria Identification***

The goal of this experiment is to be able to identify and characterize bacteria from a sample in the TILT OURA lab. This project is relevant as I strive to understand more about the microorganisms that live in our workplaces. It is important to know about the bacteria within our lab as understanding the bacteria could help us determine lab exposures, bio-safety levels, and treatments we may need to use in our lab. For this experiment I plan to collect a bacteria sample from the lab sink. Then I plan to grow it on various types of agars, perform a gram stain, and run biochemical test and metabolic test to categorize the bacteria. From the results of these tests I want to be able to classify the type of bacteria found in my sample. I expect to find gram negative bacteria with spores in my sample based on results of a previous experiment. After classifying the bacteria, I hope to have a better understanding of these tests and the microorganisms in our lab. If I get consistent results and I am able to identify the bacteria I know I have a solid foundation of a procedure that I could use in the future to identify other bacteria. If my results are unforeseen and I cannot come to a conclusion on the type of bacteria in my sample, I will need to add more tests to the procedure to help identify the bacteria.

## **Shuhuai Qin**

## ***Relationship between the personal income and household income***

### **Faculty Guide: Channing Parker, Department of Statistics**

The goal of this project is to study the relationship between household income and personal income of youths in the US. The hypothesis is that they are linearly related.

#### Introduction

I want to explore whether personal income is affected by household income. For example, if the household income is high, then the youth may not need to work and thus the personal income drops. Another possibility is if the family is wealthy, then the individual will have a better chance of getting a high-paying job and thus personal income increases.

#### METHODS

We used the data from National Longitudinal Survey of Youth 97 (nlsy97). The data includes the personal incomes and household incomes that we are interested in of more than 2000 US teenagers, along with other variables such as race and education level. The full model is:

$$Y = \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 + \epsilon$$

#### RESULTS

We found that personal income of youths is significantly related to the household income, with a p-value much less than 0.001. I want to use the result for further study and will be discussed in the next part.

#### Future directions

When cleaning the data, I deleted the missing data and zeros in the personal income part. Another choice would be using Heckman correction to simulate the process of choosing to work or not to work, and maybe would have a more reasonable result. We will try this in the future.

## **Delaney Dunlop**

### ***Traces Herbicides Leave on Bees***

Over the course of the century, insect pollinators have declined worldwide, increasing the risk of loss of ecosystem services. One possible contributor to this decline is widespread use of herbicides and agrochemicals, which may harm insects. Although herbicides are used to control weeds, certain components of their formulations may adversely affect pollinators visiting plants. Accordingly, there is a need to develop methods to determine if insect pollinators have been exposed to herbicides to evaluate relationships between pollinator health and herbicide exposure in natural settings. We test the hypothesis that compounds present in herbicides can be detected on pollinator cuticles. We performed an experiment to expose bees (*Bombus impatiens*) to two herbicides (Alligare 90™, Southern Ag Lawn Weed Killer™) and one surfactant (Silwet L77™). A hexane extract of bee cuticles was analyzed using gas chromatography/mass spectrometry to test for signals associated with herbicide exposure. Two chemical compounds (Z9-tricosene and hexacosane) were present in all bees but were found in much higher concentrations on bees treated with herbicide or surfactant in comparison to bees treated only with water. Based on these findings, we conclude that these two compounds may be reliable chemical markers for detecting if pollinators with an unknown history have been previously exposed to herbicides as the abundant chemical compounds found in the surfactant act as a marker.

**Nabila Ahmad, Sage Phuepwint, & Sebastian Bronk**

***DNA Crystallography***

**Faculty Guide: *Christopher Snow, Chemical and Biological Engineering***

Our main goal is to create large porous crystals made out of designed DNA tiles that can be used to make programmable molecular scaffolds. These scaffolds could organize other guest molecules by allowing them to bind to specifically designed sequences of the tile. We can use these crystal lattices for imaging and detection of various biomolecules. These crystals also could be used as vehicles to transport proteins. Other labs have created DNA crystals, utilizing the principle of tensegrity in their designs to ensure the internal strength and rigidity of a single DNA tile. Two different DNA tiles were designed for our experiment; one with edge lengths composed of three full twists of DNA, three nick strands, three staple strands, and a central strand (T.3). The other design had four full twists and two central strands (T.4), which should ensure the resulting crystals will have larger solvent channels than the T.3 tile. Solutions consisting of our salt stock, nuclease-free water, and the DNA strands encoding our tiles were left to anneal in an oven for the DNA to crystallize. Our trials resulted in the creation of DNA crystals that appeared in many sizes, but the best crystals were large and geometric, versus the smaller and less uniform ones. The search for optimal parameters for crystal growth is ongoing. Once large crystals are engineered for stability, we will attempt to diffuse proteins into the crystals and also determine if we can attach the guest proteins to the scaffold.

**Braden Pate**

***Tracking The Shifting Range of a Cryptic Species Using Host Data***

*Celastrina echo sidara* is a subspecies of the echo azure that is native to the front range of Colorado. The genus is continuously undergoing taxonomic revisions and there are vastly differing opinions on how they should be classified. Morphological characteristics have complicated the matter, making identification difficult and limiting observations from online databases. *Celastrina echo sidara* is a known generalist for rosacea plants, with a preference for *Jamesia americana* as a host in larval stage (Wright et al, 1998). Given the lack of usable data and for the subspecies, we present the idea of predicting these shifts using host plant collections and citizen science data. The study shows overlapping ranges in Colorado for *C. echo sidara* and *J. americana*, both longitudinally and in elevation. Insufficient and possibly biased data for *C. echo sidara* has likely resulted in an inaccurate representation of true distribution and range shifts for the subspecies. This study presses the urgency for collecting more and accurate observations of the subspecies. However, the ranges of both *C. echo sidara* and *J. americana* occur within high threat regions for wildfires, and the 2020 wildfires may influence future range studies. While the range of a cryptic species may be complicated to study, utilizing citizen science data for an easily identified host may provide key information for analysis of potential threats to range shift studies.

**Cassidy Rubin**

***Zebra Mussels: The Damages They Cause***

The introduction of zebra mussels into North America sparked new interest in the science community about invasive species. In order to remediate the environment and reduce economic damage, studies such as this are used to understand the species better. As someone who grew up in the Lake of the Ozarks, I understand how drastic this damage can be. Throughout the last 20 years, zebra mussel distribution patterns and influence on abiotic and biotic factors have been further examined. Zebra mussels cause environmental and economic damage. Researchers hope to lessen this damage by determining methods to control the invasive species. Researchers used computer-generated models that accurately predicted that the population would spread rapidly and far across North America. Their appearance correlated to decreased populations of planktonic food sources, increased risk of algal blooms, and a decline in the native mussel population. To determine the economic cost of damage, researchers collected records of damage/maintenance requests, collapsed fisheries, and other struggling businesses in the Great Lakes and Hudson River areas. This study brings awareness and proposes solutions to these issues. It better equips the field of ecology to study other invasive species and their effects. This knowledge can be applied for the sake of avoiding damage to personal property and help remedy habitats that experienced algal blooms, decreased food sources, and population decreases in native species.

## **Madison Porterfield**

### ***Maximizing Strawberry DNA Extraction Yield***

DNA extraction experiments can be found online, but depending on what you look at, the rubbing alcohol concentration can differ. Cold rubbing alcohol is relevant for DNA extraction because it is what allows for the DNA to precipitate due to DNA being insoluble in alcohol. My research experiment aims to find a way to maximize the yield of DNA extract while limiting how much alcohol is used. This allows for scientists to use less of potentially harmful solvents and still get the maximum amount of DNA extract to be used for further analysis or experiments. Studying this can reduce the waste generated by this experiment which can potentially harm the environment or those handling the chemicals. To assess this yield ratio, the alcohol content will be diluted to a chosen number of differing concentrations- 25%, 50%, 70%, 90%- with the 70% concentration serving as the control. The DNA extract yield can be quantified in a few ways: using a microscale, gel electrophoresis, and a spectrometer. It is useful to use multiple methods to quantify the DNA extract because it gathers additional data which can be used to verify the results if each method comes to a similar conclusion. The importance of addressing this question has implications for both scientists analyzing the purified DNA as they generate more material to work with and the environment by utilizing a principle in green chemistry that focuses on limiting use of separatory agents and using safer solvents.

## **Nicole Deatley**

***Comparing forage succession of Aphioidea between the native C. novemnotata ladybug and foreign Coleomegilla maculata ladybug to determine the effects of beneficial insects as a natural predator.***

As of 1987 there has been a 14% decline in ladybug populations. Beneficial insects such as these are crucial to 80% of the foods we eat (Kitwood, 2018). Beneficial insects are predators which consume harmful pests, such as aphids or tachinid flies. Two species of ladybug, Coleomegilla maculata and C. novemnotata, were separated into an enclosed habitat with a host plant, Capsicum, that were infected with Aphioidea, a common harmful pest. Aphioidea fed off the Capsicum host plant and were reproduced to a stable population, which the ladybugs ate. After 70 trials each day, the population of the aphids were recorded and calculated to see which ladybug species foraged successfully. Coleomegilla maculata consumed 97 more aphids than C. novemnotata during the weeks. Due to different growth stages disrupting normal feeding habits, differences in aphid population may have been skewed. Results from the data imply that the hypothesis, "If Coleomegilla maculata is widely known to develop better on an Aphidoidea diet, then the success rate will be higher than the C. novemnotata because of their growth habits," is supported. With this finding, using specific species of ladybugs for biocontrol will help farmers, entomologists, agriculturalists, and othersto provide a safe and effective way of farming (Garcia, 2020). Using integrated pest management such as pesticides can cause water pollution and kill grass. Comparing different beneficial species can be a natural and safe alternative.

***Jenna Hauk: Population Study of the Eastern Hellbender***

Cryptobranchus alleganiensis alleganiensis (the eastern hellbender) is North America's largest salamander, yet they continue to be hard to find. North America is at risk of losing this magnificent species without further action. This study is aiming towards finding declining population trends and negative human impact towards the species by examining professionally conducted research in journals and past petitions for the listing of this species as threatened or endangered. By examining these other articles and research, there is a trend of decline in Cryptobranchus a. alleganiensis and a trend of anthropogenic impact on the species and their habitat. The impact of these results is that the species is incorrectly being listed by the USFWS as a species of least concern in all areas of their range except for Missouri which is only a small portion of the salamanders' habitat. Going forward, this research is intended to work towards garnering further research and the correct assessment of Cryptobranchus a. alleganiensis as threatened in their entire range, if not endangered.

**Arysa Puckett, Genesis Lacy & Sam Carles**

***The Worst Flood in the History of Fort Collins: A Study on Spring Creek Water Flow***

**Faculty Guide: Aditi Bhaskar|Civil Engineering**

In 1997, Spring Creek experienced a flash flood event, resulting in major damage to many homes and buildings in the Fort Collins area. The creek rose thirty feet above its bank and completely flooded nearby landscapes including Colorado State University and western Fort Collins. Fort Collins lies in a semiarid region, and nobody was expecting the intensity of flooding that occurred in 1997. Five lives were lost, and costly damage forced the public to push for more advanced infrastructure. The City of Fort Collins responded by establishing floodwater retention basins, channels, and a flood warning system to prepare for future storms. This also led to Dr. Bhaskar's interest in Spring Creek. For our project, we surveyed the presence or absence of flow, and animal life in and around predesignated hotspots using Aneccdata, a citizen science app. For eight weeks, we took pictures of the creek to record variations in the water flow, especially as winter approached and we received less precipitation. At the end of the study, some of the designated study sites were completely dry compared to the beginning of the study where they had pools of water or even large amounts of flowing water. The data we collected can help prepare future city planners to decide where to establish monitoring devices and how to better plan for floods.

### **Quinsker Frimpong**

#### ***Increased inflamed astrocytes in aged canines***

Canine Cognitive Dysfunction (CCD) is a common neurodegenerative disease found in dogs over the age of 8. There is a great deal of similarity between CCD and Alzheimer's Disease (AD) found primarily in aged humans 65 and older. This makes dogs a great model organism for understanding the disease mechanism that causes neuroinflammation and accumulation of misfolded proteins. Just like Alzheimer's Disease, CCD is a naturally occurring disease of age, in an animal that shares the same environments and risk factors (ie. diet, exercise, exposure to pollution) as humans, further justifying the use of canines as a model for AD. Many areas of the brain have been shown to be disrupted by the misfolding of proteins and inflammation as an indicator of AD, this includes the cortex and hippocampus. Here we are studying aged canines that have not been diagnosed with CCD to determine if neuroinflammation occurs more in the aged population. Astrocytes in the central nervous system serve an important role in providing synaptic support and controlling the blood brain barrier. Both glial fibrillary acidic protein (GFAP) and S100 $\beta$  can be used as markers for inflamed astrocytes. We have found an increase in GFAP and S100 $\beta$  positive cells in aged dogs compared to young dogs. Understanding why this is happening will allow us to further study the disease mechanisms for neuroinflammation and provide future therapies.

### **Luke Davis**

#### ***Detection of SARS-CoV-2 and Influenza B in Wastewater***

**Faculty Guide: Carol Wilusz and Jim Huang, MIP**

In the past, wastewater-based assays were used to detect drug metabolites, polio outbreaks, and antimicrobial resistance genes. During the COVID-19 pandemic, Colorado State University optimized an assay to quantify the SARS-CoV-2 virus in wastewater allowing early detection of outbreaks on campus. Samples are centrifuged to remove solids and concentrated using an Innovaprep ultrafiltration device. Viral RNA is extracted and quantified using droplet digital reverse-transcription PCR (dd RT-PCR). Wastewater collection from manholes currently involves icing the sample during collection to minimize decay of the viral signal. It is not clear whether this step is necessary, and it significantly increases the cost of sampling. Experiments were conducted to see how detection of SARS-CoV-2 is affected by storing samples at ambient sewer temperature for 24 hours rather than at 4°C. To our surprise, preliminary data showed that storing at 12°C increased the SARS-CoV-2 signal 2.5fold. We hypothesize that this may be due to virus dissociating from the solid phase of the sample into solution during storage. We are planning to use sonication to intentionally dislodge viral particles from solids and assess the effect on detection. We hope to use information gleaned from these studies to reduce the cost of wastewater sampling while maintaining or even improving sensitivity.

**Christina Fournier**

***Is the Chemistry First Year Seminar Curriculum Adequately Preparing Students with Research and Critical Thinking Skills?***

This study was designed to help assess first-year chemistry students at CSU to see whether the first-year chemistry seminar prepared them with research and critical thinking skills. By assessing the students, we can see where we need to improve the curriculum to help them conduct successful research in future labs. The objective of this study was to determine how to adequately prepare students with research and problem-solving skills through the curriculum of the chemistry first-year seminar. We looked through the syllabi of different universities to see how they introduce these foundational skills. Using this information as a framework, we were able to develop a survey that reflected the students' feedback on the class curriculum. The survey was successful in helping us get an insight of how adequately the first year chemistry seminar prepared the students with research and critical thinking skills. With a response rate of 35 students out of 50 that were enrolled in the course, we were able to see that the course did not offer enough hands-on activities and presentational experiences. Students want more of these activities and experiences in order to help them expand their knowledge and present their findings on their research. This, in turn, would help them be successful in professional labs. By including more of these activities into the first-year chemistry seminar, students would be able to develop their research and critical thinking skills to a greater degree.

**Linh Bui**

***Incorporating Foundational Research Skills Into the Chemistry First-Year seminar***  
**Faculty Guide: Carlos Olivo-Delgado, Chemistry**

The objective of this study was to build the foundation of research, critical thinking, and problem-solving in CHEM 192 to enable college success. The hope for this course was for students to leave feeling a sense of comfort and confidence in the skills they have learned and applying them to their future classes. The class is a necessity to shape a student's foundation for research and give them the needed skills to be successful as chemistry professionals. Learning has always been challenging, which is why many schools have explored nontraditional routes to improve the success and foundation of students' success. CHEM 192- Introductory Seminar in Chemistry was a new course that CSU wanted to implement. First, we explored other introductory seminar classes like CHEM 192 to visualize and view how successful they were and how their method of teaching the class was different at those institutions. For instance, a summer bridge program at Bridgewater State University exposed its students to STEM-related courses and introductory seminars before attending fall courses. Viewing approaches that other institutes took allowed us to qualitatively compare and evaluate what is important when guiding students to be successful. The survey allowed us to qualitatively analyze how the students felt at the end of the course and how well it prepared and taught them research skills. The results of the survey displayed promising and hopeful chemistry professionals who took CHEM 192.

**Mackenzey Kologlu**

***The Presence of Jealousy in Domesticated Canines***

**Faculty Guide: *Christopher Kopack***

Jealousy is a secondary emotion thought to be associated with a situational threat made by a rival to a pre-established bond. Although primordial forms of jealousy have been alluded to in domesticated canines regarding a threat to the dog-owner bond, no study has incorporated direct dog-dog interactions when attempting to illicit a jealous response. This study uses a live "rival" canine which the owner exclusively interacts with, both of which the dog in the dog-owner relationship in question can directly interact/inject themselves with. Results from this study show much more highly pronounced results than those which use inanimate or animatronic "rivals", and suggest that there are three primary forms in which jealousy can be expressed: an attention-seeking, aggressive, or sulking response. Only dogs with no history of aggression of any degree towards humans or other dogs were used in order to eliminate such explanations for certain observed behaviors and the experiment was conducted in a neutral environment to both parties as to eliminate the possibility of territorial aggression or behaviors.

**Mia Carroll**

***Depression and anxiety; how CSU undergraduates moods are affected by cannabis use***

Cannabis is a recently legalized drug in Colorado. There has been a lot of research on the relationship between cannabis use and mood. However, while there is a lot of research, results tend to differ greatly. The article "The relationship between cannabis use and measures of anxiety and depression in a sample of college campus cannabis users and non-users post state legalization in Colorado" looks at 178 undergraduates at CSU and the relationship between cannabis use and depression and anxiety. First researchers looked at results from two questionnaires that were given, CES-D which measures depression and STAI which measures anxiety. Participants were put into three different groups: chronic users, casual users, and non-users. Multivariate Analysis of Variance (MAOV) was used to examine the groups differences from the two questionnaires. It found that non-users had lower CES-D scores than casual cannabis users while chronic cannabis users did not seem to have a difference compared to both groups. Results also concluded that in depressed participants an increase in cannabis use lowered STAI scores and in pre-anxious participants an increase in cannabis use lowered CES-D scores. For non pre-depressed or pre-anxious participants an increase in cannabis use was correlated with a decrease in positive mood. Cannabis use and mood is very complex to study because there are so many confounding variables and more research is needed. This research provides a good starting point.

**Priya Krakker**

***Large Genome Size effect on Brain Morphology in Plethodontid Salamanders***

Plethodontidae is the largest family of salamanders, consisting over 400 species in 28 genera. These salamanders also have the largest genomes of salamanders, ranging from 29-67 gigabases (Gb). Despite being the largest family of salamanders, relatively few studies have been done on the brain. This study aims to assess brain morphology as a consequence of large genome size. It was proposed that large genome size has effects on cell size and division time, ultimately affecting development of major organs. The brain being one of the most central and important organs to survival, it is pertinent to both genetic and evolutionary studies to understand how large genome size affects brain morphology. The brains of 9 different Plethodontid species were rendered as 3D models for analysis. Brain volume was analyzed and assessed for correlation to large genome size.

**Victoria Hurteau**

***The effects of specific lipids have on aerobic capacity***

Lipids (fatty acids) are affected by trophic level shifts due to global climate change, altering the fatty acid composition and the environment in predator and prey. The rise in temperature is causing acidification, altering the consumption of resources throughout the food chain from cyanobacteria to carnivores, such as seals (Pinnipeds). Lipids consumed by the seals are primarily through fish, which are high in Omega-3 fatty acids, and from indirectly consuming krill. Not only are fatty acids stored in adipose, or subcutaneous tissue, as blubber for insulation, but specific lipids also play a role in maintaining the relationship between myoglobin (protein) and aerobic capacity through intracellular stimuli in the skeletal muscles. Myoglobin is essential in storing oxygen for skeletal muscles, regulating lipid metabolism and carbohydrates, and maintaining homeostasis for deep diving mammals as seen in seals. The purpose of this studies' objective is to determine if lipids isolated from krill or fish oil will have differentiating effects on skeletal muscle. Using C2C12, immortalized mouse cells, we will investigate the change in aerobic activity in response to krill and fish oil. The results from this experiment will then be compared to the studies conducted on seal skeletal muscle cells. This will allow for a better understanding of global climate shifts and the effects on marine predators' (seals) specific myoglobin levels in the skeletal muscles to be able to hunt prey in their environment. Any potential changes could have a severe effect on the ability to forage in seals.

### **Lia Rocha Salazar**

#### ***How Much Water is Consumed on Average in the US?***

The overall goal of this presentation is to compare the water consumption throughout different major cities in the United States. I predicted that the bigger the city area the more water is consumed by the general public and the more expensive the water usage is. This presentation would help people in the water development fields see how the water is being used across the entirety of the United States. This helps them understand how the people in their cities consume water and how they can improve water-saving methods in their cities. To accomplish this presentation, I picked three different cities and looked into the average water consumption of each resident in the city. The three cities I researched were Phoenix, San Francisco, and New York City. With the information on water consumption in these cities, I split the overall water consumption into two general categories, indoor and outdoor usage. I also researched how much the average water bill was based on the consumption of water. Overall my hypothesis was mostly correct. New York City had astoundingly high numbers but it made sense because of the population size. Surprisingly, the residents of Phoenix use more water than the people of San Francisco. Water development teams can use this information to focus more on the size of the population and how much water they use on average rather than how much water they have to provide based on area size.

### **Jazreal Sanchez**

#### ***The Effects of Lipids on Myoglobin Expression***

**Faculty Guide: Dr. Kanatous, Biology**

Climate change has many far-reaching effects on the environment. One understudied area is the affects climate change has on the body composition of animals. Recent studies have found a shift in many prey species, such as fish and krill, in response to changing environmental temperatures. In addition, specific dietary needs and essential fatty acids play important roles in intracellular stimuli for skeletal muscle adaptations important for animal performance. This study plans to investigate the effect of fatty acids, isolated from different trophic levels in the marine environment, on the expression of the myoglobin protein, an important protein that plays a key role in oxygen homeostasis in skeletal muscle cells, especially in diving mammals such as seals. My study will focus on determining the effects of lipids isolated from krill and fish oil on the expression of myoglobin in mouse skeletal muscle cells. Once these cells have been grown, they will then be harvested and the protein concentration of the myoglobin will be measured. These results will be compared to studies on seal muscle cells. By completing these investigations, we will have a better understanding of how our changing world will affect animal performance on land and in the sea. Marine predators such as seals and sea lions are dependent on specific myoglobin levels in their skeletal muscles to be able to hunt for prey in their specific environments; any potential changes in these levels could have severe effects on their foraging abilities.

### **Raylene Mendoza**

#### ***Bacterial comparison between desert and tropical reptiles***

The independent study I want to conduct highlights my experience within the OURA Lab, using knowledge of Petrie dish making and bacteria gathering my research aims to answer; Do tropical lizards hold more bacteria than arid species? As reptiles are becoming a popular pet, it would be beneficial to know what resides on their feet- bacterial-wise. Many people experience irritations due to reptiles, so knowing which one is "cleaner" would lead to a better life for both the owner and reptile respectively. Now prior knowledge I need before the experiment consists of knowing how to isolate lizard bacteria safely and what I can expect from their samples. In knowing this beforehand, I can ensure the safety of both the experiment and my colleagues.

After safety has been taken place, the possible materials needed would be two Petri dishes, swabs, and the lizards themselves, this is a simpler experiment so nothing major is needed. The actual procedure in summary would be, to swab the lizards in their enclosures. Preferably swabbed on the feet since the feet have a higher contact rate to human hands compared to the rest of the body. Afterward, the samples would be swabbed onto the Petrie dishes for analysis of colony number and size, thus, showing the potential irritations.

When the experiment is complete, I hope to answer the question "Do tropical lizards hold more bacteria than arid species?" As this is a future experiment, my prediction is that the dryer lizard would have minimal bacteria due to the humidity being inadequate for sustaining major colonies. Therefore, my results will affect if those who are sensitive should get a tropical lizard or a dry one as they would have minimal bacteria.

### **Karen Khaykin**

#### ***The Endosymbiotic Relationship Between *Dirofilaria Immitus* and *Wolbachia*, and why it Matters.***

The purpose of this review is to create a better understanding between the bacterial genus *Wolbachia* and the nematode *Dirofilaria immitis*, also known as heartworm. *D. immitis* is a parasite that has significantly impacted veterinary medicine, and over 100,000 dogs in the United States are diagnosed with the potentially fatal heartworm disease every year. Current standard treatment for *D. immitis* infection involves the administration of antibiotics and anti-parasitic drugs such as melarsomine, doxycycline, and ivermectin. However, current research suggests there may be a mutualistic relationship between *Wolbachia* and *D. immitis*, specifically related to metabolism. *Wolbachia* is a common, gram-negative bacteria commonly found within many different organisms, especially arthropods, but also within various parasites. Understanding the relationship between these two species presents itself as an opportunity for creating new drugs that may target this relationship, while ultimately reducing antibiotic use and decreasing the potential for antibiotic resistance. Additionally, while heartworms are relevant to veterinary medicine, a breakthrough in this area of research may also be applicable to human medicine. *Wolbachia* is found in many nematodes, specifically within the subfamilies Onchocercinae, *Dirofilaria*inae, and *Splendidofilaria*inae, and arthropodic hosts. Of the nematodes located within these families, many can cause illness in multiple organisms, including humans. Unlocking the endosymbiotic relationship between *Wolbachia* and *D. immitis* poses an opportunity that will not only benefit veterinary medicine, but human medicine as well.

**Andrea Velez**

***Traces Herbicides Leave on Bees***

**Faculty Guide: *Jemma Fadum, Natural Environmental Science***

Watershed monitoring is often challenging in remote locations and countries that lack the infrastructure or consistent funding to support routine environmental monitoring. This project assesses the potential of citizen science as a sustainable and more accessible alternative to traditional monitoring plans in one such data-poor region, the Lake Yojoa watershed (Honduras). Developing an adequate low-cost monitoring strategy will help to reduce the knowledge gap between regions with access to consistent, high-quality data and those without. Developing citizen led monitoring efforts also has the potential to create economic opportunities for participants. The objective was to use a frequency analysis to identify the intervals at which citizen led measurements need to be taken to capture the natural variation in tributary discharge. We used discharge data for Lake Yojoa's major tributaries (Helado, Raices, Varsovia and Balas) taken every 15 minutes via pressure transducer. We compared different frequencies (monthly, weekly, daily, and sub-daily) to determine which had the lowest standard error and was closest to discharge when calculated using the pressure transducer data. We found that in most of the tributaries evaluated, discharge can be measured once a day, with the exception of Raices, where less error was observed with two measurements per day. This error changes between the dry and wet seasons.

**Sarah Schaller**

***The Effectiveness of Ivermectin in Treatment of COVID-19***

In the summer of 2021, I learned about information being spread through social media describing the cure of COVID-19 using Ivermectin, an antiparasitic. People were posting that a dose of Ivermectin had cured their COVID-19 infections. Shortly after learning this, I noticed a

shortage of Ivermectin when I was ordering some for my work at an equine veterinary practice.

This is when I discovered people had been purchasing tubes of livestock Ivermectin to cure their own infections. People had begun overdosing on Ivermectin resulting in admittance to the hospital before this craze began to die down. I find this topic interesting on multiple levels, but what I mostly wanted to know was whether there was any truth to these claims. Recently, I came across a study done by Steven Chee Loon Lim, et al, researching the efficacy of Ivermectin in the treatment of mild to moderate COVID-19 cases. This study was conducted between May and October of 2021 in Malaysia. The study enrolled patients 50 year and older with a diagnosed COVID-19 infection and a ratio of 1:1 randomized patients. One group received standard care, the other standard care with the addition of Ivermectin. In a summary of results, there was no significant difference between the two groups when it came to prevention of the escalation to a severe COVID-19 infection. This is the information I will be presenting on.

**Jesus Arias**

***Telomere Length and Human Longevity***

Thanks to scientific breakthroughs and medical developments, the life expectancy of humans has almost doubled in the last two centuries. While an extraordinary feat, the question remains: has human longevity forever reached its cap? A study conducted circa 2016 examined biological markers to test their correlation to longevity. Specifically, they examined the end cap sections of chromosomes known as telomeres, which, over time, degenerate until eventually the cell is incapable of dividing. These researchers took samples of DNA from red blood cells in a variety of individuals. The aim was to test for the difference in telomere length amongst different variables. The length was measured in terms of base pairs. One (kb) accounted for 1,000 A-T or C-G pairs. The first test examined what role age had on telomere length. For reference, humans begin with a 13kb telomere length. The experiment concluded that the probability of death increased as telomere length reached 5 (kb). This research helped to link telomere length and longevity. In applying this research, theoretically human life can be extended by either reducing the rate at which telomeres degrade. However, finding a way to regenerate degraded or damaged cells and DNA's could prove more effective in extending human longevity.

**Anna Galaeva**

***Characterizing Liposomal pH Dependence of Benzoic and Salicylic Acids and Subsequent Membrane Interactions***

**Faculty Guide: *Debbie Crans, Chemistry***

The interactions of benzoic and salicylic acids with liposomes were characterized to understand molecular interactions of the two acids with the membrane. The liposomal system was made of

soy 1- $\alpha$ -phosphatidylcholine (SPC) bilayers that allowed the determination of molecular interactions and potential positions within the membrane using  $^1\text{H}$  NMR. Benzoic and salicylic acids were both found to penetrate the membrane interface deeper when in their protonated forms. Significant broadening of the aromatic peaks demonstrated a pH dependence for both acids. They both penetrated deeper around their pKa. This provides justification for the inhibitory activity of benzoic and salicylic acids in lower pH environments. Also, this shows the next piece in understanding of the uptake of benzoic and salicylic acids in bacteria.

### **Marcelo Espinoza Diaz**

#### ***How High Is Too High?***

The cultivation selectivity for high THC content has altered the potential medicinal effects of Cannabis Sativa. In America the Cannabis Sativa plant is a Schedule I drug, which hinders the research needed to understand the plant. Tetrahydrocannabinol (THC) is the most well known cannabinoid in Cannabis but is only one of many compounds produced by the plant. It is extracted for concentrated use causing adverse effects. Terpenoids, terpenes, and other cannabinoids also responsible for the medicinal effects felt by the user are kept out of research. These compounds used together create an “entourage effect” more effective for patients than the isolate or high concentration of a single cannabinoid. The issue with the current state of cultivation, is the selectivity for high THC content negates opportunities for well rounded medical plants containing genuine therapeutic effects. The Medical Marijuana industry has become less prioritized about patients and more about THC content. I propose to use low THC potency cultivars to breed for higher amounts of previous compounds. I would then use these developed cultivars in comparative testing against cultivars in dispensaries. Testing includes effectiveness, memory retention, and report of long/short term effects. With results lies a need to call for the appropriate legislation of Cannabis within the United States, without it there isn't enough research nor proper regulations to ensure quality cultivation and use of Cannabis.

### **Phoenix Espinoza**

#### ***Pyruvate dehydrogenase E1-alpha subunit deficiency***

#### **Faculty Guide: Dr. Michelle Foster|Health and Human Sciences**

Pyruvate dehydrogenase E1-alpha subunit deficiency (PDHAD) is an X-linked disease characterized by lactic acid build-up within cells due to a lack of the enzyme pyruvate dehydrogenase (E1) within the pyruvate dehydrogenase complex (PDC). The PDC is

responsible for the oxidative carboxylation of pyruvate to acetyl-CoA. PDHAD inhibits acetyl-CoA production, ultimately reducing the amount of ATP available for cellular processes. To meet cellular energy demands, alternative mechanisms of ATP production take place, increasing lactic acid production within cells. This results in lactic acidosis which decreases kidney and liver function, produces Kussmaul breathing, muscle cramping and fatigue, indigestion, and polyuria. Diminished ATP production may result in poor feeding, growth retardation, hypotonia, ataxia, poor coordination, partial or complete loss of motor milestones, difficulty or inability to walk, dystonia, seizures, brain lesions, underdevelopment of the corpus callosum, and atrophy of the cerebral cortex. The resulting abnormal brain structures may cause developmental delay and intellectual disability. PDHAD is caused by mutation of the PDHA1 gene existing on chromosome Xp22.12. PDHAD is autosomal recessive, although skewed towards mutation. PDHAD treatment includes dietary supplementation with lipoic acid, carnitine, and thiamine which help to stimulate the production of E1. While the prognosis of PDHAD is poor, further research may improve disease outcomes.

### **Afra Bushara**

#### ***Micro-Interactions: how microbes in soil react to global warming***

As global warming continues to affect the Earth's climate, I have become interested in examining the complex reactions of microorganisms to increased temperatures. A study conducted by Jinbo Xiong, Huaibo Sun, Fei Peng, and colleagues focuses on how warming disturbs bacterial ecosystem structures in soil, holding importance in understanding fluctuations of amounts of greenhouse gasses released by these microorganisms. To test how warming affects bacterial community structure, three plots of land were warmed using either ambient light, and an increase of 1°C and 2°C in artificial light respectively, for 15 months. During this time, the makeup and interactions between bacterial ecosystems changed drastically. Data was collected on pH levels using a pH probe; data on microorganisms was obtained by collecting 0.5 grams of wet soil and extracting DNA using a FASTDNA kit. The DNA was purified and ran through gel electrophoresis where the bands were extracted using an Agarose Gel DNA Purification Kit. That DNA was then quantified, and PCR and pyrosequencing were used to process data. These researchers were able to identify changes in types of bacteria present in soil after the experiment. Bacterial community structure differed between ambient/natural light soil, 1°C artificial light soil, and 2°C artificial light soil, but the amount of diversity did not change. Additionally, some taxa seemed to have dependence on each other, affecting the type of bacterium in soil composition.

### **Ian Park**

#### ***Optimization of the Air Separation Unit using Aspen Plus***

Air Separation Unit (ASU) is a facility that separates oxygen from the atmospheric air. The manufactured oxygen can be utilized in various types of chemical processes, including hydrogen production. To develop a feasible model of ASU that produces high-concentration oxygen, this study utilizes Aspen Plus and the relevant literatures to optimize the ASU operation.

The designed Aspen Plus model is a double-column unit with a feed entering the high-pressure column (HPC) and its distillate entering the low-pressure column (LPC). The feed is the cryogenic atmospheric air. The products are a gaseous oxygen stream (GOX) and a nitrogen-rich gas mixture (GAN).

The optimization of the ASU was investigated by testing varying inputs into the double-column unit. The manipulated variables included the operating pressures, feed locations, and numbers of stages of the columns. The values were considered optimized if the GOX concentration was greater than 99.9%.

The results indicate that the HPC number of stages ( $n=10$ ) must be lower than LPC ( $n=30$ ) to optimize oxygen concentration. The HPC reflux ratio ( $R=0.75$ ) is lower than the LPC ( $R=3$ ). And the HPC has a higher distillate rate ( $950\text{kmol/h}$ ) than the LPC ( $900\text{kmol/h}$ ). Overall, these optimization process produced GOX with a concentration of 0.999957.

The study provides a generalized model of the ASU and its optimal conditions for oxygen production. This model and data can be further utilized to develop a more complex ASU prototype.

**Santiago Pinedo**

***Biotypic Differences in Bacteria of Russian Wheat Aphid Honeydew and Their Effects on Barley***

**Faculty Guide: Jan Leach, Agricultural Biology**

Wheat and barley make up a large portion of human diets globally and are vital in feeding a growing population. The Russian wheat aphid (RWA) feeds on these crops, and infestations lead to severe yield loss. To prevent this, resistance genes were incorporated into plants. One gene prevented RWA1 (biotype 1) from feeding, but eventually, a new aphid biotype, RWA2 (biotype 2), evolved that can feed on the plants. The biotypes are genetically identical, leaving

the question “what allows RWA2 to feed on previously resistant plants?”. We hypothesize that bacteria in aphid honeydew (HD, excrement) may help RWA overcome plant resistance. To test this, bacteria were isolated from collected HD of both biotypes (RWA1: 27 cfu/HD droplet, RWA2: 30 cfu/HD droplet). Colony PCR was performed to amplify DNA in the 16s rRNA region of the isolated bacteria, and the amplicons were sequenced. Of the HD-associated bacteria sequenced, 94% of the isolates grouped to members in the genus *Staphylococcus*. We are currently introducing each of the HD-associated bacteria into barley to determine their effect on plant phenotype. Future studies will determine the role of HD-associated bacteria in plant defense against aphid feeding. Characterizing the microbial communities in RWA will inform us on how interactions with bacteria may affect aphid virulence, and ultimately lead to more sustainable methods to prevent aphid infestation of crops, a step towards improving the stability of global food sources.

**Maya Lee & Emma Boviard**

***The Impact of Cow's Milk on Human Health and Growth***

Cow's milk is quite a complex mixture, containing many essential nutrients which have various impacts on human health. This makes it difficult to weigh the benefits and concerns (related to hormones) of the consumption of cow's milk. We analyzed an academic article that shares the conclusions of multiple studies to then consider the impact of cow's milk consumption on several aspects of human health, including growth and risk of disease. We focused on the potential impacts of milk's nutritional components, and whether the benefits of cow's milk consumption outweigh the drawbacks, which would cause it to be valuable in regions rife with malnutrition. Researchers determined that cow's milk, while being a rich source of key macronutrients, does contain some risk of disease. Further research into the long term effects of milk consumption is necessary to reach a justifiable conclusion as to whether the short term health benefits significantly outweigh the later life risks caused by milk consumption.

**Laura Moore**

***The role of litter chemistry on soil organic matter formation***

Soil organic matter (SOM) is the largest store of carbon (C) in terrestrial ecosystems. Therefore, SOM formation dynamics and persistence must be understood to manage soils more effectively for C storage and climate change mitigation. Plant litter chemistry is recognized as a critical control for SOM formation into mineral-associated organic matter (MAOM) and particulate organic matter (POM); however, comprehensive testing of these mechanisms is needed. Isotopically labeled plant litter was tracked into soils over a 3-year incubation. This analysis represents the final 3-year harvest of the experiment, building off previous 1-year incubation

results, which show that more labile litters contributed more to MAOM. After 3 years of incubation, I hypothesize that we will see more POM formation from recalcitrant plant litters, which will ultimately contribute to more soil C. Additionally, I hypothesize that grass litter will decompose faster and result in relatively higher MAOM formation earlier in the decomposition process. This experiment will help to better understand the mechanisms of SOM formation and persistence.

### **Rebekah Barry**

#### ***Integrating Critical Thinking Skills into the First-Year Chemistry Seminar***

Our hypothesis was: does the first-year chemistry seminar prepare students for future chemistry classes and careers. Our goal through our research was to find out if the students surveyed felt they had gained the skills needed to be successful. The specific topic focused on in this section was critical thinking in chemistry. What is this project's significance though? This project is important to future teachers/future employers. If their employees do not have the necessary skills to work in the chemistry field, then the classes they took were not beneficial to them. To gauge whether or not the students developed their skills in the class, we did three things; we researched three different sources for our individual topics. Then, we put together a survey and had the students take the survey at the end of their semester. We put our findings in poster-form, they show the steps we took as well as the final results. Our results showed that the students were able to acquire the necessary skills for chemistry and critical thinking. About 51% of students had responded that they were able to apply their skills to the real world/community events that were happening. The results clearly showed us that the seminar class for first-year chemistry is beneficial and develops the necessary skills needed for future careers/classes. The articles found early-on will continue to support our findings and show that the development of critical thinking skills is stable.

# MURALS

## SOCIAL SCIENCES & HUMANITIES ABSTRACTS



2018 Winners: Augusta Irechukwa, Juri Moore, Jayla Hodge, Zelle Moore

2019 1st Place: Augusta Irechukwa

2021 1st Place: Sage Mednansky

**if Butter Doesn't Kill You, Settler Colonialism Will**  
Sage Mednansky  
Colorado State University

**BACKGROUND: Land is Context**  
What does it mean to offer butter to a society which chooses to devour you, your body, and your land?  
On the verge of their 100-year anniversary, Land O' Lakes addresses "Mix the Butter Misdemeanor" (Butter Misdemeanor) from its packaging without explanation, leaving an empty space where the name "land" and "butter" are "homesteaded."  
[Link]

**ANALYSIS: Contort Misdemeanors & Princesses**  
I argue that Land O' Lakes' rein lighting, conventionalized, and more iterations of the Butter Misdemeanor narrations work to obscure about and violence treatment of Indigenous peoples and nations. The packaging discourse is one of one to viewers reflect on the colonial, white supremacist, heteropatriarchal violence perpetrated against Indigenous nations.  
  
[Link]

**DISCUSSION: Taking Butter, Land, & Lives**  
Like settlers who violently offset and removed Indigenous peoples and nations from their territories, the former owned company Land O' Lakes stole the Butter Misdemeanor and kept their land.  
Because traditional images shape ideas, the composition of Mix the Butter Misdemeanor on the Land O' Lakes packaging conveys stereotypes of who and what an Indigenous woman is, submissive, controllable, and naive colonial.  
[Link]

**METHODS: Reality Through Language**  
My critique emerges from an Indigenous, queer, Two-Spirit standpoint inspired by decolonial, Indigenous, feminisms, epistemologies, and seeks to attend to the ways' discourse, strategies produced through it, shape our understanding of reality and the actions performed from this understanding.  
**Data**  
- Land O' Lakes Packaging (2010s-present)  
**Method**  
- Performed a discourse analysis  
- Devised heuristic and analytical methods of visual rhetoric with (de)colonial and Indigenous  
[Link]

**CONTINUING MOTION: Re-Presence, Re-Imagine**  
Indigenous peoples are not obsolete, extinct, or silent. Indigenous peoples and nations are still here asserting their voice against erasing and/or narratives of displacement and victory.  
Land O' Lakes should issue a statement regarding the erasure of Mix the Butter Misdemeanor.  
- Revising local and visual imagery of official corporate advertisements, explicitly, in violence against Indigenous women.  
[Link]

[NARRATION] [POSTER] [REFERENCES] [CONTACT/ABOUT] [PRINT] [GET POSTER]

**Axel Sandoval Bravo**

***From Redlining to Gentrification. Will I Have A Place to Live?***

Rising costs of living and wages that have not kept pace with inflation, have caused many to struggle to afford housing. Studying the history of redlining and the new wave of gentrification can help us understand how patterns of displacement and socio-economic inequality of minorities can be countered.

I will aim to answer: What resources did minority communities lack that prevented their neighborhoods from flourishing? What steps need to be taken to prevent more people from being displaced? How can we make housing affordable?

These patterns of inequality are felt across the country but I will be looking closely at affected neighborhoods in Denver such as Elyria-Swansea, Globeville, Five Points, and Westwood. These neighborhoods have been greatly affected by redlining and now are being gentrified. The strategic location of Globeville and Five Points have made many incoming wealthier house-buyers to raise housing prices and displace the minority communities in them. It is important to find a solution for the people already living in these communities and provide an alternative for new residents.

For my research project, I will study the history of why these neighborhoods were redlined and how it stalled their growth. Then, I will study how gentrification is currently occurring and how people are reacting to the new wave of residents. Finally, I will research solutions to remedy current issues. This way, I will be able to open dialogue on how communities can overcome these contemporary challenges.

So far, I have learned that redlining targeted minority communities. Redlining policies prevented them from investing in their properties and caused further economic inequalities. Because these neighborhoods are comparatively more affordable, new, wealthier, and often white residents invest in these neighborhoods and drive out the current residents because they can no longer afford living there. A way to remedy gentrification and housing shortages is to change zoning laws from single family houses to apartments, duplexes, or townhomes. Neighborhoods can also create community pool investments.

I aspire to learn more and be able to bring awareness to this issue affecting many today.

**Mihika Sodani, Treasure Morgan, Anh Bui, Nichole Sinaloa Acosta, Jacob Leavitt, Luna Li, Grace Kirk, Shaza Mohamed, Maliek Swain & Rayne Veazey**

***Bridging The Divide: assessing racism-related stress and counseling services***

**Faculty Guide: *Stephanie Moreira/SLICE***

The impact of racism-related stress is qualitatively understood; however, the field needs a quantitative perspective, and our project aims to rectify this. To this end, we designed a two-part project focusing on the racism-related stress that students experience at CSU. The first part will concentrate on collecting quantitative and qualitative data. We will track students' physiological responses to stress via a wearable device, and they will journal about any moments of racism-related stress that occur throughout one week. The participants will be placed into four groups with ten students in each group: non-STEMM students of colour, STEMM students of colour, non-STEMM white students, and STEMM white students. The quantitative and qualitative data will be analyzed for statistical significance individually and collectively. The second part will focus on analyzing the effectiveness of existing counselling-related services at CSU. This will be accomplished with a student-focused survey exploring the success of counselling-related services in helping students cope with stress, which will be indicated by high student satisfaction. If our research finds that students of colour are disproportionately affected by racism on campus, we propose refining counselling-related services as a solution to combat this problem. If not, we plan to examine the counselling-related services to see what contributions are doing well in assisting students of colour.

**Akilah Martin**

***PTSD in the Black Community: It Is Really That Serious***

**Faculty Guide: *Ray Black, Ethnic Studies department***

Mental illnesses like post-traumatic stress disorder (PTSD) exist with signs like disturbing thoughts, recurring nightmares and intense emotions in the African American community. PTSD occurs in the prefrontal cortex of the brain and arises from experiencing a traumatic event such as a serious car accident, rape, witnessing death, etc., (American Psychiatric Association, 2020). Within the African American community, there is an increase in traumatic events such as police brutality, racial violence, and hate crimes (Nix et al., 2021). African Americans have an 8.7% chance of being diagnosed with PTSD over their lifetime and 58% of African Americans diagnosed with PTSD do not get help (Benítez et al., 2014). With this prevalence I want African Americans to recognize the enormity of the issue in order for those who have been affected to get help. My poster project stemmed from my identity as an African American woman and my curiosities of the brain. Mental illnesses always intrigued me due to its prevalence within my life. I witnessed family members with PTSD become estranged and alienated from everyone and I always wondered, "what happened?" Understanding the disconnect and triggers of the brain is what captured my attention because one disconnect can affect someone's entire identity. My project brings awareness to the stigma behind mental health in the African American community.

**Sarai Gonzalez:**

***Cattle'inn Around CO.***

Through my research, I developed a series of events in which I portray the life of a young man that currently lives in a Feedlot facility that is owned by a very successful fellow CSU alumni of the College of Agriculture. Through this young man's experience and time living in the feedlot, he has taught me how a feedlot works. Today I am here to represent him and how his life has evolved from living in a feedlot. My purpose is to provide unknown individuals with information about livestock feeding. There is little information regarding livestock feeding and the people behind it who run it. I got to analyze how feedlots impact the beef production industry. The feedlot used to describe this research is called Horton Feedlot and it is located at 15972 Co Rd 51, La Salle, CO 80645. The owner was Dallas Horton and he recently passed away in September of 2020. Horton attended CSU on an internship in 1966. After 7 years at CSU working in the Vet School, teaching courses, earning a Master's Degree in Animal Nutrition. Dallas launched the dream of his own business of feeding cattle, veterinary consulting for the cattle industry, researching feed additives and medicines for cattle, and improving the overall performance of cattle production through nutrition and genetic improvement. Thus, Horton Feedlots and Research Center was established in Wellington, CO in 1978. From there Dallas expanded the Horton feeding operation to the Greeley area.

**Jessica Sherwood**

***The Seven Bridges of Konigsburg: What it Teaches Us About Persistence***

The Seven Bridges of Konigsburg is a simple brain teaser in which the goal is to cross all seven bridges in one continuous journey while only going over each bridge once. It seems simple, but it's actually impossible! No matter where you start or end, there will always be at least one bridge that you cannot cross.

We asked random students on CSU's campus to attempt the puzzle. Some were told that the puzzle may be impossible, some were told that there was a solution, and some were told nothing. We secretly timed how long the students decided to persist on the puzzle before giving up. We hypothesized that the students who were told that there was a solution would persist much longer than those who were told it was impossible, with those told nothing averaging in the middle.

Our results concluded exactly that. Those that were told that the puzzle was possible persisted an average of 13 minutes, while those that were told nothing or told that it was impossible only persisted an average of 4 minutes and 2 minutes respectively.

This data supports that our thoughts greatly impact how we approach a challenge. Simply coming in with the mindset that there is a solution makes people persist much longer on an equally challenging puzzle. Therefore, the lesson learned here is to believe in success against life's challenges, and you will automatically set yourself up to persist longer and try harder!

**April Gonzalez**

***¿Son solo nervios? Cultural challenges and barriers for Latinx communities regarding mental health***

Despite progress in recent years regarding education and awareness, many diverse communities such as the Latinx community underutilize Mental health resources. The lack of usage of mental health services consequently results in many Latinx people being undiagnosed, thus adding further challenges to already a struggling minority. Therefore, now more than ever in reflection of the increasing amount of immigration, there is a need to address cultural challenges and barriers within the Latinx community in order to plan accordingly to create and foster positive Mental health care culture. In order to accomplish this goal, this project will focus on investigating and identifying cultural challenges and barriers within the CSU Latinx community specifically through surveys and questionnaires. Once results are collected, this project will identify the biggest factors and cultivate a plan of action that addresses the main issues and can be implemented in order to raise awareness of the importance of mental health and education.

**Perla Hurtado Flores**

***Undocumented in COVID's America***

Being undocumented in present-day America has been a bitter challenge for many communities. Aside from the political sphere of scapegoating and the inability to vote, the current pandemic circulating worldwide has left many families looking for a way out. Many undocumented communities are unable to receive government assistance in forms of welfare, Medicaid, and recent stimulus payments. Undocumented people are also more likely to remain in the lowest economic bracket, in which other factors such as child care became a vivid and difficult reality as parents tried to balance virtual learning and work. Many individuals' further fears of deportation and incarceration have detained them from receiving medical services related to COVID-19 treatment. Moreover, conditions in a person are further affected if they become ill from the virus, as undocumented people receive no Medicare/Medicaid or are unable to pay for privatized insurance. For this project, I will identify the factors from a sociological standpoint and theoretical frameworks to help identify solutions to this complexity of an issue. The reality is that subjects such as immigration can be difficult to solve, however, at our local level we are able to pinpoint these struggles to help students at our university receive the proper care while understanding the necessity of their situation. Surveys, interviews, and stated projections will be inferences to understand correlations and possible causations of given situations. These positionalities will be reported, and possible programming for offices at CSU will help adjust to our current state.

**Ty'Jae Herron**

## ***Inclusive and Queered Biology***

### **Faculty Guide: *Aramati Casper, Department of Biology, Civil and Environmental Engineering Department***

Our research team's goal was to teach and analyze data related to gender essentialism, the idea that men and women are different according to their biology, and how it is harmful to the queer community and biology. It fails to acknowledge the difference between sex, gender, and their spectrums.

Students were asked to answer a series of questions related to gender essentialism and its consequences. We analyzed students' responses to an open-ended response question on their unit quiz: "what is one example of gender essentialism, and why is it harmful?" The data was analyzed (n=178) through qualitative content analysis using the master narrative theory as an analytic and interpretive lens.

We found responses fit four main themes: 1) oppression/limitations due to expected gender roles, 2) biological sex as determining gender, 3) gender essentialism limits how we understand other organisms, and 4) science as a rationale for gender essentialism. The discussion of oppression/limitations due to expected gender roles included the discussion of excluding people with transgender and non-binary gender identities.

These findings will be used for future research because we can hopefully find a way to remove this way of thinking from biology as well as society. Students were receptive to this information, providing evidence to help other biology instructors integrate this into their courses. This indicates that the students were successful in engaging with the assignment, learning about gender essentialism, and meeting the learning objectives, providing research-based evidence for the continued use of this and similar assignments.

## ***Greek Counsel: Connecting Greek Membership to Mental Health***

### ***Resources***

**Faculty Guide: *Dr. Ryan Barone|Office of Student Success and Natalie Padrón|Office of Fraternity and Sorority Life***

The goal of this work is to find the correlation between membership in a fraternity or sorority and the use of mental health resources, such as therapy. Additionally, the project aims to see if the type of Greek organization determines the likelihood of mental health resource use. In other words, do members of a cultural organization, for example, use mental health resources more than members of social organizations.

An anonymous survey of 18 questions was sent to the leadership of the 5 Greek Councils at Colorado State University. Questions focused on organizational type and involvement, personal identity, and use of mental health resources. In the survey, participants were asked to indicate if they had or currently use a professional therapist, if they use therapy at the CSU Health Center, and to indicate how likely they would be to go to therapy on their own.

Additionally, participants were asked if they felt that there are any stigmas for someone with their identity around using therapy.

As the results came in, a number of trends became apparent. Straight, white men in a social fraternity on the Interfraternity Council (IFC) were the least likely to want to go to therapy, whereas women in sororities across the Multi-cultural Greek Council were the most likely to use therapy. Additionally, the members of social IFC fraternities were the most likely to say societal stigmas were the main reason they had not already sought therapy.

**Tianna Weiland**

### ***COVID-19 Racial and Ethnic Disparities***

**Faculty Assistance: *Michelle Foster, College of Health and Human Sciences***

COVID-19 has had an extensive impact on the American people since the pandemic began in 2020. Since then, the CDC has compiled data organizing COVID-19 cases by various demographics. By analyzing multiple CDC data charts in addition to raw COVID-19 data, all separated by race and ethnicity, the disparities present are able to be observed. By looking at age-corrected data, the white population was found to have the highest infection rate, while the Black population was found to have the highest hospitalization rate, and the Hispanic population has the highest death rate. These results display the health disparities present between races and ethnicities in the United States, bringing up important sociological concerns. Through an analysis of the raw data, separated by race/ethnicity and the presence of underlying conditions, it was concluded that the disparities are not due to biological factors, but rather to various social factors present in American society that need addressing. Some of these factors include, but are not limited to, access to healthcare, immigration status, language barriers, and region. By acknowledging the disparities in COVID-19 cases, hospitalizations, and deaths, and investigating the reasoning behind the discrepancies, health disparities can be reduced, hopefully leading to health equity in the future.

**Hannah Gilliard**

### ***Childhood Cancer Survivors and Psychological Outcomes: A literature review***

**Faculty Guide: *Dr. Neomi Vin-Raviv, Social Work***

The purpose of this review is to explore and focus on psychological outcomes among survivors of childhood cancer survivors.

The diagnosis, treatment, and medical late effects of childhood cancer may alter the psychosocial trajectory of survivors across their life course. This young age may place them at increased risk for psychological impairment due to the disruption of normal psychosocial development by intensive cancer treatment. The diagnosis and treatment of childhood cancer may impair the psychosocial development as some childhood cancer survivors (CCS) have been shown to be hindered in their development. This literature review focuses on mental health symptoms, achievement of social milestones, socioeconomic attainment, and risky health behaviors in survivors of childhood cancer. Long-term psychological impairment in CCS is not well characterized because, until recently, many succumbed to their disease. Studies used in this review were retrieved from PubMed database and included electronic content of professional journals. The following search terms were used: "childhood cancer survivor" AND "anxiety "OR "risky health behaviors" OR "posttraumatic stress". Search held on Colorado State University database. Overall, four studies were reviewed addressing psychological outcomes among CCS. One study served as background review on the subject. While one study examined the risk of post-traumatic stress symptoms, and two studies examined the risk of suicides among childhood cancer survivors. Childhood cancer survivors appear to have an increased risk for behavior-related causes of death. Health care providers who work with CCS should be aware and provide opportunities for preventive interventions among survivors of childhood cancer.

### **Rebeca Workineh**

#### **Faculty Guide: Beth Wittmann, Biology department**

The burden of mental health struggles affects an individual's quality of life, perception, relationships, and more. According to the National Alliance of Mental Illness, 1 out of 6 children from ages 6 through 17 experience a mental health disorder every year, of those estimated 7.7 million children half go without treatment. Various resources and outreach programs are present, but not in comparable proportions throughout America. Racial and ethnic minorities are habitually excluded from health care resources in comparison to predominantly white spaces. Current studies affirm that social positioning contributes to the proximal and distal stressors affecting mental health. Psychologists, psychiatrists, and health care workers alike are on the frontline of the crisis, but has their education prepared them for the cultural differences contributing to the mental health crisis experienced by ethnic and racial minorities? As the field of medicine strives to address the mental health crisis, the fundamental cultural competency taught in medical schools needs to be evaluated. This literature review aims to review the cultural competency and the magnitude of its effect on medical professionals and their profession. Furthermore, propose solutions on how to improve cultural competency in medical schools.

### **Raegan Gant**

#### ***Affects of Gender Essentialism in Biology Courses***

Gender has been seen as a binary for many years: we think in terms of men and women. This binary way of thinking has made it into STEM; we often disregard the queer-spectrum (anyone

identifying LGBTQ+). To counter this heteronormativity in STEM we analyzed how students in an introductory biology class responded to course materials that taught about how students responded to an open-ended response question on their unit quiz.: “what is one example of gender essentialism, and why is it harmful?” Our team analyzed student responses (n=178) through qualitative content analysis using the master narrative theory as an analytic and interpretive lens. Our themes were: oppression or other limitations due to expected gender roles, biological sex used to determine gender, how gender essentialism limits our understanding of other organisms, and how science is used as a rationale for gender essentialism. We found that the most responses fit into the “oppression or other limitations due to expected gender roles” category with the key findings in student responses being “exclusion of non-cisgendered individuals” and “stereotypes”. Through this we can gather that most of the students believe that gender essentialism is caused by societal stereotypes. We can also infer that students were receptive of this information: due to the non-hostility of their responses. This research is also a stepping stone for further research to help improve future biology classes.

**Peyton Meyer, Aidan Lyde, Ryan Murray, Madelin Risch & Grace Tiberi**

***Mapping Museums: A Spatial Analysis of the Gregory Allcar Museum of Art at Colorado State University***

**Faculty Guide: Meagan Todd, International Studies**

The goal of this project is to identify parts of the world that are represented in the Gregory Allcar Museum of Art at Colorado State University. Museums are powerful institutions for identity formation. As international studies students, we believe it is important to be mindful of bias in art consumption and to have exposure to a variety of perspectives. Thus we felt it was important to understand how the museum provides accessibility to international art for the community. Due to the museum’s location within a predominantly white community where indigenous cultures have historically been repressed, we hypothesized that a majority of the works featured in the museum would originate from Western cultures. To answer our research questions, our project consisted of statistical analysis and mapping techniques in order to visually display the data collected. Our findings show that the museum’s artworks originate from a variety of different countries, particularly in Africa, North America, and Europe. However, our findings also revealed a notable lack of representation from South and Central America, the Middle East, and Asia. We hope that by highlighting the geographical origins of art in the museum, patrons will have more awareness of the scope of cultural representation and will be encouraged to think critically about how this affects their interpretation of global artwork. Lastly, we hope to draw attention to the importance of cultural representation in art education.

**Melody Weber**

***Marginalization in Medicine: How Discrimination Hinders The Ability to 'Do No Harm'***

Previous research posits that racism, sexism, homophobia, and other forms of oppression permeate the medical field on structural and individual levels, subjecting marginalized patients and health care workers alike to subhuman treatment. This treatment manifests through

conspicuous disparities in access to and quality of healthcare for patients entering the medical sphere. Regarding those who operate within it, healthcare workers are faced with disparities in representation, especially as one progresses up the hierarchy of leadership, in addition to facing perpetual risk of being discriminated against by both colleagues exhibiting prejudice and potential incoming sources of prejudice: patients. All marginalized peoples within and outside the realm of medicine are subjugated at the unjust hands of bigotry and this treatment is correlated to heightened levels of mental distress and/or disorder and lower social mobility. Medicine is often regarded as a pillar of reason and knowledge given its supposed total allegiance to scientific principles but the concurrent presence of utterly illogical, discriminatory beliefs and according behaviors that infiltrate its plane nullifies such a proposition. This research explores the existence of marginalization in medicine and offers solutions for contending it through which equity for all is attainable

**Natalia Estevez**

***Reducing Racial Inequalities in Healthcare Systems in the United States: A Literature Review***

This project will review the literature regarding systemic racism in healthcare systems, with the aim to synthesize current knowledge on the multiple levels of systemic racism: interpersonal,

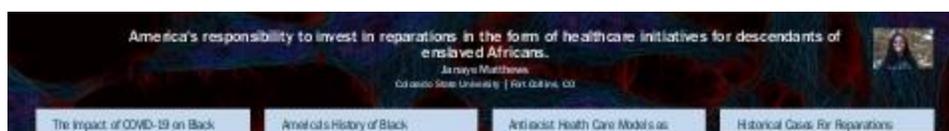
community, and institutional; how they intersect one another, and offer strategies to reduce racial inequalities in healthcare systems.

To reduce racial inequities in healthcare systems, several strategies are recommended: (1) at the interpersonal level: teaching healthcare workers how to recognize and mitigate unconscious biases, (2) at the community level: expanding community resources and increasing access to preventive health services, and (3) at the policy level: reforming federal and institutional policies to better support safety-net hospitals.



MULTICULTURAL UNDERGRADUATE RESEARCH  
ART AND LEADERSHIP SYMPOSIUM

## Innovation and Entrepreneurship



## 2021: MURALS OVERALL WINNER: Janaye Matthews

### **Karinganire Umutesi**

#### ***Advofugee ( Advocacy for refugee)***

There is a problem, a global issue impacting more than half of the world population, and that problem is the refugee crisis. Not only do we not have a method of solving it, but many of us who are not affected by it tend to neglect it. For my research project, I'll be focusing on the continent of Africa. In the Great Lakes region of East Africa lies a small nation of Rwanda. Many in the West know about Rwanda due to the infamous genocide in 1994 against the Abatutsi. On the other hand, other Africans know about Rwanda because of president Paul Kagame. For the research project, I will be discussing a different Rwanda, one hosting numerous refugees from across the continent. Although the country of Rwanda is small in size, it hosts several refugee camps within it. Due to the genocide, Rwanda now hosts Congolese refugees in more than two camps, including Burundian refugees, Libya, and Somalis located in the country as well. Life in the refugee camps is rough, especially for people who have lived in the camps for several decades now. For example, in the western province of Rwanda, in the district of Karongi is what you would call a veterans refugee camp. Kiziba refugee camp was the first refugee settlement created in Rwanda after the genocide. Like many other large refugee settlements that receive foreign aid, Kiziba refugee camp has houses, hospitals, schools, churches, and food markets. All that sounds nice, and it is, it is thanks to the Rwandan government and foreign aid like UNHCR( The United Nations High Commissioner for Refugees) who brought all those support

to the camp. But as many of us know, Kiziba camp is still a refugee settlement. The people of the camp experience hunger, lack of education, lack of proper health, and overall, the lack of resources. One Issue that I want to focus on is the unemployment problem within the refugee camps all around the country. The lack of well-paying jobs within the refugee camp is prevalent for many refugees. Even though refugees are allowed to work outside of the refugee camp in Rwanda, finding well-paying jobs that refugees are qualified for is difficult. That is why many people, specifically the older generation depend on aid from the government of Rwanda and foreign assistance. Sometimes aids run out, which puts many families in debt from the support of other refugees in the camp. Solutions to the problems refugees face exist. All it takes is the support of others to make them happen. One of the issues many young people face in refugee camps is not finishing school, many students drop out of school to help their struggling families. By supporting those students to continue school, those students would have a higher chance of getting better jobs. Another solution to improve life in the refugee camp is providing financial support. Many refugees have ideas without resources. The idea never sees the light of day. Overall, there are so many things we can do to support the refugees of Rwanda, all we are missing is people to take the first steps to solve these issues, not just in Rwanda, but around the world.

**Sabina Gebru**

***The Paradox of the Soul - Intersectionality Between Time Space Continuum and Mental Health***

I will use string theory concepts to explain how we might already be time traveling, and how the time space continuum model explains a framework for how to treat mental illnesses based on negative or traumatic reinforcement.

**Bryce Barsnick & Tyler Jacobsen**

***Crosslinked Components - Dirtbike Swingarm Protection***

Hard enduro, a fairly new genre of dirt biking coming from Europe, stands as one of the most brutal forms of dirt bike racing currently available, and pushes the limit of the rider as well as the machine. Hard Enduro racing is such a new development, especially in the United States, that proper equipment has not been fully developed to hold up to the extreme terrain that is experienced when racing hard enduro. With this in mind, a large market for dirt bike protection components has emerged.

One of the most vulnerable components on a dirt bike is the swingarm. The swingarm is a rigid piece of aluminum which connects the rear wheel to the frame and acts as a suspension component for the motorcycle. Because it is located so close to the ground, the swingarm often makes contact with rocks, roots, and other features on the trail. In the case of hard enduro, rock strikes are often unavoidable, and significant damage to the swingarm is almost guaranteed.

The swingarm guards that are currently on the market suffer from two main failure mechanisms, stripping and mechanical failure. The first failure mechanism includes the complete loss of the guard as it is removed from the bike by terrain. The second failure mechanism is caused by

repetitive damage while still attached to the bike. This failure mechanism allows damage despite the guard still being in place

At Crosslinked Components we have engineered a vastly improved swingarm guard that will not fall off of rider's bikes and will hold up to the abuse of hard enduro racing. We have accomplished this through a patent pending mounting solution and utilization of an extremely durable outer shell. Our swingarm guards are a premium option for riders looking to fully protect their investment.