2022

2022 Student Research and Creative Works Symposium Program

Eastern Washington University

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DAY ONE: STUDENT CREATIVE WORKS

Tuesday May 10th, 2022

Fine Arts Complex – Art Building

4:30 p.m.	**Welcome & Presenters Check-In Begins:**	*Art Building, Lobby*
4:30 – 7:00 p.m.	**Appetizers and Refreshments:**	*Art Building, Lobby*
4:30 – 7:00 p.m.	**Art and Design Exhibits:**	*Art Building, Gallery & Lobby*
5:20 – 6:00 p.m.	**Music Composition Presentations:**	*Art Building Gallery*

DAY TWO: STUDENT RESEARCH

Wednesday May 11th, 2022

Pence Union Building

8:30 a.m.	**Presenter Check-In Begins**	*PUB Lobby in front of NCR*
8:30 a.m. – 1:00 p.m.	**Information Table**	*PUB Lobby in front of NCR*
9:00 a.m. – 1:00 pm.	**Oral Presentations**	*PUB 3rd Floor*
9:00 a.m. – 12:35 p.m.	**OS1: Biology & Engineering**	*PUB 317*
9:00 a.m.– 11:55 a.m.	**OS2: Social Sciences**	*PUB 319*
9:00 a.m. – 12:15 p.m.	**OS3: Philosophy, Communications, & ESL**	*PUB 321*
9:00 a.m. – 11:55 a.m.	**OS4: English**	*PUB 323*
9:30 a.m. – 11:30 a.m.	**Poster Presentations**	*PUB NCR*

Symposium Sponsors

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PUB: Michelle Schultz

And to Brian Levin-Stankevich and Bill Shaw for keeping the Symposium alive

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For their generous donation and continued support

And Our Highest Thanks:

To all the students, mentors, faculty & volunteers
who have continually worked to make the Symposium a success.

If you would like to contribute to the Symposium Foundation,
envelopes are available in 115A Showalter Hall.
Please make checks payable to EWU Foundation for Student Research & Creative Works Symposium

Symposium Committee:

The mission of the EWU Student Research and Creative Works Symposium is to promote student research, scholarship, and creative activity done in partnership with faculty and staff as a vital component of higher education. Students, faculty, administrators, dignitaries and the community-at-large are invited to attend, hear and discuss undergraduate and graduate creative and scholarly work.

2022 Symposium Committee Chair: Julia Smith

2022 Symposium Committee Members

1. Drew Ayers
2. Sharon Bowland
3. Erin D. Dascher
4. Brian Davenport
5. Cynthia Dukich
6. Greg duMonthier
7. David Early
8. Gail Forsgreen
9. Robert Gerlick
10. N.M. Awlad Hossain
11. Ginelle Hustrulid
12. Bryan James
13. Jonathan Johnson
14. Taylor Kensel
15. Krizstian Magori
16. Jonathan Middleton
17. Ielleen Miller
18. Justin Otto
19. Seth Pickens
20. Chad Pritchard
21. Michelle Schultz
22. Thomas Shaffer
23. Julia Smith
24. Jeffrey Stafford
25. Anna Tresidder
26. Christina Valeo

EWU's Ronald E. McNair Post-Baccalaureate Achievement Program

Fostering Excellence and Inspiring Awesome

As one of eight federally-funded TRiO outreach and student services programs, the goal of the TRiO Ronald E. McNair Post-baccalaureate Achievement Program is to increase the attainment of PhD degrees by students from underrepresented segments of society. Eastern's McNair Program prepares eligible participants for successful doctoral studies by providing opportunities for research or other scholarly activities including summer research internships, tutoring, academic counseling, seminars, and other educational activities designed to assist participants in securing admission to and financial assistance for doctoral enrollment. McNair research interns work closely with a faculty mentor to produce a scholarly research paper and present their findings at a conference.

This research expectation has created an ongoing partnership between McNair and EWU's Symposium, which was first organized in 1997 by EWU chemistry professor Dr. Jeanne Small. The 1997 Undergraduate Research and Creative Works Symposium consisted of 16 total oral presentations (9 were McNair scholars); 12 poster presentations (4 were McNair Scholars) and two musical performances. In 2001, McNair Director Dr. Karen McKinney (now retired) took over coordination with the support of Dr. Ron Dalla (now retired) and the help of a graduate assistant. Dr. McKinney coordinated the event through 2005 in Monroe Hall, by which time the Symposium had grown to 145 presenters. The Symposium was moved to Senior Hall in 2006, and since then the event has grown to become a marquee event on campus. This year we're back after COVID and in the PUB for the first time. Since the first EWU McNair grant was funded in 1995, McNair has worked closely with Eastern faculty to build a research center community where students thrive. Our quest is to continue this partnership with EWU McNair Faculty Mentors, staff, and administrators and continue the transformation of our students.

Since 1995, twenty-seven EWU McNair Scholars have earned doctorates, 137 have earned master's degrees, and 59 are currently enrolled in graduate school. Of those 59 enrolled, 37 are in PhD programs.

STUDENT CREATIVE WORKS SCHEDULE

Tuesday May 10th, 2022

4:30 p.m. – 7:00 p.m.

4:30 p.m.	**Welcome & Presenters Check-In Begins:**	*Art Building Lobby*
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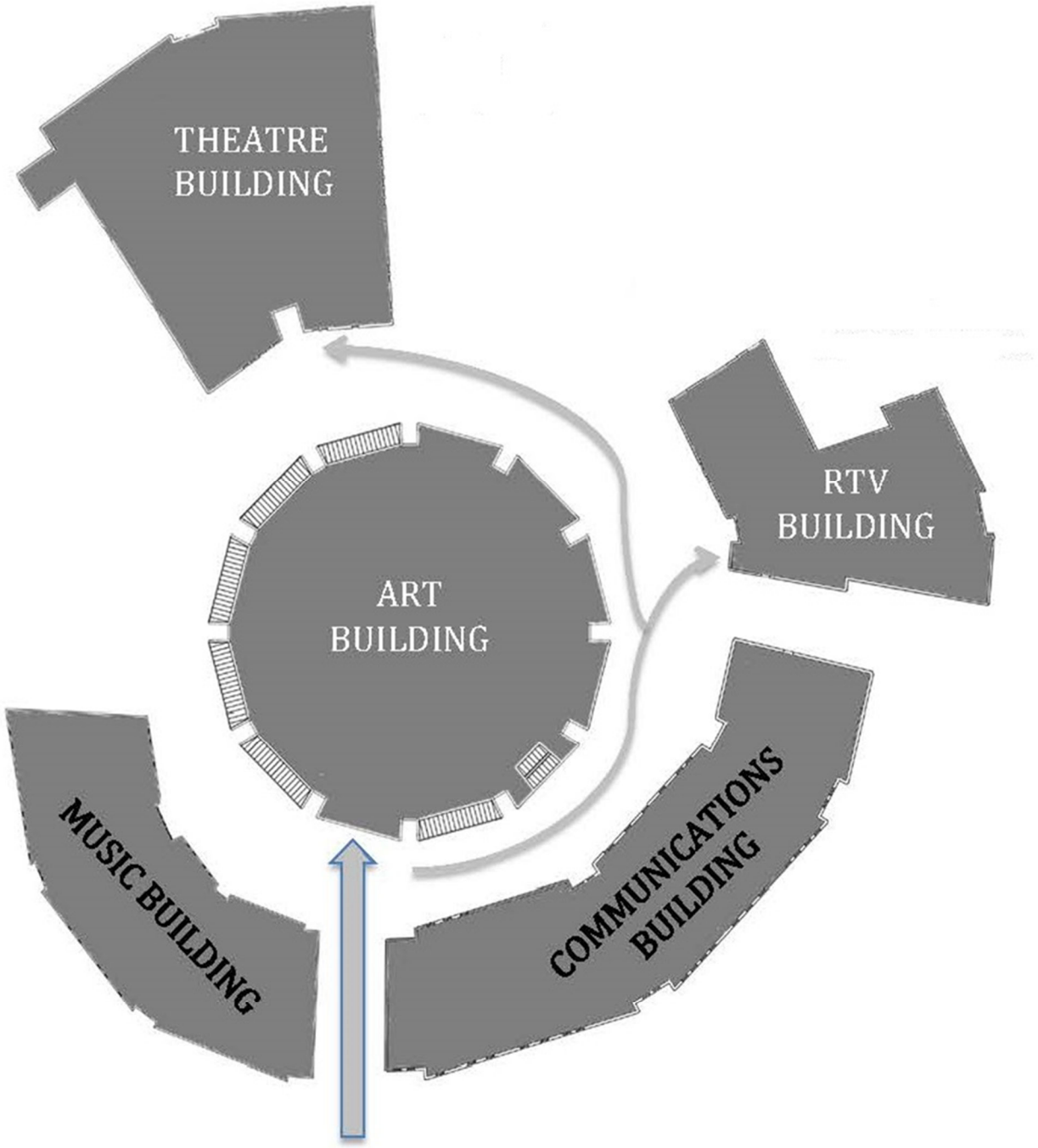
5:20 – 6:00 p.m.	**Music Composition Presentations:**	*Art Building Gallery*

Fine Arts Complex Map



STUDENT RESEARCH

ORAL & POSTER SESSIONS

Wednesday May 11th, 2022
8:30 a.m. – 1:00 p.m.

PUB NCR & 3rd Floor

9:00 a.m. –12:35 p.m.	**OS1: Biology & Engineering**	*PUB 317*
9:00 a.m. –11:55 a.m.	**OS2: Social Sciences**	*PUB 319*
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9:00 a.m. – 11:55 a.m.	**OS4: English**	*PUB 323*
9:30 a.m. – 11:30 a.m.	**Poster Presentations**	*PUB NCR*

Oral Session 1: Biology & Engineering PUB 317

9:00	Bubba Pfeffer (Mentor: Jessica Allen, Jeni Walke) **Comparative population genomics of the powder lichens *Lepraria lanata* and *Lepraria finkii***
9:20	Bryn Tennyson (Mentor: Andrea Castillo) **Does Manuka Honey Induce Antibiotic Resistant Bacterial Persister and Viable but Non-Culturable Subpopulations?**
9:40	Krista Dodd (Mentor: Jenifer Walke) **Analysis of Batrachochytrium dendrobatidis infection spread in Turnbull National Wildlife Refuge using GIS**
10:00	Allison Hayes (Mentor: Jennifer Walke), **The Relationship between Water Microbial Communities and Mosquito Breeding Sites**
10:20	Craig Wells (Mentor: Paul Spruell) **An Examination of Anthropogenic Impacts on Native Salmonid Populations in North Idaho**
10:40	Break
10:55	Lilijanna Cummings (Mentor: Jason Ashley) **Sexually-divergent differentiation and inflammatory response of osteoclast precursors**
11:15	Kristy Snyder (Mentor: Rebecca Brown) **The functional role of annual seeds and biochar in prairie restoration**
11:35	Dana Colley (Mentor: Krisztian Magori) **Investigating how bat ectoparasites influence the skin microbiome diversity and composition of Washington State bats**
11:55	Thomas Hudon, Vadim Levchenko (Mentor: Heechang Bae, Awlad Hossain, Matthew Michelis) **Analyzing the effects of Acetone Vapor surface treatment on the fatigue life of 3D printed ABS components**
12:15	Collin Hendricks (Mentor: Paul Spruell) **Estimating the Relative Production of Migratory Westslope Cutthroat Trout in Tributaries to the Lower Priest River, Idaho**
12:35	Sarah Deshazer (Mentor: Krizstian Magori) **Diversity, abundance, and dispersal of small mammals on and around the Eastern Washington University prairie restoration site**

Oral Session 2: Social Sciences PUB 319

9:00	Damalie Ndamira (Mentor: Jason Scully) **Graffiti Vandalism: Defining the role of crime prevention through environmental design**
9:20	Gabriel Root (Mentor: Bill Youngs) **Propaganda, huh! What is it good for? Absolutely everything!**
9:40	Whitney Longie (Mentor: Judy Rohrer) **The South Dakota "Fairness in Women's Sports" Bill and Its Impact on Transgender Youth**
10:00	Katie Gower (Mentor: Vandana Asthana and Matthew Anderson) **Policy & Practice: Investigating Homelessness Discourse in Spokane, Washington**
10:20	Chelsea Boothe (Mentor: Majid Sharifi) **Bolivia: Colonial Effects and the Future of Plurinational Development**
10:40	**15-minute break**
10:55	Kurtis Johnson (Mentor: Jason Scully and Margo Hill) **Barriers and Facilitators to the Creation, Maintenance, and Growth of Tribal Transit Services**
11:15	Charles Crook (Mentor: Kassahun Kebede) **Overcoming Loneliness: First-generation Slavic Immigrants' Experience with Loneliness in the Inland Northwest**
11:35	Alexia Howard-Mullins (Mentor: Vandana Asthana) **The War on Drugs and Its Legal Effects on Black Americans**

Oral Session 3:
Philosophy, Communications & English as a Second Language
PUB 321

9:00 Zoom: Natalya Sharavara (Mentor: Anna Tsepkova)
Genre Diversity in Monica Ali's "Untold Story" (2011)

9:20 Zoom: Alexandra Gordienko (Mentor: Anna Tsepkova)
Themes and Moral Messages in Rob Biddulf's Picture Books for Children

9:40 Zoom: Anastasia May (Mentor: Anna Tsepkova)
N. Gaiman's "Stardust" as a Reading and Discussion Supplement in a High School EFL Classroom

10:00 Zoom: Michael Frederick (Mentor: Philip Watkins)
Exploring the Relationship Between Gratitude and Self-Control - a Mediation Analysis

10:20 **15 Minute Break**

10:35 Terrie Cramer (Mentor: Igor Klyukanov)
Responding to COVID-19 guided by Aristotle's ethics

10:55 Shen Tsao (Mentor: Kevin Decker)
The Tempest: The Apex of Montaigne's Influence on Shakespeare

11:15 Marisa Janke (Mentor: Kevin Decker)
Actualization through Constraint: an Analysis of Hegelian Self-Consciousness in Fascism-Exclusionary Expression and in Modular Orchestral Composition

11:35 Irie Browning (Mentor: Kevin Decker)
The Necessary Passion of Religion in Hegel and Kierkegaard

11:55 Kaleb McCalden (Mentor: Christopher Kirby)
Xunzi's Humanistic Naturalism: Utilizing Rituals to Address Our Psychological Challenges

12:15 Blake Budke (Mentor: Christopher Kirby and Kevin Decker)
Hegel as a Therapist: Looking at The Human Psyche Through Parts of The Phenomenology

Oral Session 4: English PUB 323

9:00 Withdrawn

9:20 KP Kaszubowski (Mentor: Johnathan Johnson)
Summer plans

9:40 Victoria Thurmond (Mentor: Jonathan Johnson)
The Weight of the Sky

10:00 15-minute break

10:15 Richard Campbell (Mentor: Max Hohner)
The Fall of the House of Usher, and the Rise of the Civil War

10:35 Gabriel Meek (Mentor: Jonathan Johnson)
Warriors & Web-Slingers: The Shifting Contemporary Epic, from Poetry to Popular Culture

10:55 KP Kaszubowski (Mentor: Jonathan Johnson)
"Between the bitter and the sweet": longing and intimacy in Sappho's and June Jordan's love poems

11:15 Victoria Thurmond (Mentor: Jonathan Johnson)
The Evolution of Pastoral Poetry: An Examination of Kokinshū and Mary Oliver

11:35 Connor Dahlin (Mentor: Jonathan Johnson)
War on the Unknown: A Poetic History of Mythic Appropriation & Modern Mythic Dissolve

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9:30 a.m. - 11:30 a.m.

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Saul Bautista
Mentor: Joseph Lenti
Manipulation of History

Travis Bonwell, Joscelyn Bradbury, Christina Hudson, and Jenna Sotin
Mentor: Lynn Briggs
Transforming Yourself Through English

Emily Botter-Hanson, Alecia Belarde, and Heide Tyvan
Mentor: Kate Crane
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Ryan Breithaupt
Mentor: Andreas Aragoneses
Chaotic time series analysis via Rnn

Ian Broxson
Mentor: Judd Case
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Lindsay Butler
Mentor: Andrea Castillo
GABA Present in Yogurt

Serena Camacho
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Rayna Carlson
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Does Socioeconomic Status Affect Patient Satisfaction?

Malek Chreiki
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Kathryn Collins
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Marina Conner and Bryden Esquibel
Mentor: Kayleen Islam-Zwart
Interaction Between Symptoms of PTSD and Locus of Control

Katie Crisp and Zlata Krisyuk
Mentor: Kevin Criswell
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Nick Danna
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Thomas Davis
Mentor: Lindsay MacKenzie
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Madesyn Derrick NTP, PT and Jolynna Nowakowski NAC, EST, MA-P
Mentor: Rosalee Allan, FACHE, PHR, CP-SHRM
Can we overcome the dissonance between patient and medication?

Ashley Destin
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Potential Effects of the American and Pride Flag on Our Judgments of Others

William J. Doyle, Lacey B. Sell, Christina C. Ramelow, Hannah M. Kohl, Kristina Hoffman, Jasleen K. Bains, Kevin D. Strawn, Theresa Hevrin, Trevor O. Kirby, K. Michael Gibson, Jean-Baptiste Roullet, Javier Ochoa-Reparaz
Farnesol induces protection against CNS inflammatory demyelination and decreases spinal infiltration of CD4+ T-Cells

Elizabeth Dyess
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Jesse Grove
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Emily Hamada
Mentor: Bo Idsardi and Joanna Joyner-Matos
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Nicole Hamada
Mentor: Judd Case
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Kristina Hoffman, David P. Daberkow, Hannah M. Kohl, Tyrel Long, Trevor O. Kirby, and Javier Ochoa-Repáraz
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Autumn Holley
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Shayla Hust and Shandy Bursch
Mentor: Rosalee Allan, FACHE, PHR, CP-SHRM
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Nicholas Jacobs and William Eaton
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Thurman Johnson
Mentor: Rebecca Brown
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Matther Markus
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Alyssa Mitchell
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Travis Morton
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Nhat Nguyen
Mentor: Andreas Aragoneses
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Aya Osias, Dylan Parrish, and Sophia Wynecoop
Mentor: Rosalee Allan, FACHE, PHR, CP-SHRM
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Isaac Palomi
Mentor: Kyle Larsen
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Jennifer Perez
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Haili Poss
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Brenna Stafford
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Abstracts & Project Descriptions

Allen, Andrew, Beecher, Ashley, Chaney, Brandyn, Colvin, Danaca, Cousineau, Brianna, Deschenes, Richard, Devlin, McKenzie, Fitzpatrick, Kellie, and Grove, J.
Mentor: A. Ross Black

Top-down or bottom-up regulation: nutrient availability and herbivore concentration effects on primary productivity rates in the TLES pond

The purpose of this experiment was to evaluate the effects of nutrient availability and herbivore concentrations on algal primary productivity in the TLES pond. Primary productivity is a vital indicator of local environmental health. Determining factors that drive primary productivity within an ecosystem are necessary for ecologists to develop best practices in ecosystem management. We calculated primary production rates, and nutrient availability does not affect primary production rates. We utilized 20L cubitainers in the pond where we manipulated zooplankton concentration, nitrate, and phosphate based on ambient average levels determined from eight samples. Our experiment used nine separate treatments with ten replicates per treatment. After a 7-day incubation period in the pond, cubitainers were retrieved and we analyzed their chlorophyll concentrations using a fluorometer. We calculated primary productivity by comparing the initial and final chlorophyll readings. Significance of treatment effects were statistically determined using two-way ANOVA. Results will be presented at the upcoming symposium.

Anderson, Nicholas
Mentor: Lindsay MacKenzie

Depositional Characteristics of Paleolake Clarkia at site P-37

The Clarkia Fossil Beds, Idaho are a lacustrine sequence of primarily anoxic sediments that are unusually abundant in exceptionally-preserved fossils that formed as a result of paleolake Clarkia's long existence. Lake Clarkia formed ~15.4 to 16 MA (Miocene), when the Wanapum Basalt Flows of the Columbia River Basalt Group dammed the ancestral Saint Marie's River. The fossil-containing sediments are laminated silty-clays-to-silts, with occasional interbeds of fine sands and ash, all of which exhibit anoxic characteristics indicating anaerobic bottom waters, facilitating exceptional preservation.

The Clarkia Fossil Beds are best known for leaf fossils with cellular data and insects with original color, as well as a varied vertebrate assemblage. The leaves represent a diverse forest environment similar to modern forests of eastern Asia and the southeastern United States. Their exotic characteristics, coupled with the types of fishes and insects preserved, suggests a warmer and more humid paleoclimate than exists in the present.

The goal of this research was to determine the changing depositional characteristics of paleolake Clarkia. There are five localities with Lake Clarkia sediments: P-33, P-34, P-37, P-38, and P-40. P-37 is the focus of this study; this site is subdivided into localities A and B. Samples consist of stratigraphic and sedimentary samples collected in the summer of 2021. 14 total samples were collected: four from P-37A and ten from P-37B. Samples were cut, embedded in resin, and polished to expose mm-scale detail for microfacies analysis. Portions of samples were powdered for XRF and ICP-MS analyses to determine geochemical compositions and identify potential changes in provenance or climate conditions. Finally, samples exhibiting unique and/or differing characteristics were taken to WSU for SEM-EDS analyses to get finer textural details. These data will be integrated to clarify the changing depositional conditions within paleolake Clarkia over time.

Armstrong, Jourdan
Mentor: Jenny Hyde
Untitled
Acrylic on canvas

Arold, Sophie
Mentor: Joshua Hobson
Authentic Self
This is a visual representation of finding who I am as an artist and as a growing adult. As a senior pursuing my BA in fine arts at EWU, I had the chance to look back and admire the growth I have experienced as a student. After switching my major countless times, covid-19 hit. During that time I spent my new found free time really diving into what I love the most, Art. However, at the time, I did not see my inner self literally screaming back at me through my own art. It was almost as if my work was saying "Look! This is you! Stop looking for the majors you think people want you to have!" I finally took that step. I brushed off the "what if" judgmental comments and took my first quarter of art classes. And I can say with confidence I had found my calling. With so much more to learn I am excited for this new journey to be my true authentic self. Endless pages of dental hygiene books to math books to criminology books. The discovery and self-calling of trying new mediums. To now. These pictures tell my story.

Bailey, Autumn
Mentor: Suzanne Bassett
Tiny earth Research Project: A Soil Analysis of bacterial Antibiotic producers
A silent threat to public health has been looming on a worldwide scale ever since the first strains of penicillin resistant microbes were observed in the 1950's. Mass use of antibiotics has quickly led to decreased efficacy of some of our most effective antibiotics causing declining clinical outcomes. With an increasing need for a more diverse selection of antibiotics to treat infections, colleges and labs across the nation have participated in the "Tiny Earth Research Project," in an attempt to obtain a more thorough nationwide analysis of the soil microbes that may have inherent, unique antimicrobial properties. During our research, we tested approximately fifty bacterial isolates that were screened for antibiotic production using Staphylococcus epidermidis and Escherichia coli as Gram-positive and Gram-negative tester strains, respectively. Pure cultures of presumed antibiotic producers were obtained, and identification was performed through 16S rDNA sequencing of polymerase chain reaction products. Discovery of novel antibiotics may lead to better clinical outcomes in the future.

Bautista, Saul
Mentor: Joseph Lenti
Manipulation of History
This research project assesses the problematic way in which the public education system of Honduras has historically depicted Indigenous peoples of the nation. Most importantly, it demonstrates that the Honduran government, through public education textbooks, has actively perpetuated the idea that native peoples are gone – that they are but another page in the books of history. The goal of this investigation is to understand how this form of misinformation has succeeded to influence generations of Hondurans and caused them to largely believe that indigenous people are not active participants in that society today.

This research project contends that an intentional and active campaign to minimize the historical significance of indigenous peoples in Honduras has popularly minimized the importance of the local tribes in the national history. Moreover, this research highlights how the historical minimizing of the indigenous presence in Honduras contributes to contemporary discrimination and repression.

Bonwell, Travis, Bradbury, Joscelyn, Hudson, Christina, and Sotin, Jenna
Mentor: Lynn Briggs

Transforming Yourself Through English

The purpose of this project is redesigning Patterson Hall's English and Philosophy billboard to inspire students to join the department. English and Philosophy are important interdisciplinary skills that can transcend into various careers. By creating a thought-provoking billboard with a focus on inclusion outside of the classical Eurocentric authors, along with personal reflection, we hope to inspire current and future undergraduates to choose an English or Philosophy major. One of the biggest obstacles these programs face is overcoming the preconceived notions surrounding them. By informing students of the countless interdisciplinary skills these programs teach, as well as detailing alumni/famous figures who do not immediately induce thoughts of English or philosophy, we can pull students from a wider background as they see how these skills will help fulfill their dreams.

Our group went about this process by first interviewing several professors within the EWU English and Philosophy departments. Through these interviews we gathered various perspectives and thoughts in which we were able to incorporate into our billboard design. One of the recurring themes we obtained through these interviews is to transform or find yourself on the page. We will feature photographs, portraits and quotes while also creating a large open "book" in the center of the billboard which contains the information we want to share. This is an example of the visual rhetoric we will be implementing to connect to English and Philosophy. The billboard will be focused on what the student wants out of their future and how English and philosophy can help them to reach that goal. The aim is to bring the focus back on the student as the board catches their eye, and hopefully helps them to reexamine themselves before declaring an English or philosophy major.

Botter-Hanson, Emily, Belarde, Alecia, and Tyvan, Heide
Mentor: Kate Crane

The Progression of Jess Walter's Writing Style

The writing skills of new college students are often more basic than postgraduates. Using Eastern Washington University alum and New York Times best-selling author Jess Walter as a reference, this report consulted secondary and archival sources to investigate differences between Jess Walter's writing style and, more specifically, Jess Walter's changes throughout his career. Such research included secondary resources (articles from academic databases,) archival resources (articles from The Easterner archives,) and a Zoom interview with Jess Walter. The secondary sources supplied peer-reviewed articles about the writing process and essential practices for professional writers. These secondary resources also supplied inspiration for writers and skills a writer could potentially need to be successful. The Easterner's archived articles (EWU's student-run campus newspaper) offered a variety of Walter's articles, such as satire, informative, sports pieces, etc., all of which span his time as an undergraduate. The results, including direct advice from Walter, recommended practice, and dedication towards the craft of writing. This means adopting practice-based habits such as writing daily, writing assorted topics, completing in-depth research, and editing recursively. Understanding that writing is a skill to be developed and strengthened over time is just the start of the process. The purpose of this report and all the research included was to find changes in Jess Walter's writing from being a journalist for EWU's school newspaper to his writing as a professional writer/author. To conclude our research, we found that Jess Walter's process maximized his opportunities as a college student working for EWUs student-run newspaper, all of which shaped who he is as a writer today.

Bowden, Emma
Mentor: Thomas Askman
Kalos
My work, “Kalos”, is a unique composition made up of 3”x3” canvases with overall dimensions of 24”x30”. This series of acrylic paintings explores the boundaries within the photorealism technique in painting. For this painting, one 3”x3” canvas represents one corresponding square from the photorealism grid on the reference photo. The independent squares open new possibilities for viewer engagement and manipulation. The interactive piece encourages viewers to ponder the idea of beauty and how it can be manipulated.

Bowden, Noelle
Mentor: Thomas Askman
The Notion to Invade
Description/Synopsis: A part of my abstract Connect and Collect Series, this piece "The Notion to Invade" explores the subject of self-acknowledgement. Fragments of our expressed identities and bodies lace between the layers of paint that reside and reflect how we ideally coexist with the colliding world around us. The elements of the earth, including the internal and external notion of dialogue, how can a soul question themselves without destruction? What can invade? The morphing colors and compiled textures portray the sense of permanence within each fragment of applied paint, which leaves us to reminisce as time and space move on. Confronting the unknown is the process of this piece, where externally, the colors are mixed on the page, adding water to formulate different consistencies; and internally representing the form of continuous thoughts. Challenging rationality, this painting invites the collective to the abstract pattern of everyday life—the different senses and reactions of being and the emotional layers of color, dimension, texture, and intuition.
Dimensions: 40” x 50” Medium: Acrylic

Breithaupt, Ryan
Mentor: Andreas Aragoneses
Chaotic time series analysis via Rnn
Many dynamical systems behave in a complex manner that makes them indistinguishable from a random process, even though they are generated following a clear mathematical description. The Lyapunov exponent is a parameter that allows us to distinguish if a system is chaotic or not, but it is challenging computationally, mostly for experimental data. In the following paper we will strive to characterize how deterministic a given time series is by allowing a trained Recurrent Neural Network to predict the Lyapunov Exponent of a given time series. For the training process we had decided to use samples of the logistic map in order to give the network a basic training set for a known output value for each time series set. The specific type of network we will be using is Long Short-Term Memory (LTSM). The input of this neural network structure is currently 30 samples of logistic map time series. Once fed into the neural network, the output of this network is the predicted Lyapunov exponent and then cycled over several epochs or life cycles so the network may continue changing its internal weights and extracting meaningful features of the data in order to decrease loss. Once the training cycle is complete for a set of data a validation process is done for the network in which previously unseen data may be fed into the network and true prediction may be inferred through the validation loss metric. Moving further we shall supply the network with a greater diversity of data in regard to deterministicity and chaotic behavior and eventually lab data.

Broxson, Ian
Mentor: Judd Case

Reconstructing the Ecological Relationships of Late Cretaceous Antarctic Dinosaurs and How Functional Tooth Morphology Influenced These Relationships

The Sandwich Bluff Formation of the James Ross Basin of Antarctica has recently yielded a group of five late Cretaceous dinosaurs that lived contemporaneously with each other, a first for Antarctica. These five dinosaurs include fragmentary remains of two differently sized elasmarian ornithopods, a possible megaraptor, a hadrosaur, and a nodosaur. In this study we will construct a model of the ecological relationships of late Cretaceous Antarctica. Additionally, we will look at what specific factors allowed this group of four herbivores and a carnivore to coexist in a restricted locality and what niches were filled by each species. Methods to determine this will include a size estimation of these dinosaurs and a paleobotanical assessment of the Sandwich Bluff locality. A comparative analysis between these Sandwich Bluff dinosaurs and related species from other Gondwanan landmasses will help us in our analysis. Finally, we will perform an in-depth analysis of functional tooth morphology and determine how that relates to diet, size and niche, which will be important for future study of other herbivorous dinosaurs.

Buck, Marybelle
Mentor: Joshua Hobson

Small Town Silos

Grain silos are tall cylindrical buildings used to store grain that farmers bring from their crops every year. It is then taken out and poured into train cars to be transported to different companies and factories, and later on used to make food that everybody eats. This process has been used since 1873 and is still used today. After living by grain silos, I've learned that they are full of untold stories and mean much more than they may seem, inspiring this series of black and white photos "Small Town Silos".

This series is a typology made up of eight black and white film photographs. These photographs contain grain silos from eight different small towns located in Eastern Washington including Spangle, Fairfield, Waverly, Rosalia, Plaza, Rockford, Latah, and Cheney. Taking these photographs as film photographs not only connects them from their past, but also allows you to see their rustic charm and historical elements as they are in the future. All photographs were intentionally taken in the early afternoon and as close as possible. This gave the silos stark contrast and an up-close look at the abstract shapes as the light reflected off of them, allowing them to speak for themselves and tell their own stories.

Grain silos are generally observed from a distance and seen solely as a functional object. But up close, they bear little resemblance to their functional selves and are revealed as strong sculptures that hold not just grain, but history. When you move in closer and look at them from a different point of view, you can see that they are much more than giant pieces of concrete, they are storytellers.

Butler, Lindsay
Mentor: Andrea Castillo

GABA Present in Yogurt

Lactococcus lactis is a lactic acid producing bacterium commonly found in dairy products and is routinely used as a probiotic. Our lab has engineered *Lactococcus lactis* (P8) to produce high levels of the inhibitory neurotransmitter, y-aminobutyric acid (GABA). In addition to its role in the central nervous system, GABA also exerts its effects on non-neural tissue. GABA has been linked to mood and metabolic regulation, anti-hypertensive effects, and decreasing inflammation. My experiments will determine if our *L. lactis* (P8) strain can be used to make yogurt that also has high levels of GABA and could be developed as a therapeutic food. For these experiments I first determined if the *L. lactis* (P8) strain would maintain the plasmid borne GABA producing genes without including the antibiotic for its selection; adding antibiotics to food products is not desirable. I cultured *L. lactis* (P8) in media up to X days and compared cell number on growth media with and

without the antibiotic at T=X, Y and Z days and obtained a percent plasmid retention value by dividing the cell number on media with antibiotics by the cell number on media without antibiotics. The average percent plasmid retention value at T=3 days was 84.8 percent. This suggests that GABA can be maintained in the plasmid without the help of the antibiotic. Next, I followed a yogurt making procedure using *L. lactis* P8 and a strain "P" with the plasmid alone (no extra genes for making GABA). I will use an ELISA to measure GABA in these yogurt samples and hypothesize that the *L. lactis* P8 strain will contain higher GABA levels than the P stain.

Camacho, Serena
Mentor: Camille Frank

Understanding the Role Gender Might be Playing in Your Child's ASD Evaluation

During adolescence, it is common that young, female, children are misdiagnosed with autism. Some misdiagnoses are not caught until well into adulthood. Doctors and parents need to be aware of what autism looks like in female children. Bringing awareness and education to how autism is presented in young female children, will lead to a specialized and individualized plan of care for that diagnosed child. Having access to different types of therapies, would allow the child better opportunities of functional integration into society. Misdiagnosis of autism commonly happens due to lack of research surrounding young females. Parents' lack of knowledge of how autism presents itself in young females could prevent parents from access to services, if needed. Gender is a factor in misdiagnosis. Further research will show a discrepancy in autism and participants being predominantly male. With more research being conducted on young female participants, doctors and parents will be able to more accurately identify when a female child presents with autism, providing them with access to early intervention services as needed.

Carlson, Rayna
Mentor: Andrea Castillo

Determining the Most Effective Antimicrobial Mechanisms of Manuka Honey and How Time Degradation Impacts Effectiveness

Manuka honey (MH) has been documented to possess powerful anti-microbial properties through multiple mechanisms. These mechanisms include a low pH, high osmolarity, iron chelation, and its unique manuka factor (UMF). The UMF refers to the methylglyoxal (MGO) content found in MH. Although MGO is purported to be a major pillar in the honey's antimicrobial properties, its activity is variable against different bacterial species. We hypothesize that MH's other antimicrobial mechanisms may also exhibit variable activity against different bacterial species. Preliminary experiments to determine the Manuka honey minimum inhibitory concentrations (MIC) for bacterial species, *Escherichia coli*, *Pseudomonas aeruginosa*, and *Staphylococcus aureus*, suggested that some Manuka honey antimicrobial mechanisms lose effectiveness over time, but only against some species. We are interested in discovering which MH antimicrobial mechanism is most effective against three major pathogenic bacterial species, *Escherichia coli, Pseudomonas aeruginosa,* and *Staphylococcus aureus*. To investigate this, we are conducting MIC experiments weekly with newly prepared MH and aging MH. We hypothesize that the aging MH MICs will increase for bacterial species that are affected by the antimicrobial mechanism that is degraded in the aged MH. In future studies, we will endeavor to compare the chemical composition of the newly prepared and aged MH.

Castaneda, Jennifer, Jackson, Kori, and Koehn, Erin
Mentor: Rosalee Allan, FACHE, PHR, CP-SHRM

Does Socioeconomic Status Affect Patient Satisfaction?

Patient satisfaction is a top priority of healthcare. It can be defined as how happy the patient is with their healthcare, both inside and out of the providers' office. Satisfaction may be determined by the success of patient outcomes. Creating a healthy population requires that all patients are receiving the best quality care from providers

who are valued and appreciated. Neither a patient nor a provider should be judged based on ethnicity, culture, ability, age, employment, housing or socioeconomic status.

The scope of the research uses patient satisfaction survey results from different communities of various backgrounds. It also includes data from different third-party surveyors. The research will be conducted by literature review and will include statistical review and data sets available as of 2022. A patient's trust in their healthcare providers will define the outcomes and satisfaction of treatment/visit. This lack of trust may be detrimental to both the health of the population and the healthcare system. The purpose of this study is to determine if there is a relationship between the socioeconomic status of a patient and their satisfaction with their healthcare provider.

It is hoped that this study will provide insight as to how healthcare providers can improve their patient's satisfaction regardless of their socioeconomic status, which can over time lead to a more pleasant experience for both the patients and providers

Chreiki, Malek
Mentor: Jason Ashley

Design and delivery of Gamma-Retroviral CRISPR Plasmids

The Clustered Regularly Interspaced Short Palindromic Repeats (CRISPR)-Cas system is a bacterial/archaeal immune system that evolved to recognize and cleave bacteriophage DNA that has been integrated in their genome. The gRNA-Cas complex consists of the Cas9 enzyme and a guide RNA (gRNA) complementary to a target genomic sequence followed by a protospacer adjacent motif (PAM). Cas9 produces double-stranded DNA breaks in targeted genomic regions that, when resolved via a non-homologous end joining mechanism, can result in disruption of the targeted gene. gRNAs are customizable, allowing for targeted disruption of any gene. For mammalian genome cell modification there are multiple approaches for delivering the Cas9-gRNA complex with many groups using a lentivirus-based system. Lentiviral vectors (derived from HIV lentivirus) are good for infecting both dividing and non-dividing cells but are limited in their ability to transduce macrophages. Gamma-Retroviral vectors, for which there are no available Cas9-gRNA constructs, infect only dividing cells, but are effective in macrophages. The goal of this project is to produce a Moloney Murine Leukemia Virus (MMLV), gamma-retroviral (pMXs) system for delivering Cas9 and gRNA and validate the system's ability to disrupt expression of two candidate genes (Lunatic Fringe/LFNG and ST3Gal1/SIAT4A. We have constructed pMXs-based retroviral plasmids that will express gRNA under the control of the human U6 promoter and Cas9 under the control of the EF-1α promoter. This modular plasmid allows for specific gene targeting through variation in the gRNA sequence, and it can be packaged into replication-incompetent gamma-retroviral particles using Platinum-E packaging cells. Resultant viruses will be applied to the macrophage-like RAW264.7 cell line, and successful genome modification will be confirmed through PCR and enzymatic analyses. Disruption of gene expression will be confirmed through quantification of LFNG and SIAT4A messenger RNA.

Collins, Kathryn
Mentor: Luis Matos

Bioengineering a food-grade probiotic bacterium to express the enzyme Serratiopeptidase

Serratiopeptidase is a proteolytic enzyme produced by *Serratia Marcescens* that has been used as a supplement to treat inflammation. Using enzyme-based therapies for chronic intestinal inflammation would eliminate the side effects often reported with steroidal anti-inflammatory drugs. Additionally, delivering the enzyme directly to the site of inflammation (the gut) with a food-grade probiotic should modulate the microbiome and may enhance the enzyme's therapeutic effects. Probiotics are gaining traction in the therapeutics industry because some bacterial species are inherently anti-inflammatory, possibly due to direct modulation of the gut microbiome. Therefore, the objective of this project was to develop a genetically modified, food-grade probiotic (*Lactococcus lactis*) expressing serratiopeptidase. The serratiopeptidase gene (SER) was amplified from the native host, *Serratia marcescens* (NRRL B 23112; ARS Culture Collection) and

from a synthetic sequence developed previously (T. C. Mauzy, MSc 2021). The pNZ7021 (Boca Scientific) expression vector was chosen because it should provide low-level constitutive expression. The amplified gene was restricted and ligated into the vector (confirmed by PCR) and the ligation product was electroporated into *L. lactis*. Electroporated bacteria were plated on selective media. While colonies developed, none (checked by PCR) possessed the plasmid. After repeating these experiments with the same outcome, we suggest that the resistance gene became integrated in the host genome and the SER was lost. Future work will focus on an alternate vector that will facilitate inserting the SER gene directly into the *L. lactis* genome.

Conner, Marina and Esquibel, Bryden
Mentor: Kayleen Islam-Zwart

Interaction Between Symptoms of PTSD and Locus of Control

Locus of control (LOC) refers to an individual's perception of having authority over outcomes and is measured using the Internal Control Index (ICI; Duttweiler, 1984). Lower scores on the scale indicate an externalized LOC, suggesting an individual believes outcomes are outside of one's control. Externalized LOC scores are associated with adverse symptomology related to PTSD, including higher levels of trauma reactions, disorganization, avoidance, and depressive symptoms (Măirean, 2019; Melon et al., 2009; Roazzi et al., 2016). However, internalized LOC has been shown in prior studies to be a resilient factor for developing PTSD symptoms. (Assberg & Renk, 2014; Fontao & Ross, 2021; Zhang et al., 2014). The purpose of the current study was to investigate the relationship between endorsement of PTSD symptoms with a history of trauma and LOC. It was predicted that individuals exhibiting an externalized LOC would show more PTSD symptoms than those with more internalized LOCs. Participants consisted of 73 females incarcerated in the minimum-security unit of a women's prison. Participants completed a demographic and clinical interview and a packet of questionnaires including the ICI. Results show that women reporting having experienced or witnessed an event in which they thought they or another person might be physically hurt or killed exhibit lower internal LOC scores than individuals with a trauma history. Interestingly, overall and specific endorsement of PTSD symptoms did not appear to be related to trauma history.

Cook, Aidien
Mentor: Jonathan Middleton

Numb

The ambient piece titled "Numb" takes us through a sonic narrative of when one reaches a breaking point in life, we must go through utter devastation in our mental landscape. The reward that reveals itself after is nothing but a euphoric numbness of what you've become. You've made it. You've survived. You are renewed once more. Out of destruction and the insatiable process of clearing the sense, comes peace.

Crisp, Katie and Krisyuk, Zlata
Mentor: Kevin Criswell

How Positive and Negative Emotions are Regulated by and Associated with Stigma in University Students with and without Mental and Physical Chronic Health Conditions

Introduction: Over one-third of undergraduate student's report having at least one mental or physical chronic health condition (CHC). Stigma may lead to worse quality of life and academic performance. Although negative emotion regulation has garnered more attention in the literature, less is known about (a) whether positive emotional experiences may be regulated differently between students with and without CHCs and (b) whether negative and positive emotion regulation are differentially associated with stigma awareness and internalized stigma in students with CHCs. This is a secondary data analytic study of cross-sectional survey data from the Fall 2020 quarter.

Method: Fifty-one students without CHCs and 150 students with CHCs were sampled from Eastern Washington University using emailed invitations and online surveys. The Stigma Consciousness and Self Stigma scales assessed stigma awareness and internalized stigma, respectively. The Emotion Regulation Questionnaire assessed positive, negative, and neutrally worded (e.g., generally referring to trying to regulate an "emotion") emotion regulation. ANOVAs and t-tests were utilized to assess mean differences between groups on levels of emotion regulation. Pearson correlations were used to assess associations between positive, negative, and neutral emotion regulation with stigma awareness and internalized stigma. Significance was set to $p < .05$.

Results: Students with co-occurring mental and physical CHCs reported significantly greater negative emotion suppression compared to students with only mental CHCs and those without CHCs. Positive emotion suppression was positively correlated with internalized stigma in students with mental CHCs, regardless of if it was only or co-occurring with physical CHCs.

Discussion: This study fills a gap in the literature on emotion regulation in populations that report experiencing stigma. This study highlights the importance of assessing positive and negative emotion regulation separately.

Danna, Nick
Mentor: Lindsay MacKenzie

Analyses of the Latah Formation from the Cheney core

The fine-grained silt and clay deposits of the Latah Formation are located in eastern Washington and northern Idaho along the eastern edge of the Columbia River Plateau. The deposits are fine-grained aluminous clays and silts, of freshwater origins. They are hypothesized to be residual clays from the Columbia River Flood Basalts, or fluvio-lacustrine sediments deposited in interbeds of the Tertiary Columbia River Flood Basalts.
A drill core from a well in Cheney, WA, contains three interbeds of the Latah Fm; this research focuses on the lowest interbed. The facies of the Latah Fm change from an extremely fine-grained, brittle mud rock, to coarse-grained, loosely packed, laminated layers of silts and sands with visible igneous and metamorphic minerals. It is capped with an extremely fine-grained claystone at the contact with the overlying basalt. There have been many hypotheses on the source of the sedimentary beds. The presence of igneous and metamorphic minerals suggest derivation from intrusive igneous rocks related to the Cretaceous granodiorite rocks associated with the Idaho batholith. The finer-grained sediments have been proposed as residual clays derived from weathering of the Columbia River Flood Basalts. The goal of this research is to clarify the environments in which these sediments were sourced and how they were deposited.

Using pXRF, the core was analyzed every 30cm for elemental data. This data was used to identify changes in chemo-facies. Each specific change in facies is correlative to a shift in depositional environment, or a shift in provenance minerals, which generally correspond to changes in sedimentary facies. The samples have also been sent off for quantitative geochemical analyses (XRF, ICPMS) and will also be examined with SEM-EDS. These results will aid in better understanding the physical and chemical factors responsible for the changes in depositional environments within the lower interbed of the Latah Formation in the Cheney core.

Davis, Thomas
Mentor: Lindsay MacKenzie

Tectonics: Using Geologic Principles and Data to Create a Symphony for Wind Ensemble

Geology and geologic processes have featured in many pieces of classical music such as Alan Hovhaness' symphonic works after Mt. St. Helens and Glacier Peak, but these pieces are impressionistic and only take general inspiration from the geology of their subjects. This paper describes the creation of Tectonics (2021) a piece which incorporates and describes many geologic principles and processes, such as mantle convection, through the musical form of cannon, the formation of fold and thrust belts whose cross sections are directly visually recreated in the score, and the physical dynamics of earthquake waves demonstrated through variations of pitch and volume through time. The symphony also incorporates sonified data from actual earthquakes into

its structure. This piece is an attempt to use music to communicate science to the public, a field which is only recently seeing developments and has few voices communicating on earth science topics.

Derrick, Madesyn NTP, PT and Nowakowski, Jolynna NAC, EST, MA-P
Mentor: Rosalee Allan, FACHE, PHR, CP-SHRM

Can we overcome the dissonance between patient and medication?

The interconnectedness between law, facility, provider, and patient are partnered with frequent change. The progression of illness throughout America creates a demand for more medication and a strict regimen for the patient's best outcome. The fast-paced environment of an inpatient healthcare facility will differ from the calm primary care visit. Regarding both settings, a doctor may prescribe medicine. The patient may show verbal and nonverbal cues agreeing to adhere to medication. However, they exit the hospital knowing if they will or will not have prescription adherence. Patients have the right to decide their medical treatment and decline prescription use.

The research will be conducted by literature review and will include statistical review and data sets available as of 2022. Medication adherence is critical to the discharge instruction given to a patient leaving a hospital.

Plausible obstacles a patient may have are anxiety, fear, dosage questions, and a language barrier. The purpose of this study is to determine reasons why patients may not follow the medication recommendations after leaving the hospital and identify connections amongst findings. It is hoped that this study will provide insight into the size and impact this issue has on population health and provide suggestions to support patient medication adherence.

Deshazer, Sarah
Mentor: Krizstian Magori

Diversity, abundance, and dispersal of small mammals on and around the Eastern Washington University prairie restoration site

Ecosystem restoration is crucial due to unprecedented rates of habitat loss. Small mammals play a critical role in ecosystem functioning; therefore, it is imperative to gather data on what species may be present during and after restoration processes. The Palouse Prairie region is an endangered and highly fragmented, agricultural area, with little native prairie habitat remaining. Eastern Washington University (EWU) has dedicated 120 acres of campus land for restoration of native Palouse prairie. This project intends to fill a gap in ecological data of small mammal populations in and around the EWU restoration site. We live trap small mammals on and around the restoration site, to determine the genetic diversity, abundance, and dispersal rates of these animals, in three habitat types to include wheatfields, hayfields, and prairie remnant sites. Mark and recapture data, along with DNA extracted from ear clippings, will be used to determine genetic diversity and dispersal capability for the populations sampled. Microsatellite loci, from extracted DNA, will be used to determine genetic differences and population structure. Wright's FST and the island model will be used to determine gene flow and dispersal rates from mark and recapture data. Information obtained from this study will be used to inform future managers and students as to which species of small mammal may potentially colonize the EWU restoration site in the future.

Destin, Ashley
Mentor: Judd Case

Feline Red Blood Cell Shape and the Impacts of Cytauxzoonosis

With a role as important as carrying oxygen to tissues everywhere in the body, red blood cells (RBCs) have been well-studied. Due to the higher oxygen needs of large animals like humans, RBCs are the most abundant and fastest produced cells. To meet these oxygen needs, RBCs have several adaptations including deformability for movement, a biconcave disc shape to maximize the surface area to volume ratio for maximum gas transport and lack many organelles. This shape and structure have been so effective that most mammals have evolved a

similar shape. The *felid* (cat) family was no exception. Wild species of *felids*, such as pumas and lynx, maintained this discoid, red blood cell shape (Wikander, Anantatat, Kang, & Reif, 2020). However, as we investigate domesticated *felids*, there is a clear change in shape. Rather than having a distinct central pallor as seen with the biconcave disc, the cell is concave on one side and convex on the other creating more of a bowl shape. This deviation in shape can have several impacts on health like lower gas transportation and exacerbated rouleaux stacking. The cause and scope of this mutation has yet to be researched. For example, *Cytauxzoon felis*, a protozoan parasite that uses the red and white blood cells of felines to proliferate, can be more detrimental to a domestic cat than to a bobcat with a disc shaped blood cell. Wild *felids* such as bobcats, pumas, and panthers experience asymptomatic or mild cases of cytauxzoonosis, surviving to become reservoirs while the infection in domestic cats is often severe to fatal (Wang et al., 2017). Since *C. felis* uses both red and white blood cells to support their proliferation, variations in these cells may impact the severity of infection (Byers, 2016). Thus, there seems to be a strong, but untested, correlation between RBC shape and the severity of cytauxzoonosis in felids. With the range of ticks expanding, the potential for cytauxzoonosis also increases (Merck Veterinary Manual & Tarigo, 2015

Dodson, Alexander Earl, Kelton and Stevens, Shawn
Mentor: Amani El-Alayli

Potential Effects of the American and Pride Flag on Our Judgments of Others

Perception of American cues has been found to increase aggressive and negative judgments of others (Ferguson & Hassin, 2007). Flags have been shown to increase perceived entitativity which leads to groups appearing as more threatening (Callahan & Ledgerwood, 2016). We predicted an American flag on a Facebook profile would induce negative perceptions of the individual. We also predicted that the presence of a political label [or symbol incompatible with the American flag] might override negative associations of the American flag. In Study 1, participants were presented with a fake social media profile with no flag or American flag background and a liberal or conservative self-label. Participants were then asked to infer specific traits and behaviors about the individual. Results found that either the conservative label or the American flag led to increased perceived negative traits (i.e., prejudiced, domineering, and negative Facebook behaviors). However, perceptions of the individuals' prejudice were especially high among the conservative label with American flag condition. In the proposed study, Study 2, we seek to explore pairing the American flag with a seemingly incompatible symbol (i.e., Rainbow Pride flag). We will replicate the study with a control (no flag), American flag, Pride flag, and both American and Pride flag backgrounds. In addition to negative traits, we will be adding positive trait measures (e.g., Patriotism) in Study 2. I suspect the pride and American flag condition will have fewer negative inferences compared to the American flag condition. Data for Study 2 has not yet been collected. This research is significant because we can identify potential means for discrimination due to unreasonable judgments made about people by appearing alongside a flag.

William J. Doyle, Lacey B. Sell, Christina C. Ramelow, Hannah M. Kohl, Kristina Hoffman, Jasleen K. Bains, Kevin D. Strawn, Theresa Hevrin, Trevor O. Kirby, K. Michael Gibson, Jean-Baptiste Roullet, Javier Ochoa-Reparaz

Farnesol induces protection against CNS inflammatory demyelination and decreases spinal infiltration of CD4+ T-Cells

Multiple Sclerosis (MS) is an autoimmune disease that causes T-cells to attack and degrade the myelin sheath of neurons in the spinal cord and brain. Farnesol (FOL) is synthesized by plants and mammals and has anti-inflammatory and neuroprotective activities. We used the MOG35-55 induced c57BL/6 murine experimental autoimmune encephalomyelitis (EAE) model due to the model's neurodegenerative and inflammatory properties. We predicted that FOL would protect against EAE and increase autoimmunity markers. We collected spinal cords and spleens for flow cytometry analysis at the end of the study. This study found that FOL significantly reduced spinal infiltration of CD4+ T cells, and increased infiltration of Tregs compared to

untreated mice. Interestingly, the proportion of CD25+Foxp3+ was increased compared to untreated mice, and statistically significant compared to vehicle treatment. We did not observe significant changes in CD4+, or CD25+Foxp3+ frequencies in the spleens. FOL treatment showed significant increase in CD11b+F4/80+ monocyte-derived macrophages (MDM) and F4/80int granulocytes/monocytes. FOL also showed significant weight retention and reduction of disease severity compared to untreated. These findings show that FOL helps mediate the invasion of CD4+ T cells in the EAE model. Future studies should explore how FOL affects T-cell activation and differentiation, along with effects on macrophages and dendritic cells.

This work was supported in part by the National Institutes of Health (grant R15NS107743).

Dyess, Elizabeth
Mentor: Julia Smith

Remote Analysis Capabilities of Digitally Rendered Models of Human Remains: Obtaining Osteometric Data & Assessing Pathology and Taphonomic Alteration

Photogrammetric and laser-surface scanning technologies have enabled remote, non-invasive, and non-destructive analysis of human remains sourced from various contexts. Such technologies have found applications in the disciplines of osteoarchaeology, forensic anthropology, the medical sciences, and other related fields of inquiry. This presentation will assess the accuracy and reliability of osteometric data obtained from digitally rendered models, as well as the clarity and level of detail attained. Such qualifying standards are essential if practitioners are to reliably assess pathology and taphonomic alteration to the specimens from which the scans are modeled. Furthermore, a general methodology for the creation and use of such models, as well as considerations for ethical best practices, will be discussed.

Eaglebear, Sage & Ahola, Grace
Mentor: Johnathan Middleton

Starless Night

Starless Night is a duet for acoustic guitar and amplified cello. Before artificial lights and the resulting light pollution drowned out all but the brightest stars, humans looked at the night sky with curiosity and wonder, using it for navigation, to keep track of the seasons, and ascribing constellation patterns with important cultural expressions of virtue and principals. This tradition lives on in some form to this day, despite the night sky going black. Starless Night depicts the natural day/night cycle, with bright and open daytime sounds changing to a soaring melody over twinkling stars, and a darker texture to represent night. The piece closes out with a rigid and aggressive night, where the stars have stopped shining, and the mysterious celestial melody takes on qualities of fear and grief. While the piece easily reads as misanthropic and critical of the advancement of society, it is my intention to rather express a cognizance of what humans have lost in our history to better appreciate what we have gained.

Earl, Kelton, Dodson, Alexander and Stevens, Shawn
Mentor: Amani El-Alayli

The Effects of the American Flag on Individuals and Businesses

Research from Ferguson and Hassin (2007) has shown that American participants who were exposed to American cues via the news network were more likely to exhibit aggressive behaviors and thoughts towards others. Additionally, mere exposure to the American flag has been found to divide American citizens to opposing ends of the political spectrum (Carter et al., 2011). In Study 1, we hypothesized that the presence of an American flag in an individual's Facebook profile background would lead them to be perceived as conservative and having the negative associated stereotypes (e.g., domineering and negative online behaviors towards others online). Our findings supported these hypotheses. In Study 2, we would like to measure participants' perceptions of a business website that contains the American flag. We predict that the business website

containing an American flag in their website background will be perceived as being conservative, stringent with employee benefits, and lacking employee diversity. As of now, we have not yet gathered this data. This research is significant as it will reveal how we may be unfairly treating businesses who openly display the American flag, revealing the potential costs of the symbol of our nation.

Ellis, Carly (Greg duMonthier

Boombox

When creating this piece, I was thinking about my childhood and the simpler things in life. I had a boombox like this one when I was a kid and I wanted to create a portrait or representation of it. Growing up as the youngest of a big family I was often influenced by my older siblings, and I found music to always play a huge role in my life. Throughout this process I found myself thinking more about the culture surrounding boomboxes and what they mean to so many people. I wanted to capture grunge and skateboard culture mixed with the idea and love of music. I hope this piece resonates with its viewers and provides a little bit of nostalgia as well.

Gabuzyan, Renata, Paulsen, Julianna, and Leimbach-Maus, Hailee

Mentor: Jessica Allen

Recent Updates to the EWU Lichen Herbarium Facilitate Biodiversity Research in Eastern Washington

Herbaria are references for plant and fungal identification and for determination and comparison of species' locations, ranges, habitat, abundance, and fruiting as well as flowering periods.The Eastern Washington University herbarium is a collection of plant and fungal samples with associated data preserved for long-term studies. Recently, two projects in the lichen herbarium have contributed to broadening understanding of lichen diversity in eastern Washington. Jack Massie, an Eastern Washington Alumni, has donated hundreds of lichen specimens that are being integrated into the herbarium. We have database, curated, and filed 100 new specimens to the herbarium, and at least three were species not previously represented in the herbarium. In the coming weeks, additional specimens will be processed into the herbarium. Jack Massie's generous donation of lichen samples from all over Washington, Montana, and even British Columbia will add to the scientific understanding of biodiversity hundreds of years from today. Lichens produce many secondary metabolites which influence their interactions with the environment. They are also used by scientists to help identify lichens. Lecidea tessellata is a common, widely distributed, chemically diverse crustose lichen. Many of the EWU herbarium specimens of L. tessellata were collected from the same sites, which has allowed us to demonstrate the chemotypic diversity of this species within the region. We used thin layer chromatography to determine their secondary metabolite content. Our results revealed that our 38 herbarium specimens represent four different chemotypes. The most common chemotype was Confluentic acid and 2'-O-Methylmicrophyllinic acid, which comprised 84% of the specimens, and the remainder of the specimens were one of three other chemotypes. Our results indicate that lichens demonstrate impressive biodiversity, even within a sample population consisting of a single species.

Garvey, Megan, Adams, Jacy, and Lembocke, Emily

Mentor: Camille McNeely

Vernal Pool Restoration

As part of Eastern Washington University's ongoing research on Palouse Prairie restoration, this project on vernal pools will establish the current conditions of the area's seasonal and temporary wetlands as well as changes that have occurred since Bruce Lang's 2000 study on these wetland types including many of the same individual pools. Each pool is measured in its dimensions of length, depth, and three widths. Water quality information including pH, dissolved oxygen, temperature, and conductivity is recorded, and water samples are taken for analysis in the lab. An hour is then spent collecting fairy shrimp for later identification to the species level. By recording measures of water quality and physical characteristics relating to the size of these pools as

well as their abundance and diversity of *Anostraca* (fairy shrimp), we hope to determine and evaluate any changes these pools have undergone since they were last studied and to better understand their current conditions. This work should aid in the determination of what these and other pools that may be included in the Prairie Restoration Project require to function as a habitat for the plants and animals traditionally found here.

Grove, Jesse
Mentor: Jason Ashley
Overexpression of ST3Gal1 and LFNG in osteoclast precursors
The ratio of osteoclasts to osteoblasts controls the strength and brittleness of bones. Osteoclasts are made from macrophage cells via a process called differentiation. In this study we are researching how overexpression of viral trans-proteins ST3Gal1 and LFNG affect differentiation with trans-protein mCherry being used as a control. To do this, we used Platinum-E cells with a retroviral plasmid to transduce RAW 264.7 cells with our transgenes. We next differentiated and stained each cell type to observe their morphology. We observed that ST3Gal1 and LFNG cells differentiated at what appears to be both a larger and a higher number of osteoclasts. We plan to continue this study with analysis of osteoclast gene expression.

Hamada, Emily
Mentor: Bo Idsardi and Joanna Joyner-Matos
Listening to the students: Exploring attitudes towards CSTEM majors amongst diverse student groups.
When people think about what it means to be a science, technology, engineering, mathematics (STEM) student, often they already have preconceived ideas. These ideas can range based on an individual's own cultural experiences. The purpose of this study was to better understand factors that influence underrepresented STEM and non-STEM students' choice of major. At Eastern Washington University (EWU), students from all different backgrounds were given an opportunity to share their experiences with, and perspectives on CSTEM majors. We hosted five listening sessions, each with three to five students from an underrepresented group of CSTEM or non-CSTEM majors. Each session included open-ended interview questions that elicited students' experiences and perspectives. Audio recordings from each session were anonymized, transcribed using software, then qualitatively coded to characterize themes across these diverse listening sessions. We reviewed and edited the transcripts to fix any errors during transcription. This process allowed us to familiarize ourselves with the data. Participants' own language was then used to create NVivo codes. After reanalyzing and synthesizing the Nvivo codes, we used pattern coding to identify themes across all of the listening sessions. This research is currently ongoing, and we will draw conclusions on barriers that affect students' success in STEM when the pattern coding is complete. Preliminary findings included limited course availability and misinformed general advising about CSTEM courses and program structure which resulted in students needing to retake classes or extend their time at EWU. The results will be shared with Admissions, the Center for Academic Advising and Retention (CAAR) Advisors, and CSTEM Chairs and Directors to inform strategies that can empower underrepresented students to pursue a CSTEM major.

Nicole Hamada
Mentor: Judd Case
The pathology of hepatic cirrhosis: analyzing hepatocyte size and shape to determine etiology
Hepatic cirrhosis kills approximately 43,000 individuals each year in the United States. This disease is from chronic alcohol abuse, fatty liver, genetic disorders, and hepatitis. Liver disease leads to excessive fibro-genic scarring due to cytokine signaling, hepatocyte apoptosis, and replacement of type III (reticular) collagen by heavy fibers of type I collagen. The liver, whose major functional cell type is the hepatocyte, is a peculiar organ with traits that allow it to create fibrosis when it senses distress. Investigating cirrhosis of the liver expands knowledge of liver disease and the research investigated to ascertain some understanding of the different forms of liver disease by analyzing hepatocytes. The research investigated here is to: 1) determine the histological

morphologies of the liver pathologies connected to alcoholic cirrhosis, hepatitis C, or fatty liver disease or due to combinations of these diseases 2) In this determination, see if distinctive conditions within the hepatocyte populations exist and if the fibrous scaring is the same or just similar 3) correlate the causes of fibrosis with the pathologies noted above and how cytokine signaling is related to fibrosis and 4) analyze the types of collagen formed with fibrous nature of liver pathologies. Current research findings have found that alcohol induced cirrhosis show hepatocytes that are two times larger than normal hepatocyte size compared to Hepatitis C which shows larger hepatocytes of one and a half times the normal hepatocyte size. The hepatocyte shape and size were determined based on areas of heavily fibrosis. These findings are significant to help determine etiology of cirrhosis of the liver.

Hendricks, Collin
Mentor: Paul Spruell

Estimating the Relative Production of Migratory Westslope Cutthroat Trout in Tributaries to the Lower Priest River, Idaho

Westslope cutthroat trout *Oncorhynchus clarkii lewisi* (WCT) is a threatened species native to the inland western United States. These fish express two main life histories; resident, that complete their entire life cycle in the same stream, and migratory, in which individuals spawn in small tributaries and migrate to larger rivers or lakes to mature. Migratory individuals are larger than residents of the same population. This increases female fecundity as larger females produce more eggs, therefore migratory individuals contribute more to the persistence of a metapopulation than residents. Although WCT typically return to their natal stream to spawn, migrants are known to disperse and spawn in other streams. This increases gene flow and contributes to the genetic variation of a metapopulation. The Priest River Basin is a known spawning location for WCT; however, the quantity of migrants is poorly understood. In this study, we will examine tributaries to the lower Priest River, Idaho to determine the proportion of migratory WCT produced by this system. Samples will be collected from 15 tributaries of the lower Priest River and main stem. Westslope cutthroat trout will be captured through electrofishing and angling. A sterile passive integrated transponder (PIT) tag will be inserted into the fish and a fin clip will be collected as a tissue sample. Then, DNA will be extracted from the tissue samples and each fish will be genotyped using a single nucleotide polymorphisms (SNPs) panel (215 SNPs) by Washington Department of Fish and Wildlife. PIT tags will be used to track physical movement, and SNPs allow for genetic assignment of individual fish to their natal stream. We will then quantify the proportion of fish from within this system that express migratory behavior. These findings should add to our understanding of connectivity within this system and supply evidence for the importance of viable passage through migration barriers for the success of this metapopulation.

Kristina Hoffman, David P. Daberkow, Hannah M. Kohl, Tyrel Long, Trevor O. Kirby, and Javier Ochoa-Repáraz
Mentor: Javier Ochoa- Repáraz

Microbiome methods in experimental autoimmune encephalomyelitis

Multiple Sclerosis (MS) is an autoimmune disease that affects the central nervous system (CNS) via neuroinflammation and demyelination. The exact triggers, subsets and effector mechanisms that contribute to disease progression are still largely unknown. Recent studies of healthy vs MS human stool samples indicated an altered microbiome, dysbiosis, which could lead to inflammation and disease. Experimental autoimmune encephalomyelitis (EAE) is a model used for the study of MS and can be induced in multiple non-rodent and rodent species. It is critical to control the environment of both the animal facility and experimental housing conditions in microbiome studies. We compared commercial vendors, Envigo and Jackson Laboratory, C57BL/6 female mice. Fecal samples were collected at Day 0, 14, and 21 for DNA extraction and sequencing of the ribosomal DNA (rDNA) to analyze the gut microbiome composition prior to and after induction of EAE. Jackson Laboratory mice had a significantly higher severity index of disease ($p<0.01$) and a lower survival rate

(20%) than Envigo mice (85%). Our results suggest different sources of EAE mouse models have critical impacts on microbiome composition and levels of disease severity. Furthermore, this highlights the importance of consistent and controlled conditions from the animal model source, and throughout the experiment, when inducing EAE in mice and other animal models of disease.

Holley, Autumn
Mentor: Jennifer Walke

The use of probiotic applications in early life stages to mitigate *Batrachochytrium dendrobatidis* infections in *Rana luteiventris* (Columbia spotted frogs)

Chytridiomycosis, an amphibian skin disease caused by a chytrid fungal pathogen, *Batrachochytrium dendrobatidis* (Bd), has been linked to global amphibian declines. Some amphibian populations are resistant to severe infection due to symbiotic antifungal skin bacteria but attempts to develop probiotics from these bacteria have been inconsistently successful because bacteria fail to persist on the skin. Studies have largely been conducted on adult and juvenile amphibians, despite amphibians having fewer known mechanisms for microbiome regulation prior to metamorphosis. We hypothesize that probiotics will persist longer and thus be more effective against pathogen infection if they are applied at an early life stage. We conducted a laboratory study to test the effectiveness of bacterial probiotic applications to *Rana luteiventris* eggs, tadpoles immediately after hatching, tadpoles one week after hatching, and newly metamorphosed frogs. Temperature is known to play a role in Bd infection dynamics as well as microbiome composition, so two temperature regimes based on current and modeled future temperatures were used in the experiment. We exposed all treatment groups to Bd following metamorphosis and swabbed to collect skin microbiome samples. To evaluate the host-microbiome-pathogen dynamics, we will analyze 16S rRNA gene amplicon sequencing and Bd qPCR data. This research will inform future probiotic strategies to combat a pathogen contributing to significant amphibian declines.

Hughes-Brauner, April
Mentor: Jenny Hyde

Mushroom Crossing

Medieval artists used toadstools as representations of Hell— people were suspicious of the various colors and strange shapes of mushrooms growing in dark areas. Today, we tend to think of Alice in Wonderland, or the sixties and psychedelics. Mushrooms are unknowingly complex in nature and mysteriously intertwined with the history of humans. I am exploring new techniques in ideas in both my formal and conceptual work while using these extraordinary fungi as models.

I am particularly captivated by mushrooms not only in their forms and shapes, but also their impact and perception throughout history. In the works I am creating, I focus on transition and exploration. I am examining what gives me inspiration and what makes me curious… mushrooms. As seen in the past, mushrooms represent the awe of nature and its powerful magicality. For me, mushrooms symbolize a mental state— an altered state, though not necessarily altered by psilocybin, but rather by stress and anxiety.

Hust, Shayla, and Bursch, Shandy
Mentor: Rosalee Allan, FACHE, PHR, CP-SHRM

Is the Nursing Shortage Affecting the Quality of Healthcare in the United States?

There is an ongoing nursing shortage in the United States, which the COVID-19 pandemic has exacerbated. The number of nurses retiring or leaving the profession is greater than the number of new nurses entering the profession. Findings show that the supply of new nurses compared to the demand for nurses is projected to be at a severe deficit, up to 11.5% in some states by 2030.

The scope of the research investigates the shortage of nurses as of March 2022. It includes all nursing specialties, including licensed practical nurses, registered nurses, and nurse educators in all healthcare settings in

the United States. The research was conducted by literature review, including statistical review and data sets available as of 2022.

Healthcare facilities need more RNs due to an increased demand for patient care. The purpose of this study is to determine the effect that this shortage has had on patients. Is the current shortage of nurses impacting patient safety and the U.S. hospital systems' ability to provide care?

The goal of this study is to understand what areas of patient safety and quality are suffering due to the nursing shortage and provide recommendations to counteract the multiple causes of the nursing shortage.

Jacobs, Nicholas and Eaton, William
Mentor: Robert Gerlick and Kyle Larsen

Structural Integrity with Transverse vs. Parallel Weldments

The field of mechanical engineering encompasses many disciplines, one of them being strength of materials. Within this subject is the study of how to secure steel parts together, called weldments, which is a significant factor in overall structural integrity. The purpose of this project is to verify the strongest method of fillet welding two plates using MIG welding and A36 steel. We hypothesize that if we pull apart the two welded A36 steel plates in a lap joint configuration, one set with parallel welds and the other with transverse welds, then we should conclude that a transverse weld will support a greater load than a parallel weld.

First, we are MIG welding two A36 steel plates along the length of the overlaps with respect to the applied tensile force (parallel welds). Next, we will be welding along the widths of the overlaps with respect to the tensile force (transverse welds). We will use the EWU laboratory to determine the maximum tensile strength for each of the two welding methods. Then we will calculate and compare analytical and numerical values to the empirical results that we find in the laboratory. We expect that there may be a slight difference for the experimental results, due to thermal changes due to welding, compared to the ideal conditions used in Finite Element Analysis and hand calculations.

Johnson, Kayla, Moyer, Baisley, and Nypen, Hailey
Mentor: Rosalee Allan, FACHE, PHR, CP-SHRM

Has COVID-19 affected US hospital patient satisfaction?

COVID-19 is an infectious disease that originated from a coronavirus called SARS-CoV-2. From March 2020 to April 2022, the Centers of Disease Control and Prevention (CDC) documented 314,030 laboratory-confirmed COVID-19 hospitalizations in the United States. When the COVID-19 pandemic began in the US At the beginning of 2020, hospitals across the country had to make changes to their policies and procedures. In order to determine the effects of the new changes during the COVID-19 pandemic, this study will examine patient experience and overall satisfaction outcomes of a sample of hospitals in the nation during the pandemic and compare that to previous corresponding performance prior to the pandemic. The research will be conducted by literature review and will include statistical review and data sets available as of 2022. There are many examples of hospital policies and procedures that were changed over the last two years. Prior to the COVID-19 pandemic, the patient’s family/caretaker presence while in the hospital was a common occurrence. This presence provided a positive influence on the patient's recovery and made available an advocate for their loved ones. A change implemented in hospitals during Covid-19 was visitation restrictions. Labor costs were reduced by eliminating non-essential personnel. Demand for beds for Covid-19 patients has used up the capacity of hospital resources. Staffing shortages have delayed elective surgeries or admissions. The purpose of this study is to determine the effect that changes in hospital policies and procedures during the pandemic have had on the satisfaction of patients.

It is hoped that this study will acknowledge the significant change in patient experience and overall satisfaction that occurred during the pandemic compared to pre-pandemic. Future decisions may be influenced by this study as it reveals the effect these changes could make to the satisfaction of the patient. This study will also offer alternative solutions targeted at maintaining hospital-patient satisfaction during a pandemic.

Thurman Johnson
Mentor: Rebecca Brown

Improving Palouse prairie restoration by examining the role of species diversity, grass-forb composition, and seed density

Historically supporting an expansive ecosystem of diverse wildlife and vegetation, today the Palouse prairie exists as small, isolated patches with less than 1% of native prairie estimated to remain. Due to the level of alteration, degradation, and non-native species invasions sustained on the region's landscapes, establishing native vegetation that is functional and diverse requires informed practices. Seed diversity, composition, and density have each been shown to have substantial influence on resulting plant establishment, but past research has not focused on the Palouse prairie ecosystem. As a result, locally derived management recommendations are sparse for the Palouse prairie and widely defined, necessitating a more region-specific research agenda for well-informed management practices. To address critical knowledge gaps of how diversity, composition, and seeding density impact Palouse prairie restoration outcomes, I will conduct two experiments in tandem. In order to measure the effects of diversity and blend composition, four species blend treatments (100% grasses, 70% grasses with 30% forbs at low diversity, 60% grasses with 40% forbs at low diversity, and 70% grasses with 30% forbs at high diversity) have been planted. To test the hypotheses that both grass-forb composition and species diversity significantly affect diversity and plant establishment in resulting vegetation, I will measure and compare native plant cover and diversity across these blends. Additionally, I have planted four native forb species, one unseeded control, and one blend of the species at four different densities, 861, 1,615, 2,368, and 3,122 PLS/m2. I will measure native plant cover to test the hypotheses that 1) native plant cover will increase with density but not linearly, 2) the significance of seed density to establishment will vary significantly between species. This study aims to improve Palouse prairie restoration efforts in several areas critical to success.

Jordan, Tiffany
Mentor: Krisztian Magori

Behavioral differences in urban *Sciurus carolinensis* with varying human exposure as a model for synanthropic human-animal relationships

Synanthropic animals are considered a halfway point between wild and domestic animals that live in urban environments and depend on humans for their survival. *Sciurus carolinensis,* the eastern gray squirrel, symbolizes a distinctive coexistence between human and wildlife as they are commonly fed in parks and gardens. They are native to the eastern United States. Where they are invasive, they are found only in urban areas and not in rural or wildlife areas. The objective of this study is to understand how different levels of human exposure impact the behavior of *S. carolinensis* in its non-native territory of the western United States from two different perspectives by using flight initiation distance and feeding surveys. Flight initiation distance measures the distance at which *S. carolinensis* begins to flee from an approaching predator or threat and helps us better understand how prey organisms measure threats and assess the trade-offs of the conflicting demands for the need to forage and to avoid predation. Previous studies found that flight initiation distance increased with decreasing human exposure due to habituation to human exposure. *S. carolinensis* has formed a commensalism with humans as synanthropic animals, and they may even rely on us as a food source. Measuring how close *S. carolinensis* will come for food helps us better understand how they interpret the risk assessment involved with approaching us for food and their commensal relationships with humans.

Kenison, Kiler, Deschenes, Richard, and Keenan, Kyle
Mentor: Ross Black and Camille McNeely

An assessment of the sources and fates of nutrients within Deep Creek watershed

Deep Lake is a small (191 acre) exorheic body of water in northern Stevens County, Washington. Due to the cool climate and dry summers, the main source of water for this lake is the melting mountain snowpack. This

snowmelt fuels small creeks that converge and flow into the north end of Deep Lake; the outlet of the lake is the North Fork Deep Creek which flows from the lake's south end. Above the lake to the north, a large cattle ranching operation grazes livestock in valley meadows directly in contact with lake tributaries. There is also a small community of residences with septic systems for waste treatment in close proximity to the lake within the narrow valley. The goal of this study is to sample the lake as well as tributaries and outflow to map the spread of excessive levels of nutrients. These nutrients could originate from the cattle ranching or the septic systems from houses that are situated around the lake. To determine the main source of these nutrients, water samples are collected once a week from the tributaries, the lake itself, and the outflow. At each of the chosen sites along this system, three separate water samples are taken with one site randomly chosen as a replicate. One sample is for sediment, another is for nutrient testing, and a third is tested for fecal coliform, these samples are all analyzed by Tshimakain Creek Labs. In addition to the water samples, metrics such as DO, conductivity, temperature, and pH are all recorded at each site, flow is recorded in lotic settings such as tributaries and outflow. Sediment traps are placed in the deepest section of the lake to collect the sediment being deposited by the tributaries. Due to the evidence from other watersheds that grazing within riparian corridors increases levels of erosion and supplies excessive levels of fecal matter, it is likely that the presence of cattle in this river basin is contributing to the eutrophication and increased sediment load of the lake and downstream lotic systems.

Killoy, Katelin
Mentor: Rebecca Brown, Camille McNeely
Beaver Dam Analogs as a Stream Restoration Tool in fire affected tributaries of the Methow and Okanogan Watersheds
Increasing wildfires and droughts related to climate change are critical issues for incised streams, which are disconnected from their floodplains and no longer store water effectively leading to diminished ecosystem function, loss in critical riparian and aquatic habitat, and reduced biodiversity. Beaver activity improves incised streams by raising surface and groundwater levels to reconnect with floodplains, retain phosphorus, and increase critical habitat and species diversity. Beaver Dam Analogs (BDAs) may be used when beaver reintroduction is not feasible, to mitigate damage from wildfires and stream incision. However, it is unclear how effective BDAs are at mimicking natural beaver dams for wildfire-affected stream restoration. This study will begin a long-term assessment of BDA effectiveness over time. A Before-After-Control-Impact study design will compare five BDA restoration sites with paired control sites and three natural beaver dam complexes. In the summer of 2021, pre-restoration data was collected on 1) channel morphology using a laser level and stadia rod, 2) riparian vegetation using line-intercept method, 3) sediment composition using a Wolman pebble count, 4) turbidity and phosphorus loads that were collected throughout the year at upstream and downstream locations to assess transport, and 5) water retention during low flow using conservative tracer injections. Preliminary results for water retention show control and pre-restoration streams have similar mean water travel times of 58 minutes (control) and 51 minutes (pre-BDA) for 200 m of stream, whereas through beaver dammed complexes, times are 7 to >400 times slower (ANOVA, $n = 3$, $p < 0.05$). This displays the difference in water storage between natural beaver dams and incised streams, and after construction of the BDAs (summer 2022), they will be compared to see if they effectively store water similar to a natural beaver dam.

Krise-Dygert, Conrad
Mentor: Joshua Hobson
In/Out
My piece "In/Out" is a self-expressive documentation of my journey as a queer, pansexual man. The work consists of eight photos of four sculptures. The sculptures are all made from personal belongings, and this was done so that they could act as self-portraits. I did this so my self-expression would be able to be seen by anyone without biasing my image. My self-image is not anything bad, but sadly due to the work's nature and meaning, I

didn't want anyone having stereotypes in their head and then being disappointed, wrongfully, that I don't fit their made-up character.

For the visual meaning of the work, the most noticeable aspect is the contrast between colored and black and white photographs. The meaning of this is that the black and white photos are through the lens of being "closeted," and they show off the sculptures as refined and shy to represent the dark and lonely feeling of when you are forced into hiding yourself, but even when hiding, it's still you and you're still there. The opposite can be said for the colored "outed" photos. They are flamboyant, proud, and show their true colors: pink, yellow, and blue, the pansexual pride colors.

Finally, as mentioned, the sculptures act as self-portraits and are made from personal belongings. The belongings are not random, and they all work together to tell an aspect of something that is personal to me and has helped me come out and express myself as pansexual. The bottle, radio, and note for instance are all items gifted to me by my fiancé, who has been the biggest help in my journey of coming out and learning how to express my sexuality. The sculpture consisting of craft materials represents how being an artist has helped me express and explore myself, and the sculpture consisting of colored paper, pencils, and my favorite art book is also related to my art but in a more specific way. To explain, the art book is JoJo A Go! Go! and is a compilation of the artist and writer Araki Hirohiko's work relating to h

Larsen, Elaine
Mentor: Krisztian Magori

Ticks and their bacteria in Spokane county

Ticks are common ectoparasites in Spokane County. The two tick species in our area are the Rocky Mountain wood tick (*Dermacentor andersoni*) and the American Dog tick (*Dermacentor variabilis*). While neither of them has been documented to transmit *Borellia burgdorferi*, the agent causing Lyme disease, they do harbor a range of bacteria, some of which can cause disease. The most dangerous of these bacteria is *Rickettsia rickettsii*, which causes Rocky Mountain Spotted Fever (RMSF), which can be lethal. In 2019, a locally acquired case of RMSF was documented in Spokane County. Students in the Disease Ecology lab at Eastern Washington University (EWU) have been collecting and testing hundreds of ticks in the last 6 years at Turnbull National Wildlife Refuge (TNWR), located just outside of Cheney. While none of the ticks tested positive for *Rickettsia rickettsii*, other non-pathogenic *Rickettsia* species have been found in about 10% of the ticks tested. In my project, I will test about 300 ticks previously collected at TNWRand stored in ethanol in the lab, as well as ticks collected at TNWRthis Spring. Ticks will be cut in half, and one half will be stored individually. The other halves will be tested in pools of 10 to make the testing more efficient. I will extract DNA from the ticks and use PCR to amplify *Rickettsia* DNA if present. When a pool of tick's tests positive, I will then individually test the remaining halves of those ticks. *Rickettsia* DNA will be sent for sequencing to identify the specific *Rickettsia* bacteria found.

The results of this study will inform the public about the bacteria present in ticks in Spokane County, and if pathogenic bacteria such as *Rickettsia rickettsii* is present in our area. It will also benefit pathogen surveillance in ticks by developing a method to test ticks in pools for bacteria.

Larson, Kyle, LaBarre, Benjamin, and Smith, Spencer
Mentor: Robert Gerlick and Awlad Hossain

Fatigue Analysis

Engineers throughout history have often experienced components failing at stress under the materials yield stress. This would occur when a component was repeatedly subjected to cyclic loading and would fail after a certain number of cycles. There are three different ways to predict when a component will reach failure based on loading and number of cycles – by theoretical (e.g., hand calculations), experimental, and numerical (e.g., finite element analysis).

The project will use these three different methods for determining fatigue life and compare them against each other, with the end goal of determining how accurate each method is.

Hand calculations will be performed using the Goodman failure criteria to determine the number of cycles the component will reach before failure. Experimentation will be done using a rotating beam fatigue test, and finite element analysis will be performed in ANSYS Workbench. The experiment will be repeated three different times for three different loadings.

As a result of this experiment, the team expects to see similar values for predicted fatigue life from the hand calculations and finite element analysis, but a slightly lower value from the actual experiment. The final results are pending experimentation over the next two weeks.

The expectation for the experimental fatigue life to be lower than the calculated predictions are due to the conservative nature of the Goodman approach. Refined conclusions will be provided along with our data and results after experimentation has been completed.

Leo, Fletcher
Mentor: Jenny Hyde

Brother

"Brother" is a laser cut painted wood and acrylic mixed media piece. It was inspired by the short story "This World is Full of Monsters" by Jeff Vandermeer, in which a man transforms into an inhuman being, in a simultaneously beautiful and terrifying process. This transformation is represented in the transition between the transparent head and a clear acrylic head with colorful wood shapes standing vertically, bleeding into his 'shadow'- a large melting shape on the ground, painted with vibrant strokes. This piece can be viewed from all angles but will be positioned in a way that the back of the head is facing the middle of the room, and those walking up to it will first see the vibrant shadow through the transparent head. The intention is for the head to fade into nothing from far away, as the man had to abandon his humanity to be something else entirely.

Long, Tyrel
Mentor: Javier Ochoa-Reparaz

Effects of GABA on Inflammation and Intestinal Barrier Disruption

Gut dysbiosis and intestinal barrier disruption has been linked to multiple sclerosis (MS). Our previous works show that experimental autoimmune encephalomyelitis (EAE) induction modifies gut's microbiota composition, resulting in reduced frequencies of gamma-aminobutyric acid (GABA)-producing bacteria. GABA levels are reduced in the brains and circulation of MS patients. We engineered a *Lactococcus lactis* encoding the glutamic acid decarboxylase (GAD) gadB and gadC genes to increase GABA levels produced by the bacterium (GAD-*L. lactis*). EAE studies showed that the treatment with GAD-*L. lactis* and not with a *L. lactis* control expressing an empty plasmid (P-*L. lactis*) reduced the severity of the disease. We hypothesized that the increased levels of GABA produced by GAD-*L. lactis* would restore the permeability in the intestinal epithelia of EAE mice and in a monolayer composed of caco-2 cells exposed to inflammatory mediators. Intestinal permeability of the in vivo model was measured by the oral administration of 4-kDa fluorescein isothiocyanate (FITC)-labeled dextran 19 days post-EAE induction. Results showed an increased trend of intestinal integrity when EAE were treated with GAD-L. lactis vs. P-L. lactis (not significant). In vitro, Caco-2 cells were plated on tissue culture trans-well plates creating a monolayer. The caco-2 cells were exposed to TNF-α, known barrier disruptor, and to increasing concentrations of GABA (0 – 10 mM). Transepithelial electrical resistance (TER) measurements and the flux of (FITC)-labeled dextran were quantified (0-48 hrs). Our results showed dose- and time-dependent effects of GABA exposure on monolayer integrity. Exposure of cells to 0.5 – 1 mM, but not higher, of GABA resulted in significant increases of monolayer integrity, compared with TNF-α controls and unexposed caco-2 cells over the first ($p = 0.0115$) and second hour ($p = 0.0006$). Continuing work with GAD-*L. lactis* and the P-*L. lactis* in conjunction with Caco-2 cell monolayers

Madera-Cruz, Elida and Putnam, Delaney
Mentor: Carmen Nezat

Seasonal Atmospheric Elemental Concentrations from PM10 Air Filters in Spokane, WA

The dangers of particulate matter to human health and the natural environment are well documented. Thankfully, preventative measures have greatly reduced PM10 in the last several decades. Regardless, examining the components of particulate matter is an insistent subject. The toxicity of particulate matter could be as closely related to the elemental composition as to PM concentration. Historically, Spokane, Washington has experienced high PM10 concentrations. Although the city is currently in compliance with federal standards, little to no research explores the elemental composition of the city's particulate matter. Using microwave digestion and elemental analysis, the atmospheric elemental concentrations of January and July from 2004-2016 were derived from fifty-six PM10 air filters collected by the Spokane Regional Clean Air Agency (SRCAA). The concentrations of metals including lead, iron, copper, and zinc were determined. Annual trends suggested a decrease in atmospheric metal concentrations while seasonal trends demonstrated significantly higher heavy metal levels in winter when compared to summer.

Madrigal, Arcelia and Waldron-Soler, Kathleen
Mentor: Susan Ruby

An Analysis of Character Strong's Purposeful People

Social emotional learning is a growing field that focuses on the five competencies of: self-awareness, social-awareness, self-regulation, responsible decision-making, and relationship skills (CASEL.org). Research has shown that evidence-based curricula that highlight these five skills can improve students' college and career readiness, outcomes in academics, and along with physical, emotional, and mental well-being. Schools are faced with the challenge of choosing an SEL curriculum that meets the needs of their students. Character Strong focuses on students' character while strengthening their social and emotional competencies. The program prioritizes the character development of patience, kindness, honesty, selflessness, forgiveness, commitment, and humility (characterstrong.com). While Character Strong is widely used by schools in the Pacific Northwest, little information may be found regarding the alignment of the program with best practices for SEL implementation. The Wallace Foundation (2021) completed two analyses of 33 different SEL curricula and identified key features of each program through a comprehensive coding system. While the Wallace Foundation analyzed well-known curricula, they did not analyze Character Strong. The Wallace Foundation provided their coding system to be used for analyses of other curricula. We analyzed Character Strong's Purposeful People, with a focus on 12 program components. We rated the 12 program components of Character Strong's Purposeful people to serve as a guide for those who may consider use of the program. Program components include features that support high-quality implementation of SEL programs, such as training, equitable and inclusivity, and family engagement. Our analysis provides school leaders and support staff valuable information regarding Character Strong's program components in comparison to the many programs already reviewed by the Wallace Foundation (2021).

Markus, Matthew
Mentor: Chad Pritchard

Exceptional agate formation in the Spokane basalt

People do not normally associate semi-precious gems with basalt or the "boring black rock" that dominates the Eastern Washington landscape. However, northeast of Cheney in the West Plains of Spokane a site hosts a system of gem-filled veins that can be found nestled into fractures of the 16-million-year-old (Kasbohm and Schoene, 2018) Priest Rapids Member of the Wanapum Basalt that is a part of the greater Columbia River Basalt. The fractures in the volcanic rock are the host to millimeter- 10 cm wide fractures with variable colored agate, opal, or chalcedony. Analyzing the agate reveals if a chemical substitution (Mn or Fe) accounts for the

color changes, or if it could be crystal structure. The basalt solidifies at a temperature of 800 – 600 degrees C (Lamure et al., 2018) and potentially forms fractures or joints. The agate should form at temperatures less than 400 degrees C (Goetze et al., 2012), so the agates possibly formed years after the cooling of the basalt. The basalt also has about 1.8 - 2 wt% H2O and Co2 (Lange, 2002), but since the agate was over 10% of the outcrop, this would exceed the water content of the basalt. The presence of a Miocene Lake was likely the source of external water for the hydrothermal formation of the agate and helps explain why it is a unique outcrop.

McPeck, Roxanne
Mentor: Andrea Castillo
Characterization of three Helicobacter pylori sRNAs by RT-PCR and Northern blotting
Helicobacter pylori, a bacterial gastric pathogen infecting approximately 50% of the human population, produces gastritis, ulcers, and gastric cancers. Colonizing the inhospitable and fluctuating environment in the stomach requires tight genetic control. However, *H. pylori* lacks many regulatory protein elements present in other bacteria. Instead, over 200 small RNAs (sRNAs; noncoding RNAs shorter than 300 nucleotides) have been found in this bacterium, but few have been fully characterized. Of those, many are antisense to virulence genes. Characterizing these sRNAs is important in understanding the mechanisms of molecular genetics and potentially supporting medical management of this pathogen. In the current study, I will analyze three previously identified but as-yet uncharacterized sRNAs through reverse-transcription polymerase chain reaction (RT-PCR), Northern blotting, and in silico target prediction, resulting in the sequence of each sRNA, their sizes, and their likely mRNA targets. Using RT-PCR primer walking, a technique employing custom oligonucleotides to experimentally determine the beginning and end regions of a transcript, I will find the exact sequence for these three sRNAs. With this, a program that projects RNA folding and hybridization energy can predict mRNA targets for regulation by base-pairing. Northern blotting employs specialized gel electrophoresis and imaging of fluorescent probes to analyze the size and gene boundaries of these sRNAs. Current results on the first of the three sRNAs to be investigated by RT-PCR are emerging. Total results will explicate these three sRNAs and provide a foundation for further inquiry into the regulatory role these small but impactful molecules play in *H. pylori.*

Melendez, Lourdes
Mentor: Greg duMonthier
But He's Cute
Using pen and ink I created this piece with cartooning in mind, but this is not a cartoon. The difference? Your first impression will surprise you. Think about it.

Melendez, Lourdes
Mentor: Jenny Hyde
Happy Family
I was interested in exploring two possibilities of the nuclear family, the surface and its secrets. I enjoy drawing in a style that contradicts the content, in this case, figures that are comically simplistic but confined to a serious setting. The contradictory quality aides in the duality of the piece, giving two glimpses into something that isn't always what it seems.

Mitchell, Alyssa
Mentor: Nicholas Burgis

Stability and Localization of ITPase in Human Cells

Human cells are protected from abnormal increases of non-canonical nucleotides by the ITPase enzyme, which is encoded for by the ITPA gene. Increased inosine 5'-triphosphate (ITP) concentrations are thought to interfere with an unidentified cellular process causing the defect. When the ITPA gene is knocked out in mice, mutagenic dITP accumulates in the deoxyribonucleoside triphosphate (dNTP) pools and all mice die before weaning. Some mutations of humans ITPase are found to be lethal, and lead to infantile encephalopathy including seizures and cardiac defects. To gain a better understanding of the cell biology that leads to these conditions, we will use neurons as a model cell and construct plasmids to create fusion proteins of ITPase attached to mCherry, a fluorescent protein. Once constructed, the fusion protein will be used to assist in looking at the stability of the ITPase protein in the cell. This fusion protein will also give us means to look at the localization of ITPase proteins in the cell, since mCherry fluoresces, in addition to exploring other biological outcomes.

Mohammed, Badradin
Mentor: Kristin Edquist

Environmental Politics: A case study of Hydropolitics Between Egypt, Sudan, and Ethiopia over the Nile River Basin

Access to water is a critical aspect of human survival; we have seen an increased tension over transboundary water over the years. In the northeast of Africa, the Nile River is among the most vital source of water and a source of conflict among three of its major riparian countries (Egypt, Sudan, and Ethiopia). For downstream states (Egypt and Sudan), the river serves as a lifeline, but for upstream states (rest of equatorial states), it provides an opportunity for economic growth. Historically Egypt has been the regional hydro-hegemon in the Nile Basin through historical treaties and agreements. However, the independence of Nile Basin countries in the mid-1900s has allowed upstream states to reassert their rights and establish equal control and benefits from the Nile River. International efforts to establish legal structure since the 1900s were unsuccessful and has done little to convince downstream countries to agree on a legal framework. While no direct military confrontation between any of the beneficiaries of the Nile River has occurred, studies have predicted that the recent disputes between Ethiopia and Egypt over the Grand Ethiopian Renaissance Dam is likely to lead to armed conflict. This study explores the trilateral disputes over the Grand Ethiopian Renaissance Dam involving Ethiopia, Egypt, and Sudan by examining the following research question: Under what conditions can Ethiopia, Egypt, and Sudan work to resolve their disputes over the Nile River in the absence of a legal framework? The study argues that while there is a possibility of direct arm conflict, it is unlikely that it will occur because any military confrontation between any of these states will result in a costly regional crisis and will supersede peace resolution of ongoing disputes.

Morgan, Acennan
Mentor: Jenny Hyde

Stockpiles of D.O.T

The Interstate Highway System, originally the Dwight D Eisenhower National System of Interstate and Defense Highway System, is the network of interconnected controlled-access roads that span the entire United States. While the benefit of it was standardizing infrastructure standards, it had and still has several drawbacks to this day. It necessitated construction that demolished and displaced entire neighborhoods. It has been particularly harmful to lower income neighborhoods as well as neighborhoods inhabited by Black, Indigenous and other People of Color. It has also been harmful for the environment as a whole, drawing money away from public transit projects and walkable urban spaces and requiring more and more automobile dependence.
My piece, Stockpiles of D.O.T., tackles yet another issue with the highway system. As the original name suggests it was designed for the transportation of "defense" i.e war related tools at the height of the Cold War

and continues to benefit the defense industries and the automobile industries more than it does for the working masses to this day.

Morton, Travis
Mentor: Chad Pritchard
Detrital zircon ages in heavily folded quartzite compared to Steptoe Butte
Folded and altered quartzite along Interstate 90 and the Palouse to Cascades Trail out of Rosalia, WA preserves a record of the region's tectonic past. The working hypothesis is that the sandstone is Cambrian (roughly 500 million years old) and was metamorphosed and deformed during the Sevier orogeny (roughly 150 to 50 million years ago), and then uplifted about 50 million years ago. The first step to address the hypothesis is to determine the age of the rocks using detrital zircon U/Pb analyses. The second step is for a detailed field study to identify relationships between metamorphic grades and geologic structures. For comparison samples from the nearby Steptoe Butte were also analyzed, which is likely Cambrian (roughly 500 million years ago) based on an abstract with unpublished results by Ellis and others (2004). From this study we hope to help decipher the older geological past of our area, since so much of our regional geology is dominated by younger 16-million-year-old basalt and 16,000-year-old mega flood deposits.

Nall, Grace
Mentor: Jonathan Middleton
Ocherous Bloom
Ocherous Bloom is a marimba solo about flowers. When a flower starts to grow it goes through more than we think about. It faces unpredictable weather and competition for root space. While it faces all these hard things in its life, it also faces many positive things as well. The beautiful sunny days, the bees and butterflies pollinating it, natural growth, etc. In my mind, a flower reminds me of myself as I get older and grow over time. Sometimes we wonder when a flower will bloom and get nervous if it ever will, and that was a driving force for myself when I wrote this piece. Will I ever graduate? Will I ever feel like I'm exactly where I need to be? When will I bloom? These questions swirled in my mind constantly when I was a freshman in college. I've realized now that I'm exactly where I need to be. I'm growing, taking on the crazy weather and eventually, I will bloom.

Nguyen, Nhat
Mentor: Andreas Aragoneses
Dynamical Visibility in Chaotic Systems
One of the great challenges in complex and chaotic dynamics is to reveal its deterministic structures. These dynamical structures are sometimes a consequence of hidden symmetries. Detecting and understanding these structures can allow the study of complex systems even without knowing the full underlying description. Here we introduce a new technique, called Dynamical Visibility, that quantifies temporal correlations of the dynamics. It measures the departure of the dynamics from internal symmetries. We have applied this technique to well-known chaotic systems, such as the logistic map and the circle map, as well as to experimental data from diode lasers with optical feedback and external modulation. Our results show the robustness of the method in characterizing dynamics and highlighting transitions in behavior.

Osias, Aya, Parrish, Dylan, and Wynecoop, Sophia
Mentor: Rosalee Allan, FACHE, PHR, CP-SHRM
Behavioral and Mental Health - The Unseen Pandemic
The current pandemic is often associated with a deterioration in emotional, behavioral, and mental health. High life satisfaction during isolation was 71% in boys and 62% in girls but 92% and 81% in 2020. In response to this

drop in health, Jay Inslee has produced many initiatives to help combat the issue. This project will evaluate the state's policy, program planning, analysis, and evaluation of behavioral health and access to care amongst adolescents, ages 10-19 years. The research will be conducted by literature review and will include statistical review and data sets available as of 2022. The goal is to improve outcomes for individuals and families. Disruptive behavioral disorders are most common during adolescence. In most cases, adolescents are not the ones to initiate the conversation regarding their health. It is important to educate and offer support systems as poor behavioral health education can go in pair with other behavioral risks. Do we have a behavioral and mental health situation that meets the definition of being a pandemic and is often untreated? It is hoped that this study will provide resources for Washington state residents and law makers to act in the absence of addressing behavioral and mental health.

Palomi, Isaac
Mentor: Kyle Larsen
Combined Evaporative Cooling with Vapor Compression Air Conditioning to Increase Efficiency A possible way to cut costs in cooling is to increase the efficiency of an air conditioning system. Evaporative coolers are often used in dry climates as an economical means of providing cooling. They are both very effective and simple to operate since they use only a pump and a fan with no compressor. However, there are disadvantages with the evaporative cooler. These include such things as increasing the inside humidity thereby raising the chance for mold, permitting dust, pollen, and other outside contaminants to enter a building causing possible allergies and not operating effectively when there is high outside humidity. While systems using vapor compression air conditioning don't have these disadvantages, they require that much more energy be used in order to operate the compressor in the system. In climates where there is generally low humidity, combining the advantages of both the evaporative cooler with the vapor compression air conditioner could significantly increase efficiency while reducing the disadvantages of the evaporative cooler. By providing cooler air to the coils of the condenser coils of the vapor compression system by the evaporative cooler, an increase in the efficiency of the overall system should be obtained. How much savings can be obtained from this combined system is the question. The directed studies will finish equipping and installing all the instrumentation and other additional hardware necessary to study the effect of combining both the systems to increase efficiency. This includes providing both testing and analytical analysis in determining the overall increase in efficiency and cost savings of this system.

Perez, Jennifer
Mentor: Jenifer Walke and Bo Idsardi
The implementation and assessment of a course-based undergraduate experience (CURE) focused on student-driven amphibian pathogen surveillance
There are calls for a more inclusive, hands-on research experience to be accessible to all undergraduate students. This has led to the development of course-based undergraduate research experiences (CUREs) which can provide an opportunity for a larger and more diverse group of students to engage in authentic research. CUREs can make a positive improvement in student comprehension, confidence, and awareness within their learning. The North American Bsal Task Force Surveillance and Monitoring Working Group developed a CURE called the Student Network for Amphibian Pathogen Surveillance (SNAPS) in 2020-2021 across three institutions. SNAPS incorporates amphibian disease surveillance into undergraduate courses where students learn about amphibian pathogens through the lens of diverse academic disciplines. Students actively contribute to disease surveillance efforts by sampling for two fungal pathogens among local amphibians. Before and after participation in SNAPS, students completed surveys that measured their self-reported knowledge of amphibian disease, interest in the environment, and self-efficacy towards conservation. In the preliminary analysis we found that SNAPS significantly increased students' self-reported knowledge on amphibian disease (Kruskal-Wallis test, Chi-square = 7.9374, p-value < 0.02). For 2022, SNAPS has expanded to 29 participating

institutions across North America which can allow for the opportunity to further evaluate the impact of SNAPS CUREs on students' learning as well as continue amphibian pathogen surveillance.

Poss, Haili
Mentor: Jill Seiver
Sex Guilt and Attitudes towards Sex Work
Studies have shown that attitudes towards sex work and individuals that are sex workers holds significant influence on social policies and social work. This is important to the field of psychology because understanding the attitudes towards this topic can help us form policies and provide resources with the goal of reducing stigma that comes along with this issue.

I propose to conduct a survey to determine whether people with higher sex guilt hold more stigmatizing attitudes towards sex workers and/or sex work. Respondents will be recruited from psychology classes. Level of sex guilt will be measured by the Mosher Sex-Guilt Inventory (MSGI), and the degree of stigmatization of sex work (SSW) and of sex workers (SSWR) will be measured by the Attitudes towards Prostitutes and Prostitution Scale (APPS). Demographic questions such as socioeconomic status, religion, and ethnicity will be included. A Pearson's correlation will be performed on the scores from the MSGI, the SSW, and the SSWR. I predict that there will be a strong positive correlation between sex guilt and degree of stigmatization of sex work and of sex workers. Scores from the MSGI will be divided into low, moderate, and high sex guilt, and a 2 (sex) x 3 (level of sex guilt) MANOVA will be performed on the DVs of SSW and SSWR. I predict a significant main effect of sex guilt, with respondents who are high in sex guilt scoring higher on SSW and SSWR than those who are low or moderate in sex guilt. I do not expect a main effect of sex, but I do expect an interaction of sex guilt and sex; I predict that males who are high in sex guilt will score higher on SSW and SSWR than women who are high in sex guilt.

Regel, Madi, Lilleberg, Maddie, and Abdushakour, Bashaer
Mentor: Rosalee Allan, FACHE, PHR, CP-SHRM
The Increase of Fentanyl Use in Young Adults and Its Relationship to Mental Illness
The abuse of prescription pain medication has risen to exponential levels in the United States within the past few years, leading to overdose deaths. The opioid epidemic sparked the popularity of the use of Fentanyl due to its highly potent pain-fighting properties. What was once approved to manage pain symptoms for cancer patients is now being used by thousands of young individuals irresponsibly and poses a threat to the health of our population. It is also becoming increasingly common worldwide to find this synthetic opioid mixed with other illicit drugs. The scope of the research focuses on studies on self-medication due to mental disorders. The research will be conducted through a literature review and include a statistical review and available data sets.

The study aims to present a synthesized review of the relationship between fentanyl abuse in young adults and mental illnesses. Is the increase in fentanyl substance abuse amongst young adults related to mental health disorders?

It is hoped that this study will bring awareness to the fentanyl epidemic, the influence that mental health factors have on a person becoming a fentanyl user, and alternative ways people can get involved to help aid this matter.

Richardson, Jack
Mentor: Justin Bastow
The Interaction of Sulfate and Perchlorate and its Implications on Bacterial Survival on Mars
Escherichia coli, *Bacillus subtilis*, and *Staphylococcus aureus* are all known spacecraft contaminants. This makes their viability to arrive and survive on Mars feasible, however, this could prove to be a great risk to the Martian environment. In order to test this possibility, all three species were grown within brines containing

differing salts and salt concentrations. These salts and their corresponding concentrations are based on known data regarding Martian soil. Growth was measured over a course of 20 hours in solutions containing MgSO4 at concentrations of 4.6% and 9.2%, Mg (ClO4)2 at concentrations of 0.6% and 1.2%, as well as solutions containing both salts at 4.6%/0.6% and 9.2%/1.2% (concentration of MgSO4 / concentration of Mg (ClO4)2). Significantly reduced *B. subtilis* growth to the point of possible cell death was present in all salt solutions except for Mg (ClO4)2 at 0.6% where growth was present. Normal levels of growth across all salt solutions were present with *S. aureus* except for solutions containing all salts at double concentrations. Similarly, normal levels of *E. coli* growth were reported within all salt solutions except for Mg (ClO4)2 at 0.6% where a significant increase in growth was reported. Our results suggest that a combination of a lack of sulfide toxicity and the presence of perchlorate reduction may be a necessity for future microbial life on Mars.

Robertson, Michelle
Mentor: Joshua Hobson

A Reflection of a Reflection

After researching Rinko Kawauchi, I was inspired by her soft, diffused photos of everyday things. I chose to photograph flowers and plants because of their inherent ephemeral qualities and the concept of mono-no-aware, or the awareness of impermanence. I was also exploring the idea of photography as a reflection of the subject matter. I took photos of the reflected flowers and plants at the Manito Park Conservatory using a bowl of water to create the focal point. The bowl was placed under the subjects and the photo was taken of the reflection. I used an Olympus E-PL9 mirrorless camera with a 45mm 1:1.8 lens so that the focal point was sharp, while everything else was diffused and blurred. I wanted to think about photography as a meta concept as these are reflections (the image in the water) of reflections (the subject of the photograph).

Rooney-Sailand, Benjamin
Mentor: Eric Abbey

Abbey's one-pot synthesis method for organoborohydride PPN salt synthesis results in quality crystalline compounds viable for X-ray crystallography with a high % yield

Abbey’s research spells out an efficient one-pot synthesis reaction for creating *organo borohydride* PPN complexes. It also characterizes the new family of compounds by using analytical chemistry techniques to obtain, process, & communicate molecular information regarding composition (proton NMR, boron NMR, IR spectra) as well as crystal structure/arrangement of functional groups (X-ray crystallography).

The designed method involves an initial reduction of a substituted potassium trifluoroborate (RBF3K) salt to its respectively reduced borohydride followed by an ionic replacement reaction with PPNCl resulting in our desired product with a decent % yield. This establishes & idealizes a one-pot synthesis method for turning most members of the organoborohydride family into PPN complexes.

An obstacle that had to be adjusted for along the research process was solvent choice, both for the synthesis itself as well as for clean crystallizations. 2-methyltetrahydrafuran (2-MeTHF) was found to give higher yields than regular tetrahydrafuran (THF), likely because THF was failing to entirely dissolve the formed product, so it was accidently being filtered with celite along with the salts. Dichloromethane (DCM) was causing issues when trying to attain & solve crystal structures. It seemed that PPN would preferentially form a complex with this solvent over the target borohydride. The work around this was using dichlorobenzene, a bulkier solvent molecule.

These PPN complexes could possibly be used to attach metal ligands, which would open a unique door & spawn some new metal chemistry in the future. While our lab was unable to get this to work effectively with molybdenum hexacarbonyl, there are scientific papers that specify the steps on exactly what would theoretically be possible to accomplish using these new compounds. Having a wide variety of electronic environments enables manipulation of boron's hydride donating ability more selectively.

Rose, Benjamin, Scott, Daniel, and Morris, Jason
Mentor: Robert Gerlick and Kyle Larsen

PLC Hands on Learning Apparatus

This project will look into the Programmable Logic Controllers (PLC) area of study. PLCs are microcontrollers used in factories and manufacturing facilities to reliably control complex machinery in a safe and predictable manner. The purpose of this research project is to make a demonstration that can be used in a lab for future engineering students to apply their knowledge of PLC programming, installation, and troubleshooting. The goals of this project are to have a realistic model of a fluid control system and to allow a team of students to program, wire, and troubleshoot a real-life model to get hands-on experience with PLC systems. This will allow for visualization of processes used when controlling a PLC. For the design of the project, a fluid tank and control system will be created for the purpose of teaching students how to program a PLC system. The primary focuses are going to be on reliability/durability, ease of use, safety, and aesthetics. The reasoning behind the parameters is that many students are going to be using this for future classes, and said needs are going to make the learning process more streamlined. The results expected will be a working tank that will show the filling and emptying of water during a PLC process. This will help to increase students' understanding and knowledge of PLC systems. This is a work in progress started this quarter and we hope to have most of the construction completed by May 10th for the symposium.

Roussa, Lucy and Allen, Jessica
Mentor: Camille McNeely

Freshwater Sponges in Eastern Washington: Environmental Constraints, Species Composition, and Associated Photobionts

Freshwater sponges are filter-feeders that can harbor algal symbionts in their tissues. They are relatively poorly studied compared to other freshwater invertebrates. To my knowledge this is the first study of freshwater sponges in eastern Washington. The use of genetic sequencing in my research will provide a level of identification certainty for sponges and their algal photobionts that traditional microscopy cannot provide. For this study, I hypothesized that water quality characteristics such as pH, temperature, and nutrient concentrations will differ between sites with and without sponges, and that each species of sponge will have a unique consortium of algal photobionts. Since freshwater sponges are abundant when present, it is important to understand the impact that these filter feeding invertebrates have on the aquatic environment. This research will determine what species of freshwater sponges are present in eastern Washington and if there are differences in symbiont composition amongst this population. By surveying environmental parameters, we can gain an understanding of the habitat preferences of these animals. Most importantly, it is vital to document the presence of poorly studied species in the face of a changing climate. Because of the lack of research regarding freshwater sponges, we are unaware of the full impact that they have on the health of streams and rivers in the inland northwest. This research will contribute to our knowledge of these poorly documented freshwater animals and their algal symbionts.

Satheesan, Vivin and Morris, Seth
Mentor: Robert Gerlick

Applied Shear Force on Bolts

This research will examine the relationship between the theoretical, numerical, and experimental values found in fasteners with an applied shear force. Examination of these three values will present the differences found in practical versus theoretical applications. This research will be able to highlight the differences found in all three approaches to determining the same values. Bolt fasteners will be used to secure three pieces of metal plate together, these plates will then be secured within the tensile and compression testing machine and a tension force will be applied until failure occurs. The data collected from this test will be compared to the values found from numerical analysis using the Solidworks software and hand calculations derived from the given

measurements of the materials used. The purpose of this research is to compare these methods of analysis to identify what if any deviance occurs between the three data analysis methods and what potential issues that may have led to any deviation. We are in the process of manufacturing the testing material and the results and conclusion will not be available until the data has been collected and analyzed. The analysis of this data will lead to a better understanding of the differences and similarities in the three data analysis formats used.

Sattler, Brian
Mentor: Greg duMonthier
Textures & Tapes
Vine and compressed charcoal on cotton paper. My focus was less on the application of the charcoal, but what is revealed when masking tape is removed. Masking tape was applied during the application of vine charcoal at different pressures creating various shapes, textures, and unique lines when removed. Compressed charcoal was used at various pressures and application techniques to heavily contrast the lines created from the removal of masking tape, giving depth and the illusion of three-dimensionality to a two-dimensional composition.

Shimp, Zachary and Gamache, Katlin (Chad Pritchard
Deciphering Spokane's regional geology using the new USGS-EWU Mineral Separation Lab
U/Pb radiometric dating of zircon is one of the most widely used methods to determine the crystallization ages of igneous and metamorphic rocks and the provenance of sedimentary rocks. Eastern Washington University (EWU) has collaborated with the U.S. Geological Survey (USGS) to build a mineral separation lab for isolating zircon (and other) minerals for analysis. This lab was completed in Fall 2022 and is currently being transferred to the new ISC for future use. Graphically illustrated below are the methods used for sampling and pulverizing the rock, as well as grain mount preparation techniques. One of the EWU projects that is benefiting from the new lab is a mapping and detrital zircon geochronology study of local steptoes and exposures of rocks formed prior to the Columbia River Basalt. The mineral separation lab is now established, so we are entering into the field work and mineral separation parts of deciphering the tectonic past of Spokane's regional geology.

Snyder, Kristy
Mentor: Brian Buchanan
Using LiDAR to Estimate Carbon Sequestration of Evergreen Trees at Eastern Washington University (EWU) Campus, Cheney, Washington
EWU contains a variety of evergreen trees across its campus, providing several benefits. However, no comprehensive record exists of the total number, location, species, or ages of these trees. This knowledge can inform facilities of proper care for individual trees and can be used to estimate carbon sequestration on campus. Traditional on-the-ground methods for assessing tree age and height require tree cores or clinometers, making trees susceptible to pests or disease and leading to inaccurate results. Remote sensing using lidar data is a noninvasive method to measure tree height and subsequently assess tree age. This poster explores using point clouds to 1) create a thorough record of evergreen trees on campus, 2) estimate carbon sequestered by campus trees, and 3) project optimal locations to plant individual species of trees on the Cheney campus.

Stafford, Brenna
Mentor: Jennifer Walke
Diversity and Evolutionary Relatedness of the Western Honey Bee Gut Microbiome
Western honeybees (*Apis mellifera*) are important pollinators in ecosystems, but their colonies continue to experience significant loss. In the early 2000's, an abnormal phenomenon called colony collapse disorder (CCD) was brought to the attention of many researchers and led to questions of microbial pathogens,

agricultural pesticide use and beekeeping practices affecting hive survival. Honeybees form symbiotic relationships with bacteria to colonize their guts and aid in a variety of physiological processes including disease protection and nutrient acquisition. The gut microbiome is a prime target for research because of the interaction with other systems in the body to maintain overall health and could help control disease that spreads through honeybee populations. The honeybee has low taxonomic complexity in the gut microbiota containing ~8 core bacterial genera; *Bifidobacterium, Lactobacillus, Snodgrasella, Bartonella, Apibacter, Frishcella, Gilliamella, and Acetobacter*. This study challenges that notion by examining strain variation of over 200 bacterial isolates that were acquired from the guts of 6 Western honeybees that occupied 3 different hives in the same environment. Through 16S ribosomal RNA gene sequencing, we identified 5 bacterial phyla, 12 genera and 28 different bacterial species. A maximum likelihood phylogenetic tree was built to compare evolutionary relationships between the isolates that were provided and the references they were compared to from the NCBI database. Majority of the species found in all 3 hives were associated with the core genera along with the exception of *Apibacter, Frishcella* and *Acetobacter* that were not present. The complexity of the bacterial species found within the 6 bees will need additional research to determine the role and functions of individual species as well as how interactions with other members of the gut microbiota affect the Western honeybee.

Thorpe, Holly
Mentor: Jonathan Johnson
Milton's Sin as a contemporary literary symbol of the "good" and imperfect woman
In this paper I present two examples of "imperfect woman," "forgiven sinner" poems, one with an explicit biblical reference and one without. Through the framework of these examples in conversation with Milton's "Paradise Lost," I propose that Sin provides a better representation of modern feminine experiences and deserves a place alongside Eve, Adam and the Holy Trinity in contemporary feminist poetry.

Eve is a romantic character. Physically beautiful, intellectually compelling and just rebellious enough to be interesting. Milton's Sin is the result of immaculate conception born from a fallen angel, absent of any apparent sin, yet having many sins committed against her. Milton defines her solely by the violence enacted upon her and by her bodily appearance. She's intended to be hideous and pitiable. Yet, she remains powerful, rising above the circumstances of her birth, surviving the violence committed against her and literally paving the way to the new world for her father and progeny. As such, I propose Sin as the modern biblical symbol of the empowered woman.

Toulou, Erin
Mentor: Chad Pritchard and Lauren Stachowiak
Groundwater Modeling of the West Plains, WA
Located in Eastern Washington in the West Plains Region sits a plateau of Columbia River Basalts between Deep Creek, Hangman Creek, and south of the Spokane River. Primarily in Airway Heights, the amount of drinking water as well as the quality of the water has affected residents in the area. The most recent issue is PFAS contamination, which is thought to negatively affect human health and is found in drinking water wells across the West Plains. We can interpret subsurface geology using new well logs from Fairchild Air Force Base and in the Palisades area. When using ArcGIS PRO, well information can then be interpreted and projected as various data points. After this, it can be interpolated to predict multiple geological horizons and can be used to estimate the flow direction of groundwater. We will also use real PFAS results from across the West Plains to estimate if contamination can be linked to possible sources, including airports, fire stations, car washing facilities, or dumps. These models can help residences in the West Plains Region understand the possible sources of contamination as well as create a safer environment for them and their families. This research could put worried residents at ease and help them find clarity in this difficult situation.

Ulland, Justin and Cortez-Morales, Anthony
Mentor: Kevin Criswell

Causal Attribution, Personal Responsibility, and Regret in Lung Cancer Survivors

Introduction: Lung cancer is the second-most common cancer for males and females and the leading cause of cancer-related deaths in the United States. Ninety percent of lung cancer cases are associated with a smoking history. Even lung cancer survivors who never smoked report feeling associated with a stigmatizing disease. Less is known about (a) how lung cancer survivors who ever or never smoked compared on attributions of their cancer to personal or secondhand smoke and (b) how those attributions may be associated with feelings of personal responsibility, regret, and medical blame. This is a secondary data analytic study of surveys from 196 lung cancer survivors who were recruited at southern California hospitals.

Method: Paper surveys with return envelopes were mailed to lung cancer survivors who consented to participate. Surveys included attributions for personal and secondhand smoking, including (a) whether the smoking caused their cancer, (b) whether they perceived control over that cause, and (c) whether they expended effort towards avoiding that cause. t-tests were used to examine mean differences between ever and never smoking groups on attribution questions and correlations were used to examine associations between attribution questions and personal responsibility, regret, and medical blame. Significance was set to $p < .05$. Results: Survivors with a smoking history attributed the cause of their cancer to their smoking. Those without a smoking history reported expending greater effort to avoid secondhand smoke. Effort to reduce exposure to secondhand smoke was negatively associated with personal responsibility and regret in those without a smoking history. Discussion: This study fills a gap in the literature by reporting the attribution and personal responsibility for causing their cancer in lung cancer survivors without a smoking history. Results suggest that survivors with no smoking history attribute the cause of their cancer to others smoking around them.

Vallone, Cailey, Baheza, Alyssa, Chernyavsky, Denis, and Arstein, Shane
Mentor: Lynn Briggs

English/Philosophy Display Board

The purpose of this poster board for the English/Philosophy display case is to create attractive advertisements for the unique courses offered by the English/Philosophy department. The need for these posters draws from lack of student awareness on some courses. Based on theory that informs rhetorical choices, this poster will display the visual strategy we chose to attract students to these courses and majors.

Vanos, Nathan
Mentor: Shamina Yasmin

Multimodal Game-based Learning in Post-secondary STEM Education

There is a growing need for changes in the traditional education system to keep students engaged in subject materials. Some initiatives were taken at the elementary level via gamification to enrich students' learning experiences, however, game-based learning is yet to be explored in post-secondary education. Research findings demonstrate that educators prefer multiple senses in the classroom environment over traditional vision-based experiences. Multimodal, game-based learning (MGBL) is instruction through a combination of multiple senses (i.e., sight, sound, and touch) that can further enhance student engagement. A game-based approach in post-secondary STEM fields will allow students to assimilate course materials more effectively and comprehensively to keep them interested in the process. For this project, I plan to design and implement an MGBL tool for the instruction of a basic post-secondary computer science (CS) subject. In CS, students are required to learn different data structures, which are methods of organizing and storing data. I would like to build a multimodal, game-based data structure instruction tool to help students comprehend the dynamic and complex nature of data structures interactively. My goal is to develop two versions of the application: a virtual reality (VR) implementation and a non-VR desktop version. This research will assess potential improvements in student engagement and understanding via sight, sound, and wonder. Courses on data structures are offered every

quarter in the CS curriculum, thus, the concept of data structures is an excellent setting to test the efficacy of MGBL via direct feedback from students. To implement this project, I will utilize the Unity game engine. Until now, Unity has been used almost exclusively for game development. Its power and flexibility have not yet been realized in the development of applications for education. This research will also promote other researchers to use Unity in their own endeavors.

Vue, Cheyenne
Mentor: Chris Tyllia
Grandpa Blowing the qeej
This is a wheel-thrown vessel using G-mix stoneware clay. By using a very thin brush, I'm able to create thin lines using black underglaze with a clear glaze over everything. What is shown on the vessel is my grandpa (Xailong) playing or blowing a Hmong (Ethnic Asian minority originated from China) instrument called the "Qeej". The qeej is made up of six bamboo pipes and each pipe has a different size which will have different sound pitches. Each sound or note corresponds to a spoken Hmong word. Before blowing into the instrument, the player (if they so choose) will sing the verse that they will be playing. The songs are passed down through oral tradition since there are no written notes to learn from. In the Hmong culture the qeej is often played at celebrations or at funerals. When played at the funeral the qeej is a way to connect to spirits and a guide for the deceased. But when it's played at celebrations it's entertainment and music for the ears to enjoy and listen to. I used an old picture I found of my grandpa playing and dancing with the qeej at a new year celebration and used it for reference. Born in Laos, a teacher taught my grandpa how to blow the qeej, my grandpa will later on teach my dad, and my dad will teach me. Growing up I will always hear the qeej being played around the house and greatly took an interest in it. In the Hmong culture, it's standard for men to play this instrument and very unusual for women to. However, I like to challenge the norms and my grandpa without fail encourages me to keep playing the qeej and would often tell me that "women can do it as well". Entering the art field, I've always wanted to find a way to incorporate my Hmong background into whatever I am creating. I've thrown many vessels on the wheel and had extra so I thought that this would be the perfect opportunity to portray an important element in the Hmong culture. The best person to portray playing the qeej is none other than my grandpa.

Vue, Cheyenne
Mentor: Margot Casstevens
Hmong paj ntaub (cross stitch embroidery) printed on joss paper
Hmong, an ethic Asian minority with origins from China. Now, the Hmong are spread across the states and world. Being Hmong American, I've always wanted to represent and portray the Hmong culture to people. In this piece, I combined a paj ntaub (cross stitch embroidery) and joss paper into one big creation. Paj ntaub is very significant to the Hmong culture as it can be sewn into clothes or tell a story cloth. I personally enjoy doing paj ntaub on my own free time and I actually took the design from my own paj ntaub and used it as a stencil. I found out that relief or block printing worked best for printing on joss paper, therefore I carved a paj ntaub design on it and printed the design using ink on the joss paper. I printed over 20 sheets of joss paper and folded them into a boat. I folded one end of the boat to create a petal-like feature and hot glued them all together to create this piece. In the Hmong culture, joss paper is meant to be folded into a specific boat shape and burned as the Hmong believe that joss paper is money in the spirit world. With that money the deceased family members will use it for their needs and wants in the afterlife. Many people will burn joss paper for loved ones, guidance, wishes, worship, and funeral rituals. When looked upon, I want the viewer to feel enticed and enriched by the Hmong culture.

Ward, August
Mentor: Nicholas Burgis
Enzyme Kinetics of L20M and W151G ITPase Mutants
ITPase is a homodimeric pyrophosphohydrolase that catalyzes the hydrolysis of the anhydride bond between the alpha and beta phosphates of mutagenic NTP's. The enzyme is active in the cytosol, and its primary purpose is to exclude the non-canonical purines ITP and dITP from the pool of nucleobases in the cell. Mutations in ITPA, the gene that encodes ITPase, resulting in a biallelic loss of function, have been classified as the effector of developmental and epileptic encephalopathy 35. A rare, genetic, neurometabolic disease characterized by encephalopathy, severe global developmental delay, variable cardiac abnormalities, and cataracts, usually resulting in the death of affected subjects by 6 months of age. In this experiment we perform kinetics analysis on ITPA mutants, L20M and W151G, against the wild type, to determine if the mutations affect the activity of the enzyme. Both mutations are thought to have clinical relevance, where W151G has shown to be lethal. The W151G enzyme is expected to have very poor catalytic activity, the Trp151 to Gly151 mutation is expected to cause a steep loss in affinity for the substrate because Trp151 stacks with the nucleobase in the catalytic site. Counter to this we expect the L20M to have little effect on the activity of the enzyme because the missense mutation is far away from any sites known to affect catalytic activity. Activity analysis is performed by simple incubation of the induced, purified enzyme with different concentrations of ITP for set periods of time. Then subsequent analysis of the levels of IMP by HPLC. Results not available at this time.

Webster, Kole, Affholter, Abby, Del Pizzo, Catherine, Karlman, Kristy, Cornelison, Aaron, and Tristant, Andre
Mentor: Lynn Briggs
The Growth of the English and Philosophy Departments Through the Visual Interpretation of Students
English and Philosophy degrees are important and provide relevant and transferable skills. What is little understood is exactly how these transferable skills apply to the "real world." As a class the study of human interaction and reaction have been embedded within the use of creating a fulfilling display case for the department's bulletin board. Within this plan, students will use visuals such as Origami to convey creativity and the embodiment of these two departments, as well as many other visual applications. These ideas will showcase the use of skills that students within the English and Philosophy departments can use to create meaningful applications in a career-oriented future, while also featuring functioning careers that embody the goals that were amplified during undergraduate and graduate degrees.

Webster, Kole, Lucarelli, Angelo, Mendoza, Anthony, and Geleynse, Justin
Mentor: Kate Crane
EWU Mascot Name Change: A Detailed Study into What Influenced the Mascot Name Change Most current Eastern Washington University (EWU) students are unaware of the mascot controversy that took place in the 1970's. A series of votes between the students and faculty found that most of the student population was not in favor of changing the mascot name: the Savages. In 1972, the Board of Trustees began implementing the change to a new mascot and had students and faculty vote on what they would like to have as the new figurehead for the student body. Only a small percentage of students and faculty participated in the vote, but the majority of those who did participate voted to keep the Savage mascot. The other choices, Braves and Appaloosa's, did not last long in the voting polls. The Eagles mascot began to gain popularity amongst students and faculty ultimately leading to the mascot change in 1973. What influenced Eastern's decision to remove "Savages" as their mascot? For researching the use of Native mascots in EWU, two main methods were utilized. First, we explored and researched the student newspaper archives as the main source of information, especially when finding articles in the 1920s and early 1970s. Second, we conducted interviews on the topic of Native mascots and Native imagery. This connects issues of the past to the present, being able to find educated and human sources. In 1970, students along with minority groups on campus gathered around Cadet Hall to protest the Vietnam War along with the unprecedented bombing of Cambodia. With the rise of awareness in

minority groups around the nation, progression and the war on peace had begun on college campuses across the United States leading to a brand new and far more liked and appreciated school mascot. This was accomplished in no small part to the growing progressive student population at EWU.

Welsh, Zackary
Mentor: Larry Cebula

Telling Stories of The Pacific Northwest in the Second World War

In Spring of 2020 our project for Dr. Cebula's class, HIST 442: Nearby History was to collaborate with the Northwest Museum of Arts & Culture to help the curator research a forthcoming exhibit about the Spokane Homefront during World War Two. I researched two war-time Spokane individuals: Betty Marchand and James Wesley Crow, as well as two significant locations: Velox Naval Depot and the Magnesite Mines of Northeastern Washington. The research was used in the development of an exhibit for the Spokane Museum of Arts and Culture that was on display in the fall of 2020. I also contributed two stories for the Spokane Historical website (spokanehistorical.org).

Marchand served in New Guinea with the Women's Army Corp. Crow was a member of a B-17 crew that was downed in German-occupied Yugoslavia, and whose escape is worthy of a film. Velox Naval Depot was the 5th largest in the United States. Magnesite mines were important to the war efforts of both world wars, supplying an important component of steel (which was discovered and utilized when trade with Hungary, the world's largest source of magnesite at the time, was disrupted due to the warfare).

I plan on having two main sections on the poster. First would be the work done for the MAC, with pictures of the artifacts and exhibits along with summaries of the two figures, supplemented this with handouts. Second will have the two locations, Velox Depot and the mines with a QR code to the stories on Spokane Historical. I also plan on having a small section with the process of researching local history and working with the museum, that I will expand upon myself in person.

The goal is to present the history of our local area to the locals and hopefully interest them further.

Wheat, Theodore
Mentor: Judd Case

A latest Oligocene occurrence of feather-tail possums (Acrobatidae: Marsupialia) from the Wipajiri Formation, South Australia

The family *Acrobatidae* (feather tailed possums) was previously considered to have a minimal fossil record restricted to the last five hundred thousand years. This family includes *Acrobates pygmaeus*, the feather-tail glider from Australia, and *Distoechurus pennatus*, the feather-tail possum from New Guinea. Here, a new species of the family *Acrobatidae* is described based on the phylogenetic analysis of a lower left jaw fragment. The holotype specimen, UCMP-131924, was discovered in the latest Oligocene Wipajiri Formation in South Australia, which extends the temporal range of Acrobatidae back to about 24 Ma.

The jaw fragment retains the first and second molars fully intact, a partial third premolar, and the alveoli for the first two premolars and the back two molars. The lower molars of *Acrobatids* are unique in that the cristid obliqua runs across the talonid basin towards the lingual side of the tooth. The presence of this feature, among others, led to the initial hypothesis that UCMP-131924 was a member of *Acrobatidae*. A phylogenetic analysis was then run to determine UCMP-131924's relationship with known possum families, and to test the initial hypothesis that it was a member of *Acrobatidae*. The new specimen was compared with 17 other species from other Australian possum families, including *Acrobatidae, Burramyidae, Petauridae, Phallangeridae,* and *Pseudocheiridae.* A total of 44 characteristics of the teeth and jaws were used to compare the different possum species. The results of the phylogenetic analysis supported the hypothesis that the late Oligocene *acrobatid* is the sister taxon to the two extant *acrobatids*, *Acrobates* and *Distoechurus*. This discovery helps paint a clearer picture on the history and development of Acrobatidae, and it adds to the known diversity of the Wipajiri Formation.

Wilson, Sophia
Mentor: Thomas Askman

Angry Mouths

Angry Mouths is a mixed media painting on a 48x60 inch stretched canvas. This painting utilizes a variety of techniques to create a sense of pulling or smearing paint almost like smearing lipstick. Depictions of mouths and teeth make their way through the layers and layers of paint, the levels of obscuration vary, as do the moods of the mouths. Texture and abstraction create the space in this work, pulling forward and pushing back on different planes of paint and water and oil. The mouths are something of a focus in this work, but ultimately, the color and teeth and mood will be different and significant to each of us, pulling us into the painting and evoking thoughts and feeling each our own.