

2023 Ramaley Celebration Program and Book of Abstracts

April 19, 2023



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Schedule of Events

Poster Sessions

Kryzsko Commons Ballroom

Session 1 – 9:00 to 11:00 AM

Session 2 – 1:00 to 3:00 PM

**Early Years Research and Creative Mentoring Session – 10:30-12:00 - Kryzsko
Oak Room G**

Round Table Discussion – 10:00-10:45 AM – Kryzsko Solarium

Oral Session – 1:00-1:30 PM - Kryzsko Oak Room G

Videotaped Oral Presentations:

<https://openriver.winona.edu/rca/2023/ondemand/>

Faculty Research Presentations – 11:00-1:00 Kryzsko Oak Rooms E/F

Welcome to the 2023 Ramaley Celebration!

Welcome Remarks from University Leadership: <https://openriver.winona.edu/rca/2023/welcome/>

This year marks the 17th anniversary of the first Ramaley Celebration, which is a highly anticipated event that features student presentations of their research and creative achievements. At Winona State, research and creative achievement is highly valued as an integral part of the educational process and because of this every spring semester a day (now known as RCA Day) is set aside to celebrate this. Furthermore, the wonderful diversity of the student presenters, their projects, and the disciplines represented all provide a strong reminder of the distinctiveness and breadth of scholarship across the entire WSU community.

We are also pleased to note that in addition to the Ramaley Celebration and other events on April 19, numerous other presentations of students' creative scholarship are scheduled throughout the week. These include the Senior Art Exhibition "Affectum Spectrum" and Music Department hosted performances and recitals. Please see [the WSU Events Calendar](#) for more information.

The Ramaley Celebration Work Group owes thanks to George Micalone and Jarod Zobitz and the Student Union staff for their help with logistics in Kryzsko Commons. The Celebration is made possible by funding provided by the WSU Office of Academic Affairs and we also thank the WSU Administration for its continuing support through the funding of Research and Creative Projects grants to our students.

We also thank the WSU Digital Learning Commons for their sponsorship of this year's poster sessions.

Thank you to the WSU Psychology Club for their assistance with the logistics for the Celebration. We thank them very much for their interest and support!

To all of our student presenters: Thank you very much for presenting at this year's celebration and congratulations on your accomplishments!

To the faculty mentors: Thank you for including students in your continuing research and creative scholarship!

To the rest of the WSU Community, please come and examine the work of our student/faculty research teams and help us acknowledge and celebrate their accomplishments!

Sincerely,

The Ramaley Celebration Committee in coordination with the Rochester Graduate Student Experience Committee: Begum Aybar-Damali, Katie Barofsky, Amanda Brouwer, John Holden, Kendall Larson, Thomas Nalli, Amanda Pruka, Elizabeth Zold, Andrea Gierok, Samantha Schneider, Ashley Bush, Pattie Gangl

Schedules

Poster Sessions

Kryzsko Ballroom

Session 1, 9:00-11:00 AM (1a presenting at 9:00-10:00, 1b presenting at 10:00-11:00)

Session 2, 1:00-3:00 PM (2a presenting at 1:00-2:00, 2b presenting at 2:00-3:00)

Posters should be on display for the entire two hours of each session!

Presenters	Sess	#	Dept.	Title
Arndt, Muira C; Gile, Isabelle R; Beerman, Shekinah J	1B	1	BIOL	Molecular Studies to Evaluate Variegation of Philodendron var. Birkin - Are Genetic Mutations Responsible for Variegation in Philodendron Birkin?
Aung, Ei Myatnoe	1A	2	COMP	Comparison of Real-time Communication Performance between Web sockets using Socket.io and Long-Polling using Ajax
Banaszynski, Bailey J; Dailey, Justin O; Endle, Blake M; LeBrun, Joshua J; Gleisner, Josiah M	1A	3	CME	Carbon Cornhole
Barloon, Autumn B	2A	1	CHEM	Determining the Rate Constant for Hydrogen Abstraction from Water by <i>p</i> -fluorophenyl radicals
Beadling, William H	1A	4	GEOS	Impact Craters on the Moon: Making Craters in the Laboratory
Beyer, Kaylee L; Boelter, Jared R; Dennis, Charlie; Larson, William J; Wolter, Jacob H	1B	5	CME	CarbCon Table: Carbon Fiber Tensegrity Table
Blom, Kyle J; Schettl, Halie R	1A	6	CHEM	Method Development for Purification and Analysis of the PETase Enzyme
Bos, Cassidy J	1A	7	PSYC	Effects of Labetolol on Sign Tracking
Breske, John T; Holtz, Haley A; Kerschner, Caitlin K; Weber, Kaileigh A	1B	8	POLS	The Social Determinants of Political Behavior and Attitudes
Buescher, Tess E	2B	2	CHEM	HPLC and CMS Analysis of Clomipramine Metabolism: A Multi-Drug Study
Busse, Miah L; Plouff, Maggie L; Ferguson, Brady	1A	9	HERS	Influence of Ground Reaction Forces and Joint Velocities on Kicking Velocity
Cardell, Anna L	1A	10	MATH	A Closer Look at the Death Penalty in the United States
Carlson, Ruth Ann J	1A	11	COMP	The Gamification of Educational Software Leads to Faster Learning
Carvell, Benjamin A	1B	12	CHEM	Synthesis and Characterization of CdSe nanoparticles for Use in Solar Cells

Presenters	Sess	#	Dept.	Title
Chase, Sylvia P	1B	13	CHEM	Investigation of Substituent Effects on the UV-vis Spectra of Curcuminoids and Validation of TD-DFT Methods for their Prediction
Ciesluk, Sarah C; Quimby, Emma R	1B	14	BIOL	Molecular Identification of Bobcat Parasites in Wisconsin
Collett, Christian A; Hamre, Jenna R; Hiller, Zachary A; Raihle, Mark; Schmidt, Myles J	2B	3	BIOL	Analysis of Parasites Found in Ducks of the Mississippi Flyway by Parasite Type, Host Gender, Mass, and Species: A Parasitology Class Project
Daechsel, Grant	2B	4	BIOL	Species Identification of Unknown Trees in Winona State Landscape Arboretum
Degenhardt, Madelyn M	2B	5	CHEM	Exploration of Known Disease-Causing VRK1 Mutants
Dinesen, Joanna M	1B	15	CHEM	Using 3D Printing to Illustrate Protein Modularity and Dynamics
Endreson, Taya K; Volhard, Madeline E; Sok, Visara S; Amofa, Amanda A; Fortsch, Emma C; Reider, Delaney L	1A	16	BIOL	Morphological Identification of Parasites Found in Ducks (Family Anatidae) Along the Mississippi River: A Parasitology Class Project.
Engman, Amelia C; Setla, Izabella E	2A	6	BIOL	Utilizing Macroinvertebrate Communities and Chloride Levels to Evaluate Water Quality in Three Streams Near Winona, Minnesota.
Fahad, Sheikh	1A	17	COMP	Using Extreme Gradient Boosting (XGBoost) and Adaptive Boosting (AdaBoost) to Predict Mortality of Patients Aged 40 Years or Older Admitted in ICU
Flanagan, Kevin	2A	7	CHEM	Exploration of New Half-Sandwich Ruthenium(II) Curcuminoid Complexes
Franke, Madison L; Gleisner, Micaiah D; Heinzl, Ethan J; Hogie, Brooke C; Hoyt, Samantha J; McSherry, Jeffrey; Potts, Kendra J	2A	8	BIOL	Identifying and Characterizing Duck Parasites Using PCR and Bioinformatics Tools: Parasitology Class Project
Fuller, Justin J	1A	18	COMP	Gamification of Recipe-Viewing Software Leads to an Enhanced User Experience
Fuller, Zack O	1B	19	MATH	An Analysis of Major League Baseball Sabermetrics
Godfrey, Kayla M	1B	20	GEOS	A Classroom Exercise Investigating Dinosaur Body Covering and Color
Greenough, Kailee Z	1A	21	BIOL	Feasting or Fasting: The Influence of Feeding Regime on Physiological Performance.
Hernandez, Cassandra; Wager, Ellyssa N; Johnson, Justin	1A	22	BIOL	Comparison of Colorimetric Assays to Use for the Investigation of the Mitogenic Activity of vFGF in Cell Cultures
Ho, Tu Khiem	2A	10	CHEM	Investigation of Drug-Drug Effects of Propranolol and Clomipramine in Rat Liver Microsome using HPLC and Compact Mass Spectrometry
Holst, Jenna L	1B	23	CHEM	Degradation of Ovulation Inhibitor Estrogens Using HPLC Chromatography

Presenters	Sess	#	Dept.	Title
Hoyt, Christiana L	1B	24	CHEM	Student Laboratory for Synthesis and Characterization of Proton Exchange Membranes
Jilk, Matthew D	1A	25	COMP	Investigating CLI and GUI Designs Based on User Feedback
Johnson, Justin	1A	26	BIOL	vFGF Protein Purification, Expression, and Proliferation Assay
Kaufenberg-Lashua, Meagan M	2B	12	CHEM	An Exploration of the Reactivity of Triazaphosphaadamantane
Kauphusman, Max R; Harvey, Regan G	1A	27	CME	Flexural Creep Comparison to TTS Creep for PP and PP-GF30
Kellner, Elijah J	2B	14	CHEM	Development of New Synthetic Routes for Ebselen in Pursuit of the First Synthesis of Ebtellur
Kline, Coltan M	1A	28	BIOL	SARS-Coronavirus-2 Gene Mutagenesis
Lenarz, Ashley M	2B	18	PSYC	Food Insecurity Among College Students: Implication for Wellbeing and Academic Success
Lepper, Rachel K	1B	29	ENGL	The History of Punctuation in the English Language
Liu, Ryan	1A	30	CHEM	Investigations of the Effects of Mutations in Inscuteable Mediated Pins-Mud Complex and PAR Complex Functions in Drosophila Neuroblast
Louis Charles, Jean Donalson; Frye, Lane T; Hardecopf, Kellie L; Klagge, Alexander L; Dahl, Daniel A	1B	31	CME	sTable Sawhorse: A Compact Folding, Sturdy Sawhorse Designed to be Light Weight And Save Space
Luessman, Anna L	2A	20	GEOS	Characterizing a Vertebrate Microsite in the Late Cretaceous Hell Creek Formation
Lund, McKenna J	1A	32	CHEM	Validation of Computational Methods for the Tautomerism of Thiourea Dioxide
Maharjan, Arina; Hamre, Jenna R; Cushman, Karlie M	2A	22	BIOL	Identifying Lungworms (Dictyocaulus) from Cattle and Deer (Family Cervidae) through DNA analysis
McLeod, Gunner D	1A	33	MATH	Using Spotify's Web API to Examine What Audio Features Impact a Song's Popularity
Nest, Hanna E; Pearson, Natalie C; Meyer, Rylee A	1B	34	BIOL	Assessment of Qualitative PCR Protocol on <i>Ixodes scapularis</i> for the Identification of <i>Borrelia burgdorferi</i>
Nguyen, Cindy	2B	24	COMM	"You Can Do This!" Mentorship Support and Memorable Messages on the Motivations and Successes of First-Generation College Students
Nutt, Aidan J	2A	26	MATH	Business Intelligence Internship at Ashley Furniture Industries
Onyx, Drake W	2B	28	ART	Brighttusk, a Graphic Novel: Traditionally Drawn, Radically Written
Osteraas, Krista L	1B	35	CHEM	Preparation and Characterization of New Titanocene(IV) Curcuminoid Complexes
Peil, Tyler J	1B	36	POLS	How Committed to Diversity is Winona State University?
Perez, Dominic L; Gerold, Kyle; Ficker, Matt K;	1A	37	CME	Welding 3D Printed Structures for Composite Sacrificial Tooling

Presenters	Sess	#	Dept.	Title
Wooden, Matthew D; Dungy, Aidan M; Coit, Brennan G				
Phan, Kyler J	2B	30	CHEM	The Impact of Green Tea Extract (GTE) on the Metabolism of Clomipramine in Rat Liver Microsome Using HPLC and Compact Mass Spectrometry
Plouff, Maggie L; Busse, Miah L; Pieper, Mikayla J; Ferguson, Brady; Baker, Aaron M	1B	38	HERS	Correlation Between Quadriceps and Hamstring Isokinetic Strength to Ball Velocity During a Soccer Kick
Poppler, Creed D	2B	32	CHEM	Exploration of Existing Ebselen Pathways for the Synthesis of Ebtellur
Priebe, Alyssa	2A	34	CHEM	Activated Carbon from Spent Coffee Beans
Richter, Steven W	1B	39	CHEM	Purification and characterization of VRK2 for continued research
Scheithauer, Cameron J	2B	36	CHEM	Determination of the Rate Constant for H Atom Abstraction by Phenyl Radicals for THF and CH ₃ CN
Scheldroup, Cooper R; Kelly, Kaitlyn J; Rusch, Kaitlyn M; Dieterman, Abree A	1B	40	PSYC	Self-as-Doer Identity and Health Behaviors: How Approach and Avoidant Orientation Correlate with Healthy Eating
Schonitzer, Madeline D; Strohbehn, Brianna M; Venne, Emily A; Herman, Van O; Swinbank, Willow; Sutton, Page R; Hathaway, Gabriel N	1B	41	ENGL	Satori- Literary Visual Arts Magazine
Simmons, Payton	2B	21	MATH	IT Application Administrator Internship
Steberg, Dylan L	2A	38	MATH	Exploring Bald Eagle Track Data Over Lake Superior
Sultze-Lor, Synetha K	1A	42	PSYC	Changes in Depression, Stress, and Anxiety for Student Athletes; Using Guided Imagery
Thelen, Briel D	2A	40	POLS	Political Discourse on Women of Color
Wager, Ellyssa N	1A	43	BIOL	Investigation of Mitogenic Activity of Baculovirus Fibroblast Growth Factors
Yang, Paige K	1A	44	MATH	Song Recommendation Engine Using Spotify Web API
Yuan, Longge	1B	45	COMP	Investigating the comprehension of GPT's interpretation of word meanings
Zill, Olivia B	1B	46	CHEM	Synthesis and Characterization of Double Cross-Linked PVPMS Aerogels

In-Person Oral Presentations

Oak Room G – 1:00pm

Presenters	Dept	Title
Strange, Tova R	Women's & Gender Studies	Reproductive Justice as Dismantling the School-to-Prison Nexus

Pre-recorded Video Presentations

Presenters	Dept	Title
Beal, Justine M; Smith, Sydney J	HERS	Examination of Osteoarthritis in Anterior Cruciate Ligament Tear Treatment Methods
Beulke, Baylee; Otto, Ella K	HERS	Prefabricated versus Custom Orthotics on Improving Plantar Fasciitis Pain in the General Population
Heraty, Colin M; Smith, Steven T	HERS	Difference between Isometric and Isotonic Exercises and Their Effects on Patients with Patellar Tendinopathy: A Critically Reviewed Study.
Horvath, Madelyn D; Lamantia, Isabella R; Fenrick, Alexis M	HERS	Surgery with Physical Therapy versus Physical Therapy Alone in Patients with Femoroacetabular Impingement
Johnson, Adam R; Radloff, Caleb W	HERS	Surgical Versus Non-Surgical Interventions for Treating Patients with Lumbar Spinal Stenosis: A Critically Appraised Topic
Julian, Grace A; Croeker, Kaitlyn A	HERS	Treatment of Carpal Tunnel Syndrome as Measured by Patient Reported Outcomes
Kasel, Chelsey L; Echter, Brooke M	HERS	In patients with meniscus pathology, what is the effect of operative treatment vs. non-operative treatment on functional improvements?
Rupnow, Logan S; Ward, Kaitlyn S	HERS	Arthroplasty and Discectomy with Fusion Surgical Techniques in Patients with Cervical Degenerative Disc Disease: A Critically Appraised Topic
Clifford, Kristin M; Gruber, Shay L	NURS	An Evidence-Based Intervention: Provider use of Visual Aids for Patient Education during Bedside Team Rounding

Early Years Session

Oak Room G – 10:30am - 12:00pm

Presenters	Dept	Title
Acharya, Salina; Anderson, Anna	BIOL	SARS-Coronavirus-2 Gene Mutagenesis
Betcher, Elise A	CHEM	Development of Promotional Material for the Chemistry Department
Budach, Bradley F	COMP	Images of The Future
Kuehn, Siena L	GEOS	3D Printing Topographical Data Using QGIS
Lehner, Connor J	CHEM	Learning NMR by Building a Library of ³¹ P NMR Spectra for Common Phosphorus Ligands
Peachey, Alex	ENGL	William Blake Online Bibliography 2022-23
Perez, Dominic L; Gerold, Kyle; Ficker, Matt K; Wooden, Matthew D; Dungy, Aidan M; Coit, Brennan G	CME	Welding 3D Printed Structures for Composite Sacrificial Tooling
Shah, Ritesh	COMP	3D Geospatial Crystal Printing
Kpahn, Karina J	CHEM	VRK1 and Protein Purification

Round Table Discussion – Solarium – 10:00-10:45

Presenters	Dept	Title
Ellis, Tiki; Onyx, Drake W; Tyler, Chyenne M; Vatland, Travis W	WGSS	“Don’t confine your fashion enjoyment to a gender binary”: Mutual Aid, Queer Theory, and a Gender-Affirming Closet

Faculty Research Presentations – Oak Rooms E/F

Time	Presenter	Dept	Title
11:00	Becknell, Mark	Nursing	A Guide for Facilitating an Escape Room for Undergraduate Nursing Students
11:20	Smith, Amy E	Nursing	Influencing Health Disparities Through Nursing Curriculum
11:40	Anderson, Jennifer	Geoscience	Experimental Impacts into Layered Targets: Implications for the Moon
12:00	Lungerhausen, Matthew	History	The ‘Érdekes Ujság Battlefield Photo Album’: A Hungarian Newspaper’s Amateur Photography Contest at the Beginning of World War One
12:20	Eaton, Charissa	Social Work, Athletic Training, and Nursing	The Bridges Health Monologues: A Day in the Life
12:40	West, Joseph	Chemistry	ChatGPT: A Department-Level Analysis of Usage Possibilities and Actualities

Abstracts

Art

***Brighttusk*, a graphic novel: Traditionally Drawn, Radically Written**

Draconian Onyx

Faculty Mentors: Roger Boulay and Adrian Barr

Brighttusk is a handmade graphic novel telling the stories of the fictional characters Polaris Diamat and Sunny Brighttusk. Their story plays off of the tropes of fantasy races, magic, and stereotypical Dungeons and Dragons scenarios for enjoyable fantastic scenarios and to explore complex and mature themes. Inspired by media like Robert Kirkman's *The Walking Dead* and *Bojack Horseman*, the shared fantastical premises create a layer of dissonance. This better communicates the heavy undertones of concepts like surviving abuse, mental health, and LGBT issues, in addition to lighthearted breaths of reprieve. Using a unique, carefully-developed style that features hatching, gray tones, contrast, and vibrance, *Brighttusk* tells an extraordinary narrative of the relationship between two queer women navigating trauma in a fantasy setting. Beginning in the summer of 2022 and currently comprising a whopping 79 pages, it is the hope of the writer and artist, Draconian Onyx, that this project can be used to launch a career and pathway to tell more unique stories in the future.

Biology

Analysis of Parasites Found in Ducks of the Mississippi Flyway by Parasite Type, Host Gender, Mass, and Species: A Parasitology Class Project

Christian Collett, Jenna Hamre, Zachary Hiller, Mark Raihle, and Myles Schmidt

Faculty Mentor: Kimberly Bates

It is important to be aware of the potential parasitic load in any animal which may be used for human consumption. The purpose of this project was to investigate if there was any one factor, such as size, sex, location, or species of duck, which had a significant effect on the amount or type of parasite found. One hundred and nine ducks were legally harvested and donated by hunters from Buffalo and Trempealeau County, WI, and Winona County, MN, then examined for total parasites via necroscopy. The parasites found were then categorized by location within the duck and type of parasite (louse, nematode, trematode, cestode or acanthocephalan), along with the sex, species, and size of the duck. It was predicted that female ducks, along with ducks with higher mass, were more likely to have a higher parasite load. Statistical analysis will be performed on all variables with help from the WSU Statistical Consulting Center. These findings could help identify which factors may increase the chances of a duck having a high parasitic load, which could influence which ducks are targeted by hunters specifically for meat.

Assessment of Qualitative PCR Protocol on *Ixodes scapularis* for the Identification of *Borrelia burgdorferi*

Natalie Pearson, Hanna Nest, and Rylee Meyer

Faculty Mentor: Kimberly Bates

Ixodes scapularis, more commonly known as a black-legged tick or a deer tick, is the vector for Lyme disease (*Borrelia burgdorferi*) in much of the United States. Their definitive host is deer (Family *Cervidae*), which means they are found in climates where deer thrive. These areas include the eastern and northern Midwest of the United States along with southeastern Canada. The ticks are known for transmitting Lyme disease to humans (*Homo sapiens*), canines (*Canis lupus familiaris*), and other mammals. Lyme disease is caused by *Borrelia burgdorferi* which is a spirochete bacterium. The purpose of this study was to determine the prevalence of infected ticks in the Southeast MN and West Central Wisconsin areas on either side of the Mississippi river using Real-Time or Quantitative PCR (qPCR). DNA was extracted from approximately 6,000 ticks that were collected between 2005 and 2012 from legally harvested white-tailed deer (*Odocoileus virginianus*) from Buffalo County, WI and Winona County, MN. The DNA was analyzed using quantitative PCR. An iTaq Universal SYBR green supermix was used along with a RecAF and RecAR primers for the *Borrelia* DNA and ITS2F and ITS2R were used to amplify tick DNA. The amplifications that occurred from ITS2F and ITS2R were used to ensure that the tick DNA was viable. For RecAR and RecAF, the amplifications determined whether the tick had *B. burgdorferi* or not. Results to date show that the unknown tick DNA is not amplifying consistently when being tested for the presence of *B. burgdorferi*. The next step in the experiment is to determine how to amplify the DNA more consistently and to continue testing ticks for the presence of *B. burgdorferi* collected between 2005 and 2012.

Comparison of Colorimetric Assays to Use for the Investigation of the Mitogenic Activity of vFGF in Cell Cultures

Kassandra Hernandez, Ellyssa Wager, and Justin Johnson

Faculty Mentor: Casey Finnerty

Fibroblast growth factors (FGFs) are part of a large family of polypeptide growth factors that play a large role in the development and regulation of organisms using intracrine, paracrine, and endocrine cell signaling mechanisms. FGFs are known to be found in both vertebrate and invertebrate organisms. Most recently they have also been identified in viruses, such as baculoviruses. A sequence analysis of the baculovirus genomes has found that they encode for a viral fibroblast growth factor homolog (*vfgf*) early on in their stage of infection (Katsuma et al. 2006). Although there have been studies from other labs that have revealed a great deal about vFGF function, to date, nothing has been published on the potential mitogenic activity of vFGFs. Dr. Finnerty and earlier research students have obtained promising results, showing vFGFs from two baculoviruses to be mitogenic, but these results needed to be reproduced and replicated in multiple cell lines to have sufficient data for publication. To test the effects of vFGFs on cell mitogenic activity, the best method to assess cell viability and cell proliferation needed to be used, which is colorimetric assays. My research focused on finding the most accurate *in-vitro* colorimetric assay that measures cell proliferation with insect SF9 cells and mammalian NIH/3T3 cells. Such assays included the Resazurin assay, the Crystal Violet assay, and the CCK-8 assay. To accurately measure cell proliferation, I used a multi-well plate reader that measured the dyes' absorbance at specific wavelengths varying from 450nm to 590nm, depending on the reagent. From the data collected, I created a variety of standard curve graphs and produced figures that compared each reagent's sensitivity. The slopes of the Resazurin assay graphs all show a trend of starting positive with the smaller seeding densities and then turning negative with the larger densities, which is not ideal for future experiments. The CCK-8 assay graphs all show a trend of positive slopes with both the small and large seeding densities for each cell line, while the crystal violet assay graphs showed similar trends as Resazurin. I used 96-well plates to have various replicates of each cell concentration and compared the confidence interval ranges for each assay. The assay with the lowest confidence intervals throughout all

the graphs was CCK-8. The last component I used to choose the best *in-vitro* colorimetric assay was the correlation coefficients in each graph. Out of all three reagents, CCK-8 had the best coefficients in the standard curve graphs, with values above 0.9. Therefore, the CCK-8 assay was found to be the best *in-vitro* colorimetric assay to measure cell proliferation with both SF9 and NIH/3T3 cells. The CCK-8 standard curve graphs I created for each cell line will also help as a template to measure the mitogenic activity of cells after adding vFGF for future experiments.

Feasting or Fasting: The influence of feeding regime on physiological performance

Kailee Greenough

Faculty Mentor: Noah Anderson

Prior studies have shown that the environment can significantly influence the development of physiological and physical traits of life. Specifically, we investigated how the developmental condition of feeding regime influences the physiological performance of boas (*Boa constrictor imperator*). This study was part of a long-term study of different feeding regimes (feasting=weekly, fasting=1/5weeks). Prior studies in our lab have uncovered morphological differences in growth. These studies demonstrated that snakes fed frequently became more muscular and massive whereas snakes fed infrequently were more refined and less muscular despite being fed the same relative amount of prey. Our study added to these prior studies by examining the influence with feeding regime on the boas' physiological performance. We conducted measurements of strike speed and other variables with boa constrictors using a high-speed video camera. Our study is one of few studies that has looked at the influence of long-term processes on physical performance. Based on our previous observations on the morphology of these groups, we hypothesized that the more massive snakes may have a faster strike speed because they are more muscular. The snakes in the infrequent group were hypothesized to be able to have a longer strike distance because they have less body mass for gravity to act against.

Identifying and Characterizing Duck Parasites Using PCR and Bioinformatics Tools: Parasitology Class Project

Madison Franke, Micaiah Gleisner, Ethan Heinzl, Brooke Hogue, Samantha Hoyt, Jeffrey McSherry, and Kendra Potts

Faculty Mentor: Kimberly Bates

The identification and characterization of duck (Family: Anatidae) parasites is crucial for developing effective strategies to manage and prevent their transmission. Polymerase Chain Reaction (PCR), sequencing and analysis of DNA extracted from duck parasites has become an essential tool for diagnosing and understanding the diversity of these parasites. This research used the results of PCR amplification and sequencing of DNA extracted from duck parasites to identify the organisms using bioinformatics tools. The results showed the successful identification and characterization of several duck parasites. Confirmation of the parasite identifications were completed by morphologic analysis by another group. Overall, this study provided a foundation for further investigation into the genetic diversity of duck parasites and their impact on the health of ducks.

Identifying Lungworms (*Dictyocaulus*) from Cattle and Deer (Family *Cervidae*) through DNA analysis

Arina Maharjan, Jenna Hamre, and Karlie Cushman
Faculty Mentor: Kimberly Bates

Lungworms (*Dictyocaulus*) are a type of parasitic nematode that inhabit the lungs of their hosts and can cause disease such as bronchitis and pneumonia, even death. *Dictyocaulus* is a genus of lungworm specific to ruminants such as cattle (*Bos taurus*) and deer (*Cervidae*). The purpose of this study was to use DNA analysis to distinguish between different strains of *Dictyocaulus* among cattle, white-tailed deer (*Odocoileus virginianus*), and red deer (*Cervus elaphus*). Adult lungworms were collected from the lungs of cattle from research farms in Missouri, Wisconsin, and Mississippi, from the lungs of red deer from a research farm in New Zealand, and from the lungs of legally harvested white-tailed deer from Minnesota. DNA was extracted from individual lungworms. In past studies, amplification of the internal transcribed spacer 2 (ITS2) region via PCR and sequencing was used to determine molecular differences between species. This current study amplified the major sperm protein 1 (MSP1) and cyclooxygenase (COX-1) genes. After amplification, gel electrophoresis was used to visualize the quality of amplification of the desired gene. From past studies, MSP1 has been used to identify *D. eckerti* in both white-tailed deer and WI cattle, as well as *D. viviparus* from cattle in MO. The COX-1 gene has been used to identify *D. viviparus* in cattle from WI and MS and white-tailed deer, *D. capreolus* in white-tailed deer, and *D. eckerti* in red deer. The newly amplified DNA will be sent to be sequenced and compared to existing databases to determine species identifications and phylogenetic relationships.

Investigation of Mitogenic Activity of Baculovirus Fibroblast Growth Factors

Ellyssa Wager, Cassandra Hernandez, and Justin Johnson
Faculty Mentor: Casey Finnerty

Fibroblast Growth Factors (FGFs) are a family of structurally related polypeptide cytokines. 22 FGF genes (FGF1-14, FGF16-23) are found in the human genome. FGFs have various known intracrine, paracrine, and endocrine functions and are essential for the development and wound repair in organisms through these mechanisms. The role of FGFs in viruses has become an area of piqued interest in the field of pathology as several virus families have genomes that encode one or more growth factor homologues. It has been suggested that a virally encoded ortholog of FGF (vFGF) identified in the viral families of *Baculoviridae* and *Iridoviridae* is involved in the movement of these viruses across the basal lamina in the midgut of insect hosts to shift from primary infection to systemic infection (Means and Passarelli 2010). It was found that the *Baculoviridae* encodes a viral fibroblast homolog (*vfgf*) expressed as an early gene in the beginning stages of viral infection (Katsuma et al. 2006). Despite the evidence of the involvement of vFGF in cell migration, there is no published research on its role in cell proliferation, even though many FGFs are known to be mitogens. The purpose of our research is to produce recombinant FGF from two baculoviruses, AcMNPV and CfMNPV, and test their effect on cell proliferation of multiple cell lines. A part of this process includes finding the optimal seeding densities and optimal starvation periods of each cell line used. The optimal seeding density was found by seeding 96-well plates of SF9 and NIH/3T3 cells at various ranges of seeding densities correlated to their growth curves. The data was then analyzed using CCK-8 and crystal violet proliferation assays to observe where cells appeared to begin to plateau, indicating that they were overgrown. We found the optimal minimal seeding densities of SF9 cells to be about 50,000 cells/well, and about 4,000-4,500 cells/well for NIH/3T3 cells. We then took 96-well plates seeded at 3,000, 5,000, and 7,000 cells/well and treated them with media containing

a range of 0-10% and 0-2% newborn calf serum to observe which concentration of serum allowed for cells to remain viable while being starved. It was found that serum containing 1% newborn calf serum allowed cells to remain the most viable during starvation at a seeding density of around 5,000 cells/well. This data will be used to set up plates of SF9 and NIH/3T3 cells to be starved and then treated with various concentrations of vFGF to observe the effects on cell proliferation

Molecular Identification of Bobcat Parasites in Wisconsin

Sarah Ciesluk and Emma Quimby

Faculty Mentor: Kimberly Bates

Bobcats (*Felis rufus*) are a regulated species in Wisconsin requiring special permits for hunting or trapping. The WI Department of Natural Resources (DNR) monitors the number and health of these animals on a yearly basis. This research focused exclusively on the identification of parasites found in their gastrointestinal system. Research cohorts from previous years obtained legally harvested bobcat intestines from 115 animals that were donated to WSU from the Wisconsin DNR. Each individual bobcat was labeled with age, gender, and location where harvested. Morphological identification of parasites occurred after staining and mounting each specimen found in the gastrointestinal tract of each individual. Identifications were made for all the nematodes recovered but results were inconclusive for the tapeworms due to minute differences between the specimens. Additionally, previously extracted DNA samples were found to have degraded over time. A new bobcat sample provided us with five new tapeworm specimens. A molecular identification process was determined to be necessary to identify between two tapeworm Genera *Taenia* and *Diphyllobothrium*. DNA from individual worms were extracted using the DNeasy kit (Qiagen). Samples were then amplified using primers specific to Genera before being visualized using gel electrophoresis. Molecular sequencing from known tapeworm samples are currently being analyzed to provide a reference for the unknowns.

Molecular Studies to Evaluate Variegation of *Philodendron* var.

Birkin Are Genetic Mutations Responsible for Variegation in

Philodendron Birkin?

Muir Arndt, Isabelle Gile, and Shekinah Beerman

Faculty Mentor: Kimberly Evenson

Plant tissue culture and molecular genetic techniques were used to analyze the instability of the genome in *Philodendron* var. '*Birkin*'. This plant has variegated, white, green, and greenish-red leaves (that have lost their variegation) on the same plant. Did genetic mutations occur in meristematic sectors of variegated leaves that have reverted to green coloration, or is it an epigenetic change? PCR and sets of RAPD plastid primers were used to determine if the presence or absence of a PCR product correlated with differences in leaf color and variegation (white, green-white, variegated, reddish green or green leaves). A DNA isolation procedure was optimized to extract PCR-quality plastid DNA from *Philodendron* leaves. A modified DNA extraction procedure (BABEC) was used to isolate plastid DNA. It resulted in a high yield of DNA as measured by the Nanodrop system. PCR was performed with eight different RAPD plastid primers (GB07, GB8, OPA19, OPA22, OPB22, OPC08, OPC12, RAPD primer #1, RAPD primer #2). Differences in PCR products were observed for five primers, while two primers resulted in no difference in PCR products. This indicated that genetic mutations resulted in differences in leaf color and variegation. We are not excluding the possibility that epigenetic changes also play a role in variegation,

however, this has not yet been analyzed. These results could prove useful for breeding ornamental traits and introducing improvements into the genus *Philodendron*.

Morphological Identification of Parasites Found in Ducks (Family *Anatidae*) Along the Mississippi River: A Parasitology Class Project

Amanda Amofa, Taya Endreson, Emma Fortsch, Delaney Reider, Visara Sok, and Madeline Volhard
Faculty Mentor: Kimberly Bates

Ducks (*Anatidae*) can be found across much of the United States and are hosts to a variety of parasites such as nematodes, trematodes or cestodes. This study focused on identifying the species of the parasites found within ducks based on their morphological features. The morphological structures consisted of body shape, internal organs, mouthparts, and length. The ducks used in this study were legally harvested and donated by hunters from areas across the Mississippi River in Buffalo County and Trempealeau County Wisconsin. A total of 108 ducks have been analyzed for parasites. It is important to identify the types of parasites that use ducks as a host, to see if they are harmful to the ducks so that they can be better managed. Necropsy was performed on different species of ducks to extract endo and ectoparasites. The extracted parasites were stained using carmine borax so they could be viewed using microscopy. While examining the parasites under the microscope, length and width measurements were taken as well as identifying key features like hold fast organs. A published key was used as a guide to identify parasites based on the measurements and key features present. The identified parasites were compared with DNA analysis from another research group to help ensure that the identification of the parasites was correct. Finally, identifications were compared to published articles containing past research found on parasites in ducks.

SARS-Coronavirus-2 Gene Mutagenesis

Salina Acharya, Anna Anderson, and Coltan Kline
Faculty Mentor: Osvaldo Martinez

Coronavirus disease 19 (COVID-19) is a respiratory disease that is caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). Beginning in late 2019, infection and transmission of SARS-CoV-2 has led to a global pandemic that continues to be a major public health problem resulting in more than 6 million deaths worldwide. SARS-CoV-2 binding is mediated by the Spike (S) attachment protein. The S protein is composed of two subunits, S1 and S2. The S1 subunit houses the receptor binding domain (RBD) that is responsible for recognizing and binding to the host viral receptor angiotensin-converting enzyme 2 (ACE2). The S2 subunit is responsible for fusion between viral and host cell membranes. Because of its importance in virus binding and infection, the S protein has been the target for vaccine development. For example, neutralizing antibodies, induced by the SARS-CoV-2 vaccine generally bind to the S protein blocking ACE2 binding and aborting virus infection. However, the SARS-CoV-2 virus continues to evolve, accumulating mutations in the S protein that result in immune evasion and/or increased transmission. For example, S protein L452R, T478K, D614G, P681R, and D950N mutations are associated with increased infectivity, evasion of host immune functions, and enhanced disease. To tease out the functions of each and multiple combinations of these mutations we mutated the alpha variant S protein incorporating random combinations of L452R, T478K, D614G, P681R, and D950N mutations. This was done by introducing primers of differing concentrations to generate a library of transformants harboring unique combinations of S protein mutations. Sequencing of these transformants to confirm mutations is currently pending. The future goal of this project is to use safe-to-use virus-like particles

psuedotyped with the mutated SARS-CoV-2 S proteins which will be used in entry and immune cell deregulation assays.

Species Identification of Unknown Trees in Winona State Landscape Arboretum

Grant Daechsel and Elizabeth Deyo
Faculty Mentor: Amy Runck

This project was designed to identify seven trees in the WSU Landscape Arboretum which could not be adequately identified using a dichotomous key. These trees include an oak (*Quercus* sp.), three pears (*Pyrus* sp.), two birches (*Betula* sp.), and an apple tree (*Malus* sp.). This project will benefit the WSU Landscape Arboretum in their effort to educate the WSU's community about local plant life, while also confirming whether those trees should be present in the Arboretum. Specifically, if the pear trees are identified as invasive Callery pears which harm the native flora, their removal will be recommended. Chloroplast DNA was extracted from the leaves following a modified Qiagen DNeasy protocol. PCR was conducted on the samples to amplify 900 bp of the maturaseK (*matK*) gene and 600 bp of the ribulose-bisphosphate carboxylase (*rbcL*) gene, which are among the top contenders for universal barcoding in plants. Amplicons were sequenced, and they were assembled and aligned in Sequencher. Phylogenetic analyses were reconstructed in the Mesquite software package using oak, pear, birch, and apple *matK* and *rbcL* sequences from GenBank to assign a genetic identification to the seven trees. The WSU Landscape Arboretum were provided with the genetic identifications and advised about how to proceed with the new information.

Utilizing Macroinvertebrate Communities and Chloride Levels to Evaluate Water Quality in Three Streams Near Winona, Minnesota

Amelia Engman and Izabella Setla
Faculty Mentors: Neal Mundahl and Jeanne Franz

Certain water quality and chloride levels are ideal for specific macroinvertebrate species. For each of the three streams—Garvin Brook, Gilmore Creek, and Pleasant Valley Creek—three thorough macroinvertebrate samples were collected, and data was combined into one for analysis. Following periods of snowmelt, water samples were collected at each stream, and a chloride ion selective electrode was used to measure the levels of chloride. *The Izaak Walton League of America's Save Our Streams* invertebrate classification system was used to identify the invertebrates and estimate the populations in each stream. A total of 2,104 macroinvertebrates were counted across all three streams. Each macroinvertebrate species was assigned a tolerance to pollution; sensitive, less sensitive, and tolerant. Utilizing the *Save Our Streams* biological monitoring index values for water quality rating, the criteria for establishing water quality were split into four index ranges, excellent (>22), good (17-22), fair (11-16), and poor (<11). Following the calculations, all three streams had excellent water quality ratings, Gilmore Creek at 25, Garvin Brook at 24, and Pleasant Valley Creek at a rating of 23. *Brachycentrus* caddisflies, a notable pollution-sensitive group, was the dominating species at Garvin Brook. Chloride concentrations consistently measured at around 1 mg/L in Garvin Brook. The amphipods, dominant in the samples from Gilmore Creek, are classified as a less sensitive group. The chloride readings in Gilmore Creek fluctuated between 2 mg/L and 1 mg/L. Riffle beetle larvae are classified as a sensitive group and were most dominant at Pleasant Valley Creek. Pleasant Valley Creek

had chloride readings around 2 mg/L. The chloride levels and general water quality of the streams are impacted by salt runoff from the neighboring roads. In comparison to Gilmore Creek and Pleasant Valley Creek, Garvin Brook was located farther away from any road. Based on the *Save Our Streams* biological monitoring index value and the consistent chloride levels, Gilmore Creek was determined to have the best water quality out of the three streams. We further discuss the significance of our macroinvertebrate species on stream pollution monitoring, and the future implications of our three streams studied.

vFGF Protein Purification, Expression, and Proliferation Assay

Justin Johnson, Kassandra Hernandez, and Ellyssa Wager

Faculty Mentor: Casey Finnerty

Fibroblast growth factors (FGF's) are signaling molecules (cytokines) secreted from specific cells known as fibroblasts. They are essential for embryonic development, function postnatally in response to injury, in regulation of electrical excitability of cells, and as hormones that have a role in regulating metabolism. Viral Fibroblast Growth factors Ac6 and Cf6 have been encoded into E. coli plasmids which produce high concentrations of our target vFGFs which are then purified for testing. The vFGFs were expressed with maltose binding protein (MBP) tagged on the N-termini. MBP is used as a pseudo-chaperone with a hydrophobic cleft that can refold the protein in case of a misfold, increasing the amount of target soluble proteins from E. coli. The target protein was purified from all other soluble products by running the MBP attached to the virally encoded cytokine through an amylose resin column. The column sticks the MBP + vFGFs to the beads while all other substances run through. The MBP+ vFGFs were then removed from the amylose resin with an elution buffer into thirty microfuge tubes for each Ac6 and Cf6. A Bradford protein assay was performed to quantify the protein yields for Ac6 and Cf6. The Ac6 growth factor yield ranged from 600 ng - 2250 ng while the Cf6 growth factor yield ranged from 600 ng - 1200 ng. Ac6 tends to have a higher yield than Cf6. Using Coomassie stained gels and western blotting techniques it is possible to find where, how much, and how pure the vFGF is. The Coomassie stained gel showed our target protein with the attached MBP along with some denatured proteins was secluded from other soluble proteins. The western blot further confirmed that our target protein was purified from other products using antibody tagging. It was found that inoculating 2 ng/mL - 20 ng/mL of purified vFGF onto NIH/3T3 cells in a 96-well plate resulted in increased cell proliferation and mitogenesis.

Chemistry

Activated Carbon from Spent Coffee Beans

Alyssa Priebe

Faculty Mentor: Jen Zemke

Activated carbon is a material that is used in various industries. An important way that activated carbon is used, is to remove impurities and contaminants from water. Activated carbon is used to filter out odors and pollutants such as organic compounds by adsorbing and trapping these molecules within the structure of the carbon. The goal of this research is to synthesize activated carbon from spent coffee grounds. To this end, we are developing and tuning a protocol for the synthesis of activated carbon via a Microwave-Assisted Reaction System (MARS-TA). Variables investigated in this study are the amount of

phosphoric acid activator used, reaction time, and the wattage of the microwave. Characterization of the activated carbon samples will be done via adsorption isotherm studies with methylene blue.

An Exploration of the Reactivity of Triazaphosphaadamantane

Meagan M. Kaufenberg-Lashua

Faculty Mentor: Joseph West

Triazaphosphadamantane presents many unique qualities in a tertiary phosphine. It is water soluble, minimally sensitive to oxidizers and sterically completely unencumbering. These properties make it a highly valuable ligand for metals, especially when seeking to increase aqueous solubility. Interest in this substance has only more recently taken off and thus its reactivity and properties, and its potential for other applications have only minimally been explored. We have undertaken a multi-faceted exploration of triazaphosphaadamantane and are seeking to expand the chemistry community's knowledge base of its reactivity patterns and highlights of its spectroscopy.

Degradation of Ovulation Inhibitor Estrogens Using HPLC Chromatography

Jenna Holst

Faculty Mentor: Jeanne Franz

In recent years, there has been a rise in observed intersex aquatic species along with a rise of reproductive issues in humans. This has been linked to the endocrine disrupting properties of over 200 chemicals that have estrogenic activity and persist in aquatic environments. The focus of our research is the estrogens that are used in hormonal birth control as ovulation inhibitors. Between 2015-2017, 14% of US women aged 15-49 were using hormonal birth control. According to a study published in 2002, three estrogens that are used in hormonal birth controls as ovulation inhibitors, 17 α -ethynyl estradiol, mestranol, and 19-norethisterone, occur in an average of 12.8% frequency in US streams. This frequency is caused by the inability of wastewater treatment plants to fully remove pharmaceuticals before they reach surface water. With an increasing abundance of the population utilizing ovulation inhibitors, preventing persistence in the environment is crucial. To ensure full removal of pharmaceutical compounds from wastewater, High-Performance Liquid Chromatography with Ultraviolet Visible Spectroscopy was utilized. HPLC-UV Vis methodology was utilized using acetonitrile and water as solvents in an 80:20 ratio within the pumps to obtain desirable peak separation with each estrogen at wavelengths of 239 and 280nm for maximum absorbance. To ionize each estrogen for mass spectrometry analysis using HPLC-MS, 5mM sodium acetate was added to the aqueous mobile phase and a concentration curve was created. The HPLC method was then used in bleach trials using 10ppm sodium hypochlorite solution mimicking the chloride concentration of household toilet bleach tablets over an average time of 20 minutes. The HPLC method with UV detection showed clear signs of estrogen degradation. Preliminary work with a newly acquired instrument is currently underway to determine the identity of the degradation products through HPLC-MS. It is hoped that the bleach will prove to be an easy and effective way for the average consumer to do their part and prevent estrogens from entering the environment.

Determination of the Rate Constant for H Atom Abstraction by Phenyl Radicals for THF and CH₃CN

Cameron Scheithauer
Faculty Mentor: Thomas Nalli

Phenyl radicals are known to rapidly abstract hydrogens and add to double bonds and H-abstraction, particularly from the deoxyribose rings of DNA, is known to have biological significance. However, rate constants for H-abstraction (k_H) by phenyl radicals from biomolecules are largely unknown. This research used *p*-fluorophenyl radicals generated by the photolysis of *p*-fluorophenylazoisobutyronitrile (FPAIN), to allow for product yields to be measured using F-19 NMR. Specifically, the rate constant for phenyl radical iodine abstraction from a 3-iodobenzotrifluoride ($k_I = 2.2 \times 10^8 \text{ M}^{-1} \text{ s}^{-1}$) measured previously in our lab was used as a kinetic reference point for determining k_H for hydrogen abstraction from tetrahydrofuran (THF) and acetonitrile (CH_3CN). Thus, when FPAIN was photolyzed in the presence of THF or CH_3CN and 3-iodobenzotrifluoride (Arl) at 23 °C the product yield ratio of *p*-hydro- to *p*-iodofluorobenzene ($[\text{FPhH}]/[\text{FPhI}]$) gave an excellent linear correlation ($R^2 = 0.9985$ and $R^2 = 0.9655$) with the reactant concentration ratio ($[\text{THF}]/[\text{Arl}]$) and ($[\text{CH}_3\text{CN}]/[\text{Arl}]$). The slope of the trendline (slope = 0.048 and slope = 0.0024) gives the relative rate constants k_H/k_I , which in conjunction with the previously determined $k_I = 2.2 \times 10^8 \text{ M}^{-1} \text{ s}^{-1}$, gives k_H . The THF result, $k_H = 1.1 \times 10^7 \text{ M}^{-1} \text{ s}^{-1}$ at 23 °C compares favorably to the literature value $k_H = 4.8 \times 10^6 \text{ M}^{-1} \text{ s}^{-1}$. The CH_3CN preliminary results determined $k_H = 5.08 \times 10^5 \text{ M}^{-1} \text{ s}^{-1}$ which is compared to literature values reported by Galli ($k_H = 6.7 \times 10^6 \text{ M}^{-1} \text{ s}^{-1}$) and Bridger and Scaiano ($k_H = 4.0 \times 10^5 \text{ M}^{-1} \text{ s}^{-1}$).

Determining the Rate Constant for Hydrogen Abstraction from Water by *p*-Fluorophenyl radicals

Autumn Barloon
Faculty mentor: Thomas Nalli

Highly reactive oxygen species (hROS) cause oxidative stress that can lead to diseases such as cancer and cardiovascular diseases. This research explored one of the ways these species can be made in the body; through abstraction of hydrogen from water by phenyl radicals. The phenyl radicals can enter the body through medications such as benzoyl peroxide, which is commonly used to treat acne making this research of relevance in the medical community. In this research, *p*-fluorophenyl radicals (FPh) were generated from *p*-fluorophenylazoisobutyronitrile (FPAIN) by visible photolysis in the presence of varying amounts of water and 3-iodobenzotrifluoride (Arl). The *p*-fluorophenyl radicals competitively react with water to form fluorobenzene (FPhH) and with 3-iodobenzotrifluoride to form 4-fluoroiodobenzene (FPhI). The yield ratios of the products $[\text{FPhH}]/[\text{FPhI}]$ can then be measured by integration of their ^{19}F NMR peaks and plotted versus the reactant concentration ratios, $[\text{H}_2\text{O}]/[\text{Arl}]$ to give a linear correlation, the slope of which corresponds to the relative rate constant, $k_H/k_I = 0.0192$. The rate constant for iodine abstraction from ArI ($k_I = 2.2 \times 10^8 \text{ M}^{-1} \text{ s}^{-1}$) is known so the experimentally determined slope allows the determination of the rate constant for hydrogen abstraction from water ($k_H = 7.5 \times 10^6 \text{ M}^{-1} \text{ s}^{-1}$).

Development of New Synthetic Routes for Ebselen in Pursuit of the First Synthesis of Ebtellur

Elijah Kellner and Creed Poppler
Faculty mentor: Joseph West

Ebselen, N-phenyl-1,2-benzisoselenazol-3(2H)-one, an established anti-oxidant and cytoprotective agent, has been assessed for an array of pharmaceutical applications in treating a multitude of disorders and maladies. It has further been identified as an anti-microbial and anti-viral agent against multiple infectious agents and has even been FDA-approved for a variety of these applications. While ebselen has captured pharmaceutical interest, its tellurium analogue, ebtellur, has yet to be successfully obtained, and in only one case was an attempt to obtain ebtellur reported. We have developed multiple new synthetic routes specifically targeting the first synthesis of ebtellur and discuss the viability of each pathway herein.

Development of Promotional Material for the Chemistry Department

Elise Betcher

Faculty mentor: Jeanne Franz

Proper advertising catered to a specific group can leave a lasting impact upon an interested student. The goal of this project was to create a new brochure design that displays the opportunities at the Winona State Chemistry Department and produce commitment souvenirs to attract and retain prospective students. Adobe Illustrator, Tinkercad, and other software were used to create a professional, yet fun-looking brochure and a variety of 3-D printed, laser cut, and vinyl souvenirs. While there is limited data to confirm the effectiveness of these new assets, the Winona State Chemistry Department looks forward to having new tools to use for future student recruitment.

Exploration of Existing Ebselen Pathways for the Synthesis of Ebtellur

Creed Poppler and Elijah Kellner

Faculty mentor: Joseph West

Ebselen is currently being assessed for a multitude of pharmaceutical uses ranging from treating bipolar disorder, acting as a preventative for heart disease/failure, as well as being a potent antiviral and antibacterial.¹ Ebselen has also been a FDA-approved candidate during the SARS-CoV-2 pandemic by inhibiting the protease responsible for viral spread. While ebselen has captured pharmaceutical interest, its tellurium analogue, ebtellur, has yet to be successfully obtained. Multiple routes to prepare ebselen have been reported, but in only one case was an attempt with analogous Te precursor reported, which was unsuccessful.

VRK1 and Protein Purification

Karina Kpahn

Faculty mentor: Emily Ruff

Throughout this study, I was able to assist in the entire process of purifying the VRK1 protein. In order to test effects of the protein, we picked a certain base in the protein to switch, in our case it was change VRK1's 133rd base from an R to C. After using DNA translation to change the base, we created the code for the whole primer. After our primers were made and *E. coli* was used to make plasmids, we began the purification process. Once that was done, through bioinformatic resource sites like ExpASY and the NIH's BLAST tool, we were able to make sure our sequencing was correct and we also doubled checked it using gel electrophoresis. This study gave me all the tools and procedures I need to be confident in creating my own plasmids and ultimately testing protein mutations.

Exploration of Known Disease-Causing VRK1 Mutants

Madelyn Degenhardt

Faculty mentor: Emily Ruff

VRK1 is a vaccinia-related serine/threonine kinase that contributes to the regulation of cell proliferation. Point mutations within the VRK1 sequence are associated with a variety of complex neurodegenerative disorders which previous research suggests are due to changes in kinase activity and/or structure and stability. Point mutations seen with VRK1 may affect how a tail on the C-terminus of the protein interacts with the protein's active site, possibly altering the ability of the protein to bind to specific substrates.

This study looked specifically at the point mutation D263G and its effect on protein stability and ability to bind substrates at its active site. The mutation was produced in a His-tagged VRK1 construct plasmid which was then transformed into *E. coli* bacteria cells, allowing for the purification of the specific mutated VRK1 protein. Experiments were then carried out to determine both the stability of the protein and its substrate binding properties. The stability of the protein was analyzed using circular dichroism and the protein's binding ability was evaluated using differential scanning fluorimetry with ADP and ADP-competitive inhibitors. Results were compared to the wild type VRK1 protein. These experiments are also being extended to other mutations including R321C, which is seen in some patients diagnosed with neuromuscular diseases.

Exploration of New Half-Sandwich Ruthenium(II) Curcuminoid Complexes

Kevin Flanagan

Faculty Mentors: Joseph West and Valeria Stepanova (Vitterbo University)

Ruthenium complexes and curcuminoid species have both independently been shown to exhibit a number of biologically relevant properties. The complex $(\eta^6\text{-cymene})\text{Ru}(\text{Cl})(\text{curc})$ has been shown to exhibit enhanced cytotoxic properties with respect to its precursors, but no direct analogues have been reported to date. Using a straightforward method, several $(\text{cymene})\text{Ru}(\text{Cl})(\text{curc})$ have been prepared using an array of synthetic curcumin analogues. ^1H and ^{13}C NMR spectroscopy, mass spectrometry and single crystal X-ray diffractometry have all been utilized to characterize these compounds.

HPLC and CMS Analysis of Clomipramine Metabolism: A Multi-Drug Study

Tess E. Buescher, Tu Khiem Ho, and Kyler Ford

Faculty mentor: Myoung Lee

Daily use of multiple medications is commonplace for many Americans. While pharmacists monitor prescriptions for drug interactions, consumers rarely check the possible side effects when using an over-the-counter product. In this fictional case study, Sam is prescribed clomipramine and ciprofloxacin, while also taking Tylenol PM.

All three medications are orally administered, and drug metabolism is catalyzed in the liver by cytochrome P450 enzymes (CYP450). CYP isoenzymes CYP1A2, CYP3A4 and CYP2C19 are responsible for clomipramine metabolism and formation of major bioactive metabolite desmethylclomipramine, while CYP2D6 hydroxylates clomipramine and metabolite into hydroxyclopmipramine and hydroxydesmethylclomipramine, respectively. Multi-drug use can inhibit or induce metabolic activity. The extent to which activity is affected is determined by dose and ligand-enzyme binding strength. Ciprofloxacin is a known CYP1A2 inhibitor, while diphenhydramine inhibits CYP2D6. Quantification and visualization of metabolites formed from clomipramine, ciprofloxacin, and diphenhydramine in rat liver microsomes was performed using compact mass spectrometry and high-performance liquid chromatography. Chromatograms were analyzed for molecular weights of parent clomipramine and metabolized products. Data indicated a reduction ranging from 21.1% to 30.1% inhibition of clomipramine metabolism into desmethylclomipramine. It was concluded that CYP isoenzymes CYP1A2, CYP3A4, and CYP2C19 played a role in diminishing clomipramine metabolite formation. These results illustrate the need for research and education when administering multiple drugs.

Investigation of the Drug-Drug Effects of Propranolol and Clomipramine in Rat Liver Microsome using HPLC and Compact Mass Spectrometry

Tu Khiem Ho, Kyler Ford, and Tess Buescher

Faculty mentor: Myoung Lee

Polypharmacy is widely practiced today. One example is the combination of antidepressants and hypertensive drugs, as it has been found that 57.5% of people with hypertension also develop depression symptoms. The effects of propranolol (a beta blocker) on the metabolism of clomipramine (a tricyclic antidepressant) were investigated to recreate this combination, using rat liver microsomes, HPLC (high performance liquid chromatography), and CMS (compact mass spectrometry).

In the experiment, varying quantities of clomipramine, propranolol (inhibitor), NADPH, and rat liver microsome were incubated and diluted in HPLC mobile phase to be loaded onto the CMS fitted with a reverse phase column. Rat liver microsomes have similar metabolizing enzymes as the human liver. Clomipramine in the liver is metabolized by enzymes CYP2D6, CYP1A2, CYP3A4, and CYP2C19. These enzymes catalyze the metabolism of different functional groups on the clomipramine (CYP2D6 catalyzes aromatic hydroxylation, while CYP1A2, CYP2C19, and CYP3A4 drives demethylation of the amino group). The metabolism type we specifically probed was mono-demethylation of the amino group on clomipramine.

The results agree with the hypothesized inhibitory effect of propranolol. The concentration of propranolol at 50% inhibition of demethylation under these conditions was found to be 1.33 mM. ($IC_{50} = 1.33$ mM). Concentration of unmetabolized clomipramine increased by 9.3% with increasing concentration of propranolol. Propranolol is a substrate for enzymes CYP1A2 and CYP3A4, competing with clomipramine in binding the active sites of the enzymes, thus decreasing the concentration of demethylated clomipramine while increasing the concentration of clomipramine. This experiment could guide medical practitioners when prescribing antidepressants and hypertensive drugs together.

Investigation of Substituent Effects on the UV-vis Spectra of Curcuminoids and Validation of TD-DFT Methods for their Prediction

Sylvia Chase and Millie Gotelaere

Faculty Mentors: Joseph West and Valeria Stepanova (Vitterbo University)

An array of curcuminoids - analogues of the turmeric extract, curcumin - have been spectroscopically analyzed to compare absorption shifts caused by changes to substituent variations on the terminal phenyl rings. A Hammett-type analysis was conducted in hopes of providing a qualitatively predictive approach for targeting the synthesis of new curcuminoids that absorb at specific wavelengths. In conjunction with this, the time-dependent density functional theory (TD-DFT) approach has been utilized to predict UV-visible absorption spectra for these same compounds. Curcuminoids' UV-vis spectra were modeled using several DFT functionals including the popular B3LYP and CAM-B3LYP, specifically built to model electronic excitations. All methods utilized the 6-311++G** basis set for all atoms and implicit solvent modeling using the conductor-like polarizable continuum model (C-PCM). The quality of spectral matching for the various density functionals are presented as are the predictive strengths of TD-DFT in general for UV-vis spectra for this class of compounds.

Investigations of the Effects of Mutations in Inscuteable Mediated Pins-Mud Complex and PAR Complex Functions in Drosophila Neuroblast

Ryan Liu

Faculty Mentor: Jonathon Mauser

Drosophila melanogaster central brain neuroblasts asymmetrically segregate proteins along the cell's apical-basal axil. Divisions along abnormal orientations or the complete failure to divide asymmetrically may result in overgrowth phenotypes. Neuroblastoma, one of the deadliest solid tumor diseases with extremely poor survival rate for late stages, is an example of this dysregulation. The protein Inscuteable (Insc) was previously found to bind with the protein Partner of Inscuteable (Pins; mPins or LGN in mammals), a receptor-independent G-protein activator, which is a subunit of the Pins-Gai complex. The combined complex recruits Dlg to ensure correct spindle attachment on the cortex of the cell, therefore determining the orientation of the cell division. Insc was also found to bind to the protein Bazooka (Baz, Par-3) which is a subunit of the PAR-complex. This complex also contains the proteins Par-6 and aPKC. The PAR complex phosphorylate and displace cell fate determinants at the apical side of the cell, which dictate the apical-basal polarity of the cell. The two crucial complexes both interact with Insc to facilitate normal asymmetric segregation; mutation in Insc, Baz, or Pins may lead to cancer. Here we investigate the binding regions between Insc and Baz, as well as between Insc and Pins. So far, the binding sequence between Insc and Pins has been narrowed down to Insc amino acids 301-331. Further mutations will be done in this region to determine and narrow the binding sequence for all 4-protein binding sites. After determining the binding sequences between both complex interactions with Insc, point mutation will be introduced to healthy drosophila neuroblast (WT) and phenotype will be determined via the quantification of neuroblast numbers in mutant animals.

Learning NMR by Building a Library of ^{31}P NMR Spectra for Common Phosphorus Ligands

Connor Lehner

Faculty Mentor: Joseph West

NMR spectroscopy is a ubiquitous and vital tool for synthetic chemists. This instrument and analysis of its spectra are commonly introduced in the organic chemistry sequence during the sophomore year of undergraduate studies. It is intended that by gaining early exposure to technique, through analysis of common phosphorus-containing ligands, readiness for the upcoming organic chemistry curriculum will be bolstered. The development of a library of spectra that directly useful to the West Research Group is an ancillary benefit that will enable faster research progress for future students.

Method Development for Purification and Analysis of the PETase Enzyme

Kyle Blom and Halie Schettl

Faculty Mentor: Emily Ruff

Polyethylene terephthalate (PET) is the most common form of plastic used in the world today, but only accounts for 29% of plastics recycled. It can be used to make many different products, including soda bottles and polyester fabrics. In 2020 a research team based in Japan analyzed a bacteria known as *Ideonella sakaiensis* which was found to secrete the enzyme PETase. The PETase enzyme reaction converts PET grade plastic polymers to products that could then be degraded back to the plastic's structural monomers. This degradation pathway may lead to a functional solution to the massive amount of plastic waste built up around the world.

The research performed in this project aimed to develop a method to purify and test the enzyme PETase. His-tagged protein constructs were expressed in *E. coli* and purified using affinity

chromatography. The protein product was quantified using Bradford assays and SDS PAGE. Plastic degradation by the protein product was also measured using absorbance at 260 nm. Further applications of this research may include teaching labs and analysis of PETase mutants.

Preparation and Characterization of New Titanocene(IV) Curcuminoid Complexes

Krista Osteraas

Faculty Mentors: Joseph West and Valeria Stepanova (Vitterbo University)

Titanocene complexes and curcuminoid species have both independently been shown to exhibit a number of biologically relevant properties. While complexes of the type $[(\eta^5\text{-cyclopentadienyl})\text{Ti}(\beta\text{-diketonate})]^+$ have been reported, no curcumin-based analogue has ever been synthesized. Using a straight forward method, several $[(\eta^5\text{-cyclopentadienyl})\text{Ti}(\text{"curc"})]^+$ ("curc" = curcuminoidate) have been prepared using an array of synthetic curcumin analogues. ^1H and ^{13}C NMR spectroscopy, mass spectrometry and single crystal X-ray diffractometry have all been utilized to characterize these compounds.

Purification and Characterization of VRK2 for Continued Research

Steven Richter

Faculty Mentor: Emily Ruff

Kinases represent a vast and varied group of proteins, having more than 500 members in human beings alone. They have been found to be involved in various signal transduction pathways, ranging from embryonic development to apoptosis. The vaccinia-related kinases (VRKs) are a small sub-group of kinases containing three members: VRK1, VRK2, and VRK3. These proteins are involved in the cell cycle, cellular proliferation, chromatin condensation and gene transcription. VRK1 has been extensively studied not only for its normal biological roles, but also for its link to cancer. VRK2 is not as well studied as VRK1. However, the two kinases are quite closely related, sharing as much as 56% of their amino acid sequence. This indicates that there may be similarities not only in their function, but also in their influence on biological processes. Further research into VRK2 will be required to better understand its structure, function and influence in the context of normal cellular behavior, but also in the context of disease.

For this project, we have transformed bacteria with a plasmid containing our VRK2 sequence with a His-tag. The protein was extracted from these cells and purified by filtration and affinity chromatography. The purified protein was run on an SDS-PAGE to verify the presence of VRK2, and the absence of contaminant protein. Concentration was determined via Bradford assay. Finally, VRK2 was subjected to circular dichroism and differential scanning fluorimetry for specific characterization. The SDS-PAGE results showed that we were able to produce and purify our target protein, and the Bradford assay showed it could be produced at relatively high concentrations. Through DSF and CD we were able to experimentally determine melting point temperatures of VRK2, with and without ADP bound.

Student Laboratory for Synthesis and Characterization of Proton Exchange Membranes

Christiana Hoyt

Faculty Mentors: Steven Klankowski and Robert Kopitzke

The primary goal of this research was to improve the current Proton Exchange Membrane (PEM) Synthesis and Characterization laboratory exercise for CHEM 411-Synthesis and Characterization of Materials. Intended improvements to this lab included measuring conductivity of the PEM by finding the best procedure for creating the conductivity cell through both research and experiments in order to add electrochemical impedance spectroscopy in the characterizations for the lab. Commercial membranes, such as Nafion, have multiple issues: high cost, high methanol permeability, poor function at elevated temperatures and at low humidity being some of them. Using PEEK to synthesize PEMs can be used as a reduced cost alternative to Nafion as well as reduce methanol permeability. Using electrochemical impedance spectroscopy, water uptake, and percent sulfonation PEEK PEMs will be compared to Nafion PEMs.

Synthesis and Characterization of CdSe nanoparticles for Use in Solar Cells

Benjamin Carvell

Faculty Mentor: Jen Zemke

Over the last several years, interest in thin-film, nanoparticle-based solar cells have increased due to their potential to be low cost, tunable, and highly efficient when compared to other current solar cell technologies. In this research, cadmium selenide nanoparticles capped by oleic acid (CdSe-OLA) were synthesized. After those nanoparticles were synthesized, the bulky oleic acid ligand was exchanged with much smaller, more tunable ligands such as vanillic acid, malic acid, and Sodium 2,3-Dimercaptopropane-1-sulfonate (DMPS). This allows for easier energy transfer when applied to a solar cell. The successful synthesis of these nanoparticles was confirmed using FTIR, UV-vis, and NMR spectroscopy. Using these nanoparticles, thin-film solar cells were constructed and tested where it was found that the ligand exchanged solar cell (CdSe-DMPS) had a much larger photo-response than CdSe-OLA.

Synthesis and Characterization of Double Cross-Linked PVPMS Aerogels

Olivia Zill

Faculty Mentor: Robert Kopitzke

Aerogels have been rising to the surface as a material of interest for many practical applications. Aerogels are classified as "dried gels with a very high relative pore volume". The practical applications of aerogels include thermal insulators, electrical conductors, sensors, as well as optical applications and more. Aerogels are typically created through supercritical drying, in which the liquid in a sol-gel is turned into gas without destroying the structure of the gel. However, this process requires high pressures and temperatures and the solvents used are highly flammable and unsafe at these conditions. The purpose of this research experiment is to create an undergraduate student laboratory for CHEM411 Materials and Synthesis of Characterization in which the students will create polyvinylpolymethylsiloxane (PVPMS) aerogels using a new method that has been created using ambient pressure drying rather than supercritical drying. The method of ambient pressure drying is safer for an undergraduate laboratory and has significantly less risks than the method of supercritical drying. The proposed student laboratory would include both the synthesis and characterization of the PVPMS aerogels, which are both topics that fall under the American Chemical Society's guidelines for topics in Macromolecular,

Supramolecular, and Nanoscale (MSN) systems. Characterization of the resulting PVPMS aerogels would include density, mechanical properties, and infrared spectroscopy (IR).

The Impact of Green Tea Extract (GTE) on the Metabolism of Clomipramine in Rat Liver Microsome Using HPLC and Compact Mass Spectrometry

Kyler Phan, Tu Khiem Ho, and Tess Buescher
Faculty Mentor: Myoung Lee

Clomipramine is a commonly used tricyclic antidepressant in treating a variety of disorders such as obsessive-compulsive disorder, anxiety, depression, and panic disorders. Clomipramine is metabolized primarily by the isoenzyme CYP450 2D6 in the liver. It can also be metabolized by three other enzymes, CYP450 1A2, CYP450 2C19, and CYP450 3A4 isoenzymes. These are four isoenzymes for metabolizing Clomipramine, but the focus for this experiment is CYP450 1A2 with rat liver microsome using HPLC and compact mass spectrometry (CMS). Today, roughly \$11 billion is spent on green tea consumption. One form of consuming green tea is through green tea extract. Green tea extract, in a pill or powder form, contains high amounts of antioxidants, polyphenols, minerals, caffeine, carbohydrates, and various amounts of vitamins. The question of interest is "how much is too much?" for clomipramine users. This experiment explores green tea extract in a powder and the effects it has on the metabolization of clomipramine. Green tea extract is known to inhibit two metabolizing enzymes, CYP450 1A2 and CYP450 2D6, but it is unknown which is primarily inhibited. To carry out the experiment, four negative controls and various concentrations of green tea extracts were used. The negative controls contained varying amounts of clomipramine, NADPH, microsomal suspension, and buffer. The experimental samples contained varying amounts of green tea extract (inhibitor) in addition to clomipramine, microsome, and NADPH. The samples were incubated at 37 °C. The metabolite was extracted and mixed with the mobile phase to be injected through a compact mass spectrometer fitted with a C18 reverse phase column. The CMS data showed a 51.4% decreased level of desmethylated clomipramine, indicating that the CYP450 1A2 isoenzyme is being inhibited. From the data gathered through CMS, a graphical analysis determined the concentration of green tea extract at a 50% inhibition under the experimental condition. These results showed that IC50 was 28.3 mg/mL green tea extract under the experimental condition. This can be significant for informing individuals who consume green tea extract and clomipramine together.

Using 3D Printing to Illustrate Protein Modularity and Dynamics

Joanna Dinesen
Faculty Mentor: Jonathon Mauser

Many important enzymes are part of multi-subunit complexes that involve complex movements and interactions that are difficult to visualize via traditional 2-dimensional diagrams or in visualization software. Physical, 3-dimensional models are an especially effective way to illustrate abstract concepts within the curriculum, including about protein dynamics, subunit functions, pathway architectures, and the nature of protein-protein interactions. The usage of physical models in the classroom has been successful when teaching concepts such as enzyme catalysis and protein refolding, quantized by increased exam scores and positive student feedback. Here, we present work done to 3D print publicly available protein structures of the Krebs Cycle enzymes in both rigid and flexible polymers to convey

concepts of dynamics in protein structure, as well as aid in teaching the roles of different monomers within the cycle. Structures 3D printed with thermoplastic polyurethane (TPU) are lightweight and flexible, which allows the models to be safe for classroom use while simultaneously teaching dynamics of enzyme motion among subunits and individual chains. Highly regulated enzymes have been coated with a glaze to easily differentiate from the other five enzymes of the pathway. Upon integration with traditional lecture methods, student gains in key learning outcomes will be quantified by polling, comparison of results of a pre- and post-assessment, and performance on standardized test items.

Validation of Computational Methods for the Tautomerism of Thiourea Dioxide

McKenna Lund

Faculty Mentor: Joseph West

In solution, thiourea dioxide exists in an equilibrium between its dioxide and sulfinic acid forms. This tautomeric relationship, as they all are, is substantially influenced by the solvent's polarity and hydrogen bonding capabilities. More well-known systems, e.g., acetylacetone, have been extensively studied in this regard, while thiourea dioxide's equilibrium has not. We have initiated a hybrid computational-spectroscopic investigation of this system utilizing low-cost Hartree-Fock methods with the 3–21G, 3–21+G, 3–21G*, 3–21+G*, MINI, MIDI, SBKJC and HW basis sets. Beyond gas phase calculations, both tautomeric forms were modeled using the C-PCM implicit solvent model for water and toluene. Obtained modeling results are compared to room temperature NMR spectra.

Communication Studies

You can do this! Mentorship Support and Memorable Messages on the Motivations and Successes of First-Generation College Students

Cindy Nguyen

Faculty Mentor: Tammy Swenson-Lepper

This study explores the different barriers to success that first-generation college (FGC) students face and the role that social support, specifically mentorship, has on their motivations and successes. Mentors can help provide guidance and support for first-generation college students and can have a positive impact on their transition into higher education. This study looks at the impact of social support and mentoring relationships on first-generation college students and the memorable messages that they received from these sources of support. Semi-structured interviews were conducted with twelve FGC students who were either currently enrolled in a four-year university or who had previously been enrolled in a four-year university. Using a qualitative approach of thematic analysis (Braun & Clarke, 2006), relevant domains and themes were created to provide a thorough description of the data set. In total, three overarching domains were identified with eight themes to answer our research questions. Domains covered the areas of: 1) Barriers and Challenges 2) Sources of Support, 3) Sources of Memorable Messages. The results of the study reveal that memorable messages from mentors, specifically on-campus faculty, play a significant role in the motivations and successes of FGCS.

Computer Science

3D Geospatial Crystal Printing

Ritesh Shah

Faculty Mentor: Tom Hill

This is a presentation about 3D printing and the process of learning and exploring it. The presentation will focus more on the use of 3D printers in Medicine and Healthcare and how has it evolved overtime.

Comparison of Real-time Communication Performance between Web Sockets using Socket.io and Long-Polling using Ajax

Ei Myatnoe Aung

Faculty Mentors: Mingrui Zhang and Sudharsan Iyengar

Short polling, long polling, server-sent events, and web sockets are some of the current techniques used to accomplish real time communication in web applications. They are based on a client-server communication model. Among these techniques, long polling and web sockets are the most popular and are more frequently used for real life projects. Long polling keeps the connection alive until there is valid response from the server, and terminates the connection starts a new connection. Web sockets keep the connection open regardless until client or server leaves the connection. This study compares the performance of two most popular real-time communication techniques, long polling and web sockets. Real-time data dashboard was implemented in two versions: one with web sockets using Socket.io library and another in long polling using Ajax. The database in the backend was constantly updated at random intervals and all the changes were sent back to client side at real time through the respective real time techniques. The time needed by the two technologies based on the number of requests made, the total response time, and the CPU utilization were measured. The final testing results suggest that web sockets performance is comparable to that of long polling.

Gamification of Recipe-Viewing Software Leads to an Enhanced User Experience

Justin Fuller

Faculty Mentors: Mingrui Zhang and Sudharsan Iyengar

This paper explores the effect of gamification in a recipe-viewing application and its impact on user experience. Gamification incorporates game-style incentives into non-game activities. Two identical recipe applications were created, with one of them incorporating a game while the other does not. In these pieces of recipe software, the user can choose a recipe from four different categories: breakfast, lunch, dinner, and dessert. For each recipe the user selected, the user was prompted with the instructions, ingredients, and a youtube video on how to make the recipe. The gamified application has a game with a point system in which the user can unlock random recipes corresponding to the category of food they are in. The basic application is the same but without the game.

To assess user experience, the users were given a five-question survey to express their feelings about

certain parts of the applications. The questions ranged from rating their overall experience using both applications, how effective the implementation of gamification was, the usefulness of the game, and how much they liked the game's design on a scale from 1-5. The results show that the gamified application provided users with a significantly better user experience. The gamified application had a higher overall experience rating, was preferred over the basic application, and was more effective at keeping the users interest than the basic application.

Images of The Future

Bradley Budach

Faculty Mentor: Adam Beardsley

The goal of this project is to use the cutting edge of current AI to take images of problems and solve them. It will allow me to take a picture of a problem, Math, English, etc., and generate an answer to send back. The software I have created simply takes an image and uses AI to garner text from the image and interpret that text to come up with an answer to the problem given. This has many use applications. Web apps, mobile apps, and other devices could all make use of this software to assist the user. Like the Raspberry PI that I added the software to. This tiny computer and an internet connection is all that is needed to perform everything I have explained above. Besides these applications, it also serves to be an example of just how far the cutting edge of AI has come in recent years. This project will demonstrate just how powerful AI has become and serve as a vantage point to see where things could go in the future.

Investigating Graphical vs. Command Line User Interface Designs Based on User Feedback

Matthew Jilk

Faculty Mentor: Sudharsan Iyengar

User experience (UX) is a highly complex and notoriously difficult-to-study area of software design. One reason for this difficulty is that researchers often look at examples of high-quality UIs and then explain why they think they're good. A better way to study UX is to compare different UIs that offer the same functionality for the same piece of software. We conducted one such experiment. According to the results collected from our survey, text-based UIs are difficult for most people to use; graphical UIs should be preferred. Accepted, industry-standard principles adhere to visual minimalism, usage of vector graphics instead of bitmaps, easy first-time-user experience, consistency, designs that give users control of the software, and knowing users before they start using your software. Furthermore, we also recommend not relying too heavily on user feedback as users don't always understand, realize, or use the software for long enough to know what makes its current UI effectively or ineffectively designed. If feedback is to be used to make specific design decision(s), it should be specific and thorough, consisting of several detailed and specific questions; the questions should be as specific as the design choice being made and justifications for doing it one way over another.

Investigating the comprehension of GPT's interpretation of word meanings

Longge Yuan

Faculty Mentors: Mingrui Zhang and Sudharsan Iyengar

ChatGPT is a large-scale language model developed by OpenAI. Its purpose is to start a conversation with people and provide them with information ranging from simple facts to more complex topics. Trained on a large amount of text data, ChatGPT has shown us that it can understand human language and respond in a meaningful way. In this paper, we show a way to judge whether ChatGPT can accurately understand the various meanings of words and use them based on the answers output by ChatGPT. The five dimensions, each scored up to 5 points, are word explanation, etymology, synonyms and antonyms, sentence construction and explanation of words in sentences. Results of testing are Word Explanation, Etymology, Sentence Structure and Interpretation all scored 4 or above. Then, the tests show lower score for synonyms and antonyms with an average score of 1.86. The average overall score is 20.44 in 25. Although ChatGPT is slightly inferior in synonyms and antonyms, the results show that ChatGPT understands the meaning of words well.

The Gamification of Educational Software Leads to Faster Learning

Ruth Ann Carlson

Faculty Mentors: Subharsan Iyengar and Mingrui Zhang

Turning learning into a game is a standard tool in the digital age, and it can be found in many different areas, such as workplaces, stores, and classrooms. This is called gamification, adding game-like elements to non-game activities to increase user enjoyment and engagement. The goal of this research was to understand the impact of gamification on learning speeds and to review the hypothesis that “learning methods that utilize gamification lead to an increased learning speed when compared to learning methods that do not include gamified elements.”

The study was conducted as a survey where participants were asked to learn through four given methods and then take a quiz after each learning method. There were two non-gamified learning methods, the first was two short readings, and the other was a ten-minute video. The other two learning methods were gamified. These gamified learning methods were a matching game and a Jeopardy-style game. After the participant had completed all learning methods and their corresponding quiz, they took an exit survey that asked about their preferred learning methods and to disclose any prior knowledge they had on any of the topics.

This study got responses from nine participants and found that quiz scores were similar through all learning methods except for the reading, which had lower results. It was discovered that there was inconclusive evidence to state that learning methods with gamified elements resulted in faster learning than their non-gamified learning counterparts.

Using Extreme Gradient Boosting (XGBoost) and Adaptive Boosting (AdaBoost) to Predict Mortality of Patients Aged 40 Years or Older Admitted in ICU

Sheikh Fahad

Faculty Mentors: Collin Engstrom, Sudharsan Iyengar, and Mingrui Zhang

This paper presents a study that used electronic health record (EHR) data to predict the mortality of patients admitted to the ICU who are 40 years old or above. The study focused on comparing the performance of two popular machine learning algorithms, AdaBoost and XGBoost, to predict the outcome of a binary classification problem. It used data collected from PhysioNet's MIMIC-IV dataset. Both algorithms were trained on the dataset and their performance was evaluated using accuracy, precision, F1-score, and AUC (area under the curve). The hyperparameters for both algorithms were tuned using a grid search cross-validation approach, and the best hyperparameters were selected based on the performance of the algorithm on the validation set. The findings suggest that the XGBoost model performed at least 8% or higher than the AdaBoost model in all the common evaluation metrics mentioned, making it more effective in predicting mortality.

Engineering

CarbCon Table: Carbon Fiber Tensegrity Table

Kaylee Beyer, Jared Boelter, Charlie Dennis, William Larson, and Jacob Wolter

Faculty Mentor: Keith Dennehy

The function of this surface is to be aesthetically pleasing and to provide a stable space for common small items. Manufactured with carbon fiber, honeycomb, and wood core, this surface is to be lightweight but able to withstand moderate loads. Resistant to water and UV protected, the product can be used in everyday life. This product is a tensegrity table, which means the structure looks like it is floating in air. The design ensures that all the cables are in tension and able to keep the table upright and stable. The product is an eye-catching home décor piece, sparking intriguing conversations and awe.

Carbon Cornhole

Bailey Banaszynski, Justin Dailey, Blake Endle, Josiah Gleisner, and Josh LeBrun

Faculty Mentor: Keith Dennehy

The purpose of this design project is to create a durable lightweight yard game for players of all skill levels. Carbon Cornhole is a composite improvement on the already popular yard game, cornhole, with a new twist. The final product is based on valued feedback from customers. The board is manufactured of carbon fiber/epoxy sandwich panels with a closed cell foam core. The composite design provides a lightweight product. The panels are specifically manufactured to retain their mechanical properties when exposed to outdoor elements such as water and UV radiation. The addition of inlaid LED lights and two new "skill holes" allows for a new playing experience and the ability to play at night. The addition of 3D printed feet allows for the board to be played on multiple different outdoor surfaces such as grass, gravel, or concrete. Testing on the finished product will ensure the customer experiences years of enjoyment from their purchase.

Flexural Creep Comparison to TTS Creep for PP and PP-GF30

Max Kauphusman and Regan Harvey
Faculty Mentor: Eric Kerr-Anderson

Creep testing is one of the most expensive datasets to acquire in both cost (\$10k+) and time (2+ months). Dynamic Mechanical Analysis offers a unique opportunity to characterize creep properties of polymers using a technique called Time Temperature Super Positioning (TTSP) in a relatively short period of time. TTSP works by holding either frequency or loading constant at set temperatures for a constant period of time. WLF equations are then used to combine multiple curves from different temperatures into a master curve that can be used to extrapolate out creep performance at designated reference temperatures and save a considerable amount of time if it is comparable to actual creep. Methods were examined to compare neat polypropylene and PP-GF30 long fiber thermoplastic. Long-term flexural creep was also tested at multiple loads and temperatures.

sTable Sawhorse: A Compact Folding, Sturdy Sawhorse Designed to be Light Weight and Save Space

Jean Donalson Louis Charles, Daniel Dahl, Lane Frye, Kellie Hardecopf, and Alexander Klagge
Faculty Mentor: Keith Dennehy

The sTable Sawhorse is a composite, clamshell-style folding structure designed to be a mobile set of legs to support and raise objects to an appropriate work height. Designed with space saving in mind while folded, the sawhorse takes up minimal space while not in use. Manufactured with a woven fiberglass c-channel body, epoxy resin, and a foam core, the sTable Sawhorse is lightweight and robust. A large, flat top work surface allows for better contact and control of items placed on it. A wide footprint also allows for a very stable structure. This product is unique in that it combines a light-weight frame with the strength of similar bulkier and heavier alternatives. Consisting of two identical halves, the sawhorse is simple in design and construction. Testing will be conducted to determine the strength and the UV resistance of the legs as well as the overall stability of the structure.

Welding 3D Printed Structures for Composite Sacrificial Tooling

Brennon Coit, Aidan Dungy, Matt Ficker, Kyle Gerold, Dominic Perez, and Matt Wooden
Faculty Mentor: Eric Kerr-Anderson

3D printed parts offer the ability to generate dimensioned, complex objects with minimal machining touch time and skill, but they are typically very weak and limited in size. Strong and light composite parts require tooling to be created for the fabric to lay on while the resin is curing, but tooling can be quite expensive during the prototyping phase or for low part quantity runs. This study examined the techniques required to weld smaller 3D printed parts together to form large 3D printed tools that could be used as a sacrificial tool for a composite part. In this method, the 3D printed structure would remain inside the part and provide support and dimensional reference during the composite curing process. Friction, hot extrusion, and hot contact welding methods were examined using lap shear joints in both tensile and flexural test methods to determine effective joinery style and overlap lengths to achieve normal 3D printed properties. The results of this study demonstrate how multiple 3D printers could be used to create cost-effective rapid prototyping and low part quantity runs for composite structures by

welding smaller 3D printed structures into a larger single 3D printed part.

English

Satori- Literary Visual Arts Magazine

Madeline Schonitzer, Brianna Strohbehn, Emily Venne, Page Sutton, Gabriel Hathaway, Willow Swinbank, and Van Herman

Faculty Mentor: James Armstrong

Satori is Winona State University's annual journal of the arts. Founded in 1970, "satori" is Japanese for "enlightenment, awakening, comprehension, and understanding." Our journal attempts to reflect these values in our campus community.

Every year, students from across campus are invited to submit their fiction, poetry, creative nonfiction, and artistic works. This presentation will give a behind-the-scenes look at the production process of this year's magazine including editing, design, and printing.

The History of Punctuation in the English Language

Lepper, Rachel

Faculty Mentor: Andrew Higl

This project examined the history of punctuation in the English language to better understand both the history and future of English. My study traces the role of punctuation in writing from antiquity to Modern English. Writing appears to have originated as a way of keeping administrative records and was later used to represent speech, allowing the written word to be more easily understood and re-presented later. Generally, grammarians recognize two types of punctuation: rhetorical and grammatical. Punctuation was scarce and haphazard in Latin and Greek, and remained sparse through Old and Middle English until the 14th century when punctuation became more common due to the rise of silent reading. The rise of printing houses with the advent of the printing press led to house styles and a gradual systemization of punctuation. A key aspect of the Protestant Reformation was individual interpretation of the Bible, and literacy rates, although still low, were increasing. The mechanization of the Industrial Revolution led to a rapid rise in literacy, and faster and cheaper book production. It was around this time that the first rules for punctuation arose, although it was still often chaotic, grammarians wrote usage guides to assist the writer. With the rise of mass media in the 20th century, writing became less formal and trended towards lighter punctuation. The internet caused rapid changes in the way people use punctuation, with punctuation assisting in mimicking nonverbal cues in speech. For example, many people interpret a sentence ending with a period as implying a vastly different tone than ending a sentence with no punctuation. While punctuation is amid a revolution and is rapidly changing, we will probably see more of a split between formal and informal punctuation as well as overall simplification.

William Blake Bibliography

Alex Peachey

Faculty Mentor: Wayne Ripley

This is an organized collection of recent online works that describe William Blake and his works. Some works celebrate his accomplishments, and others analyze his pieces. The bibliography includes some works from 2022 and 2023. The collection is an easy introduction to William Blake, an important figure in humanistic studies.

Geoscience

3D Printing Topographical Data Using QGIS

Siena Kuehn

Faculty Mentor: Tom Hill

This is a presentation of the 3D printing process as a representation of spatial data, particularly elevation data. The programs used to create these models are the open-source QGIS and Crealty Print.

A Classroom Exercise Investigating Dinosaur Body Covering and Color

Kayla Godfrey

Faculty Mentor: W. Lee Beatty

The dermal features of dinosaurs are an actively researched and debated topic within the scientific community. Fossil preservation grows increasingly more complex as the softness of the material increases. In turn, it is rare for soft tissue such as organs, skin, scales, or attached plumage to survive the rigorous preservation process. Through relatively recent paleontological discoveries of fossilized soft tissue, researchers have been able to collect more data and build new hypotheses about the dermal features of several species of non-avian dinosaurs.

The goal of this research is to develop and implement a scalable college introductory-level lab on body covering and color of large herbivorous dinosaurs. The lab will focus on two herbivorous non-avian dinosaurs, *Edmontosaurus* and *Borealopelta*, and address both body covering features and melanin preserved in soft tissues and what those factors mean for the body color, camouflage, and ecological role of the animals. The lesson will focus on reshaping how students understand the evolutionary benefits and differences of various dermal features such as scale size, scale shape, scale color, and feathers on dinosaurs.

Before any instruction, it is vital for the instructor to gauge students' background knowledge and misconceptions. This can quickly be done by engaging the class in an opening activity. As the class time begins, students will be asked to grab out a blank sheet of paper and draw a dinosaur as best as they can. These examples being shared with the class should start with the stereotypical depictions of scale-covered dinosaurs and if there is a drawing with feathers or varying dermal features, that should be shown at the end. A short whole-class discussion can be held to talk about why dinosaurs are so often pictured as giant scaly reptiles rather than with feathers or a mixture of both.

After the discussion, a short lesson about dinosaur dermal features, their nuances, and purposes will be presented, including some specific examples. Casts of two different types of fossilized skin from an extraordinarily-preserved *Edmontosaurus* samples will be available for students to view, feel, and relate

back to the lesson. Then students will apply their reevaluated conception of dinosaur skin, scales, and feathers in a small group lab. Post-lab, individuals will complete an exit slip regarding a question such as "Which dermal feature discussed today would be most beneficial to you in playing your favorite sport? Provide the sport and an explanation as to why." Finishing off the lesson with an engaging, inquisitive question that has students apply their understanding of the lesson to a piece of their own life allows students to be more connected with the information and supports the instructor in evaluating individual student comprehension and mastery.

Students will also develop hypotheses on dinosaur coloration, shading, ecological role, and how data can be extracted from fossil reconstruction through diagrams and analysis. After investigating these aspects and research findings, students will color an image of both *Edmontosaurus* and *Borealopelta* based on the data discovered through the lab.

Characterizing a vertebrate microsite in the Late Cretaceous Hell Creek Formation

Anna Luessman

Faculty Mentor: W. Lee Beatty

The Late Cretaceous Hell Creek Formation, located in Eastern Montana and parts of North and South Dakota, represents a tidally-influenced fluvial environment that was home to a thriving ecosystem 66 million years ago. Today the formation is made of mudstones and sandstones that contain many vertebrate fossil microsites. Microsites are concentrations of fossilized vertebrate bones and teeth ranging in size from fractions of a millimeter to several centimeters. These sites frequently contain many different species of animals and plants, allowing us to paint a picture of what that environment was like in the Late Cretaceous Period. For this study, I collected and analyzed material from a fossil microsite outside the town of Marmarth, North Dakota. Fossil material was collected from the surface of the site, and two five-gallon bulk samples were also collected from the fossil-bearing sediment. The bulk sample material was sieved in a tank of water that was agitated with air from a pump. After sieving, the remaining material was dried and sorted. Fossils were separated from rock in the dried samples using tweezers and a magnifying lamp. Then I worked to identify both the fossils from the bulk sample and fossils collected on the surface of the microsite.

The fossils at this microsite indicate that the area was a shallow stream or river that was home to many different terrestrial and aquatic species. Along with many unidentifiable bone fragments, I identified turtle shell fragments; bony fish scales, teeth and bones; freshwater ray teeth; Champsosaur teeth and teeth of non-avian dinosaurs including *Triceratops* and *Tyrannosaurus*. The animals represented at this vertebrate microsite help us better understand diversity in terrestrial environments and how it changed during the end of the Age of Dinosaurs.

Impact Craters on the Moon: Making Craters in the Laboratory

William Beadling III

Faculty Mentor: Jennifer Anderson

Impact cratering is the dominant geological process affecting all planetary surfaces throughout the solar system. Impact craters form when an asteroid crashes at high speeds into a planetary surface. Here on Earth, some notable impact craters are Barringer Crater in Arizona, the Chicxulub Crater in Mexico

(which was responsible for the extinction of the dinosaurs), and the Manicouagan Impact Crater in Canada (one of the largest on Earth). Unfortunately, plate tectonics, biology, and erosion destroy impact craters on the Earth. However, impact craters are well preserved on the Moon, the Earth's dance partner in space.

One of the ways we can study the formation of impact craters is through experiments. I am one of Dr. Jennifer Anderson's research assistants in her Experimental Impact Cratering research group. We use the Vertical Impact Facility at NASA Johnson Space Center's Experimental Impact Laboratory in Houston Texas to fire projectiles at high speeds into targets that we have created to mimic the Moon's surface. Our research question is to see how crater morphology changes from "normal" bowl-shaped craters if we add a stronger layer beneath a particulate layer. In the lunar mare, ancient lava flows covered the Moon's surface and have since been broken up into what we call a regolith. We use sand to model the regolith layer and a synthetic sandstone block to simulate the buried lava flow. We fire 4-mm Aluminum spheres at 1.5 km/s (3400 mph) in a vacuum similar to the environment on the Moon into these targets and use various camera systems to watch how the craters form. We also use a handheld 3D scanner to scan the final crater topography.

Our control crater is formed into a bucket of sand only and then we completed a series of experiments into layered targets where the regolith layer is varied from 6-cm to 0-cm in thickness. We examined how the sand grains were ejected from the crater as it grows and also how the final crater topography changed as the regolith layer got thinner. In my poster presentation I will discuss the software programs that I used to investigate the ejecta kinematics and crater topography. In general, as the regolith layer got thinner, the crater morphology changed from bowl-shaped to flat-floored to concentric craters. The ejecta for the regolith-only crater is very well behaved while the ejecta for the thinner regolith experiments was much more complex. Our results have implications for understanding the substrate in the lunar mare regions.

Health, Exercise & Rehabilitative Sciences

Arthroplasty and Discectomy with Fusion Surgical Techniques in Patients with Cervical Degenerative Disc Disease: A Critically Appraised Topic

Logan Rupnow and Kaitlyn Ward

Faculty Mentors: Nora Kraemer and Brandon Donahue, DAT

Clinical Scenario: Cervical Degenerative Disc Disease (CDDD) can be identified in over 60% of the population with patients describing pain that incites numbness, tingling, and weakness in the extremities. The gold-standard for CDDD surgery has been anterior cervical discectomy and fusion (ACDF), but improvements in medical technology offers anterior disc cervical replacement (ACDR) as another option that is less invasive and easier to perform. The purpose of this appraisal is to review the current evidence regarding the differences in ACDR and ACDF on patient-reported outcomes (PROs) to help guide future providers and patients on CDDD surgical options.

Focused Clinical Question: In patients with cervical degenerative disc disease, what is the effect of ACDR versus ACDF on PROs?

Search Strategy: A literature search was conducted to find studies that investigated the effectiveness of ACDR versus ACDF on PROs. Databases that were used to search for studies were PubMed, CINAHL, ProQuest Nursing Collection, and Cochrane Library. The search terms included: "patients with cervical degenerative disc disease," "cervical arthroplasty," "cervical discectomy and fusion," "cervical disc replacement," "cervical disc herniation," and "patient reported outcomes." The following inclusion criteria was utilized: studies on ACDF and ACDR surgeries, all genders, single cervical spine levels, patients with degenerative disc disease, and randomized control studies. Studies were excluded if there were use of cervical steroid injections, no surgical interventions, acute cervical injury/surgery, or articles published before 2005. The search yielded a total of 10 articles that met the inclusion criteria.

Evidence Quality Assessment: All studies were critically appraised utilizing the PEDro and Oxford Centre for Evidence-Based Medicine (OCEBM). PEDro scores ranged from 4-7/10 and OCEBM scores ranged from 2-3.

Results and Summary of Search: All 10 studies used the Neck Disability Index (NDI) to measure the impact of surgery on pain, personal care, lifting, work, headaches, concentration, sleeping, driving, reading, and recreation. Additional PROs utilized in studies included the Visual Analogue Scale (VAS), Short Form Health Survey questionnaire (SF-36), EuroQol-5 Dimension (EQ-5D), Numeric Rating Scales (NRS), and Core Outcome Measures Index (COMI). All studies reported an improvement of scores for NDI for both ACDR and ACDF groups. Three studies identified ACDR as being statistically significant for improvement of the NDI score. A research strength included the large sample sizes that combat patient drop-out rates. A research weakness was the high variability in the timing of post-surgical follow-up between studies.

Clinical Bottom Line: Both ACDR and ACDF surgical interventions have shown to provide improved NDI scores 48 months following surgery. The ACDR surgery may provide improved outcomes over ACDF with caution support deriving from 3 of 10 studies. A Grade B is recommended on the Strength of Recommendation Taxonomy system.

Implications: This research indicates that both surgical options should be presented by the provider and that patient preference should drive decision-making based on comparable outcomes between the two procedures. Future research should investigate the efficacy of the BRYAN cervical disc device as a novel treatment of CDDD.

Correlation between Quadriceps and Hamstring Isokinetic Strength to Ball Velocity during a Soccer Kick

Maggie Plouff, Miah Busse, Brady Ferguson, Mikayla Pieper, and Aaron Baker
Faculty Mentor: Justin Geijer

When kicking a soccer ball, large forces are generated by the quadriceps and hamstring muscles that extend and flex the knee. The angular acceleration[GJR1] at this joint and the torques produced are[GJR2] related. PURPOSE: The goal of this pilot study was to explore the relationship between isokinetic strength[GJR3] of the quadriceps and hamstring muscles to velocity of a kicked soccer ball and determine if isokinetic testing of quadriceps and hamstring strength can predict soccer ball velocity during a kick.

Methods: Four female NCAA Division II soccer athletes completed maximal effort knee flexion and extension at three isokinetic speeds, 60°/second, 180°/second, and 300°/second using the Biodex 3 Isokinetic Dynamometer. Cortex 8.1 Motion Analysis Software was used to record three maximal kicks with the dominant leg. Bivariate Pearson correlation coefficients were calculated between both data sets using SPSS version 28.

Results: Ball velocity was significantly and positively correlated with Right Leg Flexion Acceleration time at 60°/second ($r = 0.860$), [GJR4] Left Leg Extension Acceleration at 180°/second ($r = 0.950$), and Left Leg Extension Acceleration at 300°/second ($r = 0.915$). Two significant negative relationships were discovered between ball velocity and left leg extension acceleration at 300°/second ($r = -0.950$), and left angle of peak extension torque at 300°/second ($r = -0.915$).

Conclusion: The ability to quickly accelerate the non-kicking leg to extension combined with the ability to reach angle of peak extension torque is associated with the ability to quickly stabilize the plant leg. Flexion of the kicking leg at a lower angular velocity corresponds with a higher force production and when combined with a positive correlation to ball velocity, suggests increased loading of the kicking leg prior to ball contact. Lastly, the negative correlation between ball velocity and kicking-leg extension acceleration would suggest that faster acceleration leads to increased ball velocity. Because of this, isokinetic testing of the quadriceps and hamstring strength is likely a good predictor of kicking velocity. Further testing is required to determine if present correlations are applicable to other populations of soccer athletes, which can affect training and return-to-play practices.

Difference between Isometric and Isotonic Exercises and Their Effects on Patients with Patellar Tendinopathy: A Critically Reviewed Study.

Colin Heraty and Steven Smith

Faculty Mentor: Brian Zeller

Clinical Scenario - In basketball players patellar tendinopathy cases are common with studies reporting that 1 in 3 college basketball players have reported patellar tendon issues. The most often type of treatment used currently is eccentric load training (ELT). A potential negative consequence to performing ELT is that it can be painful for patients to perform.² Due to this, isometric exercises have recently been investigated to determine if they produce a comparable result or offer a benefit, while causing less pain. In isometric training, the joint itself is not moving which has been shown to reduce pain levels and still supply quality stress reactions in the tendons. The use of isotonic exercises has also been incorporated into rehabilitation programs for patellar tendinopathy. Isotonic exercise involves the use of eccentric training. By comparing these two types of training, isotonic vs isometric, we can determine which type of training should be implemented to decrease pain.

Clinical Question - In patients with patellar tendinopathy, what are the effects of isometric vs isotonic exercise on pain levels during a single leg decline squat assessment?

Search Strategy - The following terms were used during an online search: patients clinically diagnosed with patellar tendinopathy, isometric exercise and isotonic exercise. Outcome measures searched for were pain scale rating of 1-10 during single leg decline squat. Inclusion criteria were human participants, clinically diagnosed chronic patellar tendinopathy, articles published after 2005, isometric exercise compared to isotonic exercise, and measured outcomes of SLDS pain scale rating. Exclusion criteria included animals, cadavers, acute injury, and published before 2005.

Quality Assessment - PEDRO scales ranged from 5/10- 8/10. The Oxford scale for all articles were level 2. All studies were determined to have internal validity.

Summary of Search - Research showed isometric exercise reduces pain during and 45 minutes post-exercise. However, multiple articles were retested from 7 to 52 weeks after the study and showed that pain level differences were insignificant. Therefore, our assessment from the appraisal of the research is that performing isometric vs isotonic exercise for pain control has no significant difference. Furthermore, it was noted that the analgesic effects of isometric exercise can be felt for 45 minutes post-completion of the exercise.

Clinical Bottom Line - While there is short-term pain relief by performing isometric vs isotonic training that lasts up to 45 minutes after rehabilitation sessions, there was no data supporting long-term pain relief past 8 weeks^{3,4,5}. The SORT score for the body of evidence was A.

Implications - Isometric exercise was found to provide pain relief immediately post-exercise and 45 minutes post-treatment but no significant differences in pain levels in the long term (>8 weeks). When treating future patients, isometric exercises may be beneficial in reducing pain levels during initial rehabilitation sessions and may potentially allow the practitioner to perform eccentric exercises with less pain.

Examination of Osteoarthritis in Anterior Cruciate Ligament Tear

Treatment Methods

Justine Beal and Sydney Smith

Faculty Mentors: Nora Kraemer and Brian Zeller

Clinical Scenario: Anterior Cruciate Ligament (ACL) ruptures are a common injury in active populations; long term outcomes of treatment options are often questioned when selecting an intervention. Although short term outcomes are measured well, follow-up studies are less pertinent when assessing the risk of osteoarthritis (OA) development. The purpose of this study is to determine the incidence of osteoarthritis among operative versus non-operative interventions following an acute ACL rupture in active populations.

Focused Clinical Question: In patients with acute ACL ruptures, what is the effect of surgical reconstruction versus non-operative rehabilitation on the incidence of osteoarthritis?

Search Strategy: 11,820 pieces of evidence were found across four databases using search terms such as ACL reconstruction, rehabilitation, conservative treatment, and osteoarthritis. Inclusion criteria included full and acute ACL rupture, no previous history of knee injuries, no associated ligamentous, meniscal, or capsular injuries, and no fractures or additional joint injuries. Exclusion criteria included partial thickness ACL tears, additional ligamentous ruptures, history of knee injuries and/or surgery, injury to the menisci and/or capsule, fractures in bones associated with the knee joint, joint injuries secondary to ACL injury, non-acute ACL rupture, and non-adherence to rehabilitation protocols.

Evidence Quality Assessment: Eight pieces of evidence were utilized following the search strategy with PEDro scores ranging from 4-to-6 and Oxford scores ranging from 2-to-4.

Results and Summary Search: Each study had similarly structured protocols including an operative group and a non-operative group, along with comparable rehabilitation protocols. Additionally, inclusion and exclusion criteria were similar in all studies, allowing for easy comparison of outcomes. Weaknesses included the inability to have blinding of the medical providers and nonspecific indication of blinding of

the assessors due to surgical involvement. Additionally, the PEDro score for each study was lower due to surgical intervention. Data comparing each treatment group was compiled to determine which intervention reported better long-term joint outcomes and decreased incidence of OA.

Clinical Bottom Line: There is consistent evidence demonstrating that early ACL reconstruction (ACL-R) resulted in no higher chance of developing OA versus completing a non-operative rehabilitation program. Seven studies found no significant difference in OA development for the operative group versus the non-operative group. 4 of those 7 studies found that OA was more prevalent in the operative group than the non-operative group; however, no outcomes reported were statistically significant. One study found that patients from the ACL-R group had significantly higher International Knee Documentation Committee (IKDC) scores reported for knee stability vs. the non-operative group; 42% of the ACL-R group had developed OA, while 25% developed OA in the non-operative group.

Implications: The literature suggests the chance of developing osteoarthritis is comparable in either intervention. Development of OA may also be influenced by other predisposing risks such as genetic and environmental factors. Future practice and patient education should consider patient history, anthropometric measurements, and the patient's recovery expectations when selecting the best course of treatment. SORT Score: C.

In patients with meniscus pathology, what is the effect of operative treatment vs. non-operative treatment on functional improvements?

Brooke Echter and Chelsey Kasel

Faculty Mentors: Nora Kraemer and Brian Zeller

Clinical Scenario: Meniscus pathology such as degenerative tears and osteoarthritis complications have become more present in older adults. Surgical options, including meniscectomy or meniscal repairs, have less invasive techniques resulting in shorter recovery times; however, there is an option to avoid surgery and have comparable results. This research is aimed to identify whether surgery or conservative therapy is a more effective option for patients with degenerative meniscus pathology in improving function and decreasing pain.

Search Strategy: A literature review was conducted to determine operative vs. non-operative treatment outcomes for a meniscus tear on function and pain. The search terms included were meniscus tears, surgery, and physical therapy OR rehabilitation. The sources utilized with final hits for each include PubMed (50), CINAHL Plus (65), ProQuest Nursing Collection (629), and Cochrane Library (4). The literature search yielded ten studies meeting the inclusion and exclusion criteria. Inclusion criteria were patients of all genders with degenerative meniscus tears who were 35+ years of age and active. Exclusion criteria included studies published before 2006 and traumatic meniscus tears.

Evidence Quality Assessment: Studies were assessed for quality by utilizing the PEDro scale. PEDro scores range from 6-10/11. The Oxford scale determined the level of evidence for each reviewed article. The Oxford scale was scored at a range of 2-3.

Results and Summary of Search: The included studies assessed the association between clinical and self-reported knee function in patients with a degenerative meniscus tear. The studies utilized the following outcomes IKDC, Isokinetic knee extension, VAS, Tegner activity scale, KOOS, Lysholm knee score, WOMET, and WOMAC. Though many of the articles supported the use of conservative methods

initially after diagnosis, while some reported that surgical intervention was not required to return patients to a functional status. However, some studies that used conventional therapy before surgery provided post-surgical benefits to patients in terms of regaining lower extremity function. Despite the effectiveness of conservative therapy prior to surgery, several limitations are present within this research topic weakening the authors' ability to answer the clinical question. Limitations included lacking control group, inability to blind all subjects, recording clinical results by separate assessors for each trial, small sample sizes, and experiencing crossover complications.

Clinical Bottom Line: Based on the evidence appraised, conservative treatment can be considered before surgical treatment as a primary treatment option for patients with degenerative meniscal tears. If conservative treatment fails, then surgical intervention is recommended. Due to inconsistent, disease-orientated, and level of evidence of the articles reviewed, the SORT score is B.

Implications for Practice, Education, and Future Research - This information can be generalized for middle-aged and older populations with degenerative meniscus tears, but not for those experiencing traumatic events or of a younger aged population. Further research should include longitudinal assessments incorporating follow-up periods greater than 2 years, larger sample sizes, and investigating the relationship between treatment methods and knee-osteoarthritis progression.

Influence of Ground Reaction Forces and Joint Velocities on Kicking Velocity

Miah Busse, Aaron Baker, Brady Ferguson, Mariah Lund, Mikayla Pieper, and Maggie Plouff
Faculty Mentor: Justin Geijer

Introduction: Kicking is a vital component in the game of soccer. One major factor that influences the success of a scoring attempt is ball velocity. Ground reaction force (GRF) and joint velocities of the lower extremities are variables of interest for increasing kicking velocity. Previous studies have shown exercise programs used to strengthen the muscles used in kicking have been successful in increasing kicking velocity (Manolopoulos, et al., 2013).[GJR1] To date, no known studies have analyzed the specific relationship between GRF, joint velocity and kicking velocity.

Purpose: The goal of this pilot study was to analyze the influence of ground reaction forces and joint velocities on kicking velocity.

Methods: Four female Division II collegiate soccer players [GJR2] completed 3 instep soccer kicks [GJR3] using their dominant, right leg. Their motion was captured using the Cortex 8.1 Motion Analysis Software. Ball velocity, right and left anterior superior iliac spine (ASIS) and right and left ankle velocities were calculated using the motion analysis software. Ground reaction forces from the plant leg were also measured using force plate data from the Cortex software. Bivariate Pearson correlations with 0.95 confidence intervals were computed using SPSS version 28 for the resultant velocities of the right and left ASIS, right and left ankles, and the velocity of the ball. They were also calculated for the peak GRF in the anteroposterior (X), mediolateral (Y) and vertical (Z) directions and ball velocity. A correlation value of >0.800 or <-0.800 was considered significant.

Results: Significant correlations were found between peak resultant ball velocity and GRF in the X direction (-0.907), GRF in the Y direction (0.867), R ASIS velocity (0.950), R ankle velocity (0.855), and L ankle velocity (0.977). No significant correlations were found between peak resultant ball velocity and GRF in the Z direction (0.788), or peak resultant ball velocity and peak joint velocity of the L ASIS (0.692).

Conclusion: Braking force of the planting leg is shown to correlate significantly with kicking velocity. Although high braking force allows for a faster ball, this can have other implications to injury [GJR4] (Ball, 2012; Jones & Graham-Smith, 2016). Linear velocity of the hip also allows for greater ball velocity. As a pilot study, this study lacks the statistical power to extrapolate the information to larger populations. Therefore, additional studies are needed to further investigate the relationships between kicking mechanics and the resulting ball velocity.

Prefabricated versus Custom Orthotics on Improving Plantar Fasciitis Pain in the General Population

Baylee Beulke and Ella Otto

Faculty Mentors: Nora Kraemer and Brian Zeller

Focused Clinical Question: In patients with plantar fasciitis, what is the effect of custom orthotics compared to prefabricated orthotics on pain reduction?

Search Strategy: Online databases including PubMed, Cochrane library, and ProQuest Nursing Collection were utilized for the search. Search terms included "plantar fasciitis", "prefabricated orthotic", "custom orthotic", "orthotic comparison", "plantar fasciitis", and "generic orthotic". 828 articles were found using the search terms. The search results were narrowed down to 8 articles that answered the PICO question and these were used for the critically appraised topic.

Evidence Quality Assessment: All articles were appraised utilizing the PEDro and Oxford scoring systems. All but one article was a "2" Oxford score as they were randomized study designs. The mean PEDro score of all articles is an "8" with the lowest rated article being a "4" and the highest being a "10" indicating the articles being of high quality as most of the participants were blinded, randomized, and completed the entire duration of the study.

Results of Search: It was found that participants in all the studies conducted reported a statistically significant decrease in pain after the use of custom and prefabricated foot orthotics for plantar fasciitis pain ($p < 0.05$). The differences between the custom orthotics group and the prefabricated orthotic group were not statistically different regarding plantar fasciitis pain ($p > 0.05$). Limitations of this literature review include variable treatment durations and outcome measurements. Additionally, some studies provided additional treatment to the orthotics thus not being able to attribute improvements in pain to solely the orthotics.

Clinical Scenario: Athletes, adults, and the elderly populations can all be affected by plantar fasciitis pain. Finding a cost-effective and successful treatment is important as plantar fasciitis pain can affect the functionality of the individual's activities of daily life. If the use of custom or prefabricated orthotics can decrease patient's reported pain, the general population will greatly benefit.

Clinical Bottom Line: Evidence indicates both customized and prefabricated orthotics are effective at reducing reported pain and beneficial at improving overall foot functionality. Prefabricated orthotics are easy to access and available at most convenience stores, making the treatment accessible and affordable for the general population. A SORT score of A is given for this recommendation since it originates from high-quality, patient-oriented research articles that have consistent findings.

Implications: Orthotics are an effective tool in treating plantar fasciitis. Patients looking to use orthotics for plantar fasciitis may select orthotic type based on preference and available resources. If cost is a considering factor, patients may opt for the prefabricated orthotics which are more affordable than

custom made orthotics. Further research should be conducted to determine the ideal duration and type of orthotic use.

Surgery with Physical Therapy versus Physical Therapy Alone in Patients with Femoroacetabular Impingement

Madelyn Horvath, Alexis Fenrick, and Isabella Lamantia

Faculty Mentors: Brandon Donahue and Nora Kraemer

Clinical Scenario - Femoroacetabular Impingement (FAI) is a bone deformity on the femoral head or acetabulum, potentially causing labrum tears, breakdown of articular cartilage, and pain. In the last 15 years, FAI patients have been recommended surgery to increase quality of life and reduce the risk of osteoarthritis. However, surgery is costly, requires a long recovery, and some patients may have contraindications leading to conservative therapy as an alternative option. The purpose of this critically appraised topic is to examine the evidence to determine the most effective course of treatment for individuals experiencing FAI.

Focused Clinical Question: In patients with FAI, what is the effect of surgery with physical therapy compared to physical therapy alone on quality of life?

Search Strategy: A search of peer-reviewed articles was completed using PubMed (21), CINAHL (10), ProQuest (816), and Cochrane Library (1). Search terms included "FAI," "femoroacetabular impingement," "hip impingement," and "femoroacetabular impingement physical therapy and surgery." Studies were included if participants were diagnosed with FAI, received arthroscopy or physical therapy, and completed a patient reported outcome (PRO). Studies that included patients diagnosed with generalized hip pain and hip osteoarthritis were excluded. Eight articles met inclusion criteria and were included in the appraisal.

Evidence Quality Assessment: The PEDro scale and the Oxford Centre for Evidence-Based Medicine (OCEBM) were used to assess the 8 articles. All articles scored between a 6/10 and 8/10 on the PEDro scale. All articles received a score of 2 on the OCEBM scale.

Results and Summary of Search: All patients who underwent surgery rather than performing only physical therapy reported higher scores on the International Hip Outcome Tool (iHOT-33). The iHOT-33 is a PRO that assesses the patients' symptoms, functional limitations, and ability to perform sports and recreational activities. Each group completed a minimum of 24 weeks of physical therapy across all studies. Many of the studies demonstrated a difference between interventions, but every study concluded that surgery in combination with physical therapy provided the best patient outcomes for FAI. A strength of the studies included a variety of populations from different demographics such as military, general sedentary, and semi-active individuals. A weakness, however, was none of the studies involved young, athletic participants.

Clinical Bottom Line: Patient-oriented evidence suggests that patients preferred arthroscopy and physical therapy over physical therapy alone for the treatment of FAI. Those who received arthroscopic procedures consistently reported higher iHOT-33 scores. Despite the scores being higher for the arthroscopy and physical therapy group, there were no statistically significant differences between interventions, thus Strength of Recommendation Taxonomy score of B is recommended.

Implications: Athletic Trainers can use these findings to help make clinical decisions based on timing of the season, the patients access to health care, and patient's preference because one intervention was not significantly more effective than the other. Future research should be conducted with athletes specifically as all the studies were performed on the general population.

Surgical Versus Non-Surgical Interventions for Treating Patients with Lumbar Spinal Stenosis: A Critically Appraised Topic

Adam Johnson and Caleb Radloff

Faculty Mentors: Brandon Donahue and Nora Kraemer

Clinical Scenario: Lumbar Spinal Stenosis (LSS) is classified as a narrowing of the spinal canal or nerve root foramen in the lumbar spine, commonly found in L3-L4 or L4-L5 junctions. Patients with this condition are severely limited in their ability to perform activities of daily living (ADLs) with surgery as the preferred treatment option. The purpose of this critical appraisal is to evaluate if surgical intervention or conservative intervention is best for treating patients with LSS.

Focused Clinical Question: In patients with lumbar spinal stenosis (LSS) what are the effects of surgical interventions versus conservative interventions on physical function as measured by patient-reported outcomes?

Search Strategy: Databases used to complete the search included PubMed, CINAHL, ProQuest Nursing Collection, and Cochrane Library. Search terms included "treatment of lumbar spinal stenosis" (30-455 results), "surgical versus non-surgical interventions for lumbar spinal stenosis" (5-500+ results), and "operative vs non-operative interventions for lumbar spinal stenosis" (7-500+ results). To quantify the effectiveness of each intervention we looked at studies that included patient-reported outcomes (PROs) to measure the physical function of patients before and after treatment. Inclusion Criteria consisted of patients with LSS and articles published 2004 and later. Exclusion criteria involved, patients with comorbidities, and studies where physical function was not measured. Nine articles matched our inclusion criteria and were used in this critical appraisal.

Evidence-Quality Assessment: The PEDro and the Oxford Center for Evidence-Based Medicine (OCEBM) scales were used to assess the quality of evidence. The PEDro scores for the studies included ranged from 4/10-8/10. All studies included scored a 2 on the OCEBM scale.

Results and Summary of Search: All studies used some combination of the following PROs to evaluate intervention effectiveness: Visual Analog Scale (VAS), 36-item short form health survey (SF-36), Oswestry Disability Index (ODI), and Zurich Claudication Questionnaire (ZCQ). All nine studies showed a significant improvement in pain and/or physical function for the surgical group. Three of nine studies utilized the SF-36 PRO and did not find a statistically significant difference in physical function for the surgical group. Two of the four studies that used the ODI form demonstrated a statistically significant improvement in physical function for both groups.

Clinical Bottom Line: No consistencies were found in the evidence comparing conservative treatment to surgical intervention. Both surgical and conservative interventions are effective in treating patients with LSS. Surgical intervention should be used if the patient's condition is not improving after six months of conservative treatment. Strength of Recommendation Taxonomy (SORT) score was rated a B.

Implications: Surgical interventions provide similar improvement regarding pain levels and physical function when compared to non-operative interventions. With this knowledge, athletic trainers can

provide more treatment options for their patients. If non-surgical treatment is not effective, the AT can refer the patient to another healthcare provider to explore alternative options, such as surgical intervention. Future research should focus on what specific type of conservative treatment is most effective in improving physical function.

The effects of conservative and surgical treatment of rotator cuff tears on pain and function: A Critically Appraised Topic

Abigail Turnquest and S. I. Washington

Faculty Mentors: Nora Kraemer and Brandon Donahue

Clinical Scenario: Rotator cuff (RTC) tears are characterized by pain, weakness, loss of function and are debilitating for the 4.5 million people who suffer from this injury yearly. The preferred treatment is controversial with surgical intervention/repair and conservative management being two viable options. This critical appraisal aims to investigate the existing evidence to determine which treatment method is most effective at decreasing pain and improving function as measured by patient-reported outcomes (PROs).

Focused Clinical Question: In patients with rotator cuff tears, what is the effect of conservative treatment compared to surgical intervention on pain and function?

Search Strategy: A comprehensive database search was conducted using CINAHL Plus, ProQuest Nursing Collection, PubMed, and Cochrane Library to answer the clinical question. The search terms utilized included rotator cuff tear repair, rotator cuff tear operative and non-operative, and rotator cuff surgery and conservative. Inclusion criteria included articles published from 2006 to current and clinical or experimental trials that utilized PROs for evaluation of pain and function. Exclusion criteria included bench trials, non-clinical trials, and patients with concomitant shoulder pathologies. Seven studies met the inclusion criteria and were included in this critical appraisal.

Evidence Quality Assessment: Peer-reviewed articles were assessed utilizing the PEDro scale and the Oxford Centre for Evidence-Based Medicine 2011 Levels of Evidence (OCEBM). The studies reviewed ranged from 3-8 out of 10 on the PEDro scale and all OCEBM scores were a level 2 or 3.

Results and Summary of Search: The studies demonstrated variability in several aspects of patient presentation including population age, tear size, and tear type. While all studies utilized physical therapy led sessions for their conservative treatment, three studies also utilized a combination of analgesics, corticosteroid injections, and modalities. The surgical intervention in many of the studies was performed using mini-open arthroscopic repair; however, in some cases an open approach was performed. The Constant-Murley Score (CMS), a functional scale used to assess strength, range of motion, and activities of daily living in addition to the visual analog scale (VAS), for pain grading, were used as a primary or secondary outcome measure in all studies. Across all studies, both groups exhibited improvement with the surgical groups having greater improvements on the CMS and VAS. However, only three studies found the difference between surgical and conservative treatment statistically significant.

Clinical Bottom Line: Conservative treatment and surgical intervention are comparable in making clinically significant change to decrease pain and improve function for patients with rotator cuff tears. The consistent findings across the reviewed articles resulted in a SORT score 'A' for the evidence.

Implications: Conservative and surgical intervention make similar impacts on pain and function PROs for patients with rotator cuff tears, and appropriate education should take place to inform patients of their options, risks, and outcomes. Conservative treatment given its efficacy is a great option for high-risk surgical candidates. Future research should be conducted on specific patient populations and long-term intervention effects.

Treatment of Carpal Tunnel Syndrome as Measured by Patient Reported Outcomes

Grace Julian and Kaitlyn Croeker

Faculty Mentors: Brian Zeller and Nora Kraemer

Focused Clinical Question: In patients with carpal tunnel syndrome (CTS), what is the effect of conservative treatment compared to surgical intervention on patient reported outcome measures?

Search Strategy: Search terms included carpal tunnel, manual therapy, rehabilitation, conservative treatment, surgical decompression, and CTS release. Sources searched included CINAHL, PubMed, ProQuest Nursing Collection, and Cochrane Library, which returned a range of 193 to 309 hits per search. Searches narrowed again to subjective complaints, health survey, symptom checklist, self-reported function, and pain intensity. Inclusion criteria consisted of presence of CTS on one or both hands, participants over the age of 18, and the ability to complete questionnaires in English. Exclusion criteria consisted of previous wrist or hand surgery within 6 months, wrist deformity, arthritis, and pregnancy.

Evidence Quality Assessment: Studies for randomized controlled groups were all critically appraised utilizing the Physiotherapy Evidence Database (PEDro) score and Oxford 200 Level of Evidence scales. Included articles scored 6/10, 7/10 or 8/10 on the PEDro checklist. Only two of the seven studies included scored a 3 on the Oxford scale, with the remaining articles scoring a 2.

Results and Summary of Search: The evidence reviewed showed that within 6 months and 4 years there was no difference in improvement of patient's symptoms with choosing surgery over a variety of conservative therapies such as low-level laser therapy, manual therapy, wrist traction and steroid injection.

Clinical Scenario: Carpal tunnel syndrome (CTS) is the most common peripheral nerve entrapment syndrome that accounts for nearly 50% of all work-related injuries. This condition is associated with repetitive motions, so it is applicable to athletic populations and workers alike. There is a reported range between 6% and 12% of the general population that suffers from pain from carpal tunnel syndrome. This Critically Appraised Topic (CAT) aims to review the current evidence regarding the effectiveness of conservative and surgical treatment on patient reported outcome measures with the intent to guide providers to make evidence-based decisions regarding the proper course of action for carpal tunnel syndrome related pain.

Clinical Bottom Line: SORT appraisal resulted in high quality evidence. Overall, the studies included had strong design, with all but two being randomized control trials. Collectively, the evidence included receives a score of a B. The evidence obtained is good-quality, and patient oriented, but the findings are mildly inconsistent. Though all articles show significant change, there was inconsistency in the

preference of surgical or non-surgical techniques. These studies suggest that both surgical and non-surgical treatments of carpal tunnel syndrome led to improved patient reported outcomes.

Implications: In months 1-3 post initiation of treatment or surgery, non-surgical treatment was superior. By 6 months, no statistically significant difference was observed. The only exception to this finding suggests though symptoms in both groups improved, surgical treatment led to marginally better symptom scores than non-surgical treatment at the 12-month mark. Overall, long term treatment of CTS can be achieved through both surgical intervention and conservative therapies with statistically equivalent satisfaction measured by patient reported outcomes.

Mathematics & Statistics

A Closer Look at the Death Penalty in the United States

Anna Cardell

Faculty Mentor: Tisha Hooks

The death penalty has always been a source of contention towards most people in the United States – some agree with it, some do not. No matter one's opinion on whether it should be allowed, this poster presentation will give an in-depth analysis and present various visualizations of information regarding the convicted felons that have been sentenced to capital punishment in the United States from 1976-2016. Variables such as gender, age, and race will be explored to create some insight on some of the most infamous killers in United States history.

Though looking at the demographics of these individuals and their victims is a main message, the states that convict and sentence them to death has a story to tell as well – is it surprising that Texas has executed over twice the amount of any other state in the U.S. during this time-period? Or that over half of the states do allow the death penalty as a way of sentencing?

Finally, when it comes to these convicted felons, there is information that is not always "well-known" to the public. For example, individuals that have been sentenced to death have an option of "volunteering", meaning that they are willing to expedite their death penalty process by eliminating all their required, by law, appeals. This project investigated which demographic factors are related to this decision. When individuals get sentenced to death when they're younger, they are more likely to volunteer to expedite their death. Additionally, the method of execution used in the state they're convicted in shows that the odds of a death row inmate volunteering are more likely when they will be killed using the firing squad in comparison to lethal injection.

Overall, I will be discussing the demographics of the individuals that have been executed, information regarding their victims since all were convicted of felony murder, the methods of execution used, the location of the executions, and the volunteer status of everyone that was executed in this 40-year period.

An Analysis of Major League Baseball Sabermetrics

Zack Fuller

Faculty Mentor: Tisha Hooks

With baseball becoming an increasingly competitive sport, professional baseball teams are looking to the statistical side of the sport to find ways to win more games. With my analysis, I studied baseball statistics to look for interesting patterns and relationships. For example, I investigated the effect of a trade on a player's performance (both batters and pitchers) and analyzed the relationship between a player's performance and salary. My analysis also determined the statistics teams should utilize to win more games. To effectively analyze these patterns and relationships, visualizations were made in Tableau, and linear models were fit with R. Overall, several interesting patterns were revealed, which will be discussed during this poster presentation.

IT Application Administrator Internship

Payton Simmons

Faculty Mentor: Silas Bergen

This presentation is a focus on my internship with Fastenal as an IT Application Administrator. I'll talk about some of my daily tasks as well as the CMDB installation that will take place in the future. I am incredibly grateful to everyone who helped make this position possible because it gave me a wealth of knowledge that I will use in the near future.

Business Intelligence Internship at Ashley Furniture Industries

Aidan Nutt

Faculty Mentor: Silas Bergen

As a Business Intelligence Intern working in HR, there's a lot of people data. Be it hiring data, or employee hierarchical data, or anything else in between, someone's got to analyze it. While at that position, I was able to use skills garnered from my academic career to produce high-end visualizations which can be used as easy reference points for the future of the company, while also learning new skills in the form of data querying. Along with those projects, my time was spent learning more about others' experiences within the company, and all the different springboards I could take in the future.

Exploring Bald Eagle Track Data over Lake Superior

Dylan Steberg

Faculty Mentor: Silas Bergen

The purpose of my senior capstone project was to create a model to predict the track points of bald eagle flight paths over Lake Superior as over land or over water using weather data. A boosted tree model was built using the XGBoost package in R to predict the track points as over land or over water. Variable importance was investigated using SHAP values. The model may be useful for predicting the best location to build future offshore wind turbines in Lake Superior in the future.

Song Recommendation Engine Using Spotify Web API

Paige Yang

Faculty Sponsor: April Kerby-Helm

This poster highlights a study on using Spotify's Web API to create personalized song recommendations based on users' existing playlists. Spotify's user-friendly platform allows users to create custom playlists,

discover new music, and share tracks with others. By leveraging the Web API, this study demonstrates how custom recommendations can enhance the music experience by helping users discover new tracks and rediscover old favorites. These findings showcase the potential of Spotify to revolutionize the way people consume and interact with music.

Using Spotify's Web API to Examine What Audio Features Impact a Song's Popularity

Gunner McLeod

Faculty Mentor: Tisha Hooks

Spotify is one of the most popular music streaming services in the world and has over one hundred million different music tracks available to its users. Being able to predict what audio features contribute to a song's popularity could be useful for musical artists and record labels as well as music listeners. Spotify offers a web application programming interface (API) that allows users to pull data on a variety of audio features for individual songs. The goal of my capstone project was to acquire and clean a data set using this API in python. Regression models were fit to predict a song's popularity using the audio features of the song such as the song's instrumentalness, energy, and key. None of the models created were very accurate; the highest R-squared value obtained was around 0.1. However, some of the audio features such as the key the song is in and the danceability of the song seemed to have a greater impact on a song's popularity than other features. These results indicate that some audio features have a greater impact than others but many other factors beside the audio features most likely have a large impact on a song's popularity such as the lyricism or artist.

Nursing

An Evidence-based Intervention: Provider use of Visual Aids for Patient Education during Bedside Team Rounding

Kristin Clifford and Shay Gruber

Faculty Mentors: Allan Bates and Sonja Meiers

Objective: To determine if an evidence-based, patient-centered, educational intervention, a simple standardized drawing (SSD) delivered by hospitals to patients and their families during bedside team rounding (BTR) improves knowledge, recall, and overall satisfaction when compared with standard practice of providing verbal or written education alone.

Methods: In this mixed-methods study, a set of simple medical drawings were developed as a practice-change intervention for use in education during BTR. Hospitals conducted education with convenience samples of hospitalized adult patients with a variety of health conditions in active clinical practices during daily rounds either with the standard practice of verbal/written education alone or with an added SSD, individualized to the patient's condition. A convenience sample of patients receiving the standard practice was accrued first. Successively, a convenience sample of patients who received the SSD was accrued. All patients in both groups completed researcher-constructed X-item Likert-scaled measures after rounds. A two-sample t-test with unequal variance was used to evaluate each question and overall score. Qualitative data were collected from written comments in both groups.

Results: Significant differences (p-value of < 0.0001 ; 0.05 confidence level) in average scores were noted on all items between the two groups. Qualitative data revealed comments reflective of satisfaction, understanding, knowledge, and recall regarding the SSD effect that aided in interpreting the quantitative data.

Conclusion: The use of an SSD individualized to the patient's condition increased the patient and family member perceptions of understanding, recall, adequate time spent, and satisfaction with education when compared to standard practice.

Practice Implications: SSDs are a feasible and useful method to implement verbal patient education in a hospital setting and can assist with increasing health literacy.

Physics

The ZINGRS Radio Survey: Observing the free-free radio emission from galaxies in the early universe with the Very Large Array.

Eric Stein, Jordyn Sears, Nick Gapinski, Deborah Hershey, Cody Lamarche, Sarah Higdon, James Higdon, Drew Brisbin, Christopher Rooney, Bo Peng, Thomas Nikola, and Gordon Stacey
Faculty Mentor: Carl Ferkinhoff

We present new observations of the radio emission from galaxies in the early universe. These observations were made as part of the ZEUS Investigated Galaxy Reference Sample (ZINGRS) Radio Survey. This survey is a program with the Very Large Array to measure the free-free radio emission from ~ 30 galaxies in the early universe that have also had the infrared emission detected by the ZEUS instrument. Here we show the free-free radio emission at 6 GHz (c-band) and 15 GHz (Ku-band) for two galaxies from the survey. These observations let us measure the amount of star formation in the galaxies. In the future we will combine these observations with the infrared observations to measure the amount of metals in these galaxies.

Political Science

How Committed to Diversity is Winona State University?

Tyler Peil
Faculty Mentor: Kim Park Nelson

This research paper evaluates Winona State University's commitment to diversity, focusing on the university's policies and practices related to diversity, equity, and inclusion. The study employs a mixed-methods approach, combining qualitative data from the university, including other universities in Minnesota, as well as qualitative data of campus landscapes with a strong commitment to diversity and a comparison to Winona State. The analysis examines the extent, to which policies and practices align with principles of diversity, equity, and inclusion. This reach paper also identifies areas where WSU can improve its commitment to diversity for faculty and underrepresented groups. Overall, the research aims to provide insights and a plan for how Winona State University can foster a more inclusive environment and promote diversity in all aspects of operation.

Political Discourse on Women of Color

Briel Thelen

Faculty Mentor: Kim Park Nelson

In the last 50 years political discourse that surrounds women of color (WOC) has changed in numerous ways. There has been an at times slow and at other times fast rise in the assertion that WOC in political movements are radical and even dangerous, and that their stances threaten American democracy. However, my research will look at how the erasure of contributions and actions of WOC in the past has impacted the direct and focused dialogue of today.

Today, politicians, news outlets, political commentators, and consequently lay American citizens will critique progressive WOC in political movements as more radical than ever. This paper looks at whether the historical erasure of WOC in American history has caused the perception of WOC as becoming more extreme. To examine this, my methodology includes a timeline of the critique and discussion over the roles and movements WOC had or took part in, from the 50s to 2022. This timeline will focus on both a broad perception of WOC and at specific women; women like: Coretta Scott King, Shirley Chisholm, Sonia Sotomayor, Kamala Harris, Ilhan Omar, Alexandria Ocasio Cortez, Cori Bush, and Ketanji Brown Jackson. I also look at numerous quantitative studies that show the growth of involvement of WOC in politics and how that correlates to heightened discourse and unfair commentary they receive.

My research breaks down whether the discourse on the assumed progressive radicalization of WOC in politics is merited. Through looking at policy viewpoints, actions, and different means of advocacy, this paper will show that it is not a new set of views or more progressive policies that are responsible for this interpretation of WOC. In fact, policies have very narrowly changed, housing, healthcare, immigration, violence, social systems and more are issues that were very important to civil rights activists.

My research suggests that the discourse on the "radical-ness" of WOC is almost completely about race and gender. Essentially, American people are not as afraid of the progressive movement as they are of the women of color that are headlining it. This research will show that the strong reaction to WOC in politics is not because of policy change but because American society has progressed to a place of electing WOC into powerful positions but has not moved passed racists and misogynistic stereotypes and tropes.

The Social Determinants of Political Behavior and Attitudes

John Breske, Haley Holtz, Caitlin Kerschner, and Kaileigh Weber

Faculty Mentor: Kara Lindaman, Ph.D.

In an empirical study of political behaviors and attitudes of Winona State University students, we consider how these attitudes are affected by demographics, educational experience, geographical residency, social media use, and political socialization. For example, does a rural or urban context affect trust in government and/or educational goals? Does social media use determine how one views all things political? And finally, does political socialization affect your political behavior later on? Through our findings, we show a better understanding of our political attitudes and behaviors help us learn across differences and find common ground.

Psychology

Changes in Depression, Stress, and Anxiety for Student Athletes; Using Guided Imagery

Synetha Sultze-lor

Faculty Mentor: Amanda Brouwer

Introduction: Mental health concerns among college students are increasing in severity. Researchers have shown that elite level athletes may be at a higher risk for suicide, with possible risks including injury, pressure, and substance abuse. Due to the high-stress levels of student athletes, this study was created to explore whether guided imagery (GI) can help student athletes reduce symptoms of stress, depression, and anxiety. GI has been shown to decrease depression and anxiety among a variety of populations, but less work has explored the role that GI has in student athletes. Therefore, it was hypothesized that GI will reduce stress, and symptoms of negative mental health states as well as increase positive mental well-being in student athletes.

Methods: Data collection is ongoing, but it is expected that participants will be 100 (18-24 years old) student athletes from a division II, public university. Participants are asked to take an online survey with questions related to mental health, stress, positive well-being, and demographics. The questions will be presented before and after a 5-minute audio clip that will ask participants to engage in a guided imagery experience. During the guided imagery experience participants will be asked to engage in controlled breathing, focus on present thoughts, and engage in mindfulness-related tasks (e.g., focusing on breathing and emotions that relate to future experiences). Data will be analyzed using a repeated measures t-test to determine if stress, symptoms of negative mental health states, and positive mental well-being will change from before to after experiencing the guided imagery task. After the guided imagery audio clip, participants are also asked open-ended questions about the guided imagery tasks.

Results: It is expected that positive mental well-being will increase, and negative mental well-being will decrease with the use of one GI session. Additionally, comments will reflect positive experiences with GI, indicating that student athletes may use it in further competitions.

Discussion: The literature suggests that GI is effective in reducing pain, depression, stress, and anxiety. GI decreases negative mental health issues associated with competition for athletes by promoting relaxation which can lower negative stress responses. The benefit of using GI as a tool to help with negative mental health issues is that it is cost effective and can be used in a variety of diverse athletic settings. For these reasons, GI can be an effective tool for student athletes due to their busy schedules and recreational activities.

Effects of Labetolol on Sign Tracking

Cassidy Bos, Brandon Yates, and Liam Kubitschek

Faculty Mentor: John Holden

Sign tracking is defined as when an organism interacts with a conditioned stimulus that signals something desired. This is comparable to when a drug addict is engaging in drug seeking behaviors after

interacting with a stimulus which could be associated with drug use. Reducing this type of behavior in addicts who are trying to overcome drug dependence may help prevent relapse. One drug which could be useful is Labetalol, which is an alpha and beta-blocker that is used to treat high blood pressure (hypertension). 17 male Sprague Dawley rats were conditioned over the course of 5 days to associate the presence of a lever with food delivery. Subjects were tested under the influence of 0 mg/kg or saline, 2.5 mg/kg, or 5 mg/kg of Labetalol. No significant effects were found on the total number of sign tracking behaviors or sign tracking latency. We have tried alpha blockers, beta blockers, and a combination thereof and this shows that more research is needed on these types of drugs.

Food Insecurity Among College Students: Implication for Wellbeing and Academic Success

Ashley Lenarz, Amelie Pflamminger, Erin Farina, and Catherine McBride
Faculty Mentor: Trisha Karr

Introduction: Food insecurity is associated with many negative effects such as increased stress and reduced well-being. Food insecurity among college students is a growing area of research as students often leave school due to financial concerns, mental health struggles, and illness. This study was conducted to assess student food insecurity in the hopes of learning how to better assist students' wellbeing and success.

Methods: Using both standardized assessments and researcher-developed questions, an online survey was created to examine food insecurity, sleep, mental and physical health, ability to focus on academics, and awareness and usage of food resources. Participants were recruited from Winona State University (N = 155).

Results: Of participants surveyed, 21% reported low to very low food security. Among the participants that responded to food resource usage, only 4% reported using any food resources. Correlational analyses found that food insecurity was associated with greater symptoms of stress, anxiety, and depression. Additional correlational analyses found relationships between food insecurity and poor sleep quality, reduced ability to focus on classes, and lower physical health.

Discussion: Findings highlight potential consequences of food insecurity, including concerns for students' wellbeing and academic success. Negative impacts of food insecurity may extend to students' completion, graduation, and retention rates. Therefore, compelling evidence supports the necessity of additional intervention at the university, state, and federal levels.

Self-as-Doer Identity and Health Behaviors: How Approach and Avoidant Orientation Correlate with Healthy Eating

Cooper Scheldroup, Kaitlyn Rusch, Katelyn Kelley and Abree Dieterman
Faculty Mentor: Amanda M. Brouwer

Introduction: The self-as-doer identity, an identity which describes one in correspondence with doing a behavior, has shown to improve healthy eating behaviors but less is known about how the orientation toward the doer identity (i.e., approach vs avoidant) might affect healthy eating behaviors. Approach motivation puts energy towards achieving a positive stimulus whereas avoidant motivation uses energy to avoid an aversive stimulus. Research indicates that approach goals are simpler to implement and may

be better for initial behavioral enactment, while avoidance goals may be better for behavior maintenance. Although research suggests that approach goals may be successful in behavioral change more research is warranted, especially in the context of a self-as-doer identity.

Therefore, the purpose of the current study was to explore how approach and avoidant self-as-doer identities are associated with healthy eating behaviors and psychosocial factors known to influence healthy eating behaviors.

Methods: Participants (N=120) completed a survey and writing activity either online (N = 34) or in-person (N=86). Demographics and questions about health beliefs and behaviors and the self-as-doer identity in the form of avoidant identities (e.g., salt avoider) and approach identities (e.g., fruit eater) were asked. Pearson's correlations and independent t-test were calculated to determine the relationship among variables and differences in approach and avoidant identities for those on a special diet.

Results: Total healthy eating and consumption of whole grains, vegetables, and fruit were positively correlated with approach doer identities but not with avoidant doer identities. Low fat dairy consumption was not correlated with approach or avoider doer identities. Approach and avoidant doer identities were also positively correlated with self-identity as a healthy eater, health regulatory focus-promotion, intentions, attitudes and perceived behavioral control. Approach and avoidant doer identities were negatively correlated with health regulatory function-prevention and were not correlated with social norms. Finally, participants who were on a special diet had stronger approach identities compared to those who were not ($t(117)=3.03, p=.003$), but were not different in avoidant identities, $t(117)=.61, p=.54$.

Discussion: Seeing oneself as a doer who enacts rather than limits or restricts a behavior is associated with more healthy eating behaviors. This may be due to the shift in healthy eating culture to focus on moderation, rather than restrictive dieting. Furthermore, there is some rejection of the thin ideal, which in turn may lead others to.

Women's, Gender, and Sexuality Studies

“Don't confine your fashion enjoyment to a gender binary”: Mutual Aid, Queer Theory, and a Gender-Affirming Closet

Chyenne Tyler, Drake Onyx, Tiki Ellis, and Travis Vatland
Faculty Mentor: Mary Jo Klinker

During the Spring 2023 semester, the WGSS 374: Queer Theories and Politics course studied the mutual aid and LGBTQ+ community organizing. Trans studies scholar Dean Spade defines “mutual aid is the radical act of caring for each other while working to change the world” (2020). Amidst national attacks on trans youth via anti-trans bills, our course imagined how collective care and mutual aid provide vehicles to “protect trans youth.” This roundtable will offer space to hear our reflections and how we localized queer praxis—theory and action—by organizing a gender-affirming closet and resource event with community partners.

Reproductive Justice as Dismantling the School-to-Prison Nexus

Tova Strange

Faculty Mentor: Mary Jo Klinker

Abolition feminism offers guiding blueprints to dismantle structures of oppression both nationally and locally. This paper explores a rural abolitionist movement to stop increased surveillance and policing of youth. Using activist political education and local newspaper archives, we will apply SisterSong's reproductive justice demands to show how parents and students used "the right to raise kids in a safe and healthy environment" to demand the removal of a school resource officer. As Mariame Kaba and Erica Meiners argue in "Arresting the Carceral State": "...we won't solve the STPP [school to prison pipeline] problem by simply changing school disciplinary policies. Because many states spend more on prisons than education, we have to change funding priorities as well." For this reason, we will examine how the removal of resource officers did not offer systemic community change, and it was the demand of collective care that was able to save a youth rec center and stop the building of a juvenile detention center in rural Minnesota.

Faculty Presentations

The 'Érdekes Ujság Battlefield Photo Album': A Hungarian Newspaper's Amateur Photography Contest at the Beginning of World War One

Dr. Matthew Lungerhausen

World War One was the first-time large numbers of soldiers could photograph their own wartime experiences. Soldiers shared their photographs with a variety of audiences including comrades, family, and the public back home. This poster focuses on a series of amateur photography contests organized by the Hungarian illustrated newspaper, *Az Érdekes Ujság* (The Interesting Newspaper, AÉU) at the beginning of the First World War. Starting in December 1914, the editors of AÉU encouraged soldiers to send in pictures from the front. The paper featured the soldiers' photographs in every issue, organized a panel of judges, and awarded cash prizes to the winning entries. These photographs were also collected into an album titled, 'Az érdekes újság háborús albuma' (The Interesting Newspaper's Battlefield Photo Album) and sold to the public during and after the war.

The soldiers' photographs circulated widely both at the front and beyond the battlefield thanks to illustrated newspapers, collectors' albums, and the public's desire for news about family members and their experiences of the war. The creation and circulation of these images was constrained by a variety of factors including: military censorship, contemporary aesthetics, and public expectations about the purpose and meaning of visual representations of soldiers on the battlefield.

This poster analyzes examples of how Hungarian war photographers used nineteenth century aesthetic categories, like the Picturesque and the Genre Picture, to make sense of their experience of total war. The pictures submitted by the soldiers and published in AEU tended to recapitulate old established genres of pre-war, nineteenth century photography. Several factors account for the aesthetic continuity between pre-war and wartime images in the AEU photo contest. First, the choices of photographers and the editors were constrained by censorship and the broadly shared goal of representing the Imperial

and Royal Armies in a positive light. The sociologist Pierre Bourdieu has argued that the limits in photography are not set by technology, but by what society designates as the photographable. Hungarian audiences also expected wartime images to reflect established aesthetic categories and subjects. Second, throughout the nineteenth century, and up through World War One, photography remained a technical pursuit. Commercial photographers and accomplished amateurs had to master the same skills and technical knowledge. Ultimately, they also shared the same aesthetic vocabulary. Finally, the jury that evaluated the contestants was composed of the editor, the publisher as well as several noted photographers and an art school professor. For professional reasons the jury members had similar ideas about what constituted a 'pretty picture.' These factors resulted in a photo album that used nineteenth century aesthetics to represent total war at the start of the twentieth century.

The Bridges Health Monologues: A Day in the Life

Dr. Charissa Eaton, Dr. Amy Koehler, Dr. Anne Vande Berg, Dr. Jen Timm, Dr. Nora Kraemer, Dr. Maryann Abendroth, Dr. Samantha Brown, April Loeffler, and Amanda Monson

Health professionals must collaborate across disciplines and with a variety of health and non-health stakeholders to improve health outcomes in groups affected by social determinants of health (SDoH), including poverty, health literacy, and food insecurity. It is these multisector collaborations that create essential community-based initiatives that improve health outcomes. Yet, students pursuing health profession degrees may experience a lack of authentic experiential education that develops interprofessional competencies.

In response to the shortage of experiential placement sites and to increase interprofessional education and practice learning opportunities at Winona State University (WSU) and unmet wellness needs in the rural community, faculty from athletic training, nursing, public health, and social work developed and organized the Bridges Health Model. This was the first formal interprofessional education model at WSU and across the Minnesota State system. Rooted in interprofessional pedagogies and the national standards from the Interprofessional Education Collaborative, Bridges Health utilizes a student-led, faculty-guided framework. This model creates extensive learning experiences within the community in collaboration with local organizations and provides access points for underserved and at-risk groups to receive health and wellness services. Health promotion, disease prevention, and early intervention programs are provided by interprofessional student teams, along with basic primary care services including mental health support, under the guidance and supervision of faculty and preceptors. Students from the College of Nursing and Health Sciences fulfill core roles at Bridges Health, and students from other Colleges across the university serve in ancillary roles. This model has sustained and became an important element of the university and college strategic plans.

This presentation describes, through storytelling monologues, the Bridges Health model. Bridges Health has provided extensive experiential opportunities for undergraduate and graduate athletic training, nursing, public health, and social work students and significantly fills a gap in health and social care needs in our rural area. This collection of monologues will delineate and share the experience of Bridges Health from the perspective of the client, student, faculty member, and community partner. These monologues will invite the audience to take an inside look at the perspectives and experiences of those served by Bridges Health and illuminate the real-life influences on those served.

ChatGPT: A Department-Level Analysis of Usage Possibilities and Actualities

Dr. Joseph K. West

WSU Co-Authors: Dr. Jeanne L. Franz, Dr. Sara M. Hein, Dr. Hannah R. Leverentz-Culp, Dr. Jonathon Mauser, Dr. Emily Ruff, Dr. Jennifer M. Zemke

In the past few months generative AI and large language models, e.g. ChatGPT, have rapidly become a target of scorn, derision, and fear amongst many faculty in higher education. The Department of Chemistry has undertaken a study to investigate current and potential future impact of this technology for students with a focus on the most common writing-intensive aspect of our curriculum: lab reports. AI-generated reports for lab exercises spanning the curriculum have been generated for analysis and compared to faculty expectations of student submissions. Assessment results for ChatGPT-generated lab reports with several tiers of sophistication in their prompts were evaluated by tenured faculty. These results will be shared. Preliminary survey results of students' knowledge and use of ChatGPT will also be shared.

Experimental Impacts into Layered Targets: Implications for the Moon

Dr. Jennifer Anderson

Non-WSU Coauthors: Gwendolyn Bart (U of Idaho), Christopher Cline (Jacobs Technology), and Mark Cintala (Johnson Space Center)

WSU Coauthors: William Beadling, Javier Abaunza Hernandez, and Ashley Miller

Impact craters provide clues about planetary surface properties. In the 1960s, for example, Oberbeck and Quaide experimentally demonstrated that crater morphology in the lunar maria reflected the thickness of a weaker regolith layer on top of its more competent, parent basalts. Small craters in the mare regions of the Moon commonly show a morphological progression from simple bowl-shapes to those with flat floors or central mounds, and finally to concentric structures as crater diameter increases. Using their experimental data and the transition diameters between these various crater forms in a given mare unit, Oberbeck and Quaide could then estimate the regolith thickness. This technique continues to be used today with even higher resolution images of the lunar surface (e.g., Bart et al., 2011; Bart, 2014).

The work presented here expands upon Oberbeck and Quaide's pioneering experiments by examining laboratory-scale impacts into layered targets consisting of a loose sand over a bonded substrate. New analytical techniques allow us to derive quantitative data not only regarding the morphologies and morphometries of the craters formed in these targets, but also for the excavation-stage flow in the form of their ejecta curtains as these craters grow. In this study, we scan the resultant craters in three dimensions to obtain high-resolution topography; we also track ejected particles in flight to compare the excavation of craters in a layered target to those in a completely cohesionless one.

A Guide for Facilitating an Escape Room for Undergraduate Nursing Students

Dr Kristi Wintheiser and Prof. Mark Becknell

Background: Nurse educators continue to look for innovative teaching modalities to meet the needs of the Generation Z learner. Escape rooms, an interactive game where participants use clues to complete a mission and escape a room, have begun to be utilized in the educational setting.

Method: A pediatric themed escape room was developed to orient the learner to pediatric nursing and to prepare the learner for their clinical rotation. The steps for an educator to facilitate an effective escape room are to determine the goal, write objectives, plan the scenario, gather the equipment, prepare the escape room, facilitated the scenario, and evaluate the scenario.

Results: A simulation escape room was an effective modality to orient the learner to a specialty clinical environment such as a pediatric setting. This successful innovation was well received by students with positive examples of application.

Conclusion: A pediatric themed escape room is an innovative teaching modality to integrate into your curriculum to meet the needs of the Generation Z learner.

Influencing Health Disparities Through Nursing Curriculum

Dr. Amy Smith and Dr. Jen Timm

Recent events and the COVID-19 pandemic have highlighted the extent of health disparities present within the United States. Racism and bias in healthcare workers has been shown to influence healthcare outcomes. The purpose of this project was to engage students, faculty, and community partners in deep and meaningful conversations to better understand the healthcare needs of the region, and to strengthen graduate nursing curriculum through a greater understanding of diversity and inclusion.

Methods - An interdisciplinary group of twenty participants met for five monthly one-hour sessions via zoom. Sessions were facilitated by an expert in diversity, equity, and inclusion and were recorded and transcribed to identify themes. To assist in understanding curricular implications, a DEI curriculum consultant met with faculty and participants for two one-hour sessions. Knowledge and attitudes were measured using pre-and post-project surveys.

Results - Themes of apprehension, embarrassment, and fear when initially engaging in conversations related to diversity equity and inclusion were identified. Confusion surrounding terminology and a general lack of knowledge of upstream and downstream factors relating to health equity provided challenges when addressing nursing curriculum. At the project's conclusion participants felt empowerment and reported an overall ability to recognize bias and racism, and their impact on interactions with students, patients, and their community.

Conclusions - Efforts to engage in curricular changes are not likely to have a lasting effect without the identification of bias or the basic knowledge of the upstream and downstream that play a role in health disparities. To recruit and prepare healthcare practitioners who are inclusive of the populations they serve, programs of nursing must first lay a foundation of mutual understanding.

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