

**Spokane Intercollegiate
Research Conference
Gonzaga University
April 26th – 27th, 2019**

Contents

Welcome to Gonzaga University	Page 2
Schedule of Presentation and Poster Sessions	Pages 5 – 8
Abstracts in order of Presentations & Sessions	Pages 9 - 34
List of Student Participants	Page 35 – 36
List of Faculty Sponsors	Page 37

This year's Spokane Intercollegiate Research Conference is sponsored by the
Office of the Dean of the College of Arts and Sciences and the
Center for Undergraduate Research and Creative Inquiry.

WELCOME FROM JEFF WATSON,
DIRECTOR OF THE CENTER OF UNDERGRADUATE RESEARCH AND CREATIVE INQUIRY

Dear Conference Participants,

It is my distinct pleasure to be able to welcome you to Gonzaga University for the 16th Annual Spokane Intercollegiate Research Conference (SIRC). This year, students from Gonzaga University, Whitworth University and Eastern Washington University will be presenting their research in a wide range of fields from the arts, the humanities, social sciences, natural sciences, engineering, and many others. This truly is an extensive cross-section of the terrific scholarly and creative work being done by students, often in collaboration with faculty mentors. On behalf of the Gonzaga community, thank you for your efforts, your dedication, and your excitement to be sharing this work with all of us.

I want to take a moment to thank the individuals who have been instrumental in organizing this year's conference. Without their efforts, this event would not exist. First and foremost, thanks go to Theresa Johnson, whose good humor and organizational genius have been invaluable. Other individuals who have been extensively involved in the planning process include Lizzie Vosler and the many faculty and staff from both Gonzaga University and Whitworth University who served on the SIRC Planning Committee. Thank you also to the many faculty sponsors for their efforts in working with the students presenting this weekend, and to the many faculty who have offered their time to serve as moderators of the oral sessions. Finally, thank you to our student volunteers, all of whom are researchers in their own right. These individuals have all presented research at conferences and meetings around the country this year, and should be applauded as well.

The Center for Undergraduate Research and Creative Inquiry (CURCI), which sponsors this year's conference, was instituted in June of 2016 to support, celebrate and advance the culture of undergraduate research particularly in Gonzaga's College of Arts and Sciences. Undergraduate research, however, is bigger and more important than any single academic unit or even any single university. The abundance of student research being presented this weekend is concrete evidence of that. Student-driven research and creative inquiry is one of the most powerful practices on a college campus, and the benefits of these activities have been shown time and again. I want to say to our presenters that by your participation in scholarly and/or creative work, you are part of a larger community worldwide that will be instrumental in making our world a better place. Thank you.

Please enjoy the events this weekend. Please visit the many posters, attend as many of the oral sessions as you can make it to, and join in the discussions that arise. As a community, discourse and discussion between participants and attendees deepens the experience for us all.

Sincerely yours,



Dr. Jeff Watson

Director, Center for Undergraduate Research and Creative Inquiry
Associate Professor, Department of Chemistry and Biochemistry

2019 Spokane Intercollegiate Research Conference (SIRC) Mission Statement

SIRC is committed to promoting excellence in undergraduate research from all disciplines.

SIRC serves as a venue for undergraduate researchers from any discipline to present their scholarly research to their fellow students and scholars in and beyond their discipline.

SIRC provides disciplinary-specific guidelines to help undergraduate researchers develop their conference presentations.

SIRC fosters meaningful mentoring relationships between faculty and undergraduates.

SIRC fosters collaboration among Spokane area universities and community colleges.

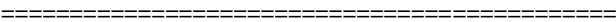
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The 2019 Spokane Intercollegiate Research Conference was planned by the following faculty and staff:

Shannen Cravens, Gonzaga University
Patrick Crosswhite, Gonzaga University
Patrick Ferro, Gonzaga University
Richard Goodrich, Gonzaga University
Peter Hamlin, Gonzaga University
Theresa Johnson, Gonzaga University
Kate Kearney, Gonzaga University
Harman Khare, Gonzaga University
Keith Lambert, Whitworth University
Kathleen Leamy, Gonzaga University
Kelly O'Brien-Jenks, Gonzaga University
Casey Schmitt, Gonzaga University
Lizzie Vosler, Gonzaga University
Jeff Watson, Gonzaga University
Kraig Wheeler, Whitworth University



The SIRC Planning Committee would like to thank US Bank for their support of this year's conference.



Funding and administrative support for this year's SIRC has been provided by:

Gonzaga University's College of Arts and Sciences Dean's Office
Gonzaga University's Center for Undergraduate Research and Creative Inquiry

SPOKANE INTERCOLLEGIATE RESEARCH CONFERENCE
April 26th – 27th --- Gonzaga University
SESSION SUMMARIES

Friday, April 26th, 2019

Poster Session A: 2:00 PM – 3:45 PM
Biochemistry, Biology, Chemistry, Psychology

Jepson Lobby & Hallway

- FA101 Haylee Hamilton: 2-n-hexyl LKE-P rescues sleep and mobility in C9ORF72 glycine-arginine Drosophila model of ALS
- FA102 Paul Hurst, Jule Schwartz: Micro plastic concentrations in the Spokane River
- FA103 Christian Winters: Synthesis of Enantioenriched Bromolactones using Chiral Catalysts
- FA104 Ryan Meehan: Chalcone Polymorphism
- FA105 Tanner Rookard: Systematically investigating nitro- and amino-substituted chalcones to identify trends in polymorph formation
- FA106 Eleanor Jones: Using HDX-MS to Find Oligomerization Interfaces of BcHMGR
- FA107 Miranda Vonpaige: Elucidating the biosynthetic pathway of rhodoquinone using RNAi knockdowns in *Caenorhabditis elegans*
- FA108 Bradley T. Rehwaltdt: High Performance Liquid Chromatography Quantification of alpha and beta-Acids in Hop Varieties Grown in Northeastern Washington
- FA109 Andrew Johnson: Characterization of Inorganic Solid-State Electrolytes from Aqueous Solution Precursors
- FA110 Sam Schrader: Examining assembly characteristics of BcHMGR in response to change in pH
- FA111 Samuel Stewart: Size Exclusion Chromatography to Characterize the Quaternary Structure of BcHMGR
- FA112 Bridget Hoag: A comparison of novel silica to reverse phase silica for metal ionophore binding in lipid membranes using affinity chromatography.
- FA113 Ben Klimok: Multi-pH Modeling of Small Molecule Interactions with Lysosomal Enzyme Arylsulfatase B (ASB)
- FA114 Erin Johnson: Displays of Masculinity at Noon Ball: An Ethnographic Research Study
- FA115 Cameron Marsh: Effects of Soil Moisture on *Chrysemys picta belli* Hatchlings
- FA116 Louisa Reilly: Non-Enzymatic Synthesis and Characterization of Glucuronides with Mass Spectrometry
- FA117 Jon Reid: Effect of Cucurbituril [7] Supramolecular Complexation on the Luminescence Properties of a Quinoline-sensitized Europium (III) Complex
- FA118 Jordan Kersten: Surface, pore, and adsorption characterization of organic based activated carbons
- FA119 Kathryn Cooper: Solubilization and Purification to Determine the Functionality of RqA
- FA120 Konner Sauve: Gratitude: Reducing Loneliness in Older Adults
- FA121 Ji Ahn: The Role Romantic Partner Personality Difference Has On Relationship Satisfaction
- FA122 Sophia Dewing: Characterizing GTP Hydrolysis in BcHMGR
- FA123 Alla Kozubenko: Investigation of Peptide Binding to Cucurbit[8]uril Supramolecular Host
- FA124 William Goodwin: Ancestry of Morpheine Characteristics in BcHMGR
- FA125 Jenna Valentine: From Lignocellulose to Dioxins: Is there a top down mechanism?

Poster Session B: 4:15 PM – 6:00 PM
Environmental Studies, Psychology, Engineering, Mathematics

Jepson Lobby & Hallway

- FB101 Daisy Montalvo, Makenzie Kooima, Riley Kvarda, Veronika Kocen: Lake Arthur Nature Trails & Signs for a Greener Future
- FB102 Alexis Smith, Abigail Folchi, Elizabeth Terry, Katie Bresnan: Community Engagement with School Gardens
- FB103 Melissa Haskin, Tori Shaw, Madison Vaughan, Spencer Gjording: Environmental Justice along the Spokane River
- FB104 Bo Gould, Shannon Brennan, Grace Shaw, Olivia Jackiewicz: Feasibility of Salmon Reintroduction in the Spokane River
- FB105 Sydney Schmidt: Musical Applications of Fourier Transforms
- FB106 Lauren Anderson, Stacey Hernandez, Alexis Kostun: The Relationship between Openness to Experience and Willingness to Travel Abroad
- FB107 Kristopher Isherwood: The Effect of an Anti-Inflammatory Diet in a Rodent Model of Depression
- FB108 Kalika Singh, Amy Larson: ARTAP
- FB109 Jason Orr and Kyle Evers: Review of Heat Treatment Effects on Tensile Properties of Titanium Alloys
- FB110 Brooke Whitsell: Experimental and Numerical Evaluation of the Flexural Capacity of Cold-Formed Metal Deck
- FB111 Jack Mudge: Effects of Music on Studying
- FB112 Regan Fehrenbacher: The Relationship between Muscle Activation and Handwriting Quality with Different Grip Styles
- FB113 Madeline Hueske, Casey Harder, Colleen Donoghue, Annie Wissmiller: Habitat Management Plans: Encouraging Conservation-Conscious Development on the Spokane River

Oral Presentations, Session 1, 4:30 PM – 5:30 PM

Session 1A:

Jepson 108

Biology & Engineering

- O1A-1 Bailey Luoma: Climate change and invasive species: impacts on a native amphibian
O1A-2 Joshua Margraf: Characteristic strength of graphite

Session 1B:

Jepson 109

Relationships & Sociology

- O1B-1 Isabelle Broussard, Meghan Foulk: Social Media and the Maximizing Mindset in Dating Relationships
O1B-2 Liam Cascelli, Kayla Proffit-James, Christopher Thomas: Narcissism and Reactivity to an Awkward Stimulus
O1B-3 Abigail Nye: Effects of Biblical Women in Pop Culture
O1B-4 Sophie Winnett: "But Did You Get Any?" The Role of Toxic Masculinity in College Hookup Culture's Self-Fulfilling Prophecy

Session 1C:

Jepson 113

Social, Environmental, Computer Science

- O1C-1 Jacob Krantz, Maxwell Dulin: Language Agnostic Syllabification with Neural Networks
O1C-2 Alex Gannett, Jed Brown, Kaiya Collins, Nels Evens: Placed Based Community Engaged K-12 Environmental Education Curriculum Development
O1C-3 Alisha Isensee: King Leopold & the Congo: Origins of the "Fake News" Phenomenon in U.S. Media
O1C-4 Piliwailana Nahale-a: Imperialistic Nostalgia's Role in the Origination of the "Lazy Polynesian" Stereotype

Saturday, April 27th, 2019

Poster Session C: 9:00 AM – 10:15 AM

Jepson 017, 122, 124, Lobby & Hallway

Biochemistry, Biology, Chemistry, Psychology, Special Education

- SC101 Jake D. Davies: The bacterium *Shewanella* sp. strain ANA-3 is a Co³⁺-EDTA super-reducer
SC102 Sahale Riedel: Effectiveness of Perch Deterrents for Avian Predators of the Greater Sage-Grouse
SC103 Kerrie Buehler: Efficacy of Anti-Microbial Solutions on *Candida albicans*
SC104 Henning Knipprath: SUMOylation of ATF5 at the Centrosome
SC105 Marcus Bernard: Investigation of Microplastics in Spokane River Sediments
SC106 Miles Gentry, Ian Rasmussen, Jaiden Warner, Madeline Hensleigh Estergard, Michael Palm-Bledsoe: The Relationship Between Grit and Academic Performance
SC107 Katherine Laco, Mallika Sharabu, & Liam Galten: Loneliness, Social Perception, and Goal Disclosure
SC108 Matthew Roberts: Effects of HeartMath on Loneliness among College Students
SC109 Larissa Brewer: School Shootings in the United States
SC110 Nicholas Bratt, Matthew Coleman, Nicholas Magarelli, Lauren Townson: Effect of Dietary Omega-3 PUFAs on Depression in Sprague Dawley Rats
SC111 McKenna Milacek: Multi-Objective Comparison of Affordable Housing Building Materials
SC112 Cannon Coats, Rebecca Udby: GPU-computing to simulate plasma flows in ion-ion propulsion for spaceflight
SC113 Megan Lavagnino: The Effects of Model, Lead, Test and Precision Teaching on Matching Coin Quantities to a High School Student with Intellectual Disability and ADHD in a High School Special Education Classroom
SC114 Sarah Bundy: Using Conversation Cards and Interval Reinforcement to Teach Appropriate Conversation Skills for a 19-year-old with Autism Spectrum Disorder in a Special Education Transition Program
SC115 Haley Wunderlich and Derrik Gratz: Biocontrol Opportunity: Understanding Habitat Influence on Growth Traits in a Pathogen of an Invasive Species
SC116 Daniel Seats: Graphic Statics Analysis of Lateral Loads
SC117 Camille Howe: The Effectiveness of a Self-Regulation Strategy Development plus a Writing Checklist to Teach Narrative Writing to an Elementary Student with a Specific Learning Disability
SC118 Courtney Kinniburgh, Weston Kroes, William Liening, Lauren Vagt: The effects of a blueberry supplemented diet on cognition in rats as measured by the Morris water-maze test
SC119 Kelsey Anderson: Examining the Interface of Molecular Topology and Molecular Assembly using Quasiracemates.
SC120 Jacob Seo: Synthesis of 1,10-phenanthroline derivatives and related rhenium(I) tricarbonyl complexes
SC121 Cordell R Bean: A Deformed Granitic Pluton in the Southern Priest River Complex, Spokane Valley, Washington
SC122 Tia Beck: The Effects of Direct Instruction Flashcards on Sight Words with an Eighth Grade Female with Autism in a Self-Contained Special Education Classroom
SC123 Yanell Magna: The Effectiveness of Direct Instruction Mathematics Procedure on Teaching Numeral Identification to Two Preschool Children with Autism in a Special Education Preschool
SC124 Jordyn McKenna: The Effectiveness of Alternating Patterns and Errorless Learning on Identifying Shapes for a Preschool Student with Anomia in an Integrated Preschool
SC125 Brooke Wagner: The Interaction of Social Media and Music

Oral Presentations, Session 2, 9:00 AM – 10:00 AM

Session 2A:

Jepson 006

Psychology & Biology

- O2A-1 Molly Betebenner and Samantha Ollmann: Visual Influences on Cognitive States
O2A-2 Jennifer Duschik: Shots and Shots: Managing Type 1 Diabetes as a College Student

Session 2B:

Jepson 014

Biology & Chemistry

- O2B-1 Michael Durka, Debora Calderon, Dasha Davis, Jameson Johnson: The Effects of $\delta^1/2$ -Caryophyllene Based on the Porsolt Swim Test in Sprague-Dawley Rats
O2B-2 Rachael Gowen: Investigating Tick Hybrids and their Role as Disease Vectors in Spokane, WA
O2B-3 Nicholas Magarelli: Thermal Degradation and Maillard Reaction Products of Sucralose

Session 2C:

Jepson 123

Art History

- O2C-1 Grace Trumbo: Sean Scully's Landline paintings: Renditions of Beauty
O2C-2 Jonathan Hammerstrom: Morphing Murals: An Analysis on Northern Ireland's Murals of Memorization
O2C-3 Julia Coons: Appropriation and Power: Restoration of Gitksan Totem Poles in 1920's British Columbia

Session 2D:

Jepson 018

Psychology

- O2D-1 Colleen Donahue, Simeon Menso: How Does Perceived Social Support Affect Stress in Highly Neurotic Individuals
O2D-2 Caitlin Bernert and Jessica Wilbur: Perceived Parental Control on Reckless Alcohol Use in College Students

Session 2E:

Jepson 108

Economics & Math

- O2E-1 Kathryn Benson: Pencils Down: Work-Based Learning and the Tradeoff Between Education and Experience
O2E-2 Russell Ford, Tyler Gonzalez, David Rudolph: Klein Links and Fun Stuff

Session 2F:

Jepson 126

Political Science, International Law

- O2F-1 Finn Carlson: International Law and the Kohinoor
O2F-2 Julia Haley: Lost to History: The Scientific Career of Laura Bassi
O2F-3 Gabriella MacKintosh: South China Sea Territorial Claims and Contention Over the Spratly Islands

Oral Presentations, Session 3, 10:00 AM – 11:00 AM

Session 3A:

Jepson 006

Race, Psychology, & Womens & Gender

- O3A-1 Filmon Abraham: Racial identity, college embeddedness, and psychological well-being of college students
O3A-2 Nicholas Peters: The Moral Obligation to Preserve Neurodiversity
O3A-3 Giulianna Pendleton: Retelling History, Transforming Tradition: Women of Color Artists and the Western Artistic Tradition

Session 3B:

Jepson 014

Social & Religious Studies

- O3B-1 Katlin Elizabeth Bowers: Should the Violence Against Women Act be Reauthorized by the Federal Government?
O3B-2 Daniel Roberts: "Reverse Missionaries" in the American Mission Field: A Case Study for Neo-Colonialism's Impact on Global Christianity
O3B-3 Karisa Westom: Understanding Friendships in France through a Sociological Lens

Session 3C:
Sociology

Jepson 017

- O3C-1 Eiryn Renouard: "But I'm a Nice Guy• ." Overdoing Masculinity in the Friend Zone
O3C-2 Rhiana Everest: A Developing Customary International Law Norm of the Decriminalization of Homosexuality
O3C-3 Camilla Canner: Giving the Golden Parachute to Someone Else: The Social Precedents for the Church's Involvement in the Me Too Movement

Session 3D:
Speech & Language, Computer Science, Engineering, English

Jepson 018

- O3D-1 Maxwell Sherman: Insights into Language Acquisition: Child-Directed Speech, Automatic Speech Processing, and Big Data
O3D-2 Phillip Fishburn, Alex Giacobbi, Allison Hayes, Jeb Kilfoyle: Examining Zipf's Law in Texts and Speech
O3D-3 Anthony Willins: Taipi: a peep at the missing voice in Herman Melville's "Typee"

Poster Session D: 10:15 AM – 11:30 AM
Chemistry, Psychology, Special Education, Engineering, Computer Science

Jepson 103, 109, 111, Lobby & Hallway

- SD101 Brenda Hagerty: Influence of Phenanthroline Substituents on Rhenium Tricarbonyl Complex Luminescence
SD102 Katriel Sahlstrom: Upsetting the cart of known amino acid quasiracemic crystalline phases
SD103 Brennan Watkins: Effects of Hydrogen Embrittlement on 6242 Titanium Alloy
SD104 Cecilia Black: Pheromone and mucous glands in *Ensatina eschscholtzii* salamanders
SD105 Alyssa La Fleur: Recreating and Improving a Deep Learning Neural Network for Protein Design
SD106 Lauren Wilkin: The Effects of Reading Racetrack on Sight Word Recognition with an Eleven-Year-Old Girl with Specific Learning Disabilities in an Elementary Resource Room
SD107 Anna Yeung: The Effect of Reading Racetracks and a Model, Lead, Test Procedure on Sight Word Reading of a 13-year-old Female with an Intellectual Disability in a Self-Contained Classroom
SD108 Julia Camara: The Use of a Direct Instruction Flashcard System on an Eight-Year-Old Student to Increase Multiplication Facts in a Home Setting
SD109 Colby Richards: Comparison of horizon edges in landscape photographs identified through manual tracing vs. image segmentation algorithms
SD110 Allie Erickson: Unwelcome usurpers: the effect of invasive brook stickleback on predator-predator and predator-prey interactions in wetland communities
SD111 Dylan Scanes: Weapon Performance of Rhinoceros Beetles
SD112 Paul Hurst, Malcolm Tomes, Sam Sampinos, Tommi Gonzales: Spokane River Walking Guide
SD113 Devan McAllister, Claire Sick, Maddie Gregory, and Cheyenne Landreth: The Effect of Hydration Levels on Calorie Burning While Exercising
SD114 Ethan Vyhmeister: Molecular Recognition in Quasiracemic Regioisomers with Fluorine Substituents
SD115 Kelly Wucherer: $\text{I}^{\pm 4}\text{I}^{27}$ Signaling and HIV-1 Pathogenesis
SD116 Hans Munzing: Testing the HeLa Cell Toxicity of Hyprotek's Antimicrobial Solutions
SD117 Aspen Avery: Hippocampal volume reductions in post-traumatic stress disorder as a function of trauma type: A meta-analytic study.
SD118 Richie Hochrein: Exploring the Dimerization of PEPX Through Site-Directed Mutagenesis
SD119 Daniel Gallab: How fast does (ax)! really grow?
SD120 Evelyn Cooper: Testing for Ferroelectric Properties in Piezoelectric Thin Films
SD121 Joshua Fenner: Formation of Racemic and Quasiracemic Crystals Using 4-(X)benzoyl-D/L-valine
SD122 Rachel Porche: Synthesis and Analysis of Quasiracemate Formation of Compounds by Thermomicroscopy
SD123 Kathryn Markham: Study of PEPN from *Lactobacillus helveticus* for use in breakdown of proline-rich molecules
SD124 Luke Pfister, Ben Mandel, Helen Roosevelt, Kelly Porter, Emily Seibold: Recreational Drugs and Academic Achievement

SPOKANE INTERCOLLEGIATE RESEARCH CONFERENCE
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SESSION SUMMARIES

Poster Session A
Friday, April 26th, 2:00 PM – 3:45 PM

FA101 2-n-hexyl LKE-P rescues sleep and mobility in C9orf72 glycine-arginine Drosophila model of ALS

Haylee Hamilton

Sleep disturbances are common in neurodegenerative diseases and may be a clinical factor in disease etiology. ALS patients have various types of sleep disturbances, such as insomnia, nightmares, and daytime sleepiness. Recent studies suggest the C9orf72 gene is the strongest genetic risk factor associated with ALS/FTD. We observe decreased locomotor activity and increased sleep time in a fruit fly C9orf72 ALS/FTD model with expanded PolyGR36 dipeptide repeats expressed in motor neurons, compared to control flies. Lanthionine ketimine ethyl ester (LKE) is a natural sulfur amino acid metabolite thought to be neuroprotective by stimulating autophagy pathways in neurodegenerative animal models. Here we test the LKE derivative, 2-n-hexyl-LKE-P, for effects on the C9orf72 ALS/FTD fly model. 2-n-hexyl-LKE-P treated flies rescued locomotor and sleep abnormalities in ALS flies back to normal control flies. Future studies examining 2-n-hexyl-LKE-P effects on neurodegeneration in ALS/FTD animal models will be useful to determine its therapeutic potential.

Faculty Sponsor: Jason Gerstner

FA102 Microplastic concentrations in the Spokane River

Paul Hurst, Jule Schwartz

Anthropogenic pollution negatively impacts ecosystems around the world. Since the environmental movements of the 1970s, national policies and citizen efforts have led to successful environmental remediation, including river clean ups. Currently attention has moved from macroscopic pollution to the microscopic scale, focusing specifically on micro-plastics. Micro-plastics are the result of plastics used by humans breaking down in the environment. In marine systems it has been shown that these pollutants are dispersing into and affecting marine organisms, including by reducing survival and growth. These microplastics are transported to the ocean by rivers, though much less is known of the abundance and effects of microplastics in river systems. The Spokane River offers a resource to develop our knowledge of how these plastics disperse in freshwater ecosystems and the effects they have in these communities. In collaboration with the Spokane Riverkeeper, we sampled seven locations on the Spokane River, all downstream from different possible point source locations, over six months in an effort to understand both seasonal and spatial trends in microplastic abundance. We identified and counted anthropogenic fibers via stereomicroscopy. A subsample of these fibers was analyzed using IR spectroscopy to identify chemical composition. This study is still in progress and results are not finalized, however the amounts of fibers found have been consistent with previous studies done on the Spokane River, with a mean of 12 anthropogenic fibers per liter. Quantifying and identifying these fibers can inform us how to manage the river and improve life for all organisms, humans included.

Faculty Sponsor: Betsy Bancroft

FA103 Synthesis of Enantioenriched Bromolactones using Chiral Catalysts

Christian Winters

Enantioselective reactions are important to organic synthesis because they product enantioenriched products with less waste and simpler isolation. However, there are limited methods for producing enantioenriched products via bromolactonization. Chiral 4-dimethylaminopyridine (DMAP) catalysts has been successful in other enantioselective reactions and this research expands their utility into bromolactonizations. Initial experiments demonstrated that an achiral DMAP-based zwitterion catalyzed the bromolactonization of 4-phenylpent-4-enoic acid with N-bromosuccinimide to produce 5-(bromomethyl)-5-phenyldihydrofuran-2(3H)-one. Reaction conditions for this bromolactonization with a chiral DMAP-based zwitterionic catalyst were then explored. Temperature, solvent, and time were varied to increase the enantioselectivity of the cyclization.

Faculty Sponsor: Kerry Breno

FA104 Chalcone Polymorphism

Ryan Meehan

Chalcones are a group of organic molecules which are comprised of two benzenes with a carbonyl-alkene bridge. Chalcones are made through an aldol-condensation reaction of an acetophenone and a benzaldehyde. These starting materials are relatively cheap to purchase can be purchased with different substituents along the benzene rings. Changing the substituents along the two benzene rings will have effects on the packing structures of the crystalline chalcones. Different packing formations of the same chalcone are called polymorphs, which can exhibit different properties such as different melting points, UV/Vis spectra, and solubilities. Polymorphs can also have different solubilities in the body, which is very important to understand, as polymorphism in pharmaceuticals will affect the rate at which drugs dissolve in the body. Our mission is to systematically change the size and the position of the substituents along the two benzene rings in the chalcones. By systematically changing and the substituents we hope to identify interesting trends in polymorph formation that are produced from these chalcones. This summer we focused on synthesizing ortho-ortho, meta-para, para-meta, and meta-meta, homohalogenated chalcones. We are now looking at synthesizing ortho-ortho, meta-meta, and para-para homohalogenated chalcones, and investigating polymorphs produced from these chalcones.

Faculty Sponsor: Matthew Cremeens

FA105 Systematically investigating nitro-and amino-substituted chalcones to identify trends in polymorph formation

Tanner Rookard

We are working to systematically investigate nitro and amino substituted chalcones to identify trends in polymorph formation. How does changing the size and position of chalcone substituent affect crystal structure and color? Chalcones are a large class of naturally occurring pharmaceutical molecules that have diverse applications including anti-cancer, anti-inflammatory, and anti-bacterial properties. Zhuang et al. describe chalcone as a common simple scaffold found in many naturally occurring compounds and as a privileged scaffold in medicinal chemistry. According to Stevens, the preferred state for administering drugs is a solid. It seems straightforward that the crystalline solids would form consistently and predictably every time, but that is not the case for molecules that can have multiple crystalline forms, called polymorphs. Each polymorph can have differences in solubility and rate of dissolution, and therefore can display different pharmacokinetics. The changes in these properties are very important for knowing how a drug behaves in the body. Chalcones are among the number of molecules that form different polymorphs. The identity of chalcones as a recurring motif in medicinal chemistry and their ability to form polymorphs make them a useful subject of investigation.

Faculty Sponsor: Matthew Cremeens

FA106 Using HDX-MS to Find Oligomerization Interfaces of BcHMGR

Eleanor Jones

Though opportunistic lung pathogen *Burkholderia cenocepacia* utilizes the non-mevalonate pathway for isoprenoid biosynthesis, this bacteria curiously requires the rate-limiting and regulatory enzyme of the widely eukaryotic mevalonate pathway: HMG-CoA Reductase. Curiously enough, the *B. cenocepacia* homolog of this enzyme exhibits morphein reaction kinetics. In addition, BcHMGR aggregation is reversible and substrate dependent - unlike most other proteins. As the cause of the bacteria's necessity for this enzyme is still unknown, more research is needed on why this homolog is unique. In order to examine the oligomeric interfaces of this protein, Hydrogen-Deuterium Exchange and Mass Spectrometry (HDX-MS) has been utilized in the presence of two of the enzyme's substrates, along with studies into its aggregation. This preliminary experiment shows that HDX-MS is a reliable source of information going forward with this particular protein, but more research is needed with a wider variety of substrates.

Faculty Sponsor: Jeff Watson

FA107 Elucidating the biosynthetic pathway of rholoquinone using RNAi knockdowns in *Caenorhabditis elegans*

Miranda Vonpaige

Parasitic helminths are an infectious parasite found in the sub-tropics of Africa, Asia, and South America. They are most commonly transmitted through soil and water in areas of low sanitation and water hygiene, thereby affecting 3rd world countries at a disproportionate rate. The 1.5 billion people afflicted with these parasites world-wide experience a range of physical defects, from nutrient malabsorption to cognitive impairment. The parasites also have detrimental effects on the socio-economics of these areas, presenting an immediate need for the development of new anti-parasitic drugs. Unlike humans, these parasites use anaerobic respiration, for which rholoquinone (RQ) is the final electron transporter in the fumarate reductase pathway. This differs from humans who rely on ubiquinone (Q) to serve as the electron transporter of the oxidative pathway during aerobic respiration. Since humans do not use RQ it may serve as a potential drug target. This, however, requires a thorough understanding of RQ's biosynthetic pathway. To begin understanding this biosynthetic pathway we have designed a series of RNAi knockdown experiments to identify the primary genes involved in biosynthesis, using *Caenorhabditis elegans* as the model organism. LC-MS was used to quantify levels of RQ and Q and RT-qPCR will verify successful gene knockdown.

Faculty Sponsor: Jennifer Shepherd

FA108 High Performance Liquid Chromatography Quantification of alpha and beta-Acids in Hop Varieties Grown in Northeastern Washington

Bradley T Rehwaldt

The concentrations of alpha-acids and beta-acids in hop cones directly affects the acidity and stability of a brew, respectively. A local brewery, in Mead, WA, needed determination of the alpha and beta-acid levels of their different hop varieties, to predict the flavor profile (e.g., the projected International Bitterness Units) and the shelf life of their brews. Using the American Society of Brewing Chemistry Hops-14 international method as a model, an effective extraction method of alpha acids and beta-acids from hop pellets was determined. Then, alpha acids (cohumulone and adhumulone/humulone) and beta-acids (colupulone and adlupulone/lupulone) were quantified utilizing reverse-phase High Performance Liquid Chromatography with ultraviolet detection. The sample data was fit to a linear regression of American Society of Brewing Chemist International Calibration Extract-3 standards. The percentage of acids for six 2018 season hop pellet samples were ascertained. The samples spanned two growing areas/plant ages and five hop varieties including Cascade, Centennial, Chinook, Styrian Golding, and Willamette.

Faculty Sponsor: Kerry Breno

FA109 Characterization of Inorganic Solid-State Electrolytes from Aqueous Solution Precursors

Andrew Johnson

The electrolytes of today need to meet the robust and conductivity needs of modern batteries, sensors, and electrochromics. Here we report an environmentally friendly aqueous solution route to create robust and conductive Lithium Lanthanum Zirconium Oxide (LLZO) in the form of an amorphous solid thin film. Solid-state ionic conductors have the potential to enhance today's appliances while simultaneously accomplishing safer and more conductive performance. To create these films, we will utilize a more environmentally friendly aqueous route with the use of water and spin coating over traditional organic or melt-quenching techniques. From this method we strive to fully dissolve all metal-salts into solution and spin into films three evolutions of LLZO: Li5La1Zr4O12, Li5La3Zr2O11, and Li5La1ZrO6. Film evolution will be monitored by TGA-DSC and FTIR then characterized with XPS, SEM, and IS. The approach is an environmentally friendly and inexpensive way to create quality ionic conductors while the LLZO chosen will hopefully be ionically conductive.

Faculty Sponsor: Donald Clayton

FA110 Examining assembly characteristics of BcHMGR in response to change in pH

Sam Schrader

The opportunistic lung pathogen *Burkholderia cenocepacia* possesses the enzyme HMG-CoA reductase (BcHMGR), which often catalyzes the key regulatory step in the mevalonate pathway used for isoprenoid biosynthesis. However, *B. cenocepacia* lacks the other enzymes in the mevalonate pathway, and BcHMGR has been shown to perform an oxidative reaction in a currently unknown pathway. BcHMGR also exhibits properties and characteristics of a morphine protein in which enzymatic activity is regulated by altering the equilibrium between multiple quaternary states. To elucidate factors that impact this equilibrium, we will perform assembly studies that examine the change in quaternary structure at a variety of pH levels. This will assist in determining which quaternary states predominate at different pH levels, and help to further explain key characteristics of BcHMGR.

Faculty Sponsor: Jeff Watson

FA111 Size Exclusion Chromatography to Characterize the Quaternary Structure of BcHMGR

Sam Stewart

The opportunistic lung pathogen *Burkholderia cenocepacia* does not utilize the mevalonate pathway and yet, the enzyme that catalyzes the rate determining step of that pathway is present. This enzyme is HMG-CoA reductase and its well-known function is to make a primary alcohol from a thioester using NADPH. However, in *B. cenocepacia* this enzyme runs in reverse to support some unknown metabolic pathway. Not only is it worth studying to characterize that novel pathway but it is also known to have the characteristics of a morphine protein. A morphine protein is one that shifts between tertiary structures but to do so must undergo a tertiary remodeling first. In this study an attempt at better understanding the pathways between the quaternary structures is made. Size exclusion chromatography is used to test for favorability of oligomers under differing environmental conditions. Conditions that have shown to change favorability in the past include enzyme concentration, substrate concentration and pH. Here is an attempt to characterize the favored quaternary structures of BcHMGR as it relates to enzyme concentration.

Faculty Sponsor: Jeff Watson

FA112 A comparison of novel silica to reverse phase silica for metal ionophore binding in lipid membranes using affinity chromatography

Bridget Hoag

Molecules that bind ions are known as ionophores. Membrane ionophores reside in the lipid membrane and are widely studied for their antibiotic activity and potential therapeutic applications. Ionophore ion complexation is sensitive to its chemical environment, and studying binding in a lipid membrane is difficult. Ionophore investigation using affinity chromatography and fluorescence allows for the characterization of binding constants and lipid membrane properties. This research compared novel silica particles to commercially available reverse phase (RP) silica particles as lipid supports for affinity chromatography. It was determined that reverse phase silica is a viable substitute for novel silica particles due to quantifiable ion binding to valinomycin within lipids on RP silica. However, notable differences in binding characteristics were observed between supported monolayer and bilayer environments for this ionophore. The RP silica lipid monolayer appeared to have a more rigid membrane, as evaluated by Laurdan fluorescence, and increased binding constants between alkali metals and Valinomycin, suggesting a more non-polar lipid environment. The effect of the lipid environment on ionophores varied for different classes of ionophore. Further investigation is required to determine additional properties of reverse phase silica with a wider variety of lipid and ionophore types.

Faculty Sponsor: Gemma D'Ambruoso

FA113 Multi-pH Modeling of Small Molecule Interactions with Lysosomal Enzyme Arylsulfatase B (ASB)

Ben Klimok

Computer simulations of drug-protein interactions show a promising future for the pharmaceutical industry. Simulations of drug interactions with arylsulfatase B (ASB) at different pH conditions present an opportunity to develop better drug candidates to treat Mucopolysaccharidosis VI (MPS VI) or Maroteaux-Lamy Syndrome. MPS VI is a rare autosomal recessive lysosomal storage disease that results in abnormal bone development among other irreversible symptoms because of mutated ASB. Over 30 praziquantel derivatives were computationally modeled as the binding ligand to ASB. Using Nanoscale Molecular Dynamics (NAMD) software and Autodock Vina, observations of ASB structural changes and ligand-protein interactions indicate different binding affinities of ligand-protein interactions at different pH levels. As a result, praziquantel derivatives with high binding affinities were filtered out for further molecular simulations of ligand-protein interaction. While high binding affinity between protein and ligand increases ASB enzyme affinity, it does not guarantee to be the same case for a mutated ASB. However, computational modeling provides viable drug candidates that resemble ideal functional properties such as stability under cellular pH and high affinity in lysosomal pH. As a result, computational modeling is a cost-effective methodology to screen large quantities of potential drug candidates so that experimental protein activities can be determined. *Faculty Sponsor: Trisha Russell*

FA114 Displays of Masculinity at Noon Ball: An Ethnographic Research Study

Erin Johnson

This study analyzed how masculinity was displayed and performed at noon ball, pick-up basketball games that occur during the noon lunch hour at Gonzaga University. Through several weeks of observation and interviews with noon ball players, this research found that playing with talent was regarded as masculine, while playing poorly was considered un-masculine or weak. This behavior directly correlates with the theory of hegemonic masculinity. When players performed well, they would affirm their masculinity and the masculinity of their teammates through verbal and non-verbal communication. Additionally, players disparaged the masculinity of their opponents when performance was considered poor. Players adherence to the hegemonic ideal of masculinity helps explain why noon ball games are overwhelmingly dominated by male students and faculty members. This research also used noon ball to illustrate how deeply the ideals of hegemonic masculinity run in modern society.

Faculty Sponsor: Kristina Morehouse

FA115 Effects of Soil Moisture on *Chrysemys picta belli* Hatchlings

Cameron Marsh

Since egg shells of *Chrysemys picta belli* (Western Painted Turtle) are flexible to allow diffusion of water into and out of the egg throughout incubation to maintain a suitable embryonic environment, these eggs are potentially susceptible to changes in soil moisture. In this study we seek to better understand how soil moisture impacts the development of *C. picta* eggs by examining hatchling survival, phenotype, and locomotor performance. We hypothesize that the amount of soil moisture will influence survival, phenotype, and locomotor performance of the hatchlings. During a 30-day period at our field site of Round Lake State Park in Sagle, Idaho, we collected 38 eggs. We divided those eggs among three treatment groups: naturally observed soil moisture, decreased soil moisture, and increased soil moisture. All eggs were incubated at 28.5°C and soil moisture was held constant. Incubation time ranged from 48 to 51 days, during which we recorded egg and hatchling mass. One week following hatching, we tested the locomotor performance of the hatchlings for both righting response and running speed. As climate models are predicting a decrease in soil moisture at the field site in the next twenty years, this research will play a crucial role in understanding the possible implications of this environmental change on *C. picta* populations.

Faculty Sponsor: Elizabeth Addis

FA116 Non-Enzymatic Synthesis and Characterization of Glucuronides with Mass Spectrometry

Louisa Reilly

All-trans farnesol, geraniol, and geranyl geraniol are isoprenoids with medicinally interesting properties. However, the metabolism of these molecules is not well understood, but it is known that they undergo glucuronidation. To gain a large enough yield for further studies, the glucuronides of these isoprenoids were synthesized non-enzymatically according to Scheme 1. Next, the glucuronides will be characterized with mass spectrometry to aid in the development of an assay for their physiological detection.

Faculty Sponsor: Stephen D. Warren

FA117 Effect of Cucurbituril[7] Supramolecular Complexation on the Luminescence Properties of a Quinoline-sensitized Europium (III) Complex

Jon Reid

Lanthanide ions exhibit paramagnetic and optical properties that make them attractive for cell imaging applications. In this project, we sought to obtain an understanding of how the formation of a supramolecular complex between cucurbituril[7] and an europium complex influences the photophysical properties of the system. We have studied the luminescence properties of the supramolecular europium complex and binding affinity of the supramolecular complex. Supramolecular complexation leads to enhancement of the brightness and stability of the europium complex, as well as an excitation red shift and an increase in luminescence lifetime. Future work will include mass spectrometry to analyze the structure and binding stoichiometry of the supramolecular complex, introduction of the supramolecular complex into living cells to test the viability of cell imaging applications, and an investigation of the MRI properties of a gadolinium complex.

Faculty Sponsor: Masaomi Matsumoto

FA118 Surface, pore, and adsorption characterization of organic based activated carbons

Jordan Kersten

Activated carbon from spent coffee grounds, as well as commercially sourced from coconut husk, was characterized for its surface area, adsorption characteristics, and pore structure. The surface area was determined through nitrogen gas surface area analysis and Brunauer-Emmet-Teller (BET) theory. The activated carbon's pore structure was characterized by iodine adsorption, methylene blue adsorption, and Procion red adsorption. Iodine adsorption was performed via sodium thiosulfate volumetric titration and the iodine number determined. Methylene blue and Procion red were analyzed spectrophotometrically against UV-Vis spectra of known dye concentrations and the remaining dye concentrations after interacting with the carbon determined. The adsorption characteristics were analyzed through Boehm titration and the number of acidic and basic functional groups quantified.

Faculty Sponsor: David Cleary

FA119 Solubilization and Purification to Determine the Functionality of RquA

Kathryn Cooper

Rhodoquinone (RQ) is an aminoquinone with a very similar structure to ubiquinone (Q), an important lipophilic cofactor required in aerobic respiration. Its reduced form, rhodoquinol (RQH₂), facilitates the reduction of fumarate in anaerobic metabolism. The enzyme RquA is required for converting Q to RQ in *R. rubrum*, and is proposed to act as a transaminase, directly catalyzing the amination of Q in certain parasites and bacteria. Inhibiting RquA and thereby the formation of RQ would be a novel target for future anti-microbial or anti-parasitic drugs. RquA is a membrane associated protein that has low solubility and readily forms inclusion bodies when overexpressed. In an attempt to improve solubility, the *rquA* gene was cloned into the pGEX *E. coli* expression vector which added a GST-tag to the N-terminus of RquA. Overexpression of RquA was attempted using the vectors pGEX_RquA and pET303_RquA (containing a C-terminal hexa-histidine tag). Mild solubilization techniques that avoid denaturation are currently being employed to recover RquA from inclusion bodies. Purified protein will ultimately be used in an *in vitro* assay to determine the amino donor for RQ biosynthesis and for crystallization to determine the structure of the active RquA protein.

Faculty Sponsor: Jennifer Shepherd

FA120 Gratitude: Reducing Loneliness in Older Adults

Konnor Sauve

Gratitude has shown positive impacts on well-being and physical health, while reducing the negative effects of loneliness. Loneliness causes a steep decline in well-being and physical health with links to depression and other illnesses. Older individuals are at higher risk of experiencing chronic loneliness than others. Little research has looked at the possibility that gratitude may help reduce loneliness and its detrimental outcomes in older adults. The current study examined how gratitude influences loneliness, subjective well-being, and health for

36 older adults over a 20-day period. Participants were randomly assigned to two groups, a gratitude treatment group and a control group. Participants completed a baseline assessment survey, before beginning the next 20 days of daily surveys asking about their health and wellness. Those in the gratitude treatment group first described three things they were grateful for about their day and explained why they were grateful before filling out the daily survey. The control group simply filled out the daily survey. We hypothesized that on days when participants felt more grateful they would also show lowered levels of loneliness and boosts in health and well-being. The results supported our hypothesis. When older individuals reported higher gratitude for their days, they also showed in higher subjective health, and well-being, and lower loneliness. Group differences and implications are discussed.

Faculty Sponsor: Monica Bartlett

FA121 The Role Romantic Partner Personality Difference Has On Relationship Satisfaction

Ji Ahn

Do “opposites attract” or “do birds of a feather flock together?” It is important to identify the role of factors such as personality in determining relationship satisfaction given the significance of relationship satisfaction in developing a healthy well-being. We examined whether romantic partners reported more relationship satisfaction when personalities between the two partners differed. It was hypothesized that relationships in which partner A has an introvert personality and partner B has an extrovert personality would report more relationship satisfaction than those in which both partners have the same personality type (i.e., partner A and B were both introverts or both extroverts). Our first study used a survey consisting of demographic questions (gender, school year, age, personality, and relationship status) and three short vignettes. These vignettes told a story of three couples (an introvert-introvert couple, an introvert-extrovert couple, and an extrovert-extrovert couple) and asked participants to rate which couple displayed more relationship satisfaction. Participants were 98 Whitworth undergraduate students; however, 41 responses were excluded due to the lack of time spent completing the survey or having answered more than one answer to a question. The results from the remaining 57 participants showed no significant association between partner personalities and relationship satisfaction. To address the self-report limitations encountered by this first study, a second study is currently underway and will have the participants take a Myers-Briggs Personality Test rather than them self-reporting their own personalities. Overall, these two studies together will help inform us on the role of personality in relationship satisfaction.

Faculty Sponsor: Alisha Epps

FA122 Characterizing GTP Hydrolysis in BcHMGR

Sophia Dewing

Previous research has shown that the HMG-CoA Reductase (HMGR) protein found in *Burkholderia cenocepacia* (Bc) preferentially catalyzes the oxidation of mevalonate to HMG-CoA in the presence of NAD⁺ and CoA. In addition to this HMGR activity, which is called the protein's primary function, BcHMGR has been shown to perform GTP hydrolysis, called the protein's secondary function. Though the protein's HMGR activity has been extensively characterized, much about the GTPase activity remains unknown. This project aims to answer three of the many questions that remain about this protein's secondary function. Previous research has found conflicting results when investigating the potential for NADH production in the presence of mevalonate, NAD⁺, and GTP. While it has been shown that NADH production certainly occurs in the presence of mevalonate, NAD⁺, and CoA, it remains unclear if GTP can function as an alternative coenzyme. First, this project will conclusively investigate these conflicting results, and if NADH production is observed in the presence of GTP it will also be tested in the presence of a non-hydrolysable analogue. BcHMGR is a morphelin protein, meaning it exists in equilibrium between multiple oligomeric states (which explains its multiple functions). In other morphelin proteins, the activities of the primary and secondary functions are inversely related. Secondly, this project seeks to determine if this pattern holds for the GTPase and HMGR functions of the protein. Thirdly, this project aims to determine if the presence of CoA affects the rate of GTP hydrolysis.

Faculty Sponsor: Jeff Watson

FA123 Investigation of Peptide Binding to Cucurbit[8]uril Supramolecular Host

Alla Kozubenko

Cucurbituril[8] supramolecular hosts are capable of binding various guests, including amphiphilic peptides. This project aims to develop a short peptide with high binding affinity to CB8, in order to study self-assembling protein secondary structures and explore a new technique for protein design. The binding of Peptide 1 to CB8 was previously established by Nuclear Magnetic Resonance (NMR) spectroscopy, Circular Dichroism (CD) spectroscopy, and Isothermal Titration Calorimetry (ITC). The ITC data suggested more than one binding event or multiple conformations, which was further explored by titrating CB8 into Peptide 1, monitoring the response of tryptophan (Trp) fluorescence. Trp fluorescence was expected to decrease upon binding, but there was found to be a significant increase followed by a decrease, likely corresponding to two distinct binding events. There was a change in CD signal at high CB8 concentration as well. In the future, NMR and molecular modeling will be utilized to thoroughly characterize this system.

Faculty Sponsor: Masaomi Matsumoto

FA124 Ancestry of Morphein Characteristics in BcHMGR

William Goodwin

The bacteria *Burkholderia cenocepacia*, which is a common cause of death in cystic fibrosis patients contains a unique HMG-CoA Reductase protein which exhibits morphelin characteristics. All morphelin proteins have two interesting properties: (1) the protein is active in multiple different oligomeric state, but each state has a different level of activity and (2) to transform from one oligomeric state to another, the protein must first break down into the monomeric form, undergo a tertiary structure change, and then a different number of monomers will come together to form the new polymers. While it is presently possible to identify a morphelin protein through its kinetic characteristics, there is nothing known regarding what it is in the amino acid chain that makes up the protein which enables this unique capability. For example, BcHMGR and the HMGR of *Pseudomonas mevalonii* are 72% identical proteins, however PmHMGR exhibits no morphelin characteristics. Clearly, the morphelin characteristics arose somewhere in the ancestry of the BcHMGR and, thanks to a colleague three of these ancestors were reconstructed so that they could be tested for morphelin characteristics, designated: 160 (the last common ancestor of BcHMGR and

PmHMGR), 183 (the first ancestor of BcHMGR not shared with PmHMGR), and 161 (the first ancestor of PmHMGR not shared with BcHMGR). By performing kinetic assays on all these proteins, it was determined that _____ does exhibit morphine characteristics while _____ does not. With this knowledge, the sequence of these highly similar proteins can be compared to determine what changes gave rise to morphine characteristics.

Faculty Sponsor: Jeff Watson

FA125 From Lignocellulose to Dioxins: Is there a top down mechanism?

Jenna Valentine

Dioxins are a carcinogenic group of polyhalogenated aromatic compound formed during the incomplete combustion of wood. The mechanism of dioxin formation from wood combustion is not well understood. Our research group is computationally investigating the dioxin mechanism of formation. Our research aims to find an exploitable detail in the dioxin mechanism that could be used as target to prevent the formation of dioxins. The commonly reported pathways for dioxin formation involve building dioxins from smaller parts with varying starting points. While these are bottom-up pathways for dioxin formation, no studies have investigated a potential top-down pathway to directly produce dioxin from lignocellulose. In pursuit of a top-down mechanism, we are assessing the impact of the lignocellulose matrix on a direct mechanism for dioxin formation. The goal of this research is to find a solvent that accurately represents the structure and chemical properties of the lignocellulose matrix. Once a solvent is established, a top-down mechanism for dioxin formation will be investigated in context of this solvent. Progress toward these goals is reported here.

Faculty Sponsor: Matthew Cremeens

Poster Session B

Friday, April 26th, 4:15 PM – 6:00 PM

FB101 Lake Arthur Nature Trails & Signs for a Greener Future

Daisy Montalvo, Makenzie Kooima, Riley Kvarda & Veronika Kocen

Currently, there is no information available about the history, native species, and conservation efforts for Lake Arthur on the actual site of the lake. Additionally, there is no trail directly along Lake Arthur. Although swimming is not allowed in the lake, we hope to engage people in a different way. A nature trail along Lake Arthur would be beneficial, as it could allow people to safely enjoy nature by keeping people away from the water's edge, preventing pollution, and unnecessary accidental destruction to plants around the lake. A nature trail could provide opportunities to enjoy activities such as bird watching, biking, and nature viewing. Ideally, this project includes interpretive signs in complement to a nature trail. By installing interpretive signs along the trail, we can educate both visitors and Gonzaga students and hopefully inspire them to care for their local environment. Community involvement on restoration sites such as Lake Arthur are important because when the community works together to create and enjoy green spaces, everyone benefits. People benefit by being in nature and nature benefits by being restored to systems that previously occurred but were interrupted by human activities degrading natural areas. By providing physical access to the lake as well as providing a learning space outdoors, we hope to close the gap between the Gonzaga community and their natural environment. The 2019 Friends of Lake Arthur (FOLA) plans to research and build a trail along the northern shores of Lake Arthur and include informative signage about the lake on the trail. By doing so we will be enhancing the area around Lake Arthur by making it more accessible to students and campus visitors. In partnering with Gonzaga Plant Services, we hope to make a nature trail and the signs be part of a new and greener future for Gonzaga University.

Faculty Sponsor: Dr. Gregory Gordon

FB102 Community Engagement with School Gardens

Alexis Smith, Abigail Folchi, Elizabeth Terry, Katie Bresnan

We are addressing food insecurity, industrial agriculture and the intersection of these two issues. Industrial agriculture is a major contributor to greenhouse gas emissions, pollution of waterways, and other environmental destruction. However, people in low-income neighborhoods often only have access to food produced in this manner. In Spokane, especially at Shaw Middle School and other nearby schools like Bemiss Elementary, this is the reality. Thus, our idea of a community garden would work to reduce the effects of industrial agriculture while providing fresh produce for students and their families. By creating this garden and the corresponding education program to go with it, we are also creating a space where kids will be able to enjoy being outside and learn about the process of gardening. For this educational program, we will have a future Ameri-Corps employee lead lessons on the scientific aspects of gardening (e.g. soil, seed growth, etc.) but will also incorporate nutrition-based lessons. With this in mind, the program will hopefully encourage the participating students to grow their own gardens one day, become more interested in science, or just generally have a greater appreciation for nature and the environment. Overall, community gardens have environmental, social, and nutritious benefits!

Faculty Sponsor: Dr. Gregory Gordon

FB103 Environmental Justice along the Spokane River

Melissa Haskin, Tori Shaw, Madison Vaughan, Spencer Gjording

The Spokane River is a defining feature of the landscape in our community, with rich historical and ecological benefits. Unfortunately, recreational access points along the river are disproportionately distributed, leaving low-income communities such as Logan, Chief Garry Park, and Hillyard with little to no access to use the river safely. Additionally, homeless camps along the river pose a serious problem to local access and usage and this reality must be addressed in upcoming development projects. Our project's main focus is to highlight these issues of environmental justice and propose potential solutions to these issues. We hope to explore and detail areas along the river where attention needs to be focused for more access to the river as well as where homeless camps are located. In attempts to locate more adequate recreational access points for the neighborhoods we will canvas the areas and involve the families directly affected. This project will involve community outreach as well as data collection to understand the current issues with access and perception of homeless camps to hopefully work towards solutions that will address this problem in the future. We hope that that this research will be used by local representatives and city planners in

the developing river plan for Spokane - the Spokane River Vision Plan. Our previous research of other river plans shows that issues of environmental justice are often excluded from plans, and we hope this project provides a framework for how to include these pertinent issues to the future development of the river.

Faculty Sponsor: Dr. Gregory Gordon

FB104 Feasibility of Salmon Reintroduction in the Spokane River

Bo Gould, Shannon Brennan, Grace Shaw, Olivia Jackiewicz

This research project seeks to explore the local attitudes towards salmon reintroduction in the Spokane River. The Spokane River was once revered as one of the most productive salmon spawning rivers in the Inland Pacific Northwest. However, the construction of dams, namely the Grand Coulee Dam, blocked access to more than 1,100 miles of spawning habitat and caused a decrease of 3 million salmon caught by indigenous people annually. These dams lack fish passage ways, preventing anadromous fish the ability to migrate up and down the river and decimating salmon populations in the Upper Columbia River Basin. Because of these barriers, the feasibility of salmon reintroduction in rivers behind the dams, especially in the Spokane River, is called into question. The goal of this study is to promote a dialogue about the role of the Spokane River in future salmon conservation efforts. In order to accurately analyze the future role of salmon in the Spokane River this study will draw on historical evidence as well as exploring the economic and cultural advantages and disadvantages of salmon reintroduction. To ensure an equitable outcome, this study will account for the arguments of all stakeholders by conducting interviews, literature research, and comparative analysis of relevant case studies. The findings of this study will be consolidated into a website that will create an accessible, educational, and interactive platform. Overall, this research creates an inclusive body of knowledge that will promote an accurate and informed understanding of the future role of salmon in the Spokane River.

Faculty Sponsor: Dr. Gregory Gordon

FB105 Musical Applications of Fourier Transforms

Sydney Schmidt

There are many connections between mathematics and music. In this poster, we examine how the wave equation can be used to model the vibration of a guitar string when it is plucked. We begin by developing the solution to the boundary value wave equation problem employing standard techniques, including finding eigenvalues and eigenfunctions and identifying an appropriate Fourier series expansion. We will then look at how this solution models vibration and in particular use the model to explain how harmonics (or frequencies) of a note are made. Finally, we conclude with some new directions and open questions relating to chord construction and traditional note intervals, we plan to pursue in this application.

Faculty Sponsor: Dr. Bonni Dichone

FB106 The Relationship Between Openness to Experience and Willingness to Travel Abroad

Lauren L. Anderson, Stacey B. Hernandez, Alexis J. Kostun

College studies offer many opportunities to travel to foreign countries and even pursue careers working overseas. This is particularly true at Gonzaga University where recent estimates show that over 52% of the students take part in a study abroad program. But, what type of person chooses to travel and engage with different cultures? In our research, we examined whether personality traits can predict a willingness to travel. Specifically, we predicted that the trait of Openness to Experience would predict travel preferences. To examine this relationship, Gonzaga undergraduates completed the HEXACO personality inventory and were then asked to answer two sets of questions about traveling, living, and working abroad. The first set offered students a choice between four pairs of locations to live in for a 6-month period. For each pair, one country was culturally similar to the USA (e.g. Australia) and one was culturally different (e.g., India). The second set of questions gauged how likely students would be to study abroad and/or move to an unnamed foreign country for a job and/or graduate school. The results show a significant positive correlation of $r = 0.33$, $p = .037$ between Openness to Experience scores and our new scale measuring willingness to travel, study or work in a foreign country. However, Openness to Experience did not significantly predict individuals' choice of countries for travel. We are currently attempting to replicate these results in a larger sample.

Faculty Sponsor: Adam Stivers

FB07 The Effect of an Anti-Inflammatory Diet in a Rodent Model of Depression

Kristopher Isherwood

Depression is a widespread problem that is in need of research and new treatment methods. Recent literature suggests that diet and inflammation can affect symptoms of depression. We decided to study the effects of an anti-inflammatory diet on depression-prone Sprague-Dawley Swim Low female rats. This diet was administered to an experimental and control group for 30 days. Struggle and float times in a Porsolt Swim Test were recorded pre and post diet manipulation. Results were analyzed using a two factor Multiway ANOVA. Significance was found for the main effect of time on struggling, a main effect of time on floating, and an interaction effect between diet and time on floating. Our hypothesis that struggle times would increase after 30 days on an anti-inflammatory diet was not supported, whereas the hypothesis that float times would decrease after 30 days on the anti-inflammatory diet was supported. These results had some significance to suggest that an anti-inflammatory diet could be an alternative treatment for depression. The second portion of this research involved the same procedural and analytical elements as stated above, however, male rats served as participants to determine whether or not the menstruation cycle in female rats acted as a confounding variable in the first portion of experimentation. The combined results of these experimentation periods provide a broader illustration of how diet influences mental health.

Faculty Sponsor: Dr. Alisha Epps

FB108 ARTAP

Kalika Singh, Amy Larson

Connecting computer science to the real world is making an increasingly strong presence in our daily lives. Exposing the public to art collections and to art overall is challenging, being that the general public only knows of a limited, and predominantly western, selection of artists and artwork. This research will create an app that will expand the user's knowledge of art and artworks through a card matching game.

Card matching can be used to strengthen numerous skills for varying levels of education, and we want to connect these skills while further increasing the knowledge of the arts. One of the ways that users can interact with the images of art would be by using a search or collection option. We will be tagging the images that interact with the app, and since the words that one might use to tag an image can be subjective a series of words can ensure that images might intersect in an insightful and surprising way during the game. For instance, if a user were to choose a heading of portraits, they will get pieces from across art history which could range from anything between Picasso to more modern and contemporary artists like Kathe Kollwitz, Alice Neel, and Kerry James Marshall. The final goal of this app will be to test the effectiveness of our app on various age groups, ranging from K through 12 to university level students.

Faculty Sponsor: Nadra Guizani

FB109 Review of Heat Treatment Effects on Tensile Properties of Titanium Alloys

Jason Orr and Kyle Evers

Titanium alloys are grouped into categories based on alloying and heat treatment effects to give one of three different stabilized microstructures. Alpha alloys are those which are minimally alloyed, and are not generally affected by heat treatment. Beta alloys are stabilized by additions of elements such as vanadium, and characterized as having good toughness. Alpha-beta alloys, such as Ti 6-4, derive a balanced combination of properties through controlled alloying additions and heat treatment. The current work is based on replicating literature data including tensile data. The published results of Rack and Qazi are compared to recent results from researchers at Gonzaga. Metallographic images are studied to correlate microstructure to properties. Bending fatigue data is used to study effects of heat treatment and environmental exposure. Future work may include studying secondary effects, including strain rate effects on tensile results.

Faculty Sponsor: Patrick Ferro

FB110 Experimental and Numerical Evaluation of the Flexural Capacity of Cold-Formed Metal Deck

Brooke Whitsell

This research project presents an analysis of experimental data and compares it to two numerical analysis methods of light gage cold formed steel deck. The flexural capacity was determined upon the first failure mode of the light gage cold formed steel deck, which was buckling. A comparison of the experimental data was made with both the effective width method (EWM) and the direct strength method (DSM). The objective of the comparison was to have a physical test provide the induced stress of the light gage cold formed steel deck at failure and evaluate how well the EWM and DSM compare against the experimental results. This allowed for the most accurate comparison between the experimental results with the numerical analysis since the exact yield strength was used in calculation. It was found that the EWM and the DSM vary in their prediction of the nominal moment capacity across material grades and deck thickness. The EWM was found to be more accurate for thinner gage steel deck, while the DSM was found to be more accurate for thicker gage steel deck. Both methods can be used to determine the capacity of the deck and it is up to the end user to determine which method is appropriate for the given application.

Faculty Sponsor: Dr. Joshua Schultz

FB111 Effects of Music on Studying

Jack Mudge

In this study, I will explore the use of music in order to aid different types of work and studying. Many people like to listen to music while they work, and it seems to be helpful in certain situations in order to increase their productivity. Some types of studying, such as reading or writing, take a different type of concentration than doing something like practice problems, or quizzing yourself. I will explore how music can aid different types of studying. Besides different types of studying, there is also different types of music, pop, rap, jazz, hip hop, etc. and all of those will have a different effect on people who are studying. Music can be extremely effective in studying, so I think that it is important to learn more about the connection between music and studying. By investigating this topic more, we will be able to understand the most effective and the most enjoyable ways to combine music and studying in order to maximize our productivity while also enjoying our work, so we can work longer and not get burned out. This research is important because it can help everyone to study better and be able to work more. I will collect data and evidence by conducting interviews with other students to see how they like to use music while they study.

Faculty Sponsor: Peter Hamlin

FB112 The Relationship Between Muscle Activation and Handwriting Quality With Different Grip Styles

Regan Fehrenbacher

A Purpose: This study evaluated differences in handwriting characteristics between four primary handwriting grips: dynamic quadrupod (DQ), dynamic tripod (DT), lateral quadrupod (LQ) and lateral tripod (LT). Different grips were hypothesized to alter muscle recruitment, writing legibility, and consistency. **Methods:** 34 college students were tested for handwriting legibility, consistency, and metrics. Legibility tests were conducted on paper while consistency and metrics protocols were conducted on a tablet recording stroke duration, length, velocity, and pen pressure. Electromyography (EMG) was used for 6 muscles involved in handwriting. Subjects used each grip style with all protocols, and scores were normalized to their native grip scores. Grips were compared using RM ANOVA, t-tests, and correlations (significance at $p < .05$). **Results:** Females had a lower range in legibility scores than males by $3.483\% \hat{\pm} 1.676\%$ ($p = .046$), but grip did not impact legibility. The upper trapezius (UT) was more active in LT and LQ than DT by $15.9\% \hat{\pm} 5.2\%$ and $14.6\% \hat{\pm} 3.7\%$, ($p = .028$, $p = .004$) respectively. DT had more extensor carpi ulnaris (ECU) activity than LT by $9.7\% \hat{\pm} 3.3\%$, ($p = .011$). **Conclusion:** Females demonstrated the ability to adapt to any grip style, but males may benefit from dynamic styles rather than laterals. Elevated UT activity suggests lateral grip styles involve whole-arm, stabilizing movements. Individuals with little gross muscle activation may benefit from dynamic grip styles to regain handwriting ability or lateral grip styles to build muscle tone. Increased ECU activity shows dynamic grip styles require fine dexterous movements. Patients with poor dexterity may be advised to avoid DT or use it to improve precision.

Faculty Sponsor: Ryan McCulloch

FB113 Habitat Management Plans: Encouraging Conservation-Conscious Development on the Spokane River

Madeline Hueske, Casey Harder, Colleen Donoghue, Annie Wissmiller

Spokane County faces increasing pressure from development, especially threatening the conservation of critical habitats and species along the Spokane River corridor. Our research will focus on assessing current and past habitat management plans and conservation techniques promised in development proposals. Throughout our research, we plan to create an evaluation rubric to consistently critique habitat management plans and evaluate both their successes and shortcomings. We will create an online platform where this rubric, along with information regarding legal obligations of the city and a comprehensive map of existing habitat management plans are organized for effective communication to the public. In order to enhance the qualities of life for all organisms that live and interact with the Spokane River and surrounding ecosystems, it is important that developers are held accountable to their habitat management plans. We aim to increase public awareness and invite all to participate in maintaining healthy ecosystems in the Spokane area.

Faculty Sponsor: Dr. Gregory Gordon

Oral Presentations, Session 1 **Friday, April 26th, 4:30 PM – 5:30 PM**

O1A-1 Climate change and invasive species: impacts on a native amphibian

Bailey Luoma

Climate change will exacerbate a number of environmental stressors such as disease, contaminants, and invasive species. Wetland habitats are susceptible to these factors, and thus, the interactions between native and invasive species in wetlands is of concern. We conducted a multi-factorial experiment to test the hypothesis that climate change and invasive species presence would act synergistically to a) reduce survival, and b) increase growth and development rates in native amphibian larvae (Pacific chorus frogs; *Pseudacris regilla*). The resulting multi-factorial experiment contained eight treatments, replicated six times. We found no evidence of a synergistic interaction between these stressors, though each stressor had individual effects. Overall survival was high and not related to treatment. Pacific chorus frogs metamorphosed earlier in elevated climate treatments ($p < 0.0001$); but mass at metamorphosis was not affected by climate treatment ($p = 0.50$). Tadpoles in the presence of invasive American bullfrogs (*Lithobates catesbeianus*) metamorphosed at the same rate as tadpoles without a bullfrog in their tank, but were smaller at metamorphosis ($p = 0.02$), regardless of whether the bullfrogs could interact directly or indirectly with the tadpoles. These data suggest that climate change may not have a negative impact on survival and development of Pacific chorus frogs. However, the presence of invasive bullfrogs in local wetlands may have a negative impact on the size of native Pacific chorus frogs at metamorphosis, potentially reducing fitness for frogs developing in the presence of invasive bullfrogs.

Faculty Sponsor: Betsy Bancroft

O1A-2 Characteristic strength of graphite

Joshua M Margraf

Given the phenomenon of frustratingly delicate graphite in contemporary mechanical pencils, modern manufacturers must be properly informed as to the nature of how their customers fatigue their products. Paramount to this goal would be a critical understanding of shear failure where the product meets the abrasive writing surface. To this effect, a widely accepted benchmark known as the Weibull Modulus has been established to describe the behavior of brittle failure in materials such as graphite. The current investigation seeks to determine the Weibull Modulus of two modern brands, Pentel and Paper-mate, by observing tensile tests under the proposed academic conditions students commonly face. The proposed three-point tensile tests should allow for an extrapolation of data to create the modulus given large enough sample size. However, further academic study may be required to fully understand the variability in data taken by the tensile tests as supplementary four-point testing may provide a more complete understanding of flaws and their effects within individual samples.

Faculty Sponsor: Patrick Ferro, Ph.D, P.E.

O1B-1 Social Media and the Maximizing Mindset in Dating Relationships

Isabelle Broussard and Meghan Foulk

Millennials are known for being on their phones all the time. One of the most popular past-times spent on phones is the use of social media. Recent studies on social media have discovered that over-usage can contribute to envy, loneliness, and various other negative emotions. This study examined if using social media creates a maximization mindset and in turn reduced relational satisfaction in dating relationships. Maximization is a decision-making style where an individual desires to make the best choice possible. Individuals high in maximization tend to search for alternative relationships, which social media can provide. Forty participants completed a short pre-test questionnaire about maximization and relational satisfaction and then were placed into one of two experimental conditions. Participants either looked at pictures of high-quality relationships on Instagram or looked at pictures on CNN Travel. Results of the experiment indicated that participants who looked at high-quality relationships on Instagram saw their relational satisfaction scores drop from the pre-test measurement. However, maximization scores did not change from the pre-test to post-test measurement, indicating that another mechanism could be responsible for the findings.

Faculty Sponsor: Alan Mikkelsen

O1B-2 Narcissism and Reactivity to an Awkward Stimulus

Liam Cascelli, Kayla Proffit-James, Christopher Thomas

Do you find something funny that others find uncomfortable? We analyzed the relationship between narcissism scores and reaction to an "awkward" stimulus. We hypothesized participants with higher narcissism scores would have lower reactivity to the awkward situation.

Faculty Sponsor: Gary Thorne

O1B-3 Effects of Biblical Women in Pop Culture

Abigail Nye

Over the past decade, media exposure to certain people has increased greatly, producing a fabricated image of what it means to be a woman. I believe there is a strict dichotomy of depictions of women. One is the overly sexualized woman while the other is a pure, chaste woman. This stark contrast in the image of women is largely perpetuated by the images of biblical women, Mary and Eve. While there is mostly a separation between these two images of women, it is important to find ways to bridge the gap and allow for a less constrained image of women.

Faculty Sponsor: Dr. Karin Heller

O1B-4 "But Did You Get Any?": The Role of Toxic Masculinity in College Hookup Culture's Self-Fulfilling Prophecy

Sophie Winnett

To better understand the role of masculinity in hookup culture, I propose that rather than individual students engaging in individual actions, the hookup culture on Gonzaga's campus is a self-fulfilling prophecy dependent on the collective action of students as social actors. I aim to study how hookups respond to and reproduce an ongoing culture that is anything but individualized. Consequently, hookup culture becomes cyclical, both impacting and impacted by perceptions and interpretations of masculinity. Data will be collected using snowball sampling from approximately 10-15 male students in two focus groups, as well as a series of ethnographic observations in the neighborhood surrounding Gonzaga's campus. No identifying characteristics of those being observed will be recorded. Participants in focus groups will answer questions regarding their dating histories, views on and involvement with hookup culture, and discuss the influence of masculinity in hookup culture.

Faculty Sponsor: Vikas Gumbhir

O1C-1 Language Agnostic Syllabification with Neural Networks

Jacob Krantz, Maxwell Dulin

The identification of syllables within phonetic sequences is known as syllabification. This task is thought to play an important role in natural language understanding, speech production, and the development of speech recognition systems. The concept of the syllable is cross-linguistic and formal definitions are rarely agreed upon, even within a language. In response, data driven syllabification methods have been developed to learn from existing examples. These methods often employ classical machine learning sequence classification models. In recent years, recurrence-based neural networks have been shown to perform increasingly well for sequence classification tasks such as named entity recognition (NER), part of speech (POS) tagging, and chunking. We present a novel approach to the syllabification problem that leverages modern neural network techniques. Our network is constructed with long short-term memory (LSTM) cells and a conditional random field (CRF) output layer. Existing syllabification approaches are rarely tested across multiple language families. The commonly used CELEX dataset is rich in syllabic transcriptions and is frequently used for model training and evaluation. However, this dataset is restricted to the Germanic languages of English, Dutch, and German. To demonstrate cross-linguistic generalizability, we evaluate the network's syllabification accuracy with the languages of English, Dutch, Italian, Basque, Brazilian Portuguese, and Russian. Preliminary results show the network is competitive with state-of-the-art systems in the English language.

Faculty Sponsor: Paul De Palma

O1C-2 Placed Based Community Engaged K-12 Environmental Education Curriculum Development

Alex Gannett, Jed Brown, Kaiya Collins, Nels Evens

Students return to school in August having forgotten important information that they learned the previous school year. This lack of retention is amplified when students are living in poverty. In Washington State, The Office of the Superintendent of Public Instruction develops curriculum with the expectation that students don't forget anything over the summer. When students enter the school year in the fall, they are often not afforded the opportunity to look back upon the information that they may have forgotten over their summer break. We were curious what appropriate summer programming and is for the students so that they return to school at grade level. The Zone Project in NE Spokane is a place-based initiative doing just that. They working within the Hillyard community and developing programming to engage students over the summer so that when they return to school they have not lost what was learned the previous school year. Due to high poverty rates and other factors, students in this area have less access to outdoor education and thus have less opportunities to feel connected to their physical surrounding communities. With this in mind, we worked to develop summer enrichment activities themed around the Spokane River and its watershed. The curriculum will provide students from low income backgrounds an opportunity to spend time learning about the river that flows through their backyard. This will allow students to gain the education that will support them moving forward in their communities and environment.

Faculty Sponsor: Greg Gordon

O1C-3 King Leopold & the Congo: Origins of the "Fake News" Phenomenon in U.S. Media

Alisha Isensee

We in the United States are grappling with the phenomenon of fake news. Journalists and historians are looking to the future to determine how citizens will combat falsified information, yet we fail to look to our past in relation to fake news. More than a century ago, King Leopold II of Belgium and his agents colonized the Congo Free State. Reports of human rights violations appeared in 1890, yet Leopold quelled the subsequent uproar and continued his rule over the Congo, unchecked. In the 1900s, media coverage returned on a broader scale, garnering attention in the American press. Because Americans criticized Leopold's rule first and because President Arthur was the first world leader to recognize Leopold's claim over the Congo, the U.S. took active interest in the controversy. Leopold depended on his cunning manipulation to launch counter-attacks, relying on disfigured factual evidence to portray his reign as philanthropic. He appealed to Catholic Americans, utilized popular business titans like J.P. Morgan and John Rockefeller, used paid agents to publish positive press and gave an interview himself. All of this played out in the press and thus became a prominent issue for Americans in the early 20th century. Many scholars and journalists believe the phenomenon of fake news is unique to modern times, but I assert that it was present more than one hundred years ago when Leopold cleverly utilized the American press to promote falsified information in order to hide the truth.

Faculty Sponsor: Dr. Richard Goodrich

O1C-4 Imperialistic Nostalgia's Role in the Origination of the "Lazy Polynesian" Stereotype

Piliwailana Nahale-a

The most prominent stereotype about Polynesian people is that we are "lazy". This notion has been carried on through literature and media, with a commitment to portraying Native people of Polynesia in a certain, damaging manner. One of the most well-known pieces of literature about Polynesians is Typee by Herman Melville. Throughout the novel, Melville attempts to capture the life of the Typee, a Marquesan group of Native people who are classified as cannibals by a vast majority of people in the mid-1800s. I explore the implications of "imperialist nostalgia" on Melville's perception of Polynesian laziness and what factors led him to an unequal recounting of Polynesian life. Through engaging with Typee as well as other works that reference this conception of Polynesian laziness, I seek to determine the origins of the lazy stereotype as well as what qualified laziness as negative and vice versa in the mind of Melville. This has also led me to consider what "civilization" implies when focused on Polynesian people. Within Typee, Melville has a varying interpretation of civilization depending on the subjects, i.e., Melville's mostly positive comments on Typee life as compared to his near constant unfavorable language on the Hawaiians. I examine what role imperialistic nostalgia plays in Melville's approach to civilization and how the rhetoric of Typee continues to impact the general perception of Polynesians today.

Faculty Sponsor: Dr. Jeff Miller

Poster Session C

Saturday, April 27th, 9:00 AM – 10:15 AM

SC101 The bacterium Shewanella sp. strain ANA-3 is a Co³⁺-EDTA super-reducer

Jake D. Davies

Radioactive ⁶⁰Co is a significant constituent of nuclear waste and has been transported in ground water at selected sites, such as Hanford, WA, through intentional or accidental co-release with synthetic chelating agents such as EDTA. Chelated forms of Co are generally more mobile than un-chelated forms in saturated subsurface sediments, and the stability and mobility of Co³⁺-EDTA complexes is also directly related to the oxidation state of the metal. The oxidized form, Co³⁺-EDTA, is over 25 orders of magnitude more stable and mobile than the reduced Co²⁺-EDTA. The dissimilatory metal-reducing bacterium Shewanella alga strain BrY, isolated from sediments of the Great Bay estuary, NH, was previously shown to use Co³⁺-EDTA as a sole terminal electron acceptor for anaerobic respiration. The current study compared Co³⁺-EDTA reduction by Shewanella alga strain BrY to that of Shewanella sp. strain ANA-3, which was originally isolated from a wooden pier within a brackish estuarine environment in Woods Hole, MA as an As⁵⁺ reducer. Washed cell suspensions of strain ANA-3 reduced Co³⁺-EDTA with a specific activity of 3.95 x 10⁻⁵ nmol min⁻¹ cell⁻¹, while BrY exhibited a specific activity of 0.086 x 10⁻⁵ nmol min⁻¹ cell⁻¹. The Co³⁺ reduction potential of ANA-3 was therefore 46 times greater than that of BrY. Preliminary data suggest that the unique c-type cytochromes within the respiratory chain of strain ANA-3 may account for this disparity. These results suggest that strain ANA-3 could be highly useful in the bioremediation of anaerobic subsurface environments contaminated with nuclear waste.

Faculty Sponsor: Dr. Frank Caccavo

SC102 Effectiveness of Perch Deterrents for Avian Predators of the Greater Sage-Grouse

Sahale Riedel

Greater sage-grouse (*Centrocercus urophasianus*) in Lincoln County, WA were considered to be locally extinct as of the late 1980s. Translocations of sage-grouse to reintroduce the population began in 2008 and continued through 2015, but in recent years the population has declined without additional augmentation. One factor that is known to influence sage-grouse populations is the presence of avian predators, including raptors and corvids. For the reintroduced population of sage-grouse in Lincoln County, avian predators were found to be the most common source of mortality from the period between 2008 and 2013 (Schroeder, 2014). As such, efforts to reduce the effectiveness of avian predation of sage-grouse are important to the establishment of this population. One approach that has been used effectively to reduce avian predation of sage-grouse is the use of perch deterrents on utility poles. Deterrents were installed on poles in key sage-grouse habitat in Lincoln County. Motion activated cameras were erected 6 m from five selected utility poles, three with perch deterrents, and two without. Photos were downloaded weekly and perching activity was assessed on each pole in order to ascertain the effectiveness of the deterrents at reducing perch activity.

Faculty Sponsor: Dr. Grant Casady

SC103 Efficacy of Anti-Microbial Solutions on *Candida albicans*

Kerrie Buehler

The *Candida* species is the second most common agent of fungal infection worldwide, which is usually eliminated or controlled by the immune system. However, immunosuppressed patients, immunocompromised patients and those recovering from invasive medical interventions are at higher risk of fungal septic shock. Sepsis due to fungal organisms is often harder to successfully treat than other non-fungal septic infections. The purpose of our research is to identify anti-fungal solutions that can be used in intravenous ports, hand scrubs, and intravenous locks to prevent hospital-acquired infections caused by the *Candida* species. A disk diffusion test was used to test the anti-fungal efficacy of solutions containing different concentrations of active key ingredients on *C. albicans*. Three classes of solutions were tested to be used as IV port disinfectants, IV lock disinfectants and disinfectant hand scrubs. The zones of inhibition and standard deviations were as follows: port solution "13.4 Å ± 2.7 mm; hand scrub solutions" 10.5-1.7 mm; lock solution "no measurable zones of inhibition. Overall, this experiment demonstrates the anti-fungal properties of these solutions and their relative disinfectant capacities. The port solution and hand scrub solutions were more effective against *C. albicans* than the lock solution. Next, we will test these solutions on ports to mimic port disinfection, in IV tubing to mimic lock disinfection and on gloves to mimic hand disinfection.

Faculty Sponsor: Dr. William Ettinger

SC104 SUMOylation of ATF5 at the Centrosome

Henning Knipprath

ATF5 is a member of the CREB (cAMP response-element binding) protein family of activation transcription factors. It has been identified as participating in autophagy, cell proliferation and differentiation, and is upregulated in neuronal brain cancer and breast cancer. It is also localized within the centrosome, an organelle responsible for the production and management of microtubules, and therefore crucial to regulating cycle progression and playing a critical role in the cell cycle of mammals, specifically during mitosis. The specific mechanism of ATF5 localization at the centrosome has heretofore been speculative. Our findings have shown that ATF5 can be modified, specifically SUMOylated, via SUMO (small ubiquitin-like modifier) proteins as a post-translational modification. This modification is upregulated during the G1 cell-cycle phase and downregulated during the G2/M phase. SUMOylation disrupts ATF5's influence on certain centrosomal proteins as the mitosis phase is completed. We have demonstrated that by impeding the translocation of ATF5 from the centrosome with resultant arrest of the cell cycle at the G2/M phase using HeLa cells, that SUMOylation of ATF5 is a critical mechanism in order to regulate ATF5 activity in the proper functioning of the centrosome.

Faculty Sponsor: Dr. Kerry Breno

SC105 Investigation of Microplastics in Spokane River Sediments

Marcus Bernard

A growing body of literature has documented the presence of plastic-derived debris in Earth's surface waters. While most of these plastics chemically degrade slowly, many undergo physical degradation to as small as a few microns in diameter within decades of being released into the environment. The presence of these microplastics negatively affects aquatic ecosystems. The scope of this problem has yet to be fully understood or quantified and is an active area of research around the world. This poster will report the results of our efforts to investigate the presence of these micro-particles in the Spokane river using density and visual separation techniques coupled with FTIR microscopy methods.

Faculty Sponsor: Dr. Joanne Smieja, Dr. David Cleary, Jule Schultz

SC106 The Relationship Between Grit and Academic Performance

Miles Gentry, Ian Rasmussen, Jaiden Warner, Madeline Hensleigh Estergard, Michael Palm-Bledsoe

The primary purpose of this study was to examine the relationship between grit and academic performance. Grit is a motivational factor comprised of Passion (a consistency of interests) and Perseverance (resilience in the face of adversity). We operationalized this construct with a 10-item self-report measure that includes a subscale for Passion and a subscale for Perseverance. People high in Passion tend to agree with items like I often set a goal but later choose to pursue a different one. People high in perseverance would tend to disagree with items like My interests change from year to year. The scale was administered to a convenience sample of 132 Gonzaga students along with a self-report of current Grade Point Average (GPA). We found that Perseverance was positively related to GPA, $r = .20$, $p = .024$. However, the Passion subscale was not significantly related to GPA, $p = .80$. This shows that the ability to respond effectively to setbacks is a predictor of higher academic performance. Additionally, we are testing whether an intervention designed to improve grit can boost academic performance in comparison to a control group.

Faculty Sponsor: Adam W. Stivers

SC107 Loneliness, Social Perception, and Goal Disclosure

Katherine Laco, Mallika Sharabu, & Liam Galten

Loneliness can lead to less self-disclosure, which plays a vital role in the development of intimacy and close relationships (Reis & Shaver, 1988). Further, loneliness relates to negative expectations of social interactions and social relationships, which is thought to contribute to a cycle of loneliness (Perlman & Peplau, 1979). Previous research exploring loneliness has been largely correlational and utilized cross-sectional survey methods. Yet, little research has explored explanations for why lonely people are less likely to disclose, via experimental methods. The purpose of this study is to explore how loneliness impacts motivation to disclose a recent goal achievement, due expectations of others' responsiveness. Participants ($N = 233$) were assigned to one of three induction conditions (high loneliness, low loneliness, and average loneliness), and received false feedback about their responses to a bogus loneliness survey. Participants in the high loneliness group reported significantly greater state loneliness after receiving their high loneliness feedback, compared to the other groups. Further, preliminary results showed that participants reporting greater loneliness also reported that they would be less likely to share an important personal goal with another person if it was achieved, and that they also expected others to be less responsive and supportive. This work is important, as sharing positive events with others has been shown to be effective in increasing and maintaining social ties (e.g., Gable et al., 2004).

Faculty Sponsor: Sarah Arpin

SC108 Effects of HeartMath on Loneliness among College Students

Matthew Roberts

Loneliness is a distressing emotional experience that is on the rise in the US, particularly among first year college students. The stressors of transitioning to college often result in immediate feelings of isolation from close family and friends. Thus, it is important for research to explore simple and effective methods which aim to reduce loneliness among college students. The current study examined HeartMath as a potential means of reducing loneliness of college students; this intervention has been previously used to reduce anxiety and stress. HeartMath is a biofeedback approach to stress reduction. Users are trained to monitor their heart-rate via a heart-rate monitor; these methods have been previously shown to increase feelings of calmness and aid in emotion regulation (Ratanasiripong et al., 2012). Participants in the current study were randomly assigned to a treatment or a control group; both groups completed a baseline and follow-up survey, administered about five weeks apart. Participants in the treatment group attended five weekly lab sessions wherein they were led through the HeartMath intervention; as a part of this, they completed a controlled breathing exercises, which involved syncing breathing to statements about past experiences of connectedness. Preliminary results showed that the experimental group showed a greater decrease in loneliness between baseline and follow-up, relative to the control group. Further, differences in loneliness related to less stress and greater well-being at follow-up. These results contribute to the current understanding of potential interventions which may be used to decrease loneliness, stress, and improve well-being among college students. *Faculty Sponsor: Sarah Arpin*

SC109 School Shootings in the United States

Larissa Brewer

In the United States, there have been over 1,244 school shootings and 219,000 students who have experienced gun violence at school since the Columbine shooting in 1999. The last school shooting to occur in the U.S was in Jacksonville, Florida at "Saint Clair Evans Academy in which during the school day an unknown gunman fired shots into a classroom while 350 children were present at the school. Unfortunately, school shootings are still incredibly relevant to our society's challenges to encourage further dialogue I explore the correlation between geographic region and the primary reason why the school shooting occurred. I focus on a data base that updates regularly with the most recent school shootings in the U.S which includes extensive information on demographics of the victims and the shooters and where the shooting took place. This paper takes a deeper consideration into what the factors such as region, sex, age, class, and category of the shooting that are taking into part of school shootings that are occurring across the United States.

Faculty Sponsor: Jason Wollschleger

SC110 Effect of Dietary Omega-3 PUFAs on Depression in Sprague dawley Rats

Nicholas Bratt, Matthew Coleman, Nicholas Magarelli, Lauren Townson

Omega-3 fatty acids have been shown to be an essential part of a mammalian diet. Low n-3 polyunsaturated fatty acid (PUFA) levels may play a role in hippocampal inflammation and have been hypothesized to predispose individuals to depression. This study endeavored to study the effects of a 1000 mg/kg supplementary dosage of omega-3 fatty acids over six weeks on SwimLo rats, which are genetically disposed to depressive behaviors. Five rats were fed a dietary supplement of yogurt mixed with flaxseed oil containing n-3 PUFA. Five control rats were fed only a yogurt dietary supplement. Results were obtained by comparing the rats' pre and post-treatment Porsolt swim test scores. These results indicated that three out of the five SwimLo rats improved, but two did not.

Faculty Sponsor: Michael Sardinia

SC111 Multi-Objective Comparison of Affordable Housing Building Materials

McKenna Milacek

Affordable housing plays an important role in providing individuals with equal opportunities to achieve success in American society. To develop a quality comparison between building materials available for affordable housing, several parameters need to be evaluated including: life-cycle cost, structural performance, and life-cycle sustainability. As this topic has gained popularity among citizens and engineers simultaneously, several studies have investigated the structural performance of non-traditional structural systems. However, there is a lack of case studies that explore the relative efficiency of these systems using a common basis of performance metrics. To address this, a case study has been completed comparing structural insulated panels (SIPs) and straw bale walls to traditional 2x4 framing. The study looks into the overall strength of each wall, embodied energy and global warming potential, and the life-cycle cost. Results show that by scaling the strength of SIP and straw bale walls to traditional framing, 2x4 framing out-performs straw bale and SIP in cost and out-performs SIP in a life-cycle analysis. While the results are instructive for future design considerations for affordable housing, the methodology presented highlights the sensitivity of decision criteria considered in maximizing the benefits for residents.

Faculty Sponsor: Mark Muszynski

SC112 GPU-computing to simulate plasma flows in ion-ion propulsion for spaceflight

Cannon Coats, Rebecca Udby

An existing simulation modeling the behavior of the near-field plume of NASA's new ion-ion plasma thruster was altered to streamline the work and time efficiency of the simulation process, while making the predictions more accurate. The model was used to determine the efficiency of such a thruster by specifically monitoring alternating bands of positive and negative ions emitted from the thruster and showing where and when the bands mix well enough to form a quasi-neutral state, relative to the end of the thruster. GPU computing and a multigrid algorithm were implemented to increase both the work and time efficiency of the simulation, decreasing its runtime. The previous mathematical model was modified so its equations were pressure-based, and wave-particle (Landau) damping was taken into consideration in the calculations so that the results were more accurate. With GPU computing, the runtime of the simulation was reduced from approximately five days to four, but the addition of the new equations and Landau damping brought it back up to closer to five days. Landau damping was determined to cause the ions to form a quasi-neutral state more quickly, but not as quickly as some literature might suggest.

Faculty Sponsor: Kamesh Sankaran

SC113 The Effects of Model, Lead, Test and Precision Teaching on Matching Coin Quantities to a High School Student with Intellectual Disability and ADHD in a High School Special Education Classroom

Megan Lavagnino

The purpose of this study was to evaluate the effects of Model, Lead, Test procedure to increase the ability to match a given coin quantity on a twelfth-grade boy with an intellectual disability and ADHD in a self-contained special education classroom. The dependent variable was the number of correctly matched coin quantities for each set. Event recording within a multiple baseline design was used across three sets to assess 10, 25 and 50 cent-quantities respectively. For each quantity, four Guide Cards were made to illustrate the four possible coin combinations taught per quantity. The Guide Cards were developed to help the participant stay organized and provided a visual learning support to see which coin combination(s) had been made. Once a given combination was made, the corresponding Guide Card was pulled out and set on the table. A Direct Instruction Model, Lead, Test strategy was used to teach matching the given coin quantity for the target amount. First the researcher showed four different coin combinations. Then, the researcher led the participant through the four expected ways to find the given coin quantity for the amount being taught. Finally, the table was cleared and the participant was asked to show the coin quantities four different ways independently. Praise was awarded if a correct response occurred. A correction procedure was given if an incorrect response occurred. The outcomes indicated that the model, lead, test intervention was an effective way to improve the number of correct responses for matching the given coin quantity.

Faculty Sponsor: Jennifer Neyman

SC114 Using Conversation Cards and Interval Reinforcement to Teach Appropriate Conversation Skills for a 19-year-old with Autism Spectrum Disorder in a Special Education Transition Program

Sarah Bundy

The purpose of this study was to evaluate the effects of conversation cards and interval reinforcement on the development of conversation skills for a 19-year-old with autism in a high school transition room. The dependent variable was correctly staying on the topic of the conversation card measured over 2-minute sessions with 10-second intervals. Interval recording within a changing criterion design monitored the development of appropriate conversational skills. During the independent variable, a conversation card topic was used in collaboration with reinforcement. Three conversation cards were turned upside down for the participant to choose from at the beginning of each session. The participant would read the chosen card, and the researcher set the timer for 2-minutes. Then, the participant was told to talk about the chosen topic for as long as he could. The researcher only spoke when the participant asked a question or to give feedback. The researcher collected data each interval as to whether Josh was on task. Stars were awarded periodically based on his performance. If he earned a specific number of stars, the participant earned a 10-minute break. Praise or a correction procedure was given each 10 seconds during the first and second criterion levels and every 30 seconds during the third criterion level. The results showed an increase of the participant's conversational skills across criterion levels, and the classroom teacher reported that the participant's natural conversation skills increased outside of the study setting.

Faculty Sponsor: Jennifer Neyman

SC115 Using Conversation Cards and Interval Reinforcement to Teach Appropriate Conversation Skills for a 19-year-old with Autism Spectrum Disorder in a Special Education Transition Program

Haley Wunderlich, Derrik Gratz

The purpose of this study was to evaluate the effects of conversation cards and interval reinforcement on the development of conversation skills for a 19-year-old with autism in a high school transition room. The dependent variable was correctly staying on the topic of the conversation card measured over 2-minute sessions with 10-second intervals. Interval recording within a changing criterion design monitored the development of appropriate conversational skills. During the independent variable, a conversation card topic was used in collaboration with reinforcement. Three conversation cards were turned upside down for the participant to choose from at the beginning of each session. The participant would read the chosen card, and the researcher set the timer for 2-minutes. Then, the participant was told to talk about the chosen topic for as long as he could. The researcher only spoke when the participant asked a question or to give feedback. The researcher collected data each interval as to whether Josh was on task. Stars were awarded periodically based on his performance. If he earned a specific number of stars, the participant earned a 10-minute break. Praise or a correction procedure was given each 10 seconds during the first and second criterion levels and every 30 seconds during the third criterion level. The results showed an increase of the participant's conversational skills across criterion levels, and the classroom teacher reported that the participant's natural conversation skills increased outside of the study setting.

Faculty Sponsor: Julie Beckstead

SC116 Graphic Statics Analysis of Lateral Loads

Daniel Seats

Graphic statics is a tool to analyze structures and the forces that individual members carry within a structure. This tool can be used to optimize the geometry of load carrying systems such as trusses. The analysis comprises of making a force diagram derived from the geometrical form diagram of a structure. This force diagram consists of reciprocal force parallelograms corresponding to the geometric form of the structure and its members. This method however, is cumbersome in that a new diagram must be drawn for each iteration. This project consists of the development of an iterative method to perform graphic statics using optimization techniques to find the most optimal and efficient form of a structure. This iterative method is to be programmed utilizing Matlab, with the final goal of performing an analysis of the Dubai Creek Tower (in construction) addressing the lateral loads that it might experience due to wind.

Faculty Sponsor: Joshua Schultz

SC117 The Effectiveness of a Self-Regulation Strategy Development Plus a Writing Checklist to Teach Narrative Writing to an Elementary Student with a Specific Learning Disability

Camille Howe

The purpose of this study was to examine the effects of a self-regulation strategy on the narrative writing skills of a 13-year-old sixth grade male diagnosed with a Specific Learning Disability and Attention Deficit Hyperactivity Disorder. The study took place in an elementary resource room with a 13-year-old male who had been diagnosed with a Learning Disability and ADHD. The dependent variables, related to narrative writing, were character(s), the story's problem, setting, sequencing with transitions, and a resolution. Permanent product within a changing criterion design was used to assess the participant's narrative writing with a rubric assessing each of the four dependent variables with a 4-point scale. The independent variable named self-regulated strategy development (SRSD) consisted of six steps: Develop background knowledge e-introduce writing structure sheet, Discuss it, talk about narrative writing purpose, Model it, show each step of narrative writing, Memorize classroom posters, Support guided practice, and Independent performance, individual work. The researcher modeled how to write a narrative paragraph using the six steps and requested the participant's input. Feedback was provided based on his response. With a new picture, the participant composed a story using a graphic organizer and a writing checklist as learning supports to write his own paragraph. The results of the study showed that the participant's score improved from an average of 5.33 baseline score to an average score of 14 during the final criterion level.

Faculty Sponsor: Jennifer Neyman

SC118 The effects of a blueberry supplemented diet on cognition in rats as measured by the Morris water-maze test

Courtney Kinniburgh, Weston Kroes, William Liening, Lauren Vagt

Antioxidants have been widely studied for their cognitive benefits. Anthocyanins and flavanols are some of the most effective agents in reducing the damage of oxidative stress in the brain, leading to reduced cognitive decline and improved free recall, memory and vocabulary.¹ Blueberries contain 15 anthocyanins capable of crossing the blood-brain barrier and impacting the central nervous system.³ This experiment sought to test the effects of a blueberry supplemented diet on the cognitive performance of rats as measured by the Morris Water Maze. When comparing the experimental versus the non-blueberry diet control rats, the experimental group had a 21% higher maze completion rate than the control group. Additionally, the average completion time for the experimental group was 11 seconds faster than the control group. No significant difference was found in memory or cognitive function between control rats and those fed a blueberry supplemented diet using the MWM. Our data does, however, correlate with an increase in cognitive function overall.

Faculty Sponsor: Mike Sardinia

SC119 Examining the Interface of Molecular Topology and Molecular Assembly using Quasiracemates.

Kelsey Anderson

Quasiracemic materials offer unique opportunities to explore how molecular components organize in organic crystals. Because the design elements for constructing quasiracemates only require the use of pairs of structurally similar enantiomers, the creation of such materials are largely unrestricted when considering classes of compounds and specific functional groups. This work investigates the behavior of benzoylamino acid quasiracemic materials from the melt. We have synthesized a homologous family of these compounds that differ in the attached Cl, NO₂, Me, and Br groups. By combining pairs of these materials e.g. R-X and S-X and processing them via hot stage thermomicroscopy, the result is micrographs that provide critical evidence of the molecular assembly ability of these systems. Both valine and leucine were employed in these studies to give a diverse collection of components. In several instances, this thermal cycling of pairs of quasisenantiomers gave way to the growth of new crystalline phases. This effort represents a new direction in quasiracemic research where the molecular framework can be easily modified to explore a wide range of molecular recognition profiles.

Faculty Sponsor: Kraig Wheeler

SC120 Synthesis of 1,10-phenanthroline derivatives and related rhenium(I) tricarbonyl complexes

Jacob Seo

Rhenium(I) tricarbonyl phenanthroline complexes are well known for their luminescence. This luminescence can be applied to biomedical, chemical, and biochemical analysis. Rhenium(I) complexes with varied phenanthroline ligands would be useful for broadening the applications for the complexes. Therefore, in this work phenanthroline derivatives including 4,7-dichloro-1,10-phenanthroline and 4,7-disulfonato-1,10-phenanthroline have been synthesized and characterized. In addition, rhenium(I) tricarbonyl complexes with 4,7-dichloro-1,10-phenanthroline, 4-methyl-1,10-phenanthroline, 4,7-dimethyl-1,10-phenanthroline, and 4,7-disulfonato-1,10-phenanthroline ligands have been synthesized and characterized using ¹H NMR and IR spectroscopy.

Faculty Sponsor: Kerry Breno

SC121 A Deformed Granitic Pluton in the Southern Priest River Complex, Spokane Valley, Washington

Cordell R Bean

The study area is located near the Dishman Hills Natural Area in Spokane Valley, WA. This small pluton is composed of a foliated equigranular granite; surface exposures are approximately 0.5 mi by 0.1 mi. The rock's dominant mineral assemblage includes; plagioclase, orthoclase, quartz, biotite, with accessory sphene, apatite, zircon, monazite, and opaque minerals. The foliation averages 172°E at 40°E SW. The pluton exhibits oblong schlieren, which are thin (< 3 cm), biotite-rich, tabular accumulations (10 cm to 2 m in length) that occur within the foliation. Outcrops exhibit two distinct sets of lineation's. The first set is defined by elongated schlieren and have an average plunge and azimuth of 31°E at 252°E. The second set of lineations is defined by rod-like quartz bands that have an average plunge and azimuth of 65°E at 256°E. The steeper quartz lineation's crosscut the biotite lineation's. Thin sections reveal fine grain quartz, with lobate grain boundaries, suggesting variable degrees of recrystallization. Major element oxide plots indicate that the pluton is a calc-alkaline granite. Based on the geochemistry, this pluton compares favorably to the Rathdrum Mountain Granite (47 Ma), approximately 10 miles NE, and to granitic dikes found at Tubbs Hill (50 Ma) in Coeur d'Alene, ID (24 miles E). From this study, the pluton correlates with the Eocene-aged Rathdrum Mountain Granite, which intruded during development of the core complex. The pluton exhibits two sets of lineation; early deformation is defined by lineated biotite schlieren, and late deformation is defined by cross-cutting, quartz-rich lineations.

Faculty Sponsor: Andrew M. Buddington

SC122 The Effects of Direct Instruction Flashcards on Sight Words with an Eighth Grade Female with Autism in a Self-Contained Special Education Classroom

Tia Beck

The purpose of this study was to determine the effects of a Direct Instruction (DI) Flashcard program on a five-year-old student to increase sight word identification in a home setting. The dependent variables were correctly and incorrectly read sight words. A sight word was defined as correct when the participant said the word on the flashcard within four seconds after being shown a flashcard during a one-minute timing. An incorrect was defined as the participant saying the correct word after four seconds of being shown the flashcard, saying the wrong word, or not responding during the one-minute timing. The researcher used event recording within a changing criterion design to measure correctly read words. For intervention, the researcher made a deck of word flashcards using three target and 12 mastered words from the 2nd grade Dolch Sight Word List. Each word was individually shown to the participant for four seconds. For each correctly read word, that card was placed in the back of the deck. For each incorrectly read word, that word was corrected with the a model, test, retest correction procedure. Then that card was placed about 2-3 cards back in the deck and reviewed two correct times. The results showed that the participant successfully learned all 12 sight words.

Faculty Sponsor: Jennifer Neyman

SC123 The Effectiveness of Direct Instruction Mathematics Procedure on Teaching Numeral Identification to Two Preschool Children with Autism in a Special Education Preschool

Yanell Magna

The purpose of this study was to evaluate the effects of a Direct Instruction Mathematics teaching strategy to teach numeral identification on the number sense skills of two participants in a self-contained special education preschool classroom. One participant was a three-year-old male with autism who could identify numerals 1-8. The other participant was a five-year-old female with autism who could identify numerals 1-11. The dependent variable was correctly identified numerals. Target numerals were chosen based on each participant's needs. Event recording within a changing criterion assessed each participant's results separately. From Direct Instruction Mathematics (Stein, Kinder, Rolf, Silbert, & Carmine, 2018), the introduction of new numerals format was used as the independent variable. At the beginning of each intervention session, the researcher would use a Model-Lead-Test format to teach the correct identification of the target numerals as the numeral introduction step. The researcher followed the numeral introduction step with discrimination practice in which the researcher asked the participant to identify the new numeral and previously introduced numerals. The presentation of the numeral flashcards followed an alternating pattern: a new numeral, one previously mastered numeral, a new numeral, two previously mastered numerals, a new numeral, three previously mastered numerals, and so on. During the discrimination practice, the researcher would show the participant the numeral on the flashcard and ask him or her to identify the numeral. If correct, praise was provided. If incorrect, Model-Lead-Test was implemented. Both participants reached mastery across their nine target numerals.

Faculty Sponsor: Jennifer Neyman

SC124 The Effectiveness of Alternating Patterns and Errorless Learning on Identifying Shapes for a Preschool Student with Anomia in an Integrated Preschool

Jordyn McKenna

The purpose of the study was to evaluate the effects of Alternating Patterns and Errorless Learning on identifying by naming ten shapes of one preschool aged girl with special needs in an integrated preschool program. The participant in the study had multiple health impairments affecting her ability to recall and name everyday objects. Anomia affected the participant's memory and maintenance of skill identification. The dependent variable in the study was the correct number of shapes verbally named. The study used event recording within a changing criterion design to assess the effectiveness of the Alternating Patterns and Errorless Learning intervention. Alternating Patterns was used to introduce new shapes, and Errorless Learning was used as the correction procedure during intervention. Shapes were presented with a combination of the new target shape and previously mastered shapes in a counterbalanced fashion to build mastery of the new shape and discrimination across new and mastered shapes. If the participant did not immediately say the correct shape, Errorless Learning was implemented to model the response and the participant then said the response. This correction was used due to the participant having Anomia. The results showed improvements in the participants ability to identify by verbally naming most shapes, but she did not reach the complete target skill of naming all ten shapes. Because the results showed improvements in most shapes, but not all shapes, the study was mostly successful.

Faculty Sponsor: Jennifer Neyman

SC125 The Interaction of Social Media and Music

Brooke Wagner

Social media is a very prevalent entity in modern society, so there is importance in learning how it impacts various aspects of our lives. This study discusses the interaction between social media and music, and how social media can help boost the prevalence of music in our society, while making it more accessible to fans. A survey is conducted that explores this relationship among 37 respondents from the Pacific Northwest. The questions involve the interactions people experience on social media, as well as how people discover new music and if social media impacts that. This study leads to believe that the interaction between artist and fan is enhanced by social media, and that the connection between the two has a positive effect. In addition, it shows that young people enjoy connecting with music on social media, showing that this relationship needs to be explored to deeper levels.

Faculty Sponsor: Peter Hamlin

Oral Presentations, Session 2 **Saturday, April 27th, 9:00 AM – 10:00 AM**

O2A-1 Visual Influences on Cognitive States

Molly Betebenner, Samantha Ollmann

Body dissatisfaction is a growing aspect of contemporary American culture. Media intake is shown to be connected with women's generalized dissatisfaction with their bodies (Grabe et al, 2008). Furthermore, individuals who compare themselves to models shown in the media are more susceptible to impacts on body self-esteem and an increased drive to be thin (Sheldon, 2010). In this study, 49 undergraduates were sampled to see if viewing photographs of idealized body images affected individual body self-esteem. We hypothesized that photographs of "idealized" body types will negatively impact body self-esteem. Our results indicated that body self-esteem scores were not lowered after the viewing of idealized body types. In addition, body self-esteem scores were also not lowered after the viewing of average body types. The findings contradict current literature on the topic and provide an avenue for further investigation.

Faculty Sponsor: Gary Thorne

O2A-2 Shots and Shots: Managing Type 1 Diabetes as a College Student

Jennifer Duschik

This research study, Shots and Shots: Managing Type 1 Diabetes as a College Student, will be focused on researching the day to day lifestyles of college students that have been diagnosed with Type 1 Diabetes. This research will be conducted through the use of face to face interviews

with college students that are willing to volunteer their time, as well as their own personal stories of being diagnosed with Type 1 Diabetes and how that diagnosis has impacted their lives in college. These research interviews will begin by asking the participant for any necessary background information. These initial background information questions will focus on when the participant was first diagnosed with Type 1 Diabetes as well as how their diagnosis immediately impacted their lives. Following the collection of this initial background information, participants will be asked about their day to day college lives in relation to their Type 1 Diabetes. These questions will be focused on how Type 1 Diabetes has impacted their college experience both in the classroom as well as in their social lives. The overall goal of this research is to create a better understanding of how the diagnosis of Type 1 Diabetes impacts an individual's college experience on both an educational and a social level

Faculty Sponsor: Michael DeLand

O2B-1 The Effects of $\delta^{\square}\frac{1}{2}$ -Caryophyllene Based on the Porsolt Swim Test in Sprague-Dawley Rats

Michael Durka, Debora Calderon, Dasha Davis, Jameson Johnson

An ongoing concern both globally and locally is the lack of antidepressant medications available to benefit the patient while also bypassing the various negative side effects. One compound currently being examined with the intent of becoming a non-addictive yet effective medication is beta-caryophyllene (BCP), a type of terpene. With this purpose in mind, 12 male, SwHi Sprague-Dawley rats were exposed to chronic variable stress (CVS). The rats received identical stressors for 18 days, and then began receiving either avocado oil (control group) or 200 mg/kg BCP (experimental group). They were then tested on the Porsolt Swim Test (PST) for effects of BCP on depression-related behaviors. While there was a significant decrease in struggling and floating from the pre-treatment tests to the post-treatment tests, little difference between the groups was observed.

Faculty Sponsor: Michael Sardinia

O2B-2 Investigating Tick Hybrids and their Role as Disease Vectors in Spokane, WA

Rachael Gowen

Ticks are known vectors of pathogens that cause diseases in humans, such as Lyme disease, Rocky Mountain spotted fever, and Colorado tick fever. Vector competence for specific pathogens varies among different tick species. In and around Spokane, two tick species commonly found are *Dermacentor andersoni* (Rocky Mountain wood tick) and *Dermacentor variabilis* (American dog tick). *D. andersoni* can transmit *Rickettsia rickettsii*, the bacteria that cause Rocky Mountain spotted fever and Colorado tick fever. *D. variabilis* can transmit *Francisella tularensis*, the bacteria that cause tularemia. In Eastern Washington, the geographic ranges of these two tick species overlap and there is evidence that hybridization has occurred. While some visual cues can be used to putatively identify these hybrid ticks, identification can be difficult as there is a range of phenotypes such as spiracular plate shape and goblet count. It is unknown which of these bacterial pathogens can be transmitted to humans by *D. andersoni* x *variabilis* hybrid ticks. The goal of the current study is to design a genetic assay, which can be used to discriminate *D. andersoni* x *variabilis* tick hybrids genetically. Thus far, a total of 45 ticks have been collected from Deep Creek Preserve and additional sites around Spokane. Ticks were visually identified and DNA was extracted prior to PCR amplification. To determine a suitable marker, several genes are being targeted with PCR and sequencing. Designing a useful genetic tool for identification of *Dermacentor* ticks will be an important addition to genetic based pathogen screening tools. Surveillance with these tools will aid in understanding the role of *D. andersoni* x *variabilis* tick hybrids in pathogen transmission in this region.

Faculty Sponsor: Christy Andrade

O2B-3 Thermal Degradation and Maillard Reaction Products of Sucralose

Nicholas Magarelli

Sucralose is an artificial sweetener used in many processed foods consumed today and is hundreds of times sweeter than sucrose. Sucralose is a sucrose derivative that has been altered by the exchange of three hydroxyl groups with three chlorine atoms. It is possible that thermal degradation or reactions found in baking with amino acids may produce products that have not yet been studied for safety. Sucralose was subjected to a boiling water bath and headspace sample was collected to be analyzed in a GC-MS to view possible fragmentation products. Three sweeteners were subjected to a Maillard Reaction. Solutions of glucose, sucrose, and sucralose (50mM) were reacted with glycine and lysine (50mM) in a sodium bicarbonate buffer (0.02M, pH = 9.52) and heated in a hot water bath. The reaction solutions were analyzed by UV-visible spectroscopy (800nm to 250nm) to identify any conjugated products which may have formed.

Faculty Sponsor: Trisha Russell

O2C-1 Sean Scully's Landline paintings: Renditions of Beauty

Grace Trumbo

Sean Scully is an Irish-American artist known for his development of the stripe motif in paintings. His most recent series, "Landline", a collection comprised mostly of oil on aluminum and copper works was completed for multiple exhibitions in 2018. These abstract works depict wide horizontal stripes of color, which deviate from Scully's past work by eliminating vertical stripes from the compositions. While previous publications are helpful for understanding Scully's philosophy from the 1960s to 1990s, these writings do not provide an extended analysis of the Landline series as it relates to Scully's perspective of his work today. This paper argues that Landline, as a development of Scully's previous style, embraces his internal struggle to express both the universal human experience and the subjective sense of beauty through a new implementation of the stripe. By examining Scully's personal writings and interviews with curators and art critics, I will show how Scully's use of abstraction can simultaneously convey human tragedy and perseverance. In comparing Scully's words to the formal elements of his paintings, I will explain Landline as a case study for artwork that might retain a relationship with artistic traditions while intentionally defying traditional expectations of art.

Faculty Sponsor: Meredith Shimizu

O2C-2 Morphing Murals: An Analysis on Northern Ireland's Murals of Memorization

Jonathan Hammerstrom

For over a century, people in Northern Ireland have painted on walls to celebrate specific ideas and events or to protest against the existing political government. As a result of the thirty-year civil conflict known as the "Troubles" between pro-Irish Nationalists and pro-British Loyalists, mural making developed into a significant tool for political dialogue. Murals became identification symbols for divided communities and a means of expression for politically marginalized voices. Both sides took advantage of the public and monumental characteristics of murals to justify their own cause and denounce the actions of the other. In this environment, murals in Northern Ireland developed into international icons for the Troubles. Both in scholarship and contemporary life, however, Northern Irish murals are frequently viewed as passive artifacts simply telling a story of the past, but this assumption does not acknowledge the dynamic nature of murals. Instead, in this paper, I will argue that the murals in Belfast maintain an active relationship with their locations due to their evolving and devolving abilities. Therefore, murals memorializing the dead function as active sites that are not merely stagnate symbols of communal identity and remembrance, but also offer a continual voice in the Northern Irish conversation on sectarian violence and reconciliation. I will provide a case study of a Nationalist mural in Belfast, NI, to examine this idea and consider how it connects to the larger culture of Northern Irish mural making

Faculty Sponsor: Meredith Shimizu

O2C-3 Appropriation and Power: Restoration of Gitksan Totem Poles in 1920's British Columbia

Julia Coons

This paper is in conjunction with the special section "Art and Ideas;" The 1920's were a defining decade for the First Nations people of Canada. Land claim issues, potlatch bans, and assimilation policies were central to First Nation and Canadian national government relations throughout the decade. It is within this context that the Canadian national government, in conjunction with the National Museum of Canada and the Canadian National Railway, endeavored on a restoration project of First Nation Gitksan totem poles. The Canadian National Railway Project (1924-1930) was ultimately a failure, but the mediated cultural exchange did have a lasting impact on the way Gitksan totem poles can be understood. In this paper I will argue that the project functioned to alter the original meaning of the Gitksan totem poles by reimagining them: as touristic objects, as emblems of a dying race, and as tools to undermine Gitksan power and underscore Canadian national policy. This postcolonial study will consider how cultural exchanges can have lasting impacts on how objects are understood.

Faculty Sponsor: Meredith Shimizu

O2D-1 How Does Perceived Social Support Affect Stress in Highly Neurotic Individuals

Colleen Donahue, Simeon Menso

We examined the relationship between stress and perceived social support amongst self-scored highly neurotic individuals. Participants filled out three questionnaires to measure neuroticism (TIPI), depression (Burns Depression Checklist), and perceived social support (MSPSS) during low and high stress times of the semester. We used a median split divide participants in to low and high neuroticism groups before running a correlation analysis to determine any relationship between personality types and perceived social support and stress conditions. On average highly neurotic individuals reported decreased perceived social support as stress increased. Overall, the highly neurotic group demonstrated stress levels that were notably higher than the low neurotic group regardless of testing time

Faculty Sponsor: Gary Thorne

O2D-2 Perceived Parental Control on Reckless Alcohol Use in College Students

Caitlin Bernert, Jessica Wilbur

We wanted to see if there was a relationship between excessive alcohol use and perceived parental control. We gave each participant two questionnaires to collect information about their relationship with their parents and their college alcohol habits. We found that more alcohol use is related to higher perceived parental control.

Faculty Sponsor: Gary Thorne

O2E-1 Pencils Down: Work-Based Learning and the Tradeoff Between Education and Experience

Kathryn Benson

With recent, bipartisan emphasis on apprenticeships and vocational programs, what role do these types of work-based learning programs have on helping youth find jobs? Are they as effective as we are lead to believe? Can traditional education be compared to these types of programs? What really is the trade-off between education and experience? In this analysis, I have a panel data set from 154 countries spanning 47 years to assess the relationship between youth unemployment and the percentage of secondary students participating in vocational programs. I find that no relationship can be made. Even after controlling for measures of economic freedom, women's social rights, government expenditure on education, literacy rate, and population demographics, I still find no relationship between the two variables. It is likely that this is due to the unique education and labor structures of various geographic regions, and thus, an assessment of our individual culture and educational infrastructure is necessary for making a more comprehensive claim.

Faculty Sponsor: Maria Tackett

O2E-2 Klein Links and Fun Stuff

Russell Ford, Tyler Gonzalez, David Rudolph

A knot is a closed curve in three dimensions and a link is a set of potentially interlocking mathematical knots. Klein links form a group of links which may be embedded across the surface of a Klein bottle. That is, a Klein link is a link which may be drawn across the surface of a Klein bottle without intersection. This particular group of links has not yet been well studied by the mathematical community. Initially, our interest in these links stemmed from the relation between Klein knots and torus knots. It is a fairly well-known fact that all Klein knots are torus knots, but our research has shown that not all Klein Links are Torus links. This presentation will provide a brief discussion of the major results of our continued research on Klein links. We will consider link invariants and other aspects of knots to show how our research findings are coming together. *Faculty Sponsor: Kate Kearney*

O2F-1 International Law and the Kohinoor

Finn Carlson

In 1949, Great Britain received the Kohinoor diamond from India following the two Anglo-Sikh Wars. This original research asks whether Great Britain was within their rights taking the Kohinoor from India through the Treaty of Lahore, if India should make a legal push for the return of the diamond, or if the diamond should be returned elsewhere. I examine the process and history by which Great Britain came to own the diamond and where the diamond came from. The legal ownership of the diamond is still in dispute to this day.

Faculty Sponsor: Julia Stronks

O2F-2 Lost to History: The Scientific Career of Laura Bassi

Julia Haley

This paper will explore the scientific career of Laura Bassi (1711 - 1778) and the influence she had on the development of Newtonian physics in Italy, and how she was able to achieve success and create a career in the sciences. As a young woman, Bassi earned a Doctor of Philosophy degree for her study of physics, and earned the highest salary given at the University of Bologna while serving as a professor at a time when very few women were educated. However, Laura Bassi has been neglected by most scholars from the historical study of science in early modern Europe. Despite her talent for physics and mathematics, Bassi had to fight to attain her position at the university and inclusion in her scientific field, and in the centuries since her death, few have done extensive research on her because of her gender. Additionally, her accomplishments have been ignored in studies of women in science because her track was so different from most women at the time, and she pushed back against the academic structures of the time. The biography and career of Bassi will be compared to that of Newton, demonstrating why his name has become ubiquitous within western society for his scientific and mathematical contributions, while Bassi remains largely unknown. This paper will examine the role of gender in their differing legacies, and how gender influenced the degree of lasting fame and name recognition the two physicists attained

Faculty Sponsor: Dale Soden

O2F-3 South China Sea Territorial Claims and Contention Over the Spratly Islands

Gabriella MacKintosh

This original research examines the South China Sea Dispute and asks which involved country contains the most legitimate claim to the resource-rich Spratly Islands. I examine the differences in claims between the seven states involved specifically breaking down the argument between China and that of the International Community (Vietnam, Japan, Taiwan, the Philippines, Malaysia, and Brunei). China and Vietnam lay claim to the islands based on a long-standing historical perspective that they'd always been under their sovereignty. On the other hand, countries such as Malaysia and Brunei rest their claims on current economic regulation and maritime law such as UNCLOS and the Exclusive Economic Zone which provide that countries possess rights over the sea based on distance from its physical border. Further complicating this issue is the common assumption that the disputed islands are considered Terra nullius, or unowned land throughout all history. This research seeks to provide an answer to the question as to which law at hand historical rights and sovereignty acquired from discovery or current legal regulations should rule within this case.

Faculty Sponsor: Julia Stronks

Oral Presentations, Session 3 Saturday, April 27th, 10:00 AM – 11:00 AM

O3A-1 Racial identity, college embeddedness, and psychological well-being of college students

Filmon Abraham

For many students, college can evoke heightened feelings of stress, anxiety, and loneliness. Because of the challenges faced within college life, students may be at a higher risk of depression and lower well-being particularly ethnic minority students. Much research has examined the impact of general college stress on depression among ethnic-minority students, showing that perceived discrimination is associated with increased risk for psychological distress, suicidal ideation, anxiety, and clinical depression (Goto & Hwang, 2009). Still, little is known about the effects of perceived racial discrimination, perceived community embeddedness, and perceived organizational support on minority student's health and well-being. Drawing from occupational health and social psychological research and theory, the current study explores how perceptions of community support and perceived discrimination impact well-being, as well as intentions to leave the university. A sample of N = 130 undergraduates completed an online survey assessing perceptions of support, perceived academic performance, perceived discrimination, depression, loneliness, and subjective well-being. Preliminary results indicated that students who identified as an ethnic minority reported greater perceived discrimination at work and school, lower belongingness/embeddedness in the university community, and subsequently reported greater depression, relative to non-minority students. Further, ethnic minority students were more likely to report intentions of leaving the university community. Results contribute to the understanding of the disadvantaged experiences of ethnic-minority students in college and potentially offer ways to provide necessary support.

Faculty Sponsor: Sarah Arpin

O3A-2 The Moral Obligation to Preserve Neurodiversity

Nicholas Peters

One of the most popular areas of dispute today is that vaccines cause autism. Even though the current conversation is centered around the evidence behind this causal relationship, what is forgotten is why this correlation is being made. Whether vaccines cause autism or not is important to figure out, but the sentiment laying under such convictions is where the "vaccines cause autism" argument becomes a problem. It is putting forward the idea that autism is less desirable than polio and other diseases that genuinely harm the health and safety of society. It is asserting that autism is not only dangerous to society but that anyone with it (or anyone diagnosed with some other neurological difference) must be avoided at any and all costs. This presentation makes the case against such ideological sentiment by proposing a new way of looking at neurological differences (like autism) as a whole: The Neurodiversity Paradigm. Through academic works that speak to the multi-faceted

nature of this issue, this presentation will explore the questions that must be asked about this anti-autism sentiment. What makes autism a problem? Is it possible that the real problem is the structures of society that do not integrate those with neurological differences? Can we really say that autism and other neurological differences are “problems”? With these questions and others in mind, the “vaccines cause autism” narrative can be dissected and understood for what it actually is: a call against the neurologically different; a narrative that must be addressed and resoundingly negated.

Faculty Sponsor: Gary Thorne

O3A-3 Retelling History, Transforming Tradition: Women of Color Artists and the Western Artistic Tradition

Giulianna Pendleton

Instead of conforming to Western, European ideals of great art, women of color artists are retelling their own stories and bringing matters of race to the forefront of the contemporary art scene. For instance, the painter Harmonia Rosales reimagines art masterpieces with black women as the subjects, instead of white subjects. Akunyili Crosby explores in her art post-colonial spaces, immigrant spaces, and spaces of the home in order to tell multiple stories and incorporate race and culture into her work. Rosales and Akunyili Crosby reclaim the power of their voices by counteracting traditional Western art with their own representations of Black women in time, as well as incorporating real spaces. This presentation will address the work of these two artists, plus that of, Mickalene Thomas and Kara Walker. Focusing on these four women and drawing on theories of the White Gaze and the Male Gaze and borderland theory, I will discuss how contemporary women of color artists are reshaping the ideals of traditional, Western art by bringing in more inclusive, dynamic stories of Black women throughout history.

Faculty Sponsor: Shalon Parker

O3B-1 Should the Violence Against Women Act be Reauthorized by the Federal Government?

Katlin Elizabeth Bowers

This original research asks whether the Violence Against Women Act (VAWA) should be reauthorized by the federal government. There has been a legal issue of territorial prosecutable rights when non-natives assault Natives on tribal lands. Natives cannot prosecute in their own courts, and outside jurisdictions fail to adequately prosecute or impose deterrent penalties. This disproportionately impacts Native women and makes them targets. The VAWA specifically addresses this issue and provides tribes the ability to exercise special domestic violence criminal jurisdiction over the non-native defendants. However, there are controversies surrounding the Act and the legal power it grants tribal courts. This conflict leads to the question, whether the VAWA should be re-authorized by the federal government? In order to answer this inquiry, I first examine the historical context as it applies to Native American and Native Alaskan women. Second, I analyze the history of the VAWA as it impacts the Native population and its current implementation status. Fourth, I describe the arguments against and for the re-authorization of the VAWA. Finally, I examine if these arguments possess validity and if there are options to achieve justice other than this particular Act.

Faculty Sponsor: Julia Stronks

O3B-2 “Reverse Missionaries” in the American Mission Field: A Case Study for Neo-Colonialism’s Impact on Global Christianity

Daniel Roberts

This paper examines the growing trend of Global South Christian missionaries evangelizing in the United States. Since the 1990s, Christian literary journals have emphasized a change in the global Christian paradigm: The United States is becoming a mission-field due to increased secularization, while Christianity is continuing to flourish in the Global South. While these American authors meant to see the increase of domestic missions, Christians from the Global South have been sending their own missionaries to western countries like the United States, making the United States the largest recipient of missionaries in the world. Missiologists have termed these non-western Christians “Reverse Missionaries,” referring to the implication that these missionary-sending countries were originally evangelized to by Westerners. This paper will focus on two models of Reverse Missionary activity, that of the South Korean organization University Bible Fellowship, which has aimed since the 1970s to impact American and global culture through mentoring white American college students, and that of the Nigerian Redeemed Christian Church of God, whose radically ambitious approach has been on planting stable church communities throughout the world. Both these models show the difficulty of evangelizing to a dominant culture and hallmark how neo-colonialism continues to impact Global-North/Global-South interactions.

Faculty Sponsor: Gerald Sittser

O3B-3 Understanding Friendships in France through a Sociological Lens

Karisa Westom

This presentation applies sociological theories to several elements of French culture, particularly the concept of friendship (in French *amitié*). Georg Simmel, a social interactionist, provides concepts of distance and access, while Pierre Bourdieu, influential in sociological understandings of stratification and inequality, provides the concept of social capital. The tools for examining the various cultural differences is provided by David Livermore and his book *Expanding Your Borders Discover 10 Cultural Clusters*. These tools help us understand how different cultures, American and French, have such different processes for making and maintaining friendships.

Faculty Sponsor: Bendi Benson Schrambach

O3C-1 “But I’m a Nice Guy:” Overdoing Masculinity in the Friend Zone

Eiryn Renouard

The friend zone is a colloquial term coined by Joey Tribbiani in Season 1: episode 7 of *Friends*, “The One with the Blackout.” He uses it to describe Ross’ relationship with Rachel—one in which he is hopelessly in love with her while she only thinks of him as a friend. The “friend zone” is used to describe a situation in which one person in a friendship (usually a friendship between two people of opposite genders) wants to actualize the relationship, or take the relationship from a platonic one to a romantic one. Actualization, described by Tavory in “The Structure of Flirtation” (2009), is “[a] pragmatic practice that signifies the passage from one set of roles and socially legitimate possibilities of action to another.” In the friend zone, the romantically interested party attempts to actualize their relationship with the object of their affection. In this “actualization process,” they take action to slowly move toward a moment of “collision”, in which they confess their feelings

and attempt to change the nature of their relationship from a platonic one to a romantic one. In the case of one who is “friend zoned,” this attempt is unsuccessful, and the “collision” does not result in a romantic relationship.

Faculty Sponsor: Michael DeLand

O3C-2 A Developing Customary International Law Norm of the Decriminalization of Homosexuality

Rhiana Everest

This original research asks whether there is a norm of customary international law in favor of the decriminalization of homosexuality. I conclude that custom does not currently exist, but then I show it might one day develop. In demonstrating this I consider the global problem of the criminalization of homosexuality, the issues limited case history, relevant international human rights documents, and the current state of affairs regarding the legality of homosexuality around the world.

Faculty Sponsor: Julia Stronks

O3C-3 Giving the Golden Parachute to Someone Else: The Social Precedents for the Church’s Involvement in the Me Too Movement

Camilla Canner

The purpose of this study was to reconcile a seemingly obvious oversight of the institutional church in America in regards to its treatment of survivors of sexual abuse. The basis for this study was to determine the precedents that exist in contemporary American society for the involvement of the institutional church in the social justice movement known as the Me Too movement, and to determine precisely how these precedents require action from the church on a biblical basis. The finding is that the church is responsible to get involved in three key ways due to three key social precedents. The first social precedent is that of social proof. This precedent requires that the church lend a listening ear to those who speak up. The second social precedent is that of the rhetoric spread by prominent political figures. The church has the responsibility to lament on behalf of the vulnerable given this rhetoric. The third social precedent is the inaction of prominent evangelical figures. The church, in response to this precedent, must repent of this inaction. In exploring these three precedents, this study has found reasonable evidence to support the claim that the institutional church in America must get involved in the Me Too movement. This was accomplished by establishing a biblical foundation for what should motivate the church into listening, lamenting, and repentance, before determining the social precedents that should stir the church into action.

Faculty Sponsor: Gerald Sittser

O3D-1 Insights into Language Acquisition: Child-Directed Speech, Automatic Speech Processing, and Big Data

Maxwell Sherman

Child-Directed-Speech (CDS) is the manner in which parents speak with their infants and toddlers. The human voice contains numerous different frequencies called harmonics, and the fundamental frequency, f_0 , is the lowest. The perceived pitch of a human’s voice is determined by its f_0 . One common component of CDS is that f_0 is raised. VanDam, M. & De Palma, P. (2014) and De Palma, P. & VanDam, M. (2017) demonstrated this by using soft computing techniques to extract and analyze CDS from audio corpora of just under 500 hours and over 7,000 hours respectively. Since 2017, over 12,000 hours of in situ infant and toddler speech have become available. This paper is a proof of concept, to 1) demonstrate that the same computing techniques can still extract CDS and analyze its f_0 in larger data sets; and 2) determine if the analysis of larger data sets would require revision of conclusions based on smaller data sets.

Faculty Sponsor: Paul De Palma

O3D-2 Examining Zipf’s Law in Texts and Speech

Phillip Fishburn, Alex Giacobbi, Allison Hayes, Jeb Kilfoyle

Zipf’s Law asserts an inverse relation between the rank of objects and their frequency of occurrence. In the case of words, Zipf’s Law predicts that the frequency of a word is inversely proportional to its rank. That is, the most frequent word in a language appears twice as frequently as the second most frequent word, three times as frequently as the third most frequent word, and so on. We verified Zipf’s Law using the Brown Corpus, the first million-word corpus of written English. Since speech and text messages are structurally different than writing, we sought to demonstrate a non-Zipfian distribution occurring through these means of communication. To test this hypothesis, we examined the Buckeye Corpus of conversational speech and the NUS SMS Corpus of text messages. Additional speech corpora, the Santa Barbara Corpus of Spoken American English and the Michigan Corpus of Academic Spoken English, were also analyzed. Zipfian distribution within a corpus is more prevalent when combining one, two, three, and four word sequences. We examined these word sequences both individually and combined in both corpora. Using more complete statistical analyses than what is found in previous papers on Zipf’s Law in human language, preliminary results indicate that while the Buckeye corpus did not follow a statistically significant Zipfian distribution, the text message corpus and the additional speech corpora did follow Zipfian distributions.

Faculty Sponsor: Paul De Palma

O3D-3 Taipi: a peep at the missing voice in Herman Melville’s “Typee”

Anthony Willins

Herman Melville’s 1846 publication, *Typee: A Peep at Polynesian Life*, presents an extended account of the author’s time among the “Typee” (Taipi) indigenous population of the Polynesian island Nuku Hiva. Throughout the narrative, the narrator dubbed Tommo muses extensively on the quality of the culture he is immersed in and frequently switches between Enlightenment and Romantic structures of thought. This uncertainty of paradigm constructs a tension throughout the narrative. This paper further explores this tension and the reasoning for it. This paper also examines the very validity of this tension. Through an examination of other descriptions of Polynesian culture and a close reading of the text in regard to Tommo’s understanding of the Taipi and their society I discuss how Melville “misses the mark by attempting to understand the Taipi “a non-western culture” through western paradigms. Using details from the narrative account and putting them in context with the Polynesian system of thought Tommo interacts with but fails to take into serious account, I enter into a discussion of how the thought systems of the indigenous community are incompatible with western schools of thought. This paper serves the purpose of working towards shedding light on the missing voice of the Taipi. By exploring this lost viewpoint, this paper helps to give a complete “peep” into Polynesian life and provides some sense of fulfillment to the “unvarnished truth” promised by Melville in the introduction. *Faculty Sponsor: Jeff Miller*

Poster Session D
Saturday, April 27th, 10:15 AM – 11:30 AM

SD101 Influence of Phenanthroline Substituents on Rhenium Tricarbonyl Complex Luminescence

Brenda Hagerty

Rhenium(I) tricarbonyl phenanthroline complexes fluoresce in the visible range, and as such, present a distinct usefulness for bioimaging and electronics. The luminescence of rhenium(I) tricarbonyl phenanthroline complexes are sensitive to substituents on the phenanthroline and the sixth ligand. In this research the photophysical properties of fac-tricarbonylchlorido(4-methyl-1,10-phenanthroline) rhenium(I) (1) and fac-tricarbonylchlorido(4,7-disulfato-1,10-phenanthroline) rhenium(I) (3) complexes were studied. UV-visible spectroscopy and emission spectra (ex. 350) at concentrations between 0.7 mM and 0.05 mM were obtained. 1: UV λ_{max} , nm (λ_{μ}): 363. Fluorescence λ_{max} , nm (λ_{μ}): 571 2: UV λ_{max} , nm (λ_{μ}): 351. Fluorescence λ_{max} , nm (λ_{μ}): 555. 3: UV λ_{max} , nm (λ_{μ}): 357. Fluorescence λ_{max} , nm (λ_{μ}): 591. The calculated quantum yield and maximum emission wavelength were compared to related rhenium tricarbonyl complexes. Research of the fluorescence of fac-tricarbonylchlorido(4,7-dimethyl-1,10-phenanthroline) rhenium(I) (2) was also begun. In addition, emission spectra were obtained of 3 under acidic and basic conditions. The emission wavelength and intensity of fluorescence was pH dependent with acidic conditions increasing fluorescence and red shifting the spectra from a λ_{max} of 533 nm to 591 nm.

Faculty Sponsor: Kerry Breno

SD102 Upsetting the cart of known amino acid quasiracemic crystalline phases

Katriel Sahlstrom

Amino acids readily form quasiracemic crystal structures that exhibit near centrosymmetric alignment of the components. These systems - generated from pairs of chemically unique amino acids of opposite handedness - provide important opportunities to understand how large structural differences between the quasisymmetric components effect the self-assembly process. The systems D-Val/L-Phe and D-Val/L-Met offer important examples where the difference in the volume of the attached R-groups is greater than 30 Å³. These previous results are extensive and seem to suggest that quasiracemate formation occurs regardless of the apparent spatial properties of the side chain. While several examples of amino acids assembled with cofomers exist in the literature, no systematic investigation has examined the structural impact of tailor-made additives on a wide variety of amino acids. This investigation examines the role of oxalic acid on the crystallization landscape of amino acid quasiracemates. Crystallographic assessment of these systems shows the oxalic acid components form molecular chains using O-H...O contacts. These 1-D motifs in turn provide a robust scaffold for linking neighboring amino acids. The structural alignment of these assemblies arise from a complex blend of charge-assisted non-bonded contacts. This ionic framework generates significant crystal stabilization that can accommodate larger structural variations of amino acids than previously reported. The assessment of crystal structures, lattice energy calculations, and spectroscopic data offers important insight to the structural preferences of these materials.

Faculty Sponsor: Kraig Wheeler

SD103 Effects of Hydrogen Embrittlement on 6242 Titanium Alloy

Brennan Watkins

Exposure to gaseous hydrogen can produce deleterious effects on the tensile properties of some metals. Loss of ductility and deviations from typical strain-hardening are among these effects. To investigate the effects of hydrogen exposure on titanium 6242 alloy, several test strips were exposed to hydrogen gas in a controlled environment; this allowed the hydrogen to diffuse into the crystal structure of the metal. Some test strips were also heat treated to above the beta transus temperature of the alloy to observe the differences between raw, hydrogen-exposed, and heat treated specimens. Some of the failed test strips were also examined under a microscope to directly observe any changes in the crystal structure of the metal resulting from hydrogen exposure or heat-induced phase changes. A constant strain rate was used to induce tensile failure in order to generate consistent data with a relatively small number of test specimens.

Faculty Sponsor: Patrick Ferro

SD104 Pheromone and mucous glands in *Ensatina eschscholtzii* salamanders

Cecilia Black

The salamander *Ensatina eschscholtzii* exhibits the characteristic lengthy courtship ritual of plethodontids. Species of this family use pheromones produced in the mental (chin) gland of the male to increase female receptivity to courtship, as well as speed up the ritual. Even though *Ensatina* lack this gland, their courtship ritual is not notably different from other species in the family. This suggests that other glands could be responsible for producing courtship pheromones. One significant morphological feature of *Ensatina* is that during courtship, the male salamander exhibits a hypertrophied anterior lip with an unknown secretory product. Recent studies show that female plethodontid salamanders have glands that are morphologically similar to pheromone producing glands, but it is unknown if female or male *Ensatina* have pheromone producing glands for courtship. To determine if *Ensatina eschscholtzii* has pheromone-producing glands in the lip and chin region, male and female tissue was dissected, embedded in paraffin, sectioned, mounted on microscope slides, and histochemical stained. I compared the frequency and size of courtship-like glands as well as mucous glands in female and male specimens. Preliminary results suggest that medially located granular glands of the chin are statistically larger than their lateral counterparts. Both males and females have glands that stain similarly to the pheromone-producing mental gland, supporting our hypothesis that *Ensatina* has other pheromone producing glands in the snout region. Even though it has been reported that *Ensatina* lack traditional mucous glands, traditional mucous glands appear concentrated in the lateral gular region of both female and male specimens.

Faculty Sponsor: Nancy Staub

SD105 Recreating and Improving a Deep Learning Neural Network for Protein Design

Alyssa La Fleur

The Inverse Protein Folding Problem is the determination of an amino acid sequence which folds into a given tertiary structure. If it could be solved, computational protein design programs could be improved. Recently, Deep Learning Neural Networks have been applied to the Inverse Folding Problem. The most accurate of these Neural Networks was replicated in this study with modifications for non-supercomputer training, and accuracy was significantly improved with network and feature engineering. Structure input only and structure plus sequence input network variations were created, reaching 40.9% and 44.1% five-fold cross validation accuracy, respectively.

Faculty Sponsor: Kent Jones

SD106 The Effects of Reading Racetrack on Sight Word Recognition with an Eleven-Year-Old Girl with Specific Learning Disabilities in an Elementary Resource Room

Lauren Wilkin

The purpose of this study was to evaluate the effectiveness of Reading Racetracks on the number of correctly read kindergarten-grade sight words. The participant was an eleven-year-old girl with specific learning disabilities in a resource room. Two dependent variables were assessed. The first was correctly read sight words from flashcards during one-minute across baseline and intervention. The second was words read per 90-second timing on the racetrack during intervention. The effects of the Reading Racetrack intervention were evaluated using event recording within a changing criterion design. The independent variable consisted of a Reading Racetrack teaching procedure. First, the researcher introduced the five target words using Model-Test. Each racetrack had 28 squares. 21 of the squares contained mastered words, which were words read correctly during the preassessment. Eight of the squares contained target words. During the first racetrack read, the participant read the words starting at the start line without being timed. Appropriate feedback was given based on each word's response. During the second racetrack read, the participant read all the words around the racetrack without feedback during 90-second timing. After the timing, a correction procedure was given for incorrectly read words. Positive reinforcement was implemented for participation and correct responses. The participant increased her average number of correct responses and increased her overall fluency with sight words. This study found that Reading Racetrack was a practical, inexpensive and efficient way to increase fluency with sight word recognition.

Faculty Sponsor: Jennifer Neyman

SD107 The Effect of Reading Racetracks and a Model, Lead, Test Procedure on Sight Word Reading of a 13-year-old Female with an Intellectual Disability in a Self-Contained Classroom

Anna Yeung

This study evaluated the effectiveness of reading racetracks and model, lead, test on the sight word reading at the second-grade level of a 13-year-old girl with an intellectual disability in a self-contained middle school classroom. The participant was a 13-year-old girl with an intellectual disability receiving special education services. The target behavior was the total number of sight words read. Event recording within a changing criterion design was used to evaluate the effects of the intervention. Each intervention session started with an entry slip asking the participant to answer three questions about her skill and establishing a daily goal. Next, the researcher began the model, lead, test teaching procedure for the five target words. Then, the adapted reading racetrack was implemented. A cheer pyramid with 10 cheerleading figures with blank cells was used instead of a racetrack. Five mastered words and five target words were randomly written in each of the cells. The first pyramid round was untimed to allow Shannon to become familiar with the layout of the board and the words for that session. If a word was incorrect, a model, lead, test was implemented. Then the researcher told Shannon she would be timed, and she was instructed to read all the words. The participant completed timed reads at least two times and tried to beat her previous timings. The results for the participant indicated that reading racetracks along with a model, lead, test procedure was quite effective in increasing oral reading of sight words.

Faculty Sponsor: Jennifer Neyman

SD108 The Use of a Direct Instruction Flashcard System on an Eight-Year-Old Student to Increase Multiplication Facts in a Home Setting

Julia Camara

The purpose of this study was to determine the effects of a Direct Instruction (DI) Flashcard program on an eight-year-old girl to increase basic multiplication fact identification in a home setting. The researcher used event recording within a changing criterion design to measure correctly identified multiplication facts. For intervention, the participant was shown a deck of multiplication fact flashcards. For each correctly said fact answer, that card was placed in the back of the deck. For each incorrectly said fact answer, that fact with the answer was corrected with the researcher guiding the participant through a model, test, retest correction procedure. Then that card was placed two-three cards back in the deck and reviewed multiple times. The results showed that the participant successfully learned all 20 of the targeted multiplication facts across four criterion levels. The DI Flashcard procedure was easy to implement and was very cost effective for an in-home intervention to teach multiplication fact identification.

Faculty Sponsor: Jennifer Neyman

SD109 Comparison of horizon edges in landscape photographs identified through manual tracing vs. image segmentation algorithms

Colby Richards

Horizons are ubiquitous features in landscape imagery and have been determined to be a major factor in what constitutes our subjective aesthetic preferences (Hagerhall, Purcell, & Taylor, 2004). But currently available edge extraction techniques fail to retain the complexity of features such as horizons. One parameter that describes complexity is the fractal dimension (D_f), which describes the rate at which fine structure is introduced at smaller scales of measurement (Mandelbrot, 1983). Unfortunately, while automated techniques are effective for extracting edges in computer-generated fractals (Bies et al., 2016), landscapes horizons and object edges have proven difficult to extract with a high degree of accuracy using automated software. As such, outlining the horizon by hand is the only acceptable technique we currently possess. To address this problem, we tested widely available edge extraction algorithms in MATLAB against hand-drawn horizon lines. We compared the edges quantitatively by computing D_f using the box-counting technique, whereby increasingly finer meshes are applied to determine the rate at which the length of the horizon edge increases as the scale decreases. This allowed us to determine the extent to which

the automated and hand-drawn edges Dfs correspond. We also compared the automated and hand-drawn edges qualitatively, by observing where they overlap and where they differ. Our results will contribute to the development of automated and semi-automated edge drawing algorithms that better approximate hand-drawn edges.

Faculty Sponsor: Alexander J Bies

SD110 Unwelcome usurpers: the effect of invasive brook stickleback on predator-predator and predator-prey interactions in wetland communities

Allie Erickson

As one of the most sensitive groups to environmental change amphibians have the potential to act as indicators for ecosystem health. In temporal wetlands, long-toed salamander larvae (*Ambystoma macrodactylum*) are exposed to multiple environmental stressors, including invasion and, as a result of climate change, reduced hydroperiod. To predict future shifts in community dynamics and structure, it is important to explore synergistic effects between such factors. Decreasing hydroperiod will shrink aquatic foraging areas within temporal wetland communities, increasing interactions between species. As mesopredators that typically inhabit fishless ponds, salamander larvae may be negatively affected by the presence of invasive brook stickleback (*Culaea inconstans*), a species of predatory fish with high potential for intraguild predation. In order to estimate stickleback impact on these native salamanders and the greater wetland community, predator-prey and predator-predator dynamics were experimentally explored through a series of ex situ feeding trials. In the lab, collected individual salamander larvae and stickleback were allowed to feed on selected macroinvertebrate prey items for an allotted time period. Data from these trials were used to determine consumption rate and prey preference of the two predators. Stickleback fed at significantly higher rates than salamanders and generalized among available prey, while salamanders tended to focus on one prey species (phantom midge). The findings indicate co-occurrence of salamander larvae and sticklebacks could result in reduced salamander fitness due to interspecific competition for prey. Furthermore, constricted spatial availability as a result of reduced hydroperiod may increase competitive interaction between these species, altering wetland community dynamics.

Faculty Sponsor: Betsy Bancroft

SD111 Weapon Performance of Rhinoceros Beetles

Dylan Scanes

Sexually selected weapons are found across a broad taxonomic range of organisms. *Trypoxylus dichotomus*, a species of Rhinoceros beetle, is a good model organism for studying exaggerated sexually selected traits because their enormous horns vary across populations. This study aims to identify morphological variation in the beetle horn weapon system, and to measure force production of beetles using beam theory and the biomaterial components of chitin. Variation in the length and morphology of the horn leads to differences in force production across populations. We expect that these performance differences can be more closely examined through investigating the structure of these weapons.

Faculty Sponsor: Brook Swanson

SD112 Spokane River Walking Guide

Paul Hurst, Malcolm Tomes, Sam Sampinos, Tommi Gonzales

The Spokane River is a landmark because of its natural awe which allows for public enjoyment and societal infrastructure. The river is rich in wildlife, history, and culture ranging from the settlers to Native Americans and organisms that have populated the region. The river provides both the societal and ecological community objective value which has been lost this past industrial era. Spokane continues to grow, building relationships with the river will foster a community that loves and protects our natural common; a unique and striking way to battle the coming urbanization of our city. As Spokane continues to grow and the city continues to work on the health of the river, our goal is to focus on developing a community that values an objective relationship with the river. The development of relationships with the Spokane River through a walking guide creates a hands on way for people to have their own individual relationships with the river, creating a stronger community centered on nature.

Faculty Sponsor: Greg Gordon

SD113 The Effect of Hydration Levels on Calorie Burning While Exercising

Devan McAllister, Claire Sick, Maddie Gregory, and Cheyenne Landreth

The most effective way to burn calories is an important topic in today's society, but many do not realize that being properly hydrated while exercising is essential, as water is necessary to maintain homeostasis. This study asked how the level of hydration, whether hypo- or hyperhydrated, affects caloric expenditure when exercising at a moderate intensity. Moderate intensity was determined using the Borg Scale of Perceived Exertion. VO₂ was determined for individuals at moderate intensity, then compared between hypo- and hyperhydrated sessions. Specific gravity was obtained through a urine sample via a refractometer in order to confirm the participants' hydration levels. We found that there is no statistically significant difference in caloric expenditure between the hypo- and hyperhydration levels, indicating the adaptive nature of the human body.

Faculty Sponsor: Michael Sardinia

SD114 Molecular Recognition in Quasiracemic Regioisomers with Fluorine Substituents

Ethan Vyhmeister

Quasiracemates are compounds formed between pairs of materials that are chemically similar, yet with slight structural differences and opposite handedness. The materials mimic true racemates with slight chemical modification. The utility of these materials has been exploited for chemical detection, separation, and crystallization. While the formation of quasiracemates follows the recognition patterns found in true racemates, the structural boundaries of these molecular associations are less well defined. This work describes the systematic use of a family of chiral compounds to explore the process of molecular recognition by combining pairs of R and S diarylamides and naphthylamides that differ by substitution patterns (e.g. (S)-X and (R)-X), not molecular framework or pendant substituents. Between pairs, the chemical frameworks and fluorine substituent remained constant, while the substitution position was changed between a 2,3, or 4- position. Results from hot-stage and X-ray crystallographic studies offer important evidence of the molecular features responsible for the molecular

organization of these materials. Our results conclude that the diarylamide framework seems to have less tolerance for change in substitution position than the naphthylamide framework in terms of possible quasiracemate formation.

Faculty Sponsor: Kraig Wheeler

SD115 $\hat{1}\pm 4\hat{1}^27$ Signaling and HIV-1 Pathogenesis

Kelly Wucherer

Human Immunodeficiency Virus (HIV-1) is a retrovirus that effects over 35 million people worldwide. The $\alpha 4\beta 7$ integrin has been identified as a crucial component of the signaling pathways involved in HIV pathogenesis. The current mechanism of signaling from $\alpha 4\beta 7$ to infection is unknown. MAdCAM is the natural ligand for the integrin which initiates signaling. ACT-1 is an antibody that blocks the $\alpha 4\beta 7$ integrin and has been shown to reduce transmission of Simian Immunodeficiency virus (SIV) in macaques. However, repeated studies and clinical trials have failed to provide similar positive results leading to further questions about the specific mechanisms of the integrin and signaling pathway. In this experiment, B cells, naturally expressing the $\alpha 4\beta 7$ integrin were activated Mn^{2+} and treated with either ACT-1 or MAdCAM. The pretense of various cell signaling markers were tested through western blot. Full characterization of the signaling pathway was inhibited due to Mn^{2+} toxicity to cells. Although the integrin is present on cells, activation by $\beta\gamma\epsilon^{-}Mn^{2+}$ is necessary to enable binding.

Faculty Sponsor: Kerry Breno

SD116 Testing the HeLa Cell Toxicity of Hyprotek's Antimicrobial Solutions

Hans Munzing Hans Munzing Hans Munzing Hans Munzing Hans Munzing

In collaboration with Hyprotek, a Spokane-based biomedical company, we have been involved in developing and testing antimicrobial products for use in the medical field. The patented solutions containing ethanol, hydrogen peroxide, and EDTA have been developed into hand washes, sanitizers, disinfectants, and lock solutions. As these antimicrobial products will potentially come into contact with sensitive human tissues, we have been testing their toxicity using HeLa cells as human cell models. We have tested the individual components of the solutions to establish baseline toxicity values and have progressed into testing combinations of the components of the solution. Our results have shown that there is a synergistic effect on cell toxicity when ethanol and hydrogen peroxide are used together as a cell treatment. We will continue to test different combinations of the components and move into testing the toxicity of the antimicrobial solutions in their complete forms. Ultimately, we plan to conduct the same line of testing using healthy human cells in order to acquire the antimicrobial products' most accurate toxicity information.

Faculty Sponsor: Bill Ettinger

SD117 Hippocampal volume reductions in post-traumatic stress disorder as a function of trauma type: A meta-analytic study.

Aspen Avery

This meta-analytic study analyzed the relationship between post-traumatic stress disorder (PTSD) and hippocampal volume as a function of trauma type. Past research shows that individuals with post-traumatic stress disorder subsequent to interpersonal violence experience more frequent and severe PTSD symptoms in comparison with those who experienced other types of trauma. Furthermore, studies have also found that individuals with PTSD have smaller hippocampi. In this meta-analytic study, we hypothesized that individuals who experienced interpersonal trauma and are later diagnosed with PTSD would have smaller hippocampi compared to those who experienced other types of trauma. Type of trauma was split into four types: interpersonal violence, combat, mixed, and "other". In total, 11 studies were included in the combat category, nine in the interpersonal violence category, eight in the "other" category, and six in the mixed category. For each study, a mean effect size (Hedges') was calculated and 95% confidence intervals were computed. Then a mean effect size and 95% confidence interval across each category was calculated. Results showed that the PTSD individuals in the "other" category did not have statistically smaller volumes in either the left or the right hippocampi compared to controls. Individuals with PTSD in the combat category did show statistically smaller volumes in both the left and right hippocampi. The mixed category showed statistically smaller volumes in the left and right hippocampi. In the interpersonal violence group, smaller left and right hippocampi were also observed. The largest effect sizes were seen in the mixed and interpersonal violence categories.

Faculty Sponsor: Michael D. Nelson

SD118 Exploring the Dimerization of PEPX Through Site-Directed Mutagenesis

Richie Hochrein

X-Prolyl-dipeptidyl-aminopeptidases (PEPX) are enzymes that can hydrolyze proline-rich substrates, like gluten. This class of aminopeptidases are of interest because of their prospective ability to treat Celiac Disease and other gluten related immune responses. PEPX is a serine peptidase known to form a homodimer with two active sites. It is unknown whether or not dimerization is needed to hydrolyze proline-rich sequences. Therefore, a double mutant (Q93N/Y101A) was synthesized from *Lactobacillus helveticus*. These mutations are suspected to disrupt the dimerization of the PEPX, resulting in two monomers. The protein was then purified and tested for hydrolytic activity. Preliminary results suggest that dimerization was disrupted, and the enzyme retained some activity.

Faculty Sponsor: Deanna Ojennus

SD119 How fast does $(ax)!$ really grow?

Daniel Gallab

A standard calculus problem is to compare the growth rates of $n!$, n^n , and b^n for large integers n , where $b > 1$ is a parameter. In this talk, I discuss the growth rate of $(ax)!$ as x grows, where a is a parameter; we first need to generalize to the gamma function to allow for non-integer values of ax . I compare the growth rate of this function with seven other functions containing the parameter a , producing a hierarchy of growth rates. In addition, I discuss various properties of the function $f(x) = x^x / \Gamma(ax+1)$. Side diversions include applying the Squeeze Theorem, Stirling's approximation, and asymptotic analysis to reach a deeper understanding.

Faculty Sponsor: Michelle Ghrist

SD120 Testing for Ferroelectric Properties in Piezoelectric Thin Films

Evelyn Cooper

PZT has long been one of the best piezoelectric structures available. PZT is composed of Lead, Zirconium, Titanium, and Oxygen. Since lead is an undesirable ingredient, posing a danger to health, Oregon State University's Materials Science laboratory worked to develop lead-free piezoelectric structures fairly successfully. This presentation discusses the developments in creating lead-free piezoelectric films, the process of synthesizing a PZT film, and confirming the properties of the film.

Faculty Sponsor: N/A

SD121 Formation of Racemic and Quasiracemic Crystals Using 4-(X)benzoyl-D/L-valine

Joshua Fenner

A racemic mixture (or racemate), is constructed from equal amounts of right and left-handed enantiomeric components. A quasiracemic mixture closely models racemates but utilizes two chemically distinct molecules. Studying quasiracemates can help explain the general principles of molecular recognition, where an understanding of molecular assembly helps in the design of functional materials. By combining diverse sets of quasisenantiomers, the structural boundaries of molecule-molecule interactions based on topological factors can be assessed. This investigation examined a family of racemic and quasiracemic compounds based on (4-(X)benzoyl)-D/L-valine molecular frameworks. These materials were synthesized using D or L-valine and 4-(X)benzoyl chloride (X= methyl, chloro, nitro, or bromo), characterized using ¹H and ¹³C NMR, and formed (4-(X)benzoyl)-D/L-valine. Pairs of these R-X and S-XTM compounds were processed using hot stage thermomicroscopy. Crystals formed at the interface of the R-X and S-XTM materials indicated quasiracemate formation, while the absence provided evidence for the lack of molecular recognition between the two components. Crystals that formed could be confirmed for quasiracemic behavior by melting point analysis. These studies showed that successful attempts occurred with the following molecular combinations: (4-chlorobenzoyl)-L-valine/(4-bromobenzoyl)-D-valine, (4-chlorobenzoyl)-L-valine/(4-chlorobenzoyl)-D-valine, (4-chlorobenzoyl)-L-valine/(4-methylbenzoyl)-D-valine, (4-methylbenzoyl)-L-valine/(4-bromobenzoyl)-D-valine, (4-methylbenzoyl)-L-valine/(4-methylbenzoyl)-D-valine. Additional studies were performed to understand the effect of quasisenantiomers that differed in amino acid fragments. Combining (4-methylbenzoyl)-L-leucine/(4-bromobenzoyl)-D-valine, and (4-bromobenzoyl)-L-leucine/(4-bromobenzoyl)-D-valine using the hot stage technique resulted in thermal signatures consistent with quasiracemate formation. These preliminary results suggest the valine and leucine adducts organize due to the compatibility of their molecular shapes. By contrast, similar valine and alanine compounds (4-chlorobenzoyl-D-alanine/4-chlorobenzoyl-L-valine) formed conglomerates instead of the expected quasiracemates.

Faculty Sponsor: Craig Wheeler

SD122 Synthesis and Analysis of Quasiracemate Formation of Compounds by Thermomicroscopy

Rachel Porche

Quasiracemate materials, equimolar mixtures of left- and right-handed enantiomers of opposite handedness that are chemically similar, have been used to provide a deeper understanding of the structural factors responsible for molecular recognition. Because quasiracemates lack any notable common features related to molecular framework or functional groups, the driving force for their assembly rests with the complementary shapes of the quasisenantiomeric components. In this study, the synthesis of the components used for quasiracemate formation combined chiral amines with benzoyl chlorides to form a group used for producing the desired compounds. These materials were used for subsequent thermomicroscopy studies that helped to identify the formation of quasiracemic crystalline phases. The target materials included N-[1-(naphthalen-2-yl)ethyl]benzyl derivatives with the attached nitriles, ethyl, and methoxy groups. Results from these studies indicate pairs of R-Et and S-OCH₃ N-[1-(naphthalen-2-yl)ethyl]benzyl compounds successfully formed a quasiracemic material as supported by the formation of a new crystalline phase at the interface between the two samples.

Faculty Sponsor: Craig Wheeler

SD123 Study of PEPN from Lactobacillus helveticus for use in breakdown of proline-rich molecules

Kathryn Markham

In this study, the gene for aminopeptidase N (PEPN) derived from Lactobacillus helveticus was cloned and expressed in E. coli using a pET-21b expression vector. The recombinant protein includes a C-terminal six-Histidine tag and can be purified by nickel-affinity chromatography. Once purified, PEPN was tested for activity against an Ala-pNA substrate mimic. The activity was compared to a recombinant protein containing a N-terminal Histidine tag. In combination with other peptidases, PEPN may be capable of the complete detoxification of protein food allergens that are rich in proline.

Faculty Sponsor: Deanna Ojennus

SD124 Recreational Drugs and Academic Achievement

Luke Pfister, Ben Mandel, Helen Roosevelt, Kelly Porter, Emily Seibold

In a series of studies, we aim to identify whether use of marijuana and other substances in a college setting can have any impact on academic performance. Marijuana is the most widely used illegal drug on college campuses across the country, it is estimated that 25-33% of college students have used marijuana at least once in the previous year (e.g., Palmer et al., 2012). Since recreational drugs play such a large role in university life, it is important to determine what, if any, effect it has on the academic achievement of its users. In an initial study, we surveyed a convenience sample of 202 college students at Gonzaga University and found that self-reported marijuana use was negatively related to Grade Point Average, $r = -.15$, $p = .028$. In a follow up study, we are attempting to replicate this finding and extend our research to examine the impact of other substances (e.g., alcohol, tobacco) on academic performance. The results of this research are intended to contribute to the conversation about the risk, or lack thereof, of participating in recreational drug use while in an academic setting.

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