4-2021

Spokane Intercollegiate Research Conference 2021

Gonzaga University

SIRC 18th ANNUAL

Spokane Intercollegiate Research Conference

April 24, 2021

VIRTUAL AT GONZAGA UNIVERSITY

STUDENT RESEARCH PRESENTATIONS

FROM ACROSS ALL DISCIPLINES

www.gonzaga.edu/sirc

Spokane Intercollegiate Research Conference
Gonzaga University
April 24th, 2021

Contents

2021 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.

SESSION OVERVIEW

Times	Session	Group	Group Name	Faculty Moderator(s)
10:00-10:50 am	A	1	Communication Studies & Psychology	Alan Mikkelson & Adam Stivers
10:00-10:50 am	A	2	Mathematics	Kate Kearney & Eric Hogle
10:00-10:50 am	A	3	Politics, English & Religious Studies	Jake Andrews
10:00-10:50 am	A	4	Biochemistry & Chemistry	Kraig Wheeler
10:00-10:50 am	A	5	Biology	William Ettinger
11:00-11:50 am	B	1	Psychology & Physiology	Adam Stivers & Patrick Crosswhite
11:00-11:50 am	B	2	Computer Science & Engineering	Harman Khare
11:00-11:50 am	B	3	Engineering & Environmental Studies	Greg Gordon
11:00-11:50 am	B	4	Chemistry	Ian Townley
11:00-11:50 am	B	5	History	Ann Ostendorf
12:00-12:50 pm	C	1	Psychology & Physiology	Alex Bies
12:00-12:50 pm	C	2	Computer Science	Gina Sprint
12:00-12:50 pm	C	3	Environmental Studies	Greg Gordon
12:00-12:50 pm	C	4	Biology & Biochemistry	Jennifer Shepherd
1:00-1:50 pm	D	1	Psychology	Gary Thorne & Alex Bies
1:00-1:50 pm	D	2	History & Sociology	Matthew Cremeens
1:00-1:50 pm	D	3	Chemistry	Kerry Breno
1:00-1:50 pm	D	4	Biochemistry	Jeff Watson & Deanna Ojennus
2:00-2:50 pm	E	1	Environmental Studies	Betsy Bancroft
2:00-2:50 pm	E	2	History, Anthropology, Geography & Dance	Katherine Karr-Cornejo
2:00-2:50 pm	E	3	Organic Chemistry & Crystallography	Kraig Wheeler
2:00-2:50 pm	E	4	Biology & Biochemistry	Kate Leamy

SESSION SUMMARIES

Session A

Session A Group 1: 10:00-10:50 am, Communication Studies & Psychology

Pilger, Cambria: Does being picky pay off? Relational Maximization and Loneliness in Friendships

Richards, Colby; Saplan, Sage; Kearns, Judge Thomas: Evaluating the efficacy of an intensity-threshold based semi-automated edge extraction technique

Guzzo, Jackson; Wentz, Amara; Durbin, Julia: Cross-Cultural Comparisons of Personality Traits

Scott, Sarah; Li, Justin: The Pushover vs. the Powerhouse Supervisor: Employee Perceptions of Supervisor Sociocommunicative style and Interpersonal Dominance

Kearns, Judge Thomas; Barber, Henry Lawrence; Goncalves, Rafaela Donato Pinheiro: Does Perception of Control influence Attitudes towards Climate Change?

Session A Group 2: 10:00-10:50 am, Mathematics

Gonzalez, Tyler; Wilson, Drake: Wicket Closures of Braids

Cramer, Caleb: Developing and Analyzing Staggered Designer Multistep Methods

Mallott, Amanda; Griffin, Caeli; Nored, Ben: Total Roman Domination of Kneser Graphs

Mallott, Amanda: Ontology Logs (Ologs) Modeling Cultural Power

Session A Group 3: 10:00-10:50 am, Politics, English, Religious Studies

Marvin, Emily: "Moody Bleach, Please" – A Creative Nonfiction Research Project

Lynde-Ginal, Ruby: Evaluation of Normative Christian Responses to the Housing Crisis in America

Mumm, Hannah: Like A Virgin (A Short Story)

Vergets, Rayce: Presidential Approval and Unemployment

Session A Group 4: 10:00-10:50 am, Biology, Biochemistry, Chemistry

Fenner, Isabella: Synthesis of a Vigabatrin Ester Prodrug

Stewart, Laura: Synthesis of a Rosuvastatin ester prodrug as a potential anticancer drug

Wells, Russell: Structurally Interesting Amino Acid Cocrystalline Phases

Orlowsky, Ana: Determining a chalcone's DNA binding mode: molecular simulations and experimental approaches

Hoopes, Dillon: SAR and QSAR Investigations in Chalcone Druglikeness

Barg, Chance: Photochemical behavior in crystalline networks of fumaric acid and nitrogen containing coformers

Session A Group 5: 10:00-10:50 am, Biology

Hoag, Thomas: Comparison and evaluation of EG cluster Microbacterium foliorum bacteriophage isolated at Gonzaga University

Vlastelica, Katherine; Needham, Hope; Torpey, Grace: Human TDP-43 mutations induce sleep disturbances in a Drosophila model of ALS

Renschler, Andy; Crews, Benjamin: The bacterium Shewanella sp. Strain ANA-3 is a Fe(III) super-reducer

Wadner, John; Meyer, Kimberly; Lumsden, Matthew; Fellin, Mark: Testing the Cytotoxicity of (Hyprotek's) Antimicrobial "Lock Solution" in Efforts to Mediate Nosocomial Infections

SESSION SUMMARIES

Session B

Session B Group 1: 11:00-11:50 am, Psychology & Physiology

Gade, Anna: Social Discounting & Health Perceptions

Ballard, Claire; Harrison, Morgan; Cheatham, Emma; Gardner, Kendall; Barfield, Gillian: Virtual Learning Versus In-Person Learning: An Anatomy and Physiology Comparison

Durbin, Julia; Solorio, Andrea: Social Dominance Orientation and Demographic Variables

Smoody, Gillian: Academic Performance and Social Support

Higley, Kirsten; Cosola, Georgia: What We Read About and What We Believe: How the Availability of (Neutral) News Media Shapes Political Priorities

Session B Group 2: 11:00-11:50 am, Computer Science & Engineering

Garcia-Camargo, Leon: Zipf's Law in Speech: Child Autism Spectrum Disorder

Encarnacion, Marissa; Young, Lindsey: Improving Hydrogels for Artificial Cartilage

Howard, Nora: Ecological Momentary Assessment of Patient Recovery in an Outpatient Environment

Grady,Ryan: An Adaptive GUI For A 2-Degree Of Freedom Strone Rehabilitation Robot

Mamolo, Steven; Miller, Anna Leigh: Friction and Wear of 3D Printed Polymer Composites

Miller, Brenden; Mamolo, Steven: Nanoscale Analysis of Transfer Films in Ultra-Low Wear Polymer Composites

Session B Group 3: 11:00-11:50 am, Engineering & Environmental Studies

Zaragoza, Valeria; Sunitsch, Grace; Wybenga, Jane: River Kids

Browning, Ruby; Coleman, Jillian; Koning, Kenneth; Maiorino, Robert: Olmsted 2.0-Urban Greenspace Viability

Marquez, Abigail Lennah: The Sustainability and Cost of Solar Roofing in Spokane Compared to Conventional Standing Seam Roofs

Margraf, Joshua: Investigation into Youngs Modulus and Tensile Strength of Tough PLA Bars

Arce, Dominic; McEachern, Cullen; Ewert, Thomas: Lake Arthur Master Plan-Trail Enhancement

Session B Group 4: 11:00-11:50 am, Chemistry & Biochemistry

Erickson, Andrew: Assessment of Enamel Erosion by Popular Beverages using Atomic Force Microscopy

DeForest, John: Iron-Zinc Complex Interaction with Fine Soil Particulates: A Proxy for Studying Diffusion Inhibition in Hydrated Sediments

Layton, Elijah: Ion affinity chromatography methodology to study synthetic anionophores in lipid environments.

Talarico, Julia: Increasing the Sensitivity of Ion Chromatography for Measurements of Polyether Ionophore-Ion Binding in Lipid Bilayers

Wheeler, David: Pulsed Corona Discharge and Electrospray Ionization from a Gateless Ion Mobility Spectrometry

Boatman, Sarah; Davis, Eric; Thiel, Alex; Jones, Michael: ArcSpray Optical Emission Spectroscopy for elemental analysis in field-based measurements

Session B Group 5: 11:00-11:50 am, History

Williams, Rhys: Mahan, Japan, and the Greatest Naval Turnabout in History

Cantu, Colin: The Battle Against the Mafia: An Evolution of United States Policy and Law Enforcement

Shelledy, Matthew: Harrison Anti-Narcotics Act

Repetti IV, Gregory: Dealing with Discrimination: Italian Immigration Experience in New York City

Larue, Hope: Edward VIII's Abdication and Its Implications

SESSION SUMMARIES

Session C

Session C Group 1: 12:00-12:50 pm, Psychology & Physiology

Simmons, Rebecca; Cook, Joie; Alonso, Katie: Confirmation Bias as it Applies to Political Party and Response to Online Articles Regarding COVID-19

Peters, Nicholas; Rinn, Erik: The Effect of Color on Visual Information Retention

Kearns, Judge Thomas: Following Pop Culture Chains of Artificial Intelligence from Alex Garland's Ex Machina

Kearns, Judge Thomas; Goldberg, Emily Luna; Bennett, Vincent Michael: Comparison of replacement techniques for missing data in survey measures

Ford, Kaitlyn; Danahy, Julia; Lerch, Nicole; Lindsey, Tyler: Methodology of the Biomechanical and Cognitive Effects of Tablet Desks on University Students

Session C Group 2: 12:00-12:50 pm, Computer Science

Olafson, Cole; Garcia_Camargo Leon; Lunder, Jason: Machine Translation Using Dependency Trees

Cole, Hannah: Natural Language Processing for Interspecies Communication

McCullough, Hunter; Evey, Alana; Compy, Kiernan: Combinatorial Analysis Study of Brandubh, an Ancient Viking Board Game

Evey, Alana; Compy, Kiernan: Prototyping For The Quadrillion Game Moves of Brandubh, a Viking Game

Call, Tristan: Gamifying Software Engineering Tools to Motivate Computer Science Students to Start and Finish Programming Assignments Earlier'

Session C Group 3: 12:00-12:50 pm, Environmental Studies

Bidaburu, Matea; Sunitsch, Grace: Microplastics in Freshwater

Zimmerman, Isabel; Klement,Zebulun; Rettig, William; Balish, Angela: Plants, Present, Future: A Digital Ethnobotanical Narrative of the Children of the Sun Trail

Ashe, Alexis: Youth Corps Project Spokane

Wells, Russell; Patterson, Brady; Richardson, Kevin; Gibson, Marissa: Costa Rican Ecotourism Efforts Maintain Avifauna Biodiversity in Cloud Forest

Session C Group 4: 12:00-12:50 pm, Biology & Biochemistry

Courtney Murray: Ancestral Protein Reconstruction of Bacterial HMG-CoA Reductase

Schmahl-Waggoner, Adikus: Investigating the genetic basis of phage immunity systems in Cluster F bacteriophages

Spawn, Jamie; Whitworth, Sophia: Locating recombinant RquA protein within S. cerevisiae via a Green Fluorescent Protein tag

Johnson, Eleanor; Fitzgerald, Sara; Storz, Sophie: Genomic analysis of two unique subcluster M2 bacteriophages, Estes and Aziz.

Dedinsky, Megan; Lau, Jalisa: Exploring DNA sequencing technologies to determine phage type prior to whole genome sequencing

Godfrey, AJ: Optimization of an in vitro Assay for the Determination of RquA Function

SESSION SUMMARIES

Session D

Session D Group 1: 1:00-1:50 pm, Psychology

Hayden, Abigail; Harmston, Ellen; Linman, Rika: Anxiety in a Pandemic
Crow, Kayla; Gade, Anna; Metzer, Zoe: Perception of Wellbeing and Mental Health of People Who are Blind
Rundquist, Charles: Depression and Face Pareidolia
Goldberg, Emily; Voigt, Kyle: Implications of Videoconferencing Usage on Willingness to use Telehealth for Medical Appointments

Session D Group 2: 1:00-1:50 pm, History & Sociology

Reyes, Paola: Beyond the pandemic: how companies can increase productivity, improve their workplaces and cut expenses by allowing their employees to work remotely
Schlesinger, Mikaela: "The Tripartite Relationship of Burkitt's Lymphoma, Climate Change and Ethical Implications for the Global North"
Fagan, Kevin: Quantifying the Mortality Effects of Wildfire Smoke in Spokane County from 2015-2019

Session D Group 3: 1:00-1:50 pm, Chemistry

Rosenbaum, Kaylee; Thackston, Samuel; Russell, Trisha: Improving the Synthetic Route for Reduced Praziquanamine
Nobley, Wyatt: Cucurbit[8]uril-mediated Peptide Assembly
Lorenz, Brooke: Synthesis of Tricarbonylchloro(bis-1,10-phenanthroline-4,7-disulfonic acid)rhenium(I): A Luminescent Complex
Hagerty, Brendan: Luminescence variation of rhenium(I) fac-tricarbonyl phenanthroline complexes
Fuller, Jack: Redox active ligands to support Zr(IV) catalyzed oxidation reactions
Huggins, James: Synthesis of Cyclic Boronic Esters from Acyclic Boronic Ester Reagents for Alcohol Capture and Release

Session D Group 4: 1:00-1:50 pm, Biochemistry

Bruner, Madeline: Examination of the structure and activity changes of the DNAzyme Dz8-17 upon uracil incorporation.
Bates, Robert: Kinetics and Structural Characterization of HMG-CoA Reductase in Burkholderia cenocepacia
Rose, Katelyn: Possible Role of Calcium Binding Domain in the Stability of X-prolyl dipeptidyl aminopeptidase
Gregory, Justin: Gene Deletion of 3-Hydroxy-3-methylglutaryl coenzyme A reductase (HMGR) in Burkholderia Cenocepacia

SESSION SUMMARIES

Session E

Session E Group 1: 2:00-2:50 pm, Environmental Studies
Leon, Julia; Simmons Alex; Bell, Kacie: Snake River Outreach Program
Munoz-Maines, Javier; Crosby, Sophie; Tveter, Sean: Snake River History
Ellinwood, Erin; Royse, Georgina; Kintzele, Keara: Urban Wildlife Monitoring
Marinkovic, Matea; Lalonde, Sarah; Chehab, Sydney; Manthey, Grace: Urban Tree Analysis

Session E Group 2: 2:00-2:50 pm, History, Anthropology, Geography & Dance
Henry, Grace: Experiences of modern anti-Semitism in Spokane
From, Delaney: Correlation between Spanish Vowel Perception and Production by Spanish Language Learners
Jones, Logan: Migration, Incorporation and the New Second Generation
Vye, Jessica; Llewellyn, Micayla: Dance as Intersectionality - Exploring Indigenous Movement and Storytelling
Cummings, Lark: From Immigration to Integration and Back: Mexican Labor in the US Economy Since 1982

Session E Group 3: 2:00-2:50 pm, Organic Chemistry & Crystallography
Whitworth, Paloma; DeCocker, Emily: Investigating halogen-substituted chalcones
Ernst, Lindsey: An investigation of the methods for cocrystallization of chalcones to determine patterns of functional group interactions and crystallization methods
Watkins, Laurelle; Laroya, Carl Joshua; McTamaney, Ian: NMR Spectroscopy and X-ray Crystallography Analysis of Azo Dyes
Battaglia, Zachary: The Synthesis and Crystallization of a Chalcone Inhibitor of the JAK2/STAT5 Pathway
Gao, James: Quasiracemic Analysis of Pairings in Norvaline/Valine Systems
Pounds, Michaela: Molecular Recognition of Quasiracemic Regioisomers of Difluoro Substituents

Session E Group 4: 2:00-2:50 pm, Biology & Biochemistry
Engley, Andrew: Investigating the Effects of Protein Crowding on Ribozyme Kinetics
Wells, Russell; Renschler, Andy; Penner, Scott: Neuroprotective effects of angiotensin IV molecule, dihexa, on 3-nitropropionic acid induced Huntington's disease-like symptoms in rats
Lane, Melanie: The Influence of Charged Protein Crowders on Hammerhead Ribozyme Activity.
Hall, Rigel: Computational Analysis of Non-Coding Functional RNA Adaptation to High Temperatures
Thomas, Rhian: Characterizing the Bacterial Diversity in Mosquito Larvae from Spokane Urban Water

ALL PRESENTERS - ALPHABETICAL BY LAST NAME

Alonso, Katie, Session C, Group 1, 12:00-12:50 pm: Confirmation Bias as it Applies to Political Party and Response to Online Articles Regarding COVID-19
Arce, Dominic, Session B, Group 3, 11:00-11:50 am: Lake Arthur Master Plan-Trail Enhancement
Arnone, Garrison, Session D, Group 2, 1:00-1:50 pm: Why don't Americans vote? How voter turnout is affected by Two-Party Plurality
Ashe, Alexis, Session: C, Group: 3, 12:00-12:50 pm: Youth Corps Project Spokane
Balish, Angela, Session: C, Group: 3, 12:00-12:50 pm: Plants, Present, Future: A Digital Ethnobotanical Narrative of the Children of the Sun Trail
Ballard, Claire, Session: B, Group: 1, 11:00-11:50 am: Virtual Learning Versus In-Person Learning: An Anatomy and Physiology Comparison
Barber, Henry Lawrence, Session: A, Group: 1, 10:00-10:50 am: Does Perception of Control influence Attitudes towards Climate Change?
Barfield, Gillian, Session: B, Group: 1, 11:00-11:50 am: Virtual Learning Versus In-Person Learning: An Anatomy and Physiology Comparison
Barg, Chance, Session: A, Group: 4, 10:00-10:50 am: Photochemical behavior in crystalline networks of fumaric acid and nitrogen containing coformers
Bates, Robert, Session: D, Group: 4, 1:00-1:50 pm: Kinetics and Structural Characterization of HMG-CoA Reductase in Burkholderia cenocepacia
Battaglia, Zachary, Session: E, Group: 3, 2:00-2:50 pm: The Synthesis and Crystallization of a Chalcone Inhibitor of the JAK2/STAT5 Pathway
Bell, Kacie, Session: E, Group: 1, 2:00-2:50 pm: Snake River Outreach Program
Bennett, Vincent Michael, Session: C, Group: 1, 12:00-12:50 pm: Comparison of replacement techniques for missing data in survey measures
Bidaburu, Matea, Session: C, Group: 3, 12:00-12:50 pm: Microplastics in Freshwater
Boatman, Sarah, Session: B, Group: 4, 11:00-11:50 am: ArcSpray Optical Emission Spectroscopy for elemental analysis in field-based measurements
Browning, Ruby, Session: B, Group: 3, 11:00-11:50 am: Olmsted 2.0-Urban Greenspace Viability
Bruner, Madeline, Session: D, Group: 4, 1:00-1:50 pm: Examination of the structure and activity changes of the DNAzyme Dz8-17 upon uracil incorporation.
Call, Tristan, Session: C, Group: 2, 12:00-12:50 pm: Gamifying Software Engineering Tools to Motivate Computer Science Students to Start and Finish Programming Assignments Earlier
Cantu, Colin, Session: B, Group: 5, 11:00-11:50 am: The Battle Against the Mafia: An Evolution of United States Policy and Law Enforcement
Chehab, Sydney, Session: E, Group: 1, 2:00-2:50 pm: Urban Tree Analysis
Chetham, Emma, Session: B, Group: 1, 11:00-11:50 am: Virtual Learning Versus In-Person Learning: An Anatomy and Physiology Comparison
Cole, Hannah, Session: C, Group: 2, 12:00-12:50 pm: Natural Language Processing for Interspecies Communication
Coleman, Jillian, Session: B, Group: 3, 11:00-11:50 am: Olmsted 2.0-Urban Greenspace Viability
Compy, Kiernan, Session: C, Group: 2, 12:00-12:50 pm: Prototyping For The Quadrillion Game Moves of Brandubh, a Viking Game
Compy, Kiernan, Session: C, Group: 2, 12:00-12:50 pm: Combinatorial Analysis Study of Brandubh, an Ancient Viking Board Game
Cook, Joie, Session: C, Group: 1, 12:00-12:50 pm: Confirmation Bias as it Applies to Political Party and Response to Online Articles Regarding COVID-19
Cosola, Georgia, Session: B, Group: 1, 11:00-11:50 am: What We Read About and What We Believe: How the Availability of (Neutral) News Media Shapes Political Priorities
Courtney Murray, Session: C, Group: 4, 12:00-12:50 pm: Ancestral Protein Reconstruction of Bacterial HMG-CoA Reductase
Cramer, Caleb, Session: A, Group: 2, 10:00-10:50 am: Developing and Analyzing Staggered Designer Multistep Methods
Crews, Benjamin, Session: A, Group: 5, 10:00-10:50 am: The bacterium Shewanella sp. Strain ANA-3 is a Fe(III) super-reducer
Crosby, Sophie, Session: E, Group: 1, 2:00-2:50 pm: Snake River History
Crow, Kayla, Session: D, Group: 1, 1:00-1:50 pm: Perception of Wellbeing and Mental Health of People Who are Blind
Cummings, Lark, Session: E, Group: 2, 2:00-2:50 pm: From Immigration to Integration and Back: Mexican Labor in the US Economy Since 1982
Danahy, Julia, Session: C, Group: 1, 12:00-12:50 pm: Methodology of the Biomechanical and Cognitive Effects of Tablet Desks on University Students
Davis, Eric, Session: B, Group: 4, 11:00-11:50 am: ArcSpray Optical Emission Spectroscopy for elemental analysis in field-based measurements
DeCocker, Emily, Session: E, Group: 3, 2:00-2:50 pm: Investigating halogen-substituted chalcones
Dedinsky, Megan, Session: C, Group: 4, 12:00-12:50 pm: Exploring DNA sequencing technologies to determine phage type prior to whole genome sequencing
DeForest, John, Session: B, Group: 4, 11:00-11:50 am: Iron-Zinc Complex Interaction with Fine Soil Particulates: A Proxy for Studying Diffusion Inhibition in Hydrated Sediments
Donato Pinheiro, Session: A, Group: 1, 10:00-10:50 am: Does Perception of Control influence Attitudes towards Climate Change?
Durbin, Julia, Session: A, Group: 1, 10:00-10:50 am: Cross-Cultural Comparisons of Personality Traits
Durbin, Julia, Session: B, Group: 1, 11:00-11:50 am: Social Dominance Orientation and Demographic Variables
Ellinwood, Erin, Session: E, Group: 1, 2:00-2:50 pm: Urban Wildlife Monitoring
Encarnacion, Marissa, Session: B, Group: 2, 11:00-11:50 am: Improving Hydrogels for Artificial Cartilage
Engley, Andrew, Session: E, Group: 4, 2:00-2:50 pm: Investigating the Effects of Protein Crowding on Ribozyme Kinetics
Erickson, Andrew, Session: B, Group: 4, 11:00-11:50 am: Assessment of Enamel Erosion by Popular Beverages using Atomic Force Microscopy

Ernst, Lindsey, Session: E, Group: 3, 2:00-2:50 pm: An investigation of the methods for cocrystallization of chalcones to determine patterns of functional group interactions and crystallization methods
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Evey, Alana, Session: C, Group: 2, 12:00-12:50 pm: Combinatorial Analysis Study of Brandubh, an Ancient Viking Board Game
Ewert, Thomas, Session: B, Group: 3, 11:00-11:50 am: Lake Arthur Master Plan-Trail Enhancement
Fagan, Kevin, Session: D, Group: 2, 1:00-1:50 pm: Quantifying the Mortality Effects of Wildfire Smoke in Spokane County from 2015-2019
Fellin, Mark, Session: A, Group: 5, 10:00-10:50 am: Testing the Cytotoxicity of (Hyprotek's) Antimicrobial "Lock Solution" in Efforts to Mediate Nosocomial Infections
Fenner, Isabella, Session: A, Group: 4, 10:00-10:50 am: Synthesis of a Vigabatrin Ester Prodrug
Fitzgerald, Sara, Session: C, Group: 4, 12:00-12:50 pm: Genomic analysis of two unique subcluster M2 bacteriophages, Estes and Aziz.
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Fuller, Jack, Session: D, Group: 3, 1:00-1:50 pm: Redox active ligands to support Zr(IV) catalyzed oxidation reactions
Gade, Anna, Session: D, Group: 1, 1:00-1:50 pm: Perception of Wellbeing and Mental Health of People Who are Blind
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Gao, James, Session: E, Group: 3, 2:00-2:50 pm: Quasiracemic Analysis of Pairings in Norvaline/Valine Systems
Garcia-Camargo, Leon, Session: C, Group: 2, 12:00-12:50 pm: Machine Translation Using Dependency Trees
Garcia-Camargo, Leon, Session: B, Group: 2, 11:00-11:50 am: Zipf's Law in Speech: Child Autism Spectrum Disorder
Gardner, Kendall, Session: B, Group: 1, 11:00-11:50 am: Virtual Learning Versus In-Person Learning: An Anatomy and Physiology Comparison
Gibson, Marissa, Session: C, Group: 3, 12:00-12:50 pm: Costa Rican Ecotourism Efforts Maintain Avifauna Biodiversity in Cloud Forest
Godfrey, AJ, Session: C, Group: 4, 12:00-12:50 pm: Optimization of an in vitro Assay for the Determination of RquA Function
Goldberg, Emily, Session: D, Group: 1, 1:00-1:50 pm: Implications of Videoconferencing Usage on Willingness to use Telehealth for Medical Appointments
Goldberg, Emily Lena, Session: C, Group: 1, 12:00-12:50 pm: Comparison of replacement techniques for missing data in survey measures
Goncalves, Rafaela Donato Pinheiro, Session: A, Group: 1, 10:00-10:50 am: Does Perception of Control influence Attitudes towards Climate Change?
Gonzalez, Tyler, Session: A, Group: 2, 10:00-10:50 am: Wicket Closures of Braids
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Griffin, Caeli, Session: A, Group: 2, 10:00-10:50 am: Total Roman Domination of Kneser Graphs
Guzzo, Jackson, Session: A, Group: 1, 10:00-10:50 am: Cross-Cultural Comparisons of Personality Traits
Hagerty, Brendan, Session: D, Group: 3, 1:00-1:50 pm: Luminescence variation of rhenium(I) fac-tricarbonyl phenanthroline complexes
Hall, Rigel, Session: E, Group: 4, 2:00-2:50 pm: Computational Analysis of Non-Coding Functional RNA Adaptation to High Temperatures
Harmston, Ellen, Session: D, Group: 1, 1:00-1:50 pm: Anxiety in a Pandemic
Harrison, Morgan, Session: B, Group: 1, 11:00-11:50 am: Virtual Learning Versus In-Person Learning: An Anatomy and Physiology Comparison
Hayden, Abigail, Session: D, Group: 1, 1:00-1:50 pm: Anxiety in a Pandemic
Henry, Grace, Session: E, Group: 2, 2:00-2:50 pm: Experiences of modern anti-Semitism in Spokane
Higley, Kirsten, Session: B, Group: 1, 11:00-11:50 am: What We Read About and What We Believe: How the Availability of (Neutral) News Media Shapes Political Priorities
Hoag, Thomas, Session: A, Group: 5, 10:00-10:50 am: Comparison and evaluation of EG cluster Microbacterium foliorum bacteriophage isolated at Gonzaga University
Hoopes, Dillon, Session: A, Group: 4, 10:00-10:50 am: SAR and QSAR Investigations in Chalcone Druglikeness
Howard, Nora, Session: B, Group: 2, 11:00-11:50 am: Ecological Momentary Assessment of Patient Recovery in an Outpatient Environment
Huggins, James, Session: D, Group: 3, 1:00-1:50 pm: Synthesis of Cyclic Boronic Esters from Acyclic Boronic Ester Reagents for Alcohol Capture and Release
Johnson, Eleanor, Session: C, Group: 4, 12:00-12:50 pm: Genomic analysis of two unique subcluster M2 bacteriophages, Estes and Aziz.
Jones, Logan, Session: E, Group: 2, 2:00-2:50 pm: Migration, Incorporation and the New Second Generation
Jones, Michael, Session: B, Group: 4, 11:00-11:50 am: ArcSpray Optical Emission Spectroscopy for elemental analysis in field-based measurements
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Laroya, Carl Joshua, Session: E, Group: 3, 2:00-2:50 pm: NMR Spectroscopy and X-ray Crystallography Analysis of Azo Dyes
Larue, Hope, Session: B, Group: 5, 11:00-11:50 am: Edward VIII's Abdication and Its Implications
Lau, Jalisa, Session: C, Group: 4, 12:00-12:50 pm: Exploring DNA sequencing technologies to determine phage type prior to whole genome sequencing
Layton, Elijah, Session: B, Group: 4, 11:00-11:50 am: Ion affinity chromatography methodology to study synthetic anionophores in lipid environments.
Leon, Julia, Session: E, Group: 1, 2:00-2:50 pm: Snake River Outreach Program
Lerch, Nicole, Session: C, Group: 1, 12:00-12:50 pm: Methodology of the Biomechanical and Cognitive Effects of Tablet Desks on University Students
Li, Justin, Session: A, Group: 1, 10:00-10:50 am: The Pushover vs. the Powerhouse Supervisor: Employee Perceptions of Supervisor Sociocommunicative style and Interpersonal Dominance
Lindsey, Tyler, Session: C, Group: 1, 12:00-12:50 pm: Methodology of the Biomechanical and Cognitive Effects of Tablet Desks on University Students
Linman, Rika, Session: D, Group: 1, 1:00-1:50 pm: Anxiety in a Pandemic
Llewellyn, Micayla, Session: E, Group: 2, 2:00-2:50 pm: Dance as Intersectionality - Exploring Indigenous Movement and Storytelling
Lorenz, Brooke, Session: D, Group: 3, 1:00-1:50 pm: Synthesis of Tricarbonylchloro(bis-1,10-phenanthroline-4,7-disulfonic acid)rhenium(I): A Luminescent Complex
Lumsden, Matthew, Session: A, Group: 5, 10:00-10:50 am: Testing the Cytotoxicity of (Hyprotek's) Antimicrobial "Lock Solution" in Efforts to Mediate Nosocomial Infections
Lunder, Jason, Session: C, Group: 2, 12:00-12:50 pm: Machine Translation Using Dependency Trees
Lynde-Ginal, Ruby, Session: A, Group: 3, 10:00-10:50 am: Evaluation of Normative Christian Responses to the Housing Crisis in America
Maiorino, Robert, Session: B, Group: 3, 11:00-11:50 am: Olmsted 2.0-Urban Greenspace Viability
Mallott, Amanda, Session: A, Group: 2, 10:00-10:50 am: Ontology Logs (Ologs) Modeling Cultural Power
Mallott, Amanda, Session: A, Group: 2, 10:00-10:50 am: Total Roman Domination of Kneser Graphs
Mamolo, Steven, Session: B, Group: 2, 11:00-11:50 am: Nanoscale Analysis of Transfer Films in Ultra-Low Wear Polymer Composites
Mamolo, Steven, Session: B, Group: 2, 11:00-11:50 am: Friction and Wear of 3D Printed Polymer Composites
Manthey, Grace, Session: E, Group: 1, 2:00-2:50 pm: Urban Tree Analysis
Margraf, Joshua, Session: B, Group: 3, 11:00-11:50 am: Investigation into Youngs Modulus and Tensile Strength of Tough PLA Bars
Marinkovic, Matea, Session: E, Group: 1, 2:00-2:50 pm: Urban Tree Analysis
Marquez, Abigail Lennah, Session: B, Group: 3, 11:00-11:50 am: The Sustainability and Cost of Solar Roofing in Spokane Compared to Conventional Standing Seam Roofs
Marvin, Emily, Session: A, Group: 3, 10:00-10:50 am: "Moody Bleach, Please" – A Creative Nonfiction Research Project
McCullough, Hunter, Session: C, Group: 2, 12:00-12:50 pm: Prototyping For The Quadrillion Game Moves of Brandubh, a Viking Game
McCullough, Hunter, Session: C, Group: 2, 12:00-12:50 pm: Combinatorial Analysis Study of Brandubh, an Ancient Viking Board Game
McEachern, Cullen, Session: B, Group: 3, 11:00-11:50 am: Lake Arthur Master Plan-Trail Enhancement
McTamaney, Ian, Session: E, Group: 3, 2:00-2:50 pm: NMR Spectroscopy and X-ray Crystallography Analysis of Azo Dyes
Metzer, Zoe, Session: D, Group: 1, 1:00-1:50 pm: Perception of Wellbeing and Mental Health of People Who are Blind
Meyer, Kimberly, Session: A, Group: 5, 10:00-10:50 am: Testing the Cytotoxicity of (Hyprotek's) Antimicrobial "Lock Solution" in Efforts to Mediate Nosocomial Infections
Miller, Anna Leigh, Session: B, Group: 2, 11:00-11:50 am: Friction and Wear of 3D Printed Polymer Composites
Miller, Brenden, Session: B, Group: 3, 11:00-11:50 am: Nanoscale Analysis of Transfer Films in Ultra-Low Wear Polymer Composites
Mumm, Hannah, Session: A, Group: 3, 10:00-10:50 am: Like A Virgin (A Short Story)
Munoz-Maines, Javier, Session: E, Group: 1, 2:00-2:50 pm: Snake River History
Needham, Hope, Session: A, Group: 5, 10:00-10:50 am: Human TDP-43 mutations induce sleep disturbances in a Drosophila model of ALS
Nobley, Wyatt, Session: D, Group: 3, 1:00-1:50 pm: Cucurbit[8]uril-mediated Peptide Assembly
Nored, Ben, Session: A, Group: 2, 10:00-10:50 am: Total Roman Domination of Kneser Graphs
Olafson, Cole, Session: C, Group: 2, 12:00-12:50 pm: Machine Translation Using Dependency Trees
Orlowsky, Ana, Session: A, Group: 4, 10:00-10:50 am: Determining a chalcone's DNA binding mode: molecular simulations and experimental approaches
Patterson, Brady, Session: C, Group: 3, 12:00-12:50 pm: Costa Rican Ecotourism Efforts Maintain Avifauna Biodiversity in Cloud Forest
Penner, Scott, Session: E, Group: 4, 2:00-2:50 pm: Neuroprotective effects of angiotensin IV molecule, dihexa, on 3-nitropropionic acid induced Huntington's disease-like symptoms in rats
Peters, Nicholas, Session: C, Group: 1, 12:00-12:50 pm: The Effect of Color on Visual Information Retention
Pilger, Cambria, Session: A, Group: 1, 10:00-10:50 am: Does being picky pay off? Relational Maximization and Loneliness in Friendships
Pounds, Michaela, Session: E, Group: 3, 2:00-2:50 pm: Molecular Recognition of Quasiracemic Regioisomers of Difluoro Substituents
Renschler, Andy, Session: E, Group: 4, 2:00-2:50 pm: Neuroprotective effects of angiotensin IV molecule, dihexa, on 3-nitropropionic acid induced Huntington's disease-like symptoms in rats

Renschler, Andy, Session: A, Group: 5, 10:00-10:50 am: The bacterium Shewanella sp. Strain ANA-3 is a Fe(III) super-reducer
Repetti IV, Gregory, Session: B, Group: 5, 11:00-11:50 am: Dealing with Discrimination: Italian Immigration Experience in New York City
Rettig, William, Session: C, Group: 3, 12:00-12:50 pm: Plants, Present, Future: A Digital Ethnobotanical Narrative of the Children of the Sun Trail
Reyes, Paola, Session: D, Group: 2, 1:00-1:50 pm: Beyond the pandemic: how companies can increase productivity, improve their workplaces and cut expenses by allowing their employees to work remotely
Richards, Colby, Session: A, Group: 1, 10:00-10:50 am: Evaluating the efficacy of an intensity-threshold based semi-automated edge extraction technique
Richardson, Kevin, Session: C, Group: 3, 12:00-12:50 pm: Costa Rican Ecotourism Efforts Maintain Avifauna Biodiversity in Cloud Forest
Rinn, Erik, Session: C, Group: 1, 12:00-12:50 pm: The Effect of Color on Visual Information Retention
Rose, Katelyn, Session: D, Group: 4, 1:00-1:50 pm: Possible Role of Calcium Binding Domain in the Stability of X-prolyl dipeptidyl aminopeptidase
Rosenbaum, Kaylee, Session: D, Group: 3, 1:00-1:50 pm: Improving the Synthetic Route for Reduced Praziquanamine
Royse, Georgina, Session: E, Group: 1, 2:00-2:50 pm: Urban Wildlife Monitoring
Rundquist, Charles, Session: D, Group: 1, 1:00-1:50 pm: Depression and Face Pareidolia
Russell, Trisha, Session: D, Group: 3, 1:00-1:50 pm: Improving the Synthetic Route for Reduced Praziquanamine
Saplan, Sage, Session: A, Group: 1, 10:00-10:50 am: Evaluating the efficacy of an intensity-threshold based semi-automated edge extraction technique
Schlesinger, Mikaela, Session: D, Group: 2, 1:00-1:50 pm: "The Tripartite Relationship of Burkitt's Lymphoma, Climate Change and Ethical Implications for the Global North"
Schmahl-Waggoner, Adikus, Session: C, Group: 4, 12:00-12:50 pm: Investigating the genetic basis of phage immunity systems in Cluster F bacteriophages
Scott, Sarah, Session: A, Group: 1, 10:00-10:50 am: The Pushover vs. the Powerhouse Supervisor: Employee Perceptions of Supervisor Sociocommunicative style and Interpersonal Dominance
Shelledy, Matthew, Session: B, Group: 5, 11:00-11:50 am: Harrison Anti-Narcotics Act
Simmons, Alex, Session: E, Group: 1, 2:00-2:50 pm: Snake River Outreach Program
Simmons, Rebecca, Session: C, Group: 1, 12:00-12:50 pm: Confirmation Bias as it Applies to Political Party and Response to Online Articles Regarding COVID-19
Smoody, Gillian, Session: B, Group: 1, 11:00-11:50 am: Academic Performance and Social Support
Solorio, Andrea, Session: B, Group: 1, 11:00-11:50 am: Social Dominance Orientation and Demographic Variables
Spawn, Jamie, Session: C, Group: 4, 12:00-12:50 pm: Locating recombinant RquA protein within S. cerevisiae via a Green Fluorescent Protein tag
Stewart, Laura, Session: A, Group: 4, 10:00-10:50 am: Synthesis of a Rosuvastatin ester prodrug as a potential anticancer drug
Storz, Sophie, Session: C, Group: 4, 12:00-12:50 pm: Genomic analysis of two unique subcluster M2 bacteriophages, Estes and Aziz.
Sunitsch, Grace, Session: B, Group: 3, 11:00-11:50 am: River Kids
Sunitsch, Grace, Session: C, Group: 3, 12:00-12:50 pm: Microplastics in Freshwater
Talarico, Julia, Session: B, Group: 4, 11:00-11:50 am: Increasing the Sensitivity of Ion Chromatography for Measurements of Polyether Ionophore-Ion Binding in Lipid Bilayers
Thackston, Samuel, Session: D, Group: 3, 1:00-1:50 pm: Improving the Synthetic Route for Reduced Praziquanamine
Thiel, Alex, Session: B, Group: 4, 11:00-11:50 am: ArcSpray Optical Emission Spectroscopy for elemental analysis in field-based measurements
Thomas, Rhian, Session: E, Group: 4, 2:00-2:50 pm: Characterizing the Bacterial Diversity in Mosquito Larvae from Spokane Urban Water
Torpey, Grace, Session: A, Group: 5, 10:00-10:50 am: Human TDP-43 mutations induce sleep disturbances in a Drosophila model of ALS
Tveter, Sean, Session: E, Group: 1, 2:00-2:50 pm: Snake River History
Vergets, Rayce, Session: A, Group: 3, 10:00-10:50 am: Presidential Approval and Unemployment
Vlastelica, Katherine, Session: A, Group: 5, 10:00-10:50 am: Human TDP-43 mutations induce sleep disturbances in a Drosophila model of ALS
Voigt, Kyle, Session: D, Group: 1, 1:00-1:50 pm: Implications of Videoconferencing Usage on Willingness to use Telehealth for Medical Appointments
Vye, Jessica, Session: E, Group: 2, 2:00-2:50 pm: Dance as Intersectionality - Exploring Indigenous Movement and Storytelling
Wadner, John, Session: A, Group: 5, 10:00-10:50 am: Testing the Cytotoxicity of (Hyprotek's) Antimicrobial "Lock Solution" in Efforts to Mediate Nosocomial Infections
Watkins, Laurelle, Session: E, Group: 3, 2:00-2:50 pm: NMR Spectroscopy and X-ray Crystallography Analysis of Azo Dyes
Wells, Russell, Session: C, Group: 3, 12:00-12:50 pm: Costa Rican Ecotourism Efforts Maintain Avifauna Biodiversity in Cloud Forest
Wells, Russell, Session: A, Group: 4, 10:00-10:50 am: Structurally Interesting Amino Acid Cocrystalline Phases
Wells, Russell, Session: E, Group: 4, 2:00-2:50 pm: Neuroprotective effects of angiotensin IV molecule, dihexa, on 3-nitropropionic acid induced Huntington's disease-like symptoms in rats
Wentz, Amara, Session: A, Group: 1, 10:00-10:50 am: Cross-Cultural Comparisons of Personality Traits
Wheeler, David, Session: B, Group: 4, 11:00-11:50 am: Pulsed Corona Discharge and Electrospray Ionization from a Gateless Ion Mobility Spectrometry
Whitworth, Paloma, Session: E, Group: 3, 2:00-2:50 pm: Investigating halogen-substituted chalcones
Whitworth, Sophia, Session: C, Group: 4, 12:00-12:50 pm: Locating recombinant RquA protein within S. cerevisiae via a Green Fluorescent Protein tag

Williams, Rhys, Session: B, Group: 5, 11:00-11:50 am: Mahan, Japan, and the Greatest Naval Turnabout in History
Wilson, Drake, Session: A, Group: 2, 10:00-10:50 am: Wicket Closures of Braids
Wybenga, Jane, Session: B, Group: 3, 11:00-11:50 am: River Kids
Young, Lindsey, Session: B, Group: 2, 11:00-11:50 am: Improving Hydrogels for Artificial Cartilage
Zaragoza, Valeria, Session: B, Group: 3, 11:00-11:50 am: River Kids
Zimmerman, Isabel, Session: C, Group: 3, 12:00-12:50 pm: Plants, Present, Future: A Digital Ethnobotanical Narrative of the Children of the Sun Trail

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SESSION SUMMARIES WITH ABSTRACTS

Session A Group 1: 10:00-10:50 am, Communication Studies & Psychology

Pilger, Cambria (Faculty Sponsor: Dr. Alan Mikkelson, Whitworth University): Does being picky pay off? Relational Maximization and Loneliness in Friendships, **Abstract**: Many people compare their current relationships to potential relationships they could pursue with others. In relationships, maximizers continually seek the best relational partners, but as a result are often less satisfied in their current relationships (Mikkelson & Ray, 2020). The goal of this study was to examine relational maximization and loneliness as they occur in college friendships. Data from 274 college-students were analyzed. Relational maximization was measured by examining the choosing the best and alternative search subdimensions. Results indicated that choosing the best was negatively related to loneliness, whereas alternative search was positively related to loneliness. Practical and theoretical implications of these findings are discussed.

Richards, Colby; Saplan, Sage; Kearns, Judge Thomas (Faculty Sponsor: Dr. Alex Bies, Gonzaga University): Evaluating the efficacy of an intensity-threshold based semi-automated edge extraction technique, **Abstract**: Despite edge detection software being readily available and easily accessible, the extant automated techniques don't produce images that are representative of how we perceive our environment. To remediate this problem, we developed a program that allows a user to extract edges from an image by manipulating the intensity threshold value of a given color channel to define where edges exist within the image. The human component of this edge-extraction process is unique to this program and comes with its own set of complications. While it allows for extracted edges that better represent how the original image is perceived by a human, the subjective valuation of one user may be different from that of another, introducing the possibility of users selecting different thresholds when extracting the edges in the image. To determine the extent to which this is a problem, we asked three people to extract edges from 200 images of natural scenes by manipulating the intensity threshold of three isolated color channels (red, green, and blue). We found that while there was limited variation across users within the same color channel, extractions varied more between different color channels, both within and between users. This problem was exacerbated for images that were deemed difficult for edge extraction. This work 1) advances our ability to extract edges from an entire image at once, and 2) exposes problems with this technique which may be resolved with more complex algorithms in future iterations of the program.

Guzzo, Jackson; Wentz, Amara; Durbin, Julia (Faculty Sponsor: Dr. Adam Stivers, Gonzaga University): Cross-Cultural Comparisons of Personality Traits, **Abstract**: We are interested in investigating whether USA and Poland participants differ with respect to personality. In the proposed exploratory study, we will distribute a personality survey to participants in the USA and Poland. We will look at a variety of personality measures like Social Value Orientation, the Dark Triad, and Social Mindfulness but our analysis will primarily focus on the HEXACO 60-item personality inventory (Ashton & Lee, 2009). The HEXACO-60 personality inventory measures six main dimensions of personality: Honesty-Humility, Emotionality, Extraversion, Agreeableness, Conscientiousness, and Openness to Experience (for full descriptions, see HEXACO.org). Data on the personality measures will be collected through a survey that will be distributed by students in concurrent personality classes at Gonzaga University (in the United States) and the University of Warsaw (in Poland). Each student will distribute the survey to 5 individuals across a variety of age groups to obtain a combined sample of over 200 participants. We will be analyzing the data for differences in personality across age, gender, and culture between the US and Polish sample.

Scott, Sarah; Li, Justin (Faculty Sponsor: Dr. Alan Mikkelson, Whitworth University): The Pushover vs. the Powerhouse Supervisor: Employee Perceptions of Supervisor Sociocommunicative style and Interpersonal Dominance, **Abstract**: The leadership capabilities of an individual are often measured and assessed by those being led. However, the reputation and image of a supervisor can be either a powerful tool used to organize, direct and guide a hectic workplace environment; or, detrimental to employee satisfaction, work output and interpersonal connections. This study analyzed the relationship between supervisors' use of their sociocommunicative style (assertiveness and responsiveness) and its association with perceptions of dominance (influence and focus/poise). In this study, 303 participants working in various industries completed measures about their direct supervisors' sociocommunicative style and interpersonal dominance. As hypothesized, assertiveness was positively related to influence and responsiveness was positively related to focus/poise.

Kearns, Judge Thomas; Barber, Henry Lawrence; Goncalves, Rafaela Donato Pinheiro (Faculty Sponsor: Dr. Vinai Norasakkunkit, Gonzaga University): Does Perception of Control influence Attitudes towards Climate Change?, **Abstract**: Attitudes of individual accountability in the fight against climate change continue to pervade public and private discourse (Carvalho, 2007). While general topics of addressing climate change arise across cultures, people's perception of control and accountability vary under different cultural contexts (McNeeley & Lazrus, 2014; Rudiak–Gould, 2013). Research suggests that those who belong to more collectivistic (Japanese) than individualistic (American) cultures are more likely to adjust to social environments and engage in pro-environmental behaviors (Cho et al., 2013; Markus & Kitayama, 1991; Xiang et al., 2019). Additionally, people's perception of control is moderated by their culture, whereby cultural situations may prime an individual to influence their social environments compared to adjusting to one's social environments (Morling et al., 2002; Kitayama et al., 1997). The present study seeks to prime influence and adjustment mindsets to manipulate perceptions of control. As such, we're investigating whether having an influence or adjustment mindset will affect attitudes towards climate change.

Session A Group 2: 10:00-10:50 am, Mathematics

Gonzalez, Tyler; Wilson, Drake (Faculty Sponsor: Dr. Kate Kearney, Gonzaga University): Wicket Closures of Braids, **Abstract**: Knot Theory is the study of closed curves, called knots, in three-dimensional space. A link is a collection of potentially interlocking knots. These knots and links can be represented vertically using a braid diagram. Each braid is said to be closed when corresponding ends of the braid are connected, forming a knot or link. In our research, we look specifically at braid closures using wickets, a certain type of closure that applies to the study of trisections of surfaces embedded in four manifolds. This talk will include an explanation of the braid and wicket moves that maintain isotopy and an example of how these moves can be used to simplify a knot or link.

Cramer, Caleb (Faculty Sponsor: Dr. Michelle Ghrist, Gonzaga University): Developing and Analyzing Staggered Designer Multistep Methods, **Abstract**: Multistep methods can provide an efficient way for computers to approximate a solution to a differential equation because they utilize past function values and derivatives. However, requiring more accuracy generally results in worse stability, i.e., more roundoff error. Our research explores staggered multistep methods, which can be applied to linear wave equations; in these methods, the function values and their derivatives are given at interlacing grid locations, which allows for better accuracy and stability than corresponding nonstaggered methods. Dahlquist's First Stability Barrier puts a cap on the maximum order of a stable method; we seek to maximize the order while maintaining stability. A stability domain is a picture in the complex plane that shows for which differential equations and stepsizes a given method will give stable solutions. We have analyzed the stability domains of all 3 and 3.5-step methods and are currently examining 4-step methods. Requiring stability gives bounds on the domains of the free parameters; varying the parameters within this domain results in changes in the size and shape of the stability domain, allowing us to produce methods that work better for a given differential equation.

Mallott, Amanda; Griffin, Caeli; Nored, Ben (Faculty Sponsor: Katharine Shultis, Gonzaga University): Total Roman Domination of Kneser Graphs, **Abstract**: In graph theory, Total Roman Domination (TRD) colors every vertex in a graph with a 0, 1, or 2 by specific rules that originate from Roman military strategy. The TRD-number $\gamma_t R(G)$, or "weight" of a graph, is the smallest possible sum of all the vertices' numbers that follow TRD rules. In this talk, we discuss strategies for finding the TRD-number of generalized Kneser graphs, a type of graph of which the Petersen graph is a well-known example. We will begin with some basic definitions of graphs, domination, and the "rules" for Total Roman Domination.

Mallott, Amanda (Faculty Sponsor: Eric Hogle, Gonzaga University): Ontology Logs (Ologs) Modeling Cultural Power, **Abstract**: In this talk we will introduce the mathematical knowledge representation tool known as ologs, or ontology logs, and we will then model various forms of cultural power using ologs to explore similarities and differences in how they function.

Session A Group 3: 10:00-10:50 am, Politics, English, Religious Studies

Marvin, Emily (Faculty Sponsor: Dr. Nicole Sheets, Whitworth University): "Moody Bleach, Please" – A Creative Nonfiction Research Project, **Abstract**: "Moody Bleach, Please" is a Creative Nonfiction essay by Emily Marvin, a current English and Biology Junior at Whitworth University. The piece is a Creative Nonfiction research essay that focuses on the experience of a queer student at the now closed Moody Bible Institute Spokane. Because Creative Nonfiction research differs from research in other fields, the sources for a paper such as this include the writers personal journal entires, old emails, interviews with eye witness accounts, and memory. A contrast between this story of Moody Bible Institute and the growth of fungal mold is also explained. As the author is both an English Major and a Biology Major, this essay is the convergence of these two areas of study. Therefore, "Moody Bleach, Please" depicts a different kind of research and storytelling only found in Creative Nonfiction essay writing.

Lynde-Ginal, Ruby (Faculty Sponsor: Dr. Kevin Vander Schel, Gonzaga University): Evaluation of Normative Christian Responses to the Housing Crisis in America, **Abstract**: The numbers of Americans suffering under the homelessness crisis in America are rising, and Christians must reckon with what their response needs to be. God calls us to build just communities and participate in the affirmation of the human person. God calls us to care for the oppressed. God calls us to clothe the naked, feed the hungry, give drink to the thirsty, visit the sick and imprisoned, and to invite the stranger. In a word, God calls us to practice radical social justice. But what does that mean for us today in light of our current circumstances? This research seeks to examine the ideologies that are embedded into the cultural psyche of the American that directly impacts the ways that we treat people in suffering. It also seeks to acknowledge the good work being done by Christians through some of the normative approaches to the homelessness crisis; however, it will critique the ways in which these approaches fall short of their goals. Those responses examined will be the rescue/recovery response, a low-income home ownership response, a human dignity response, and a liberationist response.

Mumm, Hannah (Faculty Sponsor: Dr. Jake Andrews, Whitworth University): Like A Virgin (A Short Story), **Abstract**: My short story, "Like A Virgin," follows the misadventures of a young American expat living in Paris. When the narrator visits the Moulin Rouge, she realizes just how much she doesn't understand about the Parisian red light district.

Vergets, Rayce (Faculty Sponsor: Dr. Maria Tackett, Gonzaga University): Presidential Approval and Unemployment, **Abstract**: For each president that has taken office in the U.S., the public seems to pull from a variety of variables to justify their approval or disapproval. One of the more commonly used metrics used by the public to determine the quality of the current standing president is the unemployment rate. This connection between jobs and presidential quality has never been more present than with president Trump's most recent term in office (2017-2021) where he promised to be the greatest job-producing president in U.S. history. His 2016 campaign was highlighted by a pledge to create 25 million jobs within the next 10 years; besting the job-creation by president Bill Clinton (1993-2001). However, did job creation have a strong relationship on the

public's perception of him or any other recent presidents like Bill Clinton? This paper compares monthly data collected during the U.S. presidencies since 1993 on their average presidential approval rating, U.S. unemployment rate, and other economic variables during their times to see how strong the relationship is.

Session A Group 4: 10:00-10:50 am, Biology, Biochemistry, Chemistry

Fenner, Isabella (Faculty Sponsor: Dr. Stephen Warren, Gonzaga University): Synthesis of a Vigabatrin Ester Prodrug, **Abstract**: The use of prodrugs to alter the pharmacokinetics of a drug through the addition of a biologically inactive component that will alter the absorption, distribution, metabolism or excretion of the active component is extensive. Here we demonstrate the synthesis of a unique ester prodrug with possible applications in the treatment of seizures. The addition of a new side chain to an existing anticonvulsant drug, vigabatrin, has the potential to alter the pharmacokinetics of the drug and avoid common side effects. On its own, vigabatrin prevents excessive neuronal excitation by irreversibly inhibiting the enzyme γ-aminobutyric acid transaminase and preventing the metabolism of the primary inhibitory neurotransmitter γ-aminobutyric acid. However, vigabatrin has been known to accumulate in the retina and cause visual field deficits so, despite its efficacy as an anticonvulsant, it is only used as an adjunct therapeutic for patients who have been unresponsive to other forms of treatment. The creation of a vigabatrin ester prodrug has the potential to modulate the distribution of the drug and prevent ocular toxicity while maintaining the anticonvulsant properties.

Stewart, Laura (Faculty Sponsor: Dr. Stephen Warren, Gonzaga University): Synthesis of a Rosuvastatin ester prodrug as a potential anticancer drug, **Abstract**: Statins are an important class of drugs used for the treatment of hyperlipidemia and are among the most commonly prescribed medications in the United States. Statins are competitive inhibitors of 3-hydroxy-3-methylglutaryl-coenzyme A reductase (HMGCR), which is the rate limiting enzyme of the mevalonate pathway. This pathway is responsible for the production of sterol isoprenoids including cholesterol and steroid hormones and is crucial for cell growth and signaling. Importantly, studies have shown that the use of statins has been correlated with a lower risk of certain cancers. While these studies demonstrated the anticancer potential of statins, others uncovered limitations of the use of statins as monotherapies for cancer treatment due to dose-limiting toxicities and lack of specificity for cancer cells. This research will focus on the chemical synthesis of a substituted Rosuvastatin prodrug in the hopes of reducing these limitations. Rosuvastatin was chosen as the statin for this research because it boasts the longest half-life of the FDA-approved statins. The substituent group will be linked to the carboxylic acid functional group of Rosuvastatin via an ester linkage. In future research, the biological properties of the resultant molecule will be tested to assess its potential for use as a cancer treatment.

Wells, Russell (Faculty Sponsor: Dr. Kraig Wheeler, Whitworth University): Structurally Interesting Amino Acid Cocrystalline Phases, **Abstract**: The spatial organization of molecular building-blocks can directly affect the properties of functional materials; hence, it is not surprising the scientific community continues to hold a strong interest in understanding the structural features that contribute to self-assembly. 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 spatial differences between the quasienantiomeric components affect the self-assembly process. Previous studies examining the interactions between amino acid quasienantiomers revealed that all known quasiracemic systems form packing motifs described by approximate inversion symmetry. Our investigation examines the role of oxalic acid, as a conformer molecule, on the cocrystallization landscape of amino acid quasiracemates. Here, we focus on the distinct scaffold-like structural support that oxalic acid provides through a complex blend of charge-assisted non-bonded contacts. The addition of this tertiary structural element can dramatically alter the degree of inversion symmetry that describes the orientation of the amino acid quasienantiomers in the crystal. This observation is greater in the presence of sulfur-containing amino acids such as methionine and ethyl-cysteine. In these cases, the alignment of the amino acids takes on a decidedly different crystal packing pattern where the R group of the components lack any notable symmetry relationship as compared to other extant quasiracemates. This study systematically quantifies the conformational and symmetrical deviations of these quasiracemic amino acid crystal structures and provides novel insight regarding the molecular recognition and self-assembly of pairs of amino acids.

Orlowsky, Ana (Faculty Sponsor: Dr. Shannen Cravens, Gonzaga University): Determining a chalcone's DNA binding mode: molecular simulations and experimental approaches, **Abstract**: Chalcones are polyphenolic compounds that have been recognized for their variety of bioactive properties through different cellular therapeutic targets. Most therapeutic chalcones have direct anti-cancer activity or they can be modified to increase molecular targeting. Recently, it was determined that at least one chalcone synthesized in an Organic Chemistry lab at Gonzaga University had antimicrobial activity, but the mechanism of action was unknown. Given the precedent for various chalcones to interact with DNA, we began an investigation to determine this particular molecule binds DNA and through what mechanism. Based on its structure alone, the chalcone of interest resembles a minor groove binding molecule with the ability to form ionic and hydrogen bonding interactions with the DNA phosphate backbone, but it also contains aromatic moieties that could be used in intercalation through π-π stacking. We endeavored to predict the chalcone's binding mode using docking simulations (AutoDock Vina). Based on these results, the chalcone appeared to favor minor groove binding. The validity of our docking simulation results were then assessed using fluorescent competition assays. These results help to confirm the mechanism of action of this chalcone on DNA and serve as a framework for future DNA-binding chalcone syntheses.

Hoopes, Dillon (Faculty Sponsor: Dr. Matthew Cremeens, Gonzaga University): SAR and QSAR Investigations in Chalcone Druglikeness, **Abstract**: The term "chalcone" refers to the common biphenolic enone scaffold that is shared between almost 100,000 molecules within the chalconoid family. These molecules are readily found naturally in plants, often contributing taste and flavor to certain teas and beers. The chalcone scaffold

has recently garnered widespread attention for the numerous medicinal properties exhibited by chalcone derivatives and stands to be a reservoir for future pharmaceutical research. However, in order to properly excavate this research, the question must be answered: how can one increase the druglikeness of this chalcone scaffold? The answer for this question likely lies in structure-activity relationship (SAR) analysis of the chalcone scaffold through application of the Lipinski Rule of 5 (RO5) and pharmacophore analysis. As well as in Quantitative Structure-Activity Relationship (QSAR) analysis of the chalcone scaffold through the calculation of the partition coefficient (LogP). Altogether, by designing a chalcone molecule that obeys the RO5 and contains pharmacophores and then quantifying the LogP of this molecule through utilizing FNMR, this experiment aims to investigate the possibility of generating novel chalcone pharmaceuticals from a simple Claisen-Schmidt Reaction involving substituted benzaldehydes and acetophenones.

Barg, Chance (Faculty Sponsor: Dr. Kraig Wheeler, Whitworth University): Photochemical behavior in crystalline networks of fumaric acid and nitrogen containing coformers, **Abstract**: Examining the intermolecular interactions of crystalline solids allows for a broadened knowledge of the factors that influence the construction of multi-dimensional, multi-molecular frameworks. Here, we examine the cocrystalline networks of various fumaric acid and nitrogen-containing coformers. The molecule of fumaric acid has a C=C (olefin group) that, when aligned properly in the crystal, can be used to advantage to study solid-state [2+2] photodimerization reactions. The designed coformer molecules act as molecular "ushers," driving crystal alignment and the photochemical behavior of neighboring fumaric acids. By UV processing a number of cocrystals composed of fumaric acid and a coformer molecule, a deeper understanding of the favored molecular orientations of this reaction is possible. Previous studies have focused on how olefin distance affects the likelihood of a photochemical reaction. These historical studies provide evidence that molecular crystals can be exploited as a medium for organic synthesis, yet predicting their orientation in crystals is not yet available. By examining crystallographic data and the outcomes from these reactions, we were able to generate a predictive structural tool that can be applied to future studies focusing on photochemical dimerizations.

Session A Group 5: 10:00-10:50 am, Biology

Hoag, Thomas (Faculty Sponsor: Dr. Marianne Poxleitner, Gonzaga University): Comparison and evaluation of EG cluster Microbacterium foliorum bacteriophage isolated at Gonzaga University, **Abstract**: Microbacteriophages are viruses that infect hosts in the bacterial genus Microbacterium. There are currently twelve clusters of phage known to infect the host Microbacterium foliorum. The EG cluster currently has 22 unique phages with an average genome size of 62,263 base pairs and an average G+C content of 67.2%. Four different phages within the EG cluster were investigated, all of which were isolated and annotated at Gonzaga University as part of the SEA-PHAGES program. The phages are Teehee, StrawberryJamm, Quammi, and Casend.

Vlastelica, Katherine; Needham, Hope; Torpey, Grace (Faculty Sponsor: Dr. Jason Gerstner, Washington State University): Human TDP-43 mutations induce sleep disturbances in a Drosophila model of ALS, **Abstract**: Amyotrophic Lateral Sclerosis (ALS) is a fatal neurodegenerative disease characterized by the progressive loss of motor neurons. While the mechanism remains unclear, many ALS patients experience sleep disturbances such as insomnia, nightmares, and daytime sleepiness. 5-10% of patients with familial ALS, and up to 97% of patients with sporadic ALS display alterations in the DNA/RNA binding protein TDP-43. Recent studies have shown that a hyper-phosphorylated, ubiquitinated, and cleaved form of TDP-43 aggregates in the neurons of the brain and spinal cord, forming protein inclusions that are characteristic of ALS. Two ALS-causing mutants TDP-43 M337V and Q331K, but not wild-type human TDP-43, are known to generate age-dependent, progressive motor axon degeneration when expressed in mice. Here, we were interested in determining whether these mutations in TDP-43 lead to sleep disturbance. We observe fragmented sleep in both the hTDP-43 M337V and hTDP-43 Q331K mutants compared to hTDP-43 WT. These findings offer the first report of sleep patterns in the Drosophila mutant, hTDP-43 Q331K, as well as a characterization of sleep in both hTDP-43 WT and hTDP-43 M337V flies. Future studies using this model may help in the screening of pharmacological therapeutics for the treatment of ALS.

Renschler, Andy; Crews, Benjamin (Faculty Sponsor: Dr. Frank Caccavo, Whitworth University): The bacterium Shewanella sp. Strain ANA-3 is a Fe(III) super-reducer, **Abstract**: Bacterial dissimilatory metal reduction influences the biogeochemical cycling of carbon, trace metals, and other nutrients in anaerobic sedimentary environments, and may be beneficial in the bioremediation of a variety of toxic environmental contaminants. The Shewanella strains BrY and ANA-3 have been previously shown to use Co3+ as a terminal electron acceptor in anaerobic respiration. This study compared the Fe3+ reduction potential of these DMRB strains by evaluating their ability to reduce ferric pyrophosphate with hydrogen as as an electron donor. The results of the study demonstrate ANA-3 reduces ferric pyrophosphate with a specific activity of 1.42x10-7 nmol cell-1 min-1 which is 387 times greater than the specific activity of BrY. These results indicate ANA-3 may be a super reducer of both Co(III) and Fe(III).

Wadner, John; Meyer, Kimberly; Lumsden, Matthew; Fellin, Mark (Faculty Sponsor: Dr. William Ettinger, Gonzaga University): Testing the Cytotoxicity of (Hyprotek's) Antimicrobial "Lock Solution" in Efforts to Mediate Nosocomial Infections, **Abstract**: Hospital-acquired infections are a massive problem in the US, accounting for 28-45 billion dollars in healthcare costs every year. Between 5-10% of patients in the hospital contract an HAI. The purpose of our research is to minimize the rate of HAIs by developing antimicrobial solutions that can effectively sanitize catheter lines/ports without harming the healthy cells of the patient. This year, we worked specifically with an antimicrobial solution dubbed "Lock solution", composed of Hydrogen peroxide, Ethanol and EDTA. This Lock solution is meant to replace the heparin lock solution in catheters. Lock solution prevents blood from clotting in catheter lines, is antimicrobial, and relatively non-toxic. We tested this Lock solution against several types of microbes including Pseudomonas aeruginosa, Staphylococcus aureus, as well as Bacillus cereus spores, all of which account for many nosocomial infections. These were purposeful targets. We also examined the effect of Lock solution on HeLa cells as a model of healthy human cells that could

be incidentally exposed to low concentrations of Lock solution. Additionally, we wanted to determine whether or not apoptosis was being induced during this possible incidental exposure, which is the topic of our current research.

Session B Group 1: 11:00-11:50 am, Psychology & Physiology

Gade, Anna (Faculty Sponsor: Dr. Paul Romanowich, Gonzaga University): Social Discounting & Health Perceptions, **Abstract**: The purpose of this study was to investigate the impact of different diabetes diagnoses on sharing practices. Diabetes is a family of diagnoses that involves a dysfunction of the pancreas and impacted insulin levels. Different forms of diabetes include type 1 diabetes, an autoimmune condition, type 2 diabetes, gestational diabetes, and prediabetes. Diabetes is a health condition that may incur certain stigma and bias, and this may impact social interaction. Through this study, data collection was performed in order to surmise if there is a difference in sharing practices concerning diabetes diagnoses. It was hypothesized that sharing practices would be impacted by the types of diabetes diagnosis, versus control, in a negative manner. Using a between subject model, social discounting was tested at different social distances within each different group. The participants, university students, were divided into four different groups correlating to type 1 diabetes, type 2 diabetes, prediabetes, and control. Data was collected and analyzed. Through the use of different statistical analyses, it was seen that there may be a difference between sharing for diabetes and non-diabetic individuals with participants trending towards being more willing to share with individuals diagnosed with diabetes.

Ballard, Claire; Harrison, Morgan; Cheatham, Emma; Gardner, Kendall; Barfield, Gillian (Faculty Sponsor: Dr. Patrick Crosswhite, Gonzaga University): VIRTUAL LEARNING VERSUS IN-PERSON LEARNING: AN ANATOMY AND PHYSIOLOGY COMPARISON, **Abstract**: Purpose: With the outbreak of the coronavirus disease 2019 (COVID-19) pandemic, many courses traditionally taught in-person have moved to an online platform in a fully virtual setting. While online courses appear to have many benefits, many questions remain as to how well students perform online compared to in-person. Moreover, there is little specific information on how learning anatomy and physiology (A&P) virtually compares to traditional in-person classes. Methods: Fifteen students from the fall 2019 in-person A&P cohort and 24 students from the fall 2020 online A&P cohort were included in the study. Each of these students took the course as sophomores for the first time and were enrolled in the School of Nursing and Human Physiology at Gonzaga University. Each student was asked to complete a survey categorizing their overall perception of education as well as self-reported GPA. Exam grades and GPAs were used to analyze across sections. IBM SPSS version 27.0 was used to perform t-test, one way ANOVA, regression, bivariate correlation and overall descriptive statistics. Each test was performed against gender as well as in person and online instruction. Results: Data collection was completed in January 2021 and therefore analysis is currently on-going and preliminary results will be presented. Potential implications of this study could inform A&P instructors of how student learning is potentially impacted when courses shift online.

Durbin, Julia; Solorio, Andrea (Faculty Sponsor: Dr. Adam Stivers, Gonzaga University): Social Dominance Orientation and Demographic Variables, **Abstract**: Introduction: The year 2020 has illuminated a variety of social justice issues that continue to plague society. At the root of many of these injustices is the support for unequal power dynamics which we conceptualized as Social Dominance Orientation (SDO), defined as “one's degree of preference for inequality among social groups” (Pratto, Sidanius, Stallworth, & Malle, 1994). With the goal of understanding individual differences in SDO, we tested SDO across a variety of predictor variables such as gender, race, and number of siblings. Method: A sample of 126 participants recruited by students from a Gonzaga class completed a short on-line survey. Social dominance orientation was operationally defined using the SDO7 scale developed by Pratto et. al. (1994). This 16-item scale measure emphasizes the endorsement of dominance and anti-egalitarianism. Finally, a series of demographic questions was included to test our research questions. Results and Discussion: An independent sample T-Test showed that males score higher on social dominance than females ($d = .678$, $p < .001$). We found no effect for age, income, education, race or ethnicity, but we attribute this to sampling limitations. Additionally, we found that people with more siblings scored lower on social dominance ($r = -.19$, $p = .038$).

Smoody, Gillian (Faculty Sponsor: Dr. Sarah Arpin, Gonzaga University): Academic Performance and Social Support, **Abstract**: Current literature explores the effects of social support on stress (Diedricks et. al, 1995). However, to our knowledge, there have been no investigations into how specific facets of social support buffer the effects of stress on academic performance. As a result of the Covid-19 pandemic, students are facing a new reality where learning is predominantly online and their traditional social support networks have been restructured. Thus, it is essential to investigate how course modality has affected stress, and whether social support students buffers these outcomes. To explore whether higher reported social support for students taking more in-person classes lowers stress and inhibits negative consequences on academic performance, we surveyed college students (N = 213) through self-report measures. These measures assess variables like academic stress, perceived social support, academic performance, course modality, etc.. Our preliminary data analysis has revealed that when students are taking more online courses, they are more likely to be stressed and perform worse in school, but only if they are experiencing low levels of familial social support.

Higley, Kirsten; Cosola, Georgia (Faculty Sponsor: Dr. Adam Stivers, Gonzaga University): What We Read About and What We Believe: How the Availability of (Neutral) News Media Shapes Political Priorities, **Abstract**: Our research focus is the availability heuristic and its relationship to how people judge the importance of political issues. The availability heuristic is the tendency of individuals to make judgements and decisions based on the frequency of topics they are exposed to (Schwarz et al., 195). Prior research in our laboratory has shown that a group exposed to (politically neutral) media reports about climate change perceived it to be an important topic in comparison to a group exposed to media reports about immigration. However, there was no evidence that the immigration group regarded the immigration issue as more important (Matheison, 2020).We propose to test the replicability and generalizability of these findings by conducting the same study with a group of 100 undergraduate

psychology students. The prior study utilized a sample of all ages from an on-line crowdsourcing platform, so it will be interesting to see whether the original findings replicate in a sample of college students that may have more malleable political attitudes.

Session B Group 2: 11:00-11:50 am, Computer Science & Engineering

Garcia-Camargo, Leon (Faculty Sponsor: Dr. Paul De Palma, Gonzaga University): Zipf's Law in Speech: Child Autism Spectrum Disorder, **Abstract**: Zipf's law describes the relationship between the frequency of words in a large corpus and their rank. Its most basic form is a harmonic series, indicating that the frequency of words is inversely proportional to rank. Research on Zipfian distribution in certain disorders such as Alzheimer's and Non-Fluent Aphasia suggest the language patterns of patients are affected in subtle but measurable ways. Our study furthers this hypothesis by analyzing word frequency distributions of Typically Developing (TD) children and that of children diagnosed with Autistic Spectrum Disorder (ASD). Access to large corpora of child speech was provided by generous organizations in the Netherlands. The transcripts were analyzed using statistical methods established in an academic paper written by students from the Gonzaga NLP Research Group. Our findings (soon to be published) establish that TD child speech, as the speech of adults, is Zipfian. To our surprise, unlike TD child speech, speech from children diagnosed with ASD is non-Zipfian. This indicates a measurable difference between speech patterns of the two populations and refutes the assertion that all naturally occurring speech is Zipfian.

Encarnacion, Marissa; Young, Lindsey (Faculty Sponsor: Dr. Harman Khare, Gonzaga University): Improving Hydrogels for Artificial Cartilage, **Abstract**: An improved understanding of articular biomaterials' properties is key to the development of synthetic materials that may act as functional prosthetics. An accurate probe of tribological properties of these "soft" materials requires measurement of forces in the 1-100 μN range. Phase 1 of this project focused on the design and fabrication of a micro-tribometer capable of measuring frictional forces between soft materials in the 1-100 μN range. The sliding mechanism for this device utilizes a compound flexure, comprising of 4 spring-steel flexures for translation along a single axis of motion. After CAD development and assembly, the micro-tribometer stage was instrumented with linear actuators, force and position sensors, and a data-acquisition system. Phase 2 tested the accuracy and precision of the micro-tribometer by comparing the measured forces against standards in published literature. Ongoing work in phase 3 of this project focuses on improving synthetic materials for use as artificial cartilage – specifically, PAAm hydrogels. Current hydrogels being explored for use as artificial cartilage have been promising, however their use as an implant has been limited due to poor reliability. The tools and materials being developed as part of this project will enable development of more suitable replacements for cartilage in the future.

Howard, Nora (Faculty Sponsor: Dr. Nora Sprint, Gonzaga University): Ecological Momentary Assessment of Patient Recovery in an Outpatient Environment, **Abstract**: Clinically validated wearable devices, such as Actigraphs, are often used by researchers to objectively analyze physical activity, sleep, and recovery from an injury or illness. Specifically for recovery, recent research has utilized activity and sleep/wake data from Actigraphs to study rehabilitation patients and their recovery process. This research can provide insights that are valuable for therapy providers and for rehabilitation patients, especially if they can access the insights "on-demand" and in near "real-time". In order to research the feasibility and utility of such an online system, we have designed and implemented an Android app to interface with patients who wear Actigraph devices while undergoing rehabilitation. The app also provides support for ecological momentary assessment (EMA). EMA is often used in healthcare settings to track a patient's progress by asking a patient to rate their current activity and fatigue levels via standardized clinical assessments. Existing research has not taken advantage of both EMA data and time-aligned Actigraph data in an online, mobile application to help provide healthcare services. We hypothesize that our application associated data analytics can help improve the recovery process for rehabilitation patients, and more generally, for all populations aiming to improve their health.

Grady,Ryan (Faculty Sponsor: Dr. Richard Stevens, Whitworth University): An Adaptive GUI For A 2-Degree Of Freedom Strone Rehabilitation Robot, **Abstract**: An Adaptive Graphical User Interface (GUI) was developed using the Simulink Real-Time programming environment. This interface will allow for a patient and a therapist to interact with a 2-degree of freedom stroke assessment and rehabilitation robot.

Mamolo, Steven; Miller, Anna Leigh (Faculty Sponsor: Dr. Harman Khare, Gonzaga University): Friction and Wear of 3D Printed Polymer Composites, **Abstract**: Polylactic acid, or PLA, is a common polymer used in fused deposition modeling (FDM) 3D printing. For many applications and assemblies, 3D printed PLA parts may experience sliding contact with other parts and surfaces. Understanding the associated friction and wear life of these parts is crucial for the effective operation, reliability, and longevity of the system. The purpose of this research is to quantify the wear coefficient and coefficient of friction of PLA samples fabricated by an FDM 3D printing process. Three types of PLA were selected for this study: commercial pure PLA, pure PLA manufactured in-house, and a blend of PLA and PTFE (polytetrafluoroethylene, commercially known as TeflonTM), also manufactured in-house. We hypothesize that PTFE may lower the wear coefficient of PLA by forming a protective film between the 3D printed part and a steel countersurface. To test this hypothesis, wear tests were carried out using a custom reciprocating "tribometer" (i.e. wear tester) in dry sliding conditions. A Filabot EX2 filament extruder was used to manufacture all in-house filament, which was subsequently printed using a commercially available FDM printer. It is anticipated that findings of this work will help to inform predictive design of 3D printed parts, capable of sustaining low friction and low wear sliding.

Miller, Brenden; Mamolo, Steven (Faculty Sponsor: Dr. Harman Khare, Gonzaga University): Nanoscale Analysis of Transfer Films in Ultra-Low Wear Polymer Composites, **Abstract**: Reliability and wear are concerns that many engineers face when developing products. In unique environments such as the human body or industrial machinery, one method of improving reliability is using an ultra-low wear polymer composite

as a solid lubricant. Polymer composites exhibit low wear behavior due to the formation of a thin film through material transfer to the opposing surface during sliding. Understanding how these films - known as transfer films - develop during sliding, and how their properties can be tailored holds promise for creating novel, ultra-low wear materials. In this study, we report on transfer films developed from ultra-low wear polymers derived from polytetrafluoroethylene (PTFE) and ultra-high molecular weight polyethylene (UHMWPE). PTFE and UHMWPE matrix materials are mixed with fillers that impart beneficial mechanical properties to these composites. The wear analysis looks closely at the role of the nanoscale interfacial films in the high wear resistance of tribological polymers. Polymer composites tested include chromia-PTFE and PEEK-UHMWPE. For each composite, filler weight percentages are varied and the subsequent effect on transfer film development is analyzed. Atomic force microscopy (AFM) measurements additionally help determine the morphological characteristics of transfer films, helping identify the most effective composite compositions for reducing wear.

Session B Group 3: 11:00-11:50 am, Engineering & Environmental Studies

Zaragoza, Valeria; Sunitsch, Grace; Wybenga, Jane (Faculty Sponsor: Dr. Betsy Bancroft, Gonzaga University): River Kids, **Abstract**: The Spokane River provides recreational opportunities, water and energy resources, and is home to many Spokane native wildlife species. However, without a comprehensive understanding of the historical context and the unique connection to our local aquifer, this vital river can be easily overlooked. Our group aims to target 5th-grade-classes to help foster ideas of environmental stewardship and greater awareness of the environment around them. We created three videos encompassing a brief lesson, activity, and conclusion focusing on the Spokane watershed, its ecosystem, and a restoration exercise designed to provide students with the knowledge of how to improve the river for the future. To measure the efficacy of this project we will implement a pre and post-evaluation for the students to provide feedback on the lessons. The overall goal behind this project is to create a curriculum that can be implemented into the Science in Action program in partnership with students majoring in Environmental Studies at GU. Additionally, serving grade school children from the Spokane community will hopefully be a way to instill a respect and certain reverence for the Spokane River and the environment as a whole, helping to contribute to a future generation of environmentally conscious individuals.

Browning, Ruby; Coleman, Jillian; Koning, Kenneth; Maiorino, Robert (Faculty Sponsor: Dr. Betsy Bancroft, Gonzaga University): Olmsted 2.0-Urban Greenspace Viability, **Abstract**: Spokane is a city often praised for its abundance of outdoor recreation opportunities, many of which occur in the city's green spaces. However, this access to green space is not an equitable one, for there are many marginalized neighborhoods with little access to any places of recreation. One way in which this issue can be addressed is to use GIS software to identify plots of land where a green space can be established, in order to minimize the gap in greenspace access. Based on factors such as existing parks, waterways, municipalities and mass transit routes, we will be able to recommend land that is available for purchase to the Inland Northwest Land Conservancy. This land will be conserved as green space acting as an immediate benefit for the community. Green space provides various benefits in areas such as recreation, health, and the economic sector. Proper allocation of green space can be used to promote equity between Spokane's neighborhoods.

Marquez, Abigail Lennah (Faculty Sponsor: Dr. Joshua Schultz, Gonzaga University): The Sustainability and Cost of Solar Roofing in Spokane Compared to Conventional Standing Seam Roofs, **Abstract**: Roofing on residential and commercial buildings is an underutilized space in terms of consumer usage. This paper studies solar shingles and standing seam metal roofs and compares their engineering performance in both sustainability and costs as gathered from academic, engineering, and vendor sources. This study finds while solar roofing reduces consumer fossil fuel emissions and saves on electricity, the normalized monetary costs are still 2.5 times that of a standing seam metal roof. Additionally, the embodied carbon paid back upon its production is dependent on the energy generated by the system, as shown in an 11.3 kW system on an 1885 ft^2 house based in Spokane, WA. If a household stays within its annual generation limit, it can offset the embodied carbon from its production within 12 years of its 25-year lifetime.

Margraf, Joshua (Faculty Sponsor: Dr. Patrick Ferro, Gonzaga University): Investigation into Youngs Modulus and Tensile Strength of Tough PLA Bars, **Abstract**: An ongoing research project propagated by Joshua Margraf and overseen by Professor Ferro is attempting to discern the effects of changing infill percentage and aging treatments in 3D printed parts. Project focuses on material properties such as Yield Strength, Ultimate Tensile Strength, Young's Modulus, and Relaxation Modulus of 3D printed tough PLA dog bones. Larger infill percentages increase the plastic density within the part by removing air space. This is expected to increase part strength but often results in greater part cost and part print time. Aging treatments allow for more cross-linking between PLA strands which increases part strength at cost of ductility. Project goal is to then inform and advise 3D printer users as to how such varied conditions might affect the structural properties of their 3D prints.

Arce, Dominic; McEachern, Cullen; Ewert, Thomas (Faculty Sponsors: Dr. Greg Gordon and Dr. Betsy Bancroft, Gonzaga University): Lake Arthur Master Plan-Trail Enhancement, **Abstract**: This project revolves around the restoration and enhancement of the Lake Arthur region on Gonzaga's campus. Our vision is centered on the potential improvements to the Spokane and Gonzaga community that would arise from the development of a trail circumnavigating Lake Arthur. Furthermore, we hope to heavily highlight sustainable practices in our construction, providing the lake region with native species of plants, better water irrigation, and cleaner runoff from the campus into the lake. The impacts of this project are extensive, with primary benefits including: 1) Bothe the visual and practical enhancement of the region immediately surrounding the Lake Arthur region for the Gonzaga and Spokane community, 2) a sustainable trail helping to aid in the current and future health and biodiversity of the area, and 3) helping to clear pollutants caused from runoff of the surrounding Gonzaga campus.

Session B Group 4: 11:00-11:50 am, Chemistry & Biochemistry

Erickson, Andrew (Faculty Sponsor: Dr. Shannen Cravens, Gonzaga University): Assessment of Enamel Erosion by Popular Beverages using Atomic Force Microscopy, **Abstract**: It is well known that acidic beverages can interact with the hard outer tooth structure known as enamel. Since 95% of enamel is made up of hydroxyapatite (HA), a repeating monomer with the chemical formula Ca10(PO4)6(OH)2, the calcium ions can be replaced by the free protons in acidic solution, resulting in etching of the enamel surface. In recent years, hard seltzer and kombucha have risen in popularity, however, their impact on dental health is largely unexplored. By using atomic force microscopy (AFM), which can detect nanometer scale changes in surface morphology, we have investigated the early erosive effects of these popular acidic drinks. Since actual teeth can vary due to age, genetics and quality of care over time, we confirmed using AFM images that manufactured HA discs resemble the surface of tooth enamel and can be used in the place of real teeth. We used two methods for soaking HA discs in beverages in order to assess the effect of carbonation on enamel decay. To aide in the interpretation of the AFM decay profiles collected, pH and titratable acidity were also measured.

DeForest, John (Faculty Sponsor: Dr. Ian Townley, St. George's School): Iron-Zinc Complex Interaction with Fine Soil Particulates: A Proxy for Studying Diffusion Inhibition in Hydrated Sediments, **Abstract**: Iron-zinc complexes can be found in soils as a result of mining waste, and due to increased nutrient loading in the Coeur d'Alene basin, facultatively anaerobic bacteria are releasing zinc and other heavy metals from the sediment into Lake Coeur d'Alene. The release of heavy metals threatens wildlife habitat and the region's water supply—the Spokane Valley-Rathdrum Prairie Aquifer. A recent study by researchers at the University of Idaho detailed a volcanic ash layer in lakebed sediment that divides regions of different concentrations of zinc, effectively preventing normal diffusion of the iron-zinc complexes. Why does the ash layer affect the movement of iron-zinc complexes in Lake Coeur d'Alene? To investigate the properties of this possible heavy metal trap, we synthesized ferrihydrites and complexed them with zinc, then mixed the complexes with various sediments, including volcanic ash, natural, and purified clay to determine if the impermeable properties of the ash layer described are due to a molecular interaction with the ash or to larger physical properties of the layer itself. Results will inform further study on possible "cap" layers and bioremediation efforts to sequestrate and neutralize heavy metals in soils and limit damage to local and regional ecosystems.

Layton, Elijah (Faculty Sponsor: Dr. Eric Ross, Gonzaga University): Ion affinity chromatography methodology to study synthetic anionophores in lipid environments., **Abstract**: Cystic Fibrosis (CF) is caused by the dysfunction of the cystic fibrosis transmembrane conductance regulator (CFTR), which selectively transports chloride across the cell membrane. The Gale (U. Sydney) group is designing synthetic anionophores that might possibly replace the function of CFTR in individuals suffering from CF. One reported molecule, FtetraU, functions as a H+/Cl- symporter and has similar transport activity to the naturally occurring anionophore Prodigiosin. One limitation to the studies performed by the Gale group is that measurements of binding ion binding affinity were taken in solvent, which is not an accurate mimic for a lipid environment. The second limitation is that the spectroscopic studies used require a large amount of ionophore. Here, we present a chromatographic method to measure ionophore complexation that removes these limitations, as well as report the observed apparent binding constant of FtetraU for chloride. The binding affinity of FtetraU with chloride was investigated within diacylglyceride (DAG) lipids on reverse phase silica particles using affinity chromatography and competitive binding studies with bromide, the ion that can be monitored by ICP-MS. Characterizing studies of the DAG retained on the particles as tested by TGA is 65%, and fluorescent microscopy showed DAG forming a uniform monolayer on the silica particles.

Talarico, Julia (Faculty Sponsor: Dr. Eric Ross, Gonzaga University): Increasing the Sensitivity of Ion Chromatography for Measurements of Polyether Ionophore-Ion Binding in Lipid Bilayers, **Abstract**: Polyether (PE) ionophores selectively bind to metal cations and shuttle them across the lipid bilayer. This class of compounds is currently used for antibiotics in the agricultural industry. However, they are not used as human therapeutics due to idiosyncratic toxicity. An understanding of the mechanisms resulting in ionophore selectivity is critical for exploring their potential as human therapeutics. Ion-ionophore binding plays a role in the mechanism but is very difficult probe analytically within the lipid bilayer environment. This work reports advances in a chromatographic method for evaluating ion-ionophore binding affinity that uses lipid monolayers supported on commercial silica particles. The hybrid bilayer is comprised of porous reverse-phase (RP) silica and POPC lipid-hosted with an ionophore. A library of synthetic ionophores provided by Dr. Thomas Poulson (Aarhus U, Denmark) is probed. All compounds are found to bind less strongly than the natural PE ionophore nigericin. The observation of very weak binding has required modifications to the methodology that works with stronger-binding ionophores. These are discussed, along with characterizing studies examining the percent retention of the lipid onto the RP silica along with the percent retention of the ionophore in the hybrid lipid bilayer.

Wheeler, David (Faculty Sponsor: Dr. Eric Davis, Whitworth University): Pulsed Corona Discharge and Electrospray Ionization from a Gateless Ion Mobility Spectrometry, **Abstract**: Ion Mobility Spectrometry (IMS) is an analytical technique for the separation and identification of ionized molecules through a gas buffer. IMS is used in the detection of narcotics and explosives in security applications, and is frequently hyphenated to other separation methods in research applications. An IMS experiment consists of an ionization source and an IMS cell with a reaction region and drift region, separated by an ion gate. The ion gate introduces a small packet of ions from the reaction region into the drift cell for separation and detection. However, the gate introduces increased complexity of the IMS system as well as a depletion region around the gate itself which reduces the overall signal that may reach the detector. A gateless IMS was developed by replacing the ionization chamber and ion gate with an orthogonal metallic Electrospray Ionization (ESI) emitter. This emitter was pulsed to produce the packet of ions to be separated in the drift cell, precluding the use of a reaction region or ion gate. The pulsed orthogonal ESI setup used dual aperture grids on either side of the emitter, to produced high-resolution and high-accuracy separations with reduced mobility values matching within experimental error for IMS standards in the positive mode.

Boatman, Sarah; Davis, Eric; Thiel, Alex; Jones, Michael (Faculty Sponsor: Dr. Eric Davis, Gonzaga University): ArcSpray Optical Emission Spectroscopy for elemental analysis in field-based measurements, **Abstract**: As an excellent and effective method of elemental analysis, glow discharge optical emission spectroscopy (GD-OES) utilizes an electrical discharge for elemental determination, with a stable low temperature plasma generated between two electrodes in the presence of high voltage. Upon the introduction of sample in this region, the excited analyte molecules produce an AES signal. Commercially, GD-OES is only available for use with solid samples, and requires complicated electronics to maintain a stable plasma. Eliminating the need for complex instrumentation, this study seeks to produce similar intense AES signals for metal ions utilizing a full arc event rather than glow discharge. Termed ArcSpray Optical Emission Spectroscopy (AS-OES), the arc established between a flowing solution and counter electrode produces an instantaneous aerosol through which the arc is propagated to produce electronically excited atoms. In this work, optimal testing parameters, such as electrode geometry and angle of electrode to hollow needle, as well as electrode composition, were investigated utilizing 10 ppm sodium as an analyte, representing an initial proof-of-concept effort toward concentration-dependence in field-based ArcSpray measurements.

Session B Group 5: 11:00-11:50 am, History

Williams, Rhys (Faculty Sponsor: Dr. Ann Ostendorf, Gonzaga University): Mahan, Japan, and the Greatest Naval Turnabout in History, **Abstract**: The writings of American naval historian and theorist Alfred Thayer Mahan were undeniably influential on Western naval development for a substantial period of time, and influenced the formation of the modern steel and steam navy. What less may know is to how his writings affected the east, particularly the only state in the east with a naval presence of note, Japan. His work would be the guide (at times directly and later indirectly) that led to victory in the Russo-Japanese War, and later defeat in the Pacific in the Second World War. This is shown in a number of naval engagements including the well known Pearly Harbor, but is perhaps best displayed in the Battle Off Samar. An analysis of primary and secondary sources covering the battle will show that it was not only the largest naval battle in human history, but the largest example of the failings of the Mahanian/Jominian theories of concentration of force and decisive battle as well.

Cantu, Colin (Faculty Sponsor: Dr. Ann Ostendorf, Gonzaga University): The Battle Against the Mafia: An Evolution of United States Policy and Law Enforcement, **Abstract**: My project will focus on how the United States government gradually began to focus on cracking down on organized crime starting in the 1950s by holding Senate Hearings that called major suspected crime figures to testify. My research project will discuss other organized crime groups and some background of its reach prior to the 1960s, but it will mostly focus on the American Mafia or Cosa Nostra, and on the United States response to it from the 1960s to the 1990s. I want to show how and why the government began to focus on this problem, how they framed it, and what their successes were against the Mafia, but also their failures. I want to wrap up and explore if the Mafia has been crippled or still lingers on to this day.

Shelledy, Matthew (Faculty Sponsor: Dr. Ann Ostendorf, Gonzaga University): Harrison Anti-Narcotics Act, **Abstract**: This project seeks to inform its audience on the Harrison Anti-Narcotics Act of 1914 before using this piece of legislation to open up discussion on America's failures in drug legislation.

Repetti IV, Gregory (Faculty Sponsor: Dr. Ann Ostendorf, Gonzaga University): Dealing with Discrimination: Italian Immigration Experience in New York City, **Abstract**: The project will examine the immigration of Italian's to the United States at the beginning of the twentieth century. It will examine the reasons for leaving Italy, their experience upon arrival in New York City, the discrimination that they experienced and how some dealt with that discrimination. Specifically, I will draw upon the notes and letters of my great-grandfather and an interview I conducted with my grandfather to look into the founding of the Columbia Association of the NYPD and its legacy today. I hope to demonstrate how the lessons learned by this population might be applied to drive change in today's world.

Larue, Hope (Faculty Sponsor: Dr. Ann Ostendorf, Gonzaga University): Edward VIII's Abdication and Its Implications, **Abstract**: As I began my research for my last proposed topic, I realized the content I wanted to cover was too vast for a twenty to twenty-five-page paper. Considering this, I have decided to focus on one key actor: Prince Edward VIII, Duke of Windsor. Edward VIII was a charismatic young man, king for a moment, and embarrassment to the royal family for the rest of his lifetime. The oldest child of the then king, George V, Edward VIII was easy to be around, intelligent, an astounding military man, and next to rule the British empire. When his father died, Edward VIII became king, but not without complication. He was in love with a married American woman who had already been divorced. In England, even during the twentieth century, it was unacceptable to remarry but especially forbidden for a royal to remarry a twice-divorced American actress. Placed in the position to choose his one true love or his title, the King abdicated his position in favor of his ill-prepared brother, George VI. From then, the line took a sharp turn and resulted in the still reigning Elizabeth II of England's rule. By changing not only his fate but the entire fate of England, the failed king was not able to remain in England. He and his new wife were exiled to a phony military post position in France, leaving any life of English prominence behind them. However, as time went on, the desire for his old reputation came creeping back. The second World War was in full swing, granting Edward VIII a prime opportunity to interject himself back into English politics. Since his brother had just passed away, his niece Elizabeth had been ruling for a few years. Eager to make a mark, the Duke of Windsor was given a personal tour of Nazi Germany's Third Reich by Hitler himself. After photos, videos, and letters were unearthed after the end of the war, historians were tasked with compiling and reporting on the massive development in history. For example, Churchill was a part of the coverup as it would have brought the end of the English monarchy during such tumultuous times. For this project, I plan on tracking the lifetime of Edward VIII from childhood, kingship, and exile. Considering the ties and attributes of this Prince, the history of the English monarchy avoided a massive controversy and potential upheaval. With ties to one of the vilest men in world history, the

royal family knew the consequences and kept Edward VIII at an arm's length for the remainder of his life. What were all of the implications of the abdication, positive and negative? Was it more than love that drove the Duke from his duty? How did Mrs. Simpson deal with the scandal and being blamed for the entire thing?

Session C Group 1: 12:00-12:50 pm, Psychology & Physiology

Simmons, Rebecca; Cook, Joie; Alonso, Katie (Faculty Sponsor: Dr. Gary Thorne, Gonzaga University): Confirmation Bias as it Applies to Political Party and Response to Online Articles Regarding COVID-19, **Abstract**: We are going to investigate whether political party preference predicts confirmation bias as it relates to choices between online article headlines about COVID-19. Confirmation bias in the context of this experiment is measured by the biased source of the article and the liberal/conservative views about COVID-19 restrictions represented in the headlines. Knobloch-Westerwick, Johnson and Westerwick (2015) showed that when presented with articles presenting opposing stances, attitude-consistent messages and messages from high-credibility sources were preferred. We predict that people that align more with republican ideals will display greater confirmation bias in regard to COVID-19. Republican philosophy leans more towards individual freedoms, rights and responsibilities. In contrast, Democrats attach greater importance to equality and social/community responsibility. Given these distinctions, we believe the Republican party's values may correlate positively with a higher level of confirmation bias.

Peters, Nicholas; Rinn, Erik (Faculty Sponsor: Dr. Gary Thorne, Gonzaga University): The Effect of Color on Visual Information Retention, **Abstract**: The purpose of this study is to explore the effects of color on visual information retention. In this study participants were exposed to non-threatening videos that are of similar quality. One video was in color and the other was in black and white. Both were videos from the show "How It's Made" about how classic American treats - the Oreo and chocolate mints - are made. With the Oreo video in color and the chocolate mints video in monochrome, participants answered six questions about each video. They watched the Oreo video first, answered six questions about it, then watched the chocolate mints video and responded to six questions about it. The results of this research and its implications will be the focus of our presentation.

Kearns, Judge Thomas (Faculty Sponsor: Dr. Heather Crandall, Gonzaga University): Following Pop Culture Chains of Artificial Intelligence from Alex Garland's Ex Machina, **Abstract**: Human communication is changing in the face of emerging artificial intelligence (AI) (Boddington, 2021). This change has reshaped our awareness from seeing AI as a tool to now seeing AI as a pervasive force in mediating and replicating human communication (Smith & Marx, 1994). Today, scientific advancement has incorporated more humanlike qualities in AI (Salles et al., 2020). Many of the fears, anxieties, and existential reflections about AI are found in popular culture (Corcos, 2017). The present research uses symbolic convergence theory to examine a popular narrative—the creation of an independent and conscious AI—in the movie, Ex Machina, to illuminate the rhetorical vision of robot humanization. Furthermore, this humanization suggests a focus on "roboethics"—a reflection and application of human ethics (Zawieska, 2020). The analysis reveals a vital component of maintaining a purposeful and ethical dimension in AI's development, as well as the relationships we foster with its use. Further implications are discussed.

Kearns, Judge Thomas; Goldberg, Emily; Bennett, Vincent Michael (Faculty Sponsor: Dr. Alex Bies, Gonzaga University): Comparison of replacement techniques for missing data in survey measures, **Abstract**: Missing data poses a threat for misrepresenting relationships among variables in a study. Being able to control for missing data by replacement can significantly strengthen the statistical power of an experiment. The present analyses are performed on a dataset composed of 257 participants' responses to a variety of questionnaires measuring psychological phenomena (personality traits, aesthetic interest, spirituality, etc.). In particular, we used the following metrics: The Big Five personality test, Nature Relatedness Scale (NR), Spiritual Connection Questionnaire (SCQ-48), Need for Cognition Scale, Art Experience & Aesthetic Fluency Scale, Lifestyles Questionnaire (DFAS), Positive and Negative Affective State (PANAS) Questionnaire, and the Autism Quotient (AQ) Questionnaire. A few participants failed to answer a subset of the survey items. We believe these items were missed at random (MAR, in contrast with data that are missing not at random, MNAR, and not necessarily missing completely at random, MCAR). Here we assess multiple replacement strategies (e.g., Little's method, participant's mean or median) to determine the effect of imputation on the results of our analyses (i.e., score distributions, scales' correlations). In sum, this study addresses the effects of replacing missing values in a survey study and their effects on the relationships among measured variables.

Ford, Kaitlyn; Danahy, Julia; Lerch, Nicole; Lindsey, Tyler (Faculty Sponsor: Dr. Ryan McCulloch, Gonzaga University): Methodology of the Biomechanical and Cognitive Effects of Tablet Desks on University Students, **Abstract**: Introduction: Right-handed tablet (RHT) desks are prevalent across universities, but only offer support for the right arm. Approximately ten percent of the world's population is left-handed, yet little research has been conducted to understand how RHT desks may impact left-handed university students. Purpose: The purpose of this study was to develop a methodology examining the extent to which different desk types can influence cognition, muscle activation, legibility and handwriting speed of left-handed university students. Methods: Left-handed participants and right-handed controls were assessed in flat-top tables and RHT desks. Electromyography data was collected and normalized to a participant's maximum voluntary contraction for four muscles: upper trapezius (UT), anterior deltoid, flexor carpi radialis and extensor digitorum. From speed tests, legibility and rate were determined using a standardized method. Cognition was assessed with quizzes at each desk style. Data was analyzed using independent and paired sample t-tests. Results: Increases in UT activation were detected for left-handed participants in a RHT desk. Conclusion: This approach detected distinct differences in muscle recruitment of left-handed students at different desk types. This methodology warrants a full-scale study, as it successfully formalized a multi-pronged approach to evaluate legibility, speed, muscle activation and cognition, while modeling a university classroom.

Session C Group 2: 12:00-12:50 pm, Computer Science

Olafson, Cole; Garcia_Camargo, Leon; Lunder, Jason (Faculty Sponsor: Dr. Paul De Palma, Gonzaga University): Machine Translation Using Dependency Trees, **Abstract**: Machine translation, the use of software to translate text or speech from one language to another, is a problem at the frontier of natural language processing. Current approaches to this task include bi-directional Seq2seq models and transformer models which are computationally expensive and require exponentially increasing quantities of data to continue to learn. Christopher Manning introduced the concept of Tree-LSTMs through his work on prediction of semantic relatedness and sentiment classification. However, few studies have explored the use of Tree-LSTMs beyond his work. Our research consists of creating a machine translation model using modified dependency-tree LSTMs with additional techniques to increase accuracy and efficiency of learning.

Cole, Hannah (Faculty Sponsor: Dr. Paul De Palma, Gonzaga University): Natural Language Processing for Interspecies Communication, **Abstract**: Studying orca vocalizations is rapidly expanding specialty since the release of the Orchive, a publicly available archive of orca vocals. Finding, identifying, and labeling each vocal is a difficult and time-consuming process for humans. If software could perform these functions, we would have a massive amount of information to further orca research, particularly with regards to studying their linguistic abilities. The methods I am studying include neural networks and spectrogram analysis. I hope to create the schematic for software that can classify orca vocalizations into the particular matriline (mother-led family unit) they belong to.

McCullough, Hunter; Evey, Alana; Compy, Kiernan (Faculty Sponsor: Dr. Aaron Crandall, Gonzaga University): Combinatorial Analysis Study of Brandubh, an Ancient Viking Board Game, **Abstract**: Before chess came to Northern Europe there was Tafl, a family of asymmetric strategy board games associated strongly with the Vikings. The purpose of this project is to study the combinatorial state-space complexity of an Irish variation of Tafl called Brandubh. Brandubh was chosen because of its asymmetric goals for the two players, but also its overall complexity well below that of chess, which should make it more tractable for strongly solving. A strongly solved game is one where a proven series of moves leads to a guaranteed outcome, win, lose, or draw. Brandubh's rules and characteristics are used to derive the state-space complexity of the game, which shows how difficult strongly solving it will be. This work uses the game rules to establish the upper bound for Brandubh's number of states. Overall, the upper bound complexity for solving the game is around 10^14 states, which places it between that of connect four and draughts (checkers). Once the complexity is analyzed, it opens the door to evaluating the game balance for each player, which artificial intelligence algorithms would best suit the game for further research, and whether the game's rules contribute positively to fair gameplay or not.

Evey, Alana; Compy, Kiernan (Faculty Sponsor: Dr. Aaron Crandall, Gonzaga University): Prototyping For The Quadrillion Game Moves of Brandubh, a Viking Game, **Abstract**: Brandubh is an ancient northern European board game strongly associated with Viking history and culture. The game is played on a 7x7 board with asymmetric goals for the two players. The moves are similar to chess with fully deterministic and observable results for each turn taken. This leads the game to being evaluatable for the maximum quantity of possible board states. Earlier work showed this limit to be around 10^14 board states. Given Brandubh's asymmetric nature, with a tractable number of states, it opens the door to strongly solving a relatively unique game. Strongly solving would provide insights into game balance and other game theory questions. This work reports on a prototype system attempting to strongly solve Brandubh by expanding and storing all game states. It uses a PostgreSQL database and high performance computing clusters to compute and store all game states to solve Brandubh. The authors can use these early results to estimate needed resources to complete the expansion of all 10^14 states, which will take somewhere between 3-5 years and 2 petabytes of disk storage. Once complete, the full project shall add a chess like game to the small list of strongly solved games.

Call, Tristan (Faculty Sponsor: Dr. Gina Sprint, Gonzaga University): Gamifying Software Engineering Tools to Motivate Computer Science Students to Start and Finish Programming Assignments Earlier., **Abstract**: Research has shown that computer science students who start programming assignments early generally receive higher grades. This is likely because students often struggle with errors and do not know how to properly test their code. These are problems that are more easily overcome when students have more time to complete the assignment. Furthermore, software engineering tools that can help mitigate these issues, like version control and unit testing, are increasingly important for students to learn early in their career. To motivate computer science students to start and finish programming assignments earlier, we designed and implemented a gamification framework called the Leaderboard. The Leaderboard is an open-source plugin that runs in the Moodle learning management system. Using gamified points, the Leaderboard rewards students who pass programming assignment unit tests well before the assignment is due. We designed the system to be fully automated using software engineering tools and educational platforms, including Github Classroom, a build server, and Moodle. Results indicate students who used the Leaderboard did not start assignments significantly earlier; however, they finished assignments earlier, committed code more frequently, and passed more unit tests. The students found the Leaderboard to be motivating and passing unit tests was exciting for them.

Session C Group 3: 12:00-12:50 pm, Environmental Studies

Bidaburu, Matea; Sunitsch, Grace (Faculty Sponsor: Dr. Betsy Bancroft, Gonzaga University): Microplastics in Freshwater, **Abstract**: This past semester we worked with Dr. Bancroft and a group of Gonzaga students to study microplastics in freshwater. During the span of a few months, we utilized the laboratory in order to view microplastics under microscopes, conducted dissections, and filtered water samples from various locations such as Texas and Spokane. The first few weeks were spent analyzing and counting microplastics via microscopes in order to hone our skillset. The purpose of this research was to understand the effects microplastics have on species that live in freshwater environments where the water samples were collected from. More specifically, Dr. Bancroft was partnered with other scientists who were studying those effects on a specific type

of bat. Starting off with viewing and identifying microplastics the lab group quickly learned how to identify microplastics. Then transitioning into collecting water samples from Lake Arthur or other local ponds or rivers; we filtered and analyzed those samples. All of this work was in preparation for filtering and analyzing the water samples from the bat experiment. Additionally, we conducted dissections. The dissections that occurred were used for viewing potential microplastics from their intestines which allowed for more knowledge of microplastic pollution from those habitats.

Zimmerman, Isabel; Klement, Zebulun; Rettig, William; Balish, Angela (Faculty Sponsor: Dr. Greg Gordon, Gonzaga University): Plants, Present, Future: A Digital Ethnobotanical Narrative of the Children of the Sun Trail, **Abstract**: This research aims to connect people and place through both cultural and historical lenses. Drawing from literature, interviews, and collaborative research, this study will focus on gathering an ethnobotany of the land along the Children of the Sun Trail in Spokane, Washington. The Children of the Sun Trail is a paved multi-use trail that runs parallel to the North Spokane Corridor. Through meetings with representatives of the Spokane Tribe of Indians, we have heard stories that define the social and cultural significance of the land. By using oral histories collected from tribal members, we plan to construct a thorough ethnobotanical narrative that depicts these cultural stories and connects people with the land. This research will inform a digital narrative along the length of the trail that will provide an educational and interactive experience for trail users. Ultimately, the project assesses the following components: 1) Ethnobotany, 2) Oral histories collected from tribal members regarding plant usage and significance, and 3) Community engagement.

Ashe, Alexis (Faculty Sponsor: Dr. Betsy Bancroft, Gonzaga University): Youth Corps Project Spokane, **Abstract**: In the wake of virtual school experiences and the isolation teenagers have endured in the past year, exposure to nature is increasingly important. A youth corps program offers first jobs to teenagers while improving the natural spaces (trails, parks, and wetland areas) in their community. The benefit of these programs is twofold, as it fosters good relationships with nature and strengthens positive outcomes in youth development. I propose an outline that describes the suggested youth corps program and the needs it is meant to address in Spokane. Outside input and suggestions will be incorporated into the final proposal for the program. This program proposal will help both degraded natural spaces in the Spokane area and the youth workers who would participate in the program.

Wells, Russell; Patterson, Brady; Richardson, Kevin; Gibson, Marissa (Faculty Sponsor: Dr. Grant Casady, Whitworth University): Costa Rican Ecotourism Efforts Maintain Avifauna Biodiversity in Cloud Forest, **Abstract**: Birds have been shown to serve as bioindicators for healthy ecosystems due to the variety of roles they fulfill in their environments. Our study examines differences in avian species richness and evenness between cultivated gardens, orchards, and naturally forested areas in the Savegre River Valley of Costa Rica. Because bird watching ecotourism contributes to a large portion of the Costa Rican economy, it is important to determine if cultivated bird watching gardens preserve and promote avian biodiversity. Collecting additional data that specifically address a comparison between cultivated areas and their natural counterparts can provide valuable insight on the effects of anthropogenic modifications within cloud forest landscapes. We studied avian diversity at four distinct birding gardens as well as additional orchard and forest locations. Timed visual and audio surveys were performed at three different time intervals throughout the day, examining species richness and abundance. Preliminary results indicate that cultivated gardens are effective at promoting bird diversity relative to the other study sites, while the orchard areas maintained the lowest species richness and abundance. Our study suggests that functional birding gardens with similar characteristics to those found in the Savegre River Valley can effectively maintain avian richness and diversity, while simultaneously supporting local ecotourism efforts.

Session C Group 4: 12:00-12:50 pm, Biology & Biochemistry

Courtney Murray (Faculty Sponsor: Dr. Jeff Watson, Gonzaga University): Ancestral Protein Reconstruction of Bacterial HMG-CoA Reductase, **Abstract**: The opportunistic lung pathogen, Burkholderia cenocepacia, contains a 3-hydroxyl-3-methylgultaryl coenzyme A (HMG-CoA) reductase (HMGR). In most organisms, it catalyzes the reduction of HMG-CoA to mevalonate as part of the isoprenoid synthesis pathway; however, in B. cenocepacia, it catalyzes the reverse reaction, functioning oxidatively. The HMGR in B. cenocepacia has been known to exist in multiple oligomeric states that are non-additive, indicating that it exhibits morpheein-like behavior. These oligomeric states have been shown to change dependent upon condition including varying pH and substrate concentrations. It has also been found that the HMGR in Pseudomonas mevalonii, which also functions oxidatively, is 72% similar in sequence, while not expressing morpheein behavior. Through the technique of ancestral protein reconstruction (APR), the most recent common ancestors as well as the first derivations of B. cenocepacia and P. mevalonii will be assessed with the aim to grow, purify, and obtain kinetics and size exclusion data of the ancestors. We aim to determine their models of allostery.

Schmahl-Waggoner, Adikus (Faculty Sponsor: Dr. Kirk Anders, Gonzaga University): Investigating the genetic basis of phage immunity systems in Cluster F bacteriophages, **Abstract**: Bacteriophages offer a vast area of exploration due to their large genetic diversity between individual phages and between clusters of related phages. Cluster F phages, for example, exhibit many genetic differences, including in their immunity systems. Phage immunity systems play a role in the lysis-lysogeny decision during infection, and provide defense to the host bacterial cell from infection by other phages. We are interested in discovering the differences in immunity between Cluster F phages and how they can interact with members of the same cluster. We constructed lysogens of the Cluster F phages and tested their immunity responses by infecting them with different phages of the same cluster. We observed that six phages fell into four groups based on their varying immunities to each other. In the future, we hope to associate the varying immune responses between the phages with their genetic differences. Constructing chimeric phages may be a strategy for identifying the genes responsible for the defense system of each phage.

Spawn, Jamie; Whitworth, Sophia (Faculty Sponsor: Dr. Jennifer Shepherd, Gonzaga University): Locating recombinant RquA protein within S. cerevisiae via a Green Fluorescent Protein tag, **Abstract**: Certain species of microbes and parasites are able to grow anaerobically, utilizing an alternative electron transport chain that does not require oxygen. Rhodoquinone (RQ) works within this alternative electron transport chain as an electron carrier and is essential to survival in anaerobic conditions, such as infection of a human host. Humans cannot survive anaerobically and thus do not have this alternative electron transporter, making its biosynthetic pathway an excellent target for antiparasitic and antimicrobial therapeutics. Our lab has previously isolated and identified the protein RquA, which has been determined to be essential in the conversion of the precursor ubiquinone (UQ) to RQ in microbes. It has been previously shown that organisms that do not normally produce RQ, such as S. cerevisiae, are able to produce it when expressing the RquA protein. The goal of this research was to determine the location of recombinant RquA within S. cerevisiae by transforming the cells with a plasmid containing the rquA and green fluorescent protein (GFP) genes. The GFP tag allows the protein to be visible under a fluorescent confocal microscope. The GFP tag along with the use of DAPI stain allowed us to determine that the protein is most likely being expressed in the mitochondria of the yeast cells.

Johnson, Eleanor; Fitzgerald, Sara; Storz, Sophie (Faculty Sponsor: Dr. Kirk Anders, Gonzaga University): Genomic analysis of two unique subcluster M2 bacteriophages, Estes and Aziz., **Abstract**: Bacteriophages are viruses that can infect and kill bacteria. They represent an astounding degree of diversity and abundance that has yet to be discovered. Characterization of these viruses may have medical applications as antibacterial therapies. Bacteriophages Estes and Aziz were found in soil samples on the Gonzaga campus and DNA sequencing and annotation placed them into the phage group called Cluster M. In order to learn how Estes and Aziz are related to other phages, and to begin studying their gene functions, we compared their genome structures to each other and to their Cluster M relatives. The genomes are ~83,000 basepairs in length and share 92% similarity. They each contain 150 protein-coding genes, 21 tRNAs, and carry short conserved repeated sequences of four types. The genomes are organized in a way that is similar to that of other cluster M phages. The genomes contain a gene for integrase, providing the ability for the lysogenic life cycle, in which the phage genome integrates into the host chromosome. However, other genes involved in lysogeny, like the immunity repressor, are not easily identified. We found a mutant of Estes that produces clear plaques, suggesting its lysogeny ability is impaired. The location of this mutation may lead us to identifying a gene required for lysogeny.

Dedinsky, Megan; Lau, Jalisa (Faculty Sponsor: Dr. Kirk Anders, Gonzaga University): Exploring DNA sequencing technologies to determine phage type prior to whole genome sequencing, **Abstract**: Bacteriophages are prevalent everywhere; from the soil we walk on to our microbiomes, we interact with phages on a daily basis. In fact, they are the most abundant organism on earth, at 10^31 particles. Bacteriophages are viruses capable of killing and lysing bacteria, and understanding them may lead to antibacterial therapies. One challenge lies in efficiently identifying the vast number of phages that exist in the world. Our research aims to obtain at least partial genome sequences from a group of unknown phage samples in order to learn the identity of each phage. We pooled DNA samples from nine unknown phages and sent them to the University of Pittsburgh for Illumina next-generation sequencing. We used Newbler to assemble the reads into contiguous sequences and BLASTN to identify phage types among the contigs. We identified at least nine different phage genomes from subclusters A2, A8, A12, A14, K1, K5, K6, EE, and EG. We designed PCR primers to identify each contig and tested the unknown phages for the presence of each specific contig DNA. We have unambiguously assigned five phages to subclusters and continue to work on the remaining. We will comment on the potential use of this method in a genetics lab course.

Godfrey, AJ (Faculty Sponsor: Dr. Jennifer Shepherd, Gonzaga University): Optimization of an in vitro Assay for the Determination of RquA Function, **Abstract**: The protein RquA, coded by the gene rquA in select bacteria and protists, has been elucidated as a key enzyme in the biosynthesis of rhodoquinone (RQ) from ubiquinone (UQ). RQ is a prenylated quinone required for electron transport during anaerobic energy metabolism in these species. RquA has been characterized as a methyltransferase-like enzyme, displaying sequence homology to class I S-adenosylmethionine (SAM)-dependent methyltransferase enzymes; however, this role of RquA has not been corroborated by our data and it is instead proposed to catalyze a transamination for the direct conversion of UQ to RQ. Due to RQ's essential role in anaerobic bioenergetics, its biosynthesis represents a considerable area of interest, and the structure and function of RquA still remains widely unexplored. To this end, our research utilized an in vitro assay for the determination of RquA function. These assays were performed using recombinant RquA, refolded from solubilized inclusion bodies or MBP-tagged, and a synthetic UQ3 substrate to generate RQ3 under various conditions. The RQ3 produced was extracted and quantified using LC-MS. These assay results have demonstrated the requirement of both SAM and zinc (II) co-factors for RquA function. Inhibition and kinetic assays are currently being explored to further characterize RquA.

Session D Group 1: 1:00-1:50 pm, Psychology

Hayden, Abigail; Harmston, Ellen; Linman, Rika (Faculty Sponsor: Dr. Gary Thorne, Gonzaga University): Anxiety in a Pandemic, **Abstract**: This year, the world has experienced a pandemic due to the Covid-19 virus which has caused vast cultural, political, and psychological changes worldwide. For this research experiment, we choose to focus on the increase in anxiety levels in college students during the corona virus quarantine period. We used self-report surveys to measure different variables that indicate increased stress such as trouble sleeping, heightened emotions, changes in appetite, etc. We primarily focused on returning college students in order to get an accurate read on if their anxiety levels have increased based on Covid-19 rather than the new stress of the college environment.

Crow, Kayla; Gade, Anna; Metzer, Zoe (Faculty Sponsor: Dr. Gary Thorne, Gonzaga University): Perception of Wellbeing and Mental Health of People Who are Blind, **Abstract**: The purpose of this research is to determine sighted individuals' perception of mental health and wellbeing in

people who are blind. Participants filled out one of two questionnaires that were randomly assigned. One group answered questions based off scenarios where they are told the main character is a college student who is blind and the other group answered questions based off of scenarios where they are told the main character is a college student. We will analyze the results by comparing the two groups.

Rundquist, Charles (Faculty Sponsor: Dr. Alex Bies, Gonzaga University): Depression and Face Pareidolia, **Abstract**: Previous studies have shown that depressed individuals tend to be able to recognize facial expressions faster and more accurately than non-depressed counterparts (Pu et al., 2012), leading to the question of whether or not depressed individuals are more likely to perceive faces in objects where a real face is not present. This phenomenon, known as Face Pareidolia, is the experience in which one's visual system is tricked into seeing a facelike structure in some form of everyday object (Palmer & Clifford, 2020). Common examples of this phenomenon are found in food, nature/natural landscapes, and even common household items. The present study aims to test the relationship between depression and frequency of experiencing face pareidolia by testing for a correlation between participants' self-reported mental state (i.e., positive and negative mood and depression) and ability to accurately detect the presence of pareidolic features in images and their non-pareidolic counterparts with matching low- and high- level image statistics. The study will test pareidolic facial recognition by assessing accuracy in selecting the correct location of the pareidolic face. Results will contribute to the understanding of depression and could potentially open up a new way of recognizing and diagnosing the disorder in individuals experiencing depression.

Goldberg, Emily; Voigt, Kyle (Faculty Sponsor: Dr. Gary Thorne, Gonzaga University): Implications of Videoconferencing Usage on Willingness to use Telehealth for Medical Appointments, **Abstract**: This study investigated how perceived ability to create, and keep, connections via videoconferencing platforms influenced one's likelihood to pursue telehealth options of medical care. Undergraduate students (N=83) completed a quantitative survey on Qualtrics, which measured perceived ability to make and/or maintain new or previous connections via videoconferencing platform and likelihood to pursue a telehealth option of medical care (measured on a 1-5 scale: 1) strongly disagree to 5) strongly agree). Parametric Pearson correlational analysis revealed that among those willing to use telehealth, there was a significant correlation of $r=.454$, $p<.01$ with willingness to use telehealth with a provider established prior in person, but not with willingness to use telehealth with a new provider. Additionally, there was a significant correlation of $r=.227$, $p<.01$ between ability to maintain connections via videoconferencing platforms and willingness to use telehealth. Finally, there was a significant correlation of $r=.568$, $p<.05$ between perceived interpersonal communication skills via videoconferencing and perceived connectivity via videoconferencing. These findings stress the importance of providers establishing an in-person relationship with their patient prior to using telehealth. Additionally, educational interventions, providing people with strategies to increase perceived interpersonal connectivity via videoconferencing could allow more individuals to feel comfortable using telehealth.

Session D Group 2: 1:00-1:50 pm, History & Sociology

Reyes, Paola (Faculty Sponsor: Stefanie Dorn, J.D., City University of Seattle): Beyond the pandemic: how companies can increase productivity, improve their workplaces and cut expenses by allowing their employees to work remotely, **Abstract**: Covid-19 has caused serious amounts of change in the world as we know it, but one of the things that has changed the most is the way people work. With the beginning of the pandemic came a revolution in the business world where more companies are now using telecommuting as their main way of work. This project will establish that companies who continue working remotely will find three main benefits: a rise in productivity rates, an improvement of the workplace environment, and a reduction of company expenses. In addition, by identifying the most common downsides of telecommuting companies will be able to prevent and overcome the hurdles that might come. While not every company may be a perfect match for telecommuting, the ones who are should allow their employees to continue with this modality after the pandemic ends due to the benefits it brings for both companies and employees.

Schlesinger, Mikaela (Faculty Sponsor: Dr. Christy Andrade, Gonzaga University): "The Tripartite Relationship of Burkitt's Lymphoma, Climate Change and Ethical Implications for the Global North", **Abstract**: The climate crisis is already impacting human health and will continue to do so in the future. Changes in climate will impact the distribution of pathogens and potentially the severity of disease as new human and animal hosts are infected. The prevalence of vector-borne diseases, such as malaria, are predicted to increase with rising temperatures and changes in weather patterns that will likely expand the range of vector mosquitoes. I predict that the range of endemic Burkitt's lymphoma, a non-Hodgkin's lymphoma, may also increase. A strong association exists between patients with a history of malaria and development of Burkitt's lymphoma; however, the current literature fails to include studies on the potential effects of climate change on prevalence of endemic Burkitt's lymphoma. Additionally, the burden of climate change related health impacts such as increased endemic Burkitt's lymphoma will likely be carried by the Global South, specifically in sub-Saharan Africa. Yet the Global South produces few greenhouse gases and has contributed the least to global climate change relative to the Global North. There is an ethical imperative for the Global North to work to mitigate climate change as well as compensate the people and countries being most affected by their actions.

Fagan, Kevin (Faculty Sponsor: Dr. Naghme Morlock, Gonzaga University): Quantifying the Mortality Effects of Wildfire Smoke in Spokane County from 2015-2019, **Abstract**: Spokane County, Washington has seen some of the worst air quality in its history in the past few years directly due to wildfire smoke that traveled mostly from forest fires in nearby states. There have been several events in 2015, 2017, & 2018 that have eclipsed the EPA standard for "Very Unhealthy" and even "Hazardous" air conditions that can be sustained for hours or days. Only one other study has looked at the mortality effects of wildfire smoke in Washington state, and that study was on the state level and did not analyze the health burdens on a

county-by-county level. Previous studies have shown that there is an increased rate of all-cause mortality when wildfire smoke is present. The goal of this analysis is to understand the increased rate of mortality on days with wildfire smoke present.

Session D Group 3: 1:00-1:50 pm, Chemistry

Rosenbaum, Kaylee; Thackston, Samuel; Russell, Trisha (Faculty Sponsor: Dr. Trisha Russell, Whitworth University): Improving the Synthetic Route for Reduced Praziquanamine, **Abstract**: Mucopolysaccharidosis VI (MPS VI) is a rare lysosomal storage disorder caused by mutations and deficiencies in the N-acetylgalactosamine-4-sulfatase (arylsulfatase B or ASB) gene. Reduced praziquanamine (PQA) and its derivatives have been identified as having the potential to stabilize and activate the mutated ASB enzyme. The synthesis of reduced PQA (red-PQA) is complicated and poses several problems for lab safety, efficiency, and isolation. An alternative synthetic pathway was used for amide reduction, and several isolation methods were attempted. PQA was successfully reduced using lithium aluminum hydride, purified, and confirmed with proton NMR although in a low yield (25%).

Nobley, Wyatt (Faculty Sponsor: Dr. Masaomi Matsumoto, Gonzaga University): Cucurbit[8]uril-mediated Peptide Assembly, **Abstract**: This work focuses on supramolecular complexes (host-guest complexes) involving peptides and cucurbit[8]uril (CB[8]). Through techniques including SPPS, HPLC, TOF-MS, CD Spectroscopy, ITC, HNMR and diffusion ordered spectroscopy, the nature of the binding complex is under investigation. Initial results indicated that tryptophan 1 and lysine 7 residues from Peptide 1 (WGFVNGKFGK) bound in the CB[8] cavity. The data suggest that the peptide:CB[8] complex is 2:2 in nature, forming a small, synthetic, antiparallel dimer brought together by CB[8]. Building off this initial data, Peptide 1 derivatives with mutated amino acids have been synthesized in order to test a multitude of binding factors: strength of binding, flexibility/rigidity, and the necessity of each residue in the sequence. Analysis of a diverse selection of Peptide 1 mutants has provided insight into how resilient this complex is to change at the binding residues, and within the sequence. Future work in project includes confirming the binding parameters, and investigating the applications of the peptide:CB[8] complex.

Lorenz, Brooke (Faculty Sponsor: Dr. Kerry Breno, Whitworth University): Synthesis of Tricarbonylchloro(bis-1,10-phenanthroline-4,7-disulfonic acid)rhenium(I): A Luminescent Complex, **Abstract**: Rhenium tricarbonyl complexes are known to be stable and have luminescent behavior. These complexes can be used in solar cells, fluorescent materials, and biological imaging probes for cancer imaging and diagnosis. The phenanthroline ligands contribute to the fluorescence due to its planar electron donating properties. In this study, organometallic complexes that have a 4,7-disubstituted-1,10-phenathroline ligand with rhenium tricarbonyl core were investigated. Use of electron-withdrawing groups such as chloride or sulfanto groups on phenanthroline ligands can influence the absorption and emission spectra. With ReDSphen, the complexes are protic and pH sensitive. In this work, a 4,7-disulfanto-1,10-phenathroline ligand was synthesized from 4,7-dichloro-1,10-phenathroline. Then the ligand was coordinated to the rhenium tricarbonyl core. The ligands and complex were characterized usingH1 NMR and IR spectroscopy. The final product, tricarbonylchloro(bis-1,10-phenanthroline-4,7-disulfonic acid)rhenium(I), was tested for fluorescence. At an excitation of 420 nm, the complex had a maximum absorption of 540 nm, which was sensitive to the pH. Additional quantitative luminescence is currently under investigation.

Hagerty, Brendan (Faculty Sponsor: Dr. Kerry Breno, Whitworth University): Luminescence variation of rhenium(I) fac-tricarbonyl phenanthroline complexes, **Abstract**: Rhenium(I) tricarbonyl phenanthroline complexes fluoresce in the visible range and as such are useful for bioimaging and electronics. The luminescence of rhenium(I) tricarbonyl phenanthroline complexes are sensitive to substituents on the phenanthroline ring and the sixth ligand site. In this work, the photophysical properties of fac-tricarbonylchlorido(4,7-disubstituted-1,10-phenanthroline) rhenium(I) complexes with chloride(2), sulfate(3), and methyl(1) groups as substituents were studied. UV-Vis and luminescence of the complexes were determined to correlate with the electron withdrawing ability of the substituents [λmax (350 ex) (1): 555 nm, (2):571 nm, (3):591 nm]. The calculated quantum yield and maximum emission wavelength were compared to related rhenium tricarbonyl complexes. 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 λmax of 533 nm to 591 nm.

Fuller, Jack (Faculty Sponsor: Dr. Wilson Bailey, Gonzaga University): Redox active ligands to support Zr(IV) catalyzed oxidation reactions, **Abstract**: In recent years there has been a push to develop new early transition metal catalysts capable of oxygenase type reactivity due to their abundance and low cost. However, d0 metal ions usually lack the ability to activate molecular oxygen due to an absence of reducing electrons. Use of a redox active ligand can provide the necessary reducing equivalents and allow the metal complex to activate molecular oxygen through metal-ligand cooperation. Previous computational studies have shown that two equivalents of a bidentate aminoxide ligand coordinated to a zirconium(IV) center can help activate molecular oxygen to form a bis-peroxo complex, which can then undergo O-atom transfer to suitable organic substrates. Efforts in the synthesis of this complex are underway, and currently are focused on the oxidation of a diamine into a dihydroxylamine proligand. Metalation of the dihydroxylamine with zirconium(IV) will be followed with O2 reactivity, stoichiometric O-atom transfer, and catalytic oxidation studies.

Huggins, James (Faculty Sponsor: Dr. Stephen Warren, Gonzaga University): Synthesis of Cyclic Boronic Esters from Acyclic Boronic Ester Reagents for Alcohol Capture and Release, **Abstract**: Cyclic boronic esters have the potential to act as capture and release agents for interesting alcohols. Attempts to synthesize 2-alkoxy-1,3,2-dioxaborinanes and 2-alkoxy-1,3,2-dioxaborolanes from acyclic boronic esters are described. 1H NMR and 11B NMR spectroscopy was used to analyze the synthesized products and showed the successful creation of 2-alkoxy-1,3,2-dioxaborolanes but not

the 2-alkoxy-1,3,2-dioxaborinanes. 1H and 11B NMR spectroscopy also confirmed the successful capture of long chain alcohol using 2-ethoxy-4,4,5,5-tetramethyl-1,3,2-dioxaborolane.

Session D Group 4: 1:00-1:50 pm, Biochemistry

Bruner, Madeline (Faculty Sponsor: Dr. Shannen Cravens, Gonzaga University): Examination of the structure and activity changes of the DNAzyme Dz8-17 upon uracil incorporation., **Abstract**: Leukemia, a blood cancer that affected an estimated 60,500 people in the year 2020, is the result of genome instability arising from overexpression of error-prone DNA repair proteins. DNAzymes are a recently developed class of synthetically made, single-stranded DNA molecules that have the potential to regulate gene expression by targeting and cleaving specific mRNA sequences used for protein synthesis. This is facilitated by the DNAzyme folding in the presence of metal ions. While the versatility of a DNAzyme is vast, its single-stranded nature makes it prone to chemical damage like the spontaneous deamination of cytosine to uracil. If DNAzymes are to be used as therapeutic agents, how might these damaging events affect their activity? To investigate this question, uracil was incorporated into four different cytosine positions in the sequence of a well characterized, lead sensing DNAzyme known as Dz8-17. Using a combination of Förster resonance energy transfer experiments and RNA cleavage assays, we assessed changes in folding and activity of uracilated Dz8-17 in the presence of Mg2+ and Pb2+. These tests provided the quantitative data needed to evaluate the therapeutic potential of a DNAzyme by determining if it retains its ability to degrade specific mRNA after spontaneous deamination has occurred.

Bates, Robert (Faculty Sponsor: Dr. Jeff Watson, Gonzaga University): Kinetics and Structural Characterization of HMG-CoA Reductase in Burkholderia cenocepacia, **Abstract**: Burkholderia cenocepacia is an opportunistic lung pathogen, resistant to nearly all known antibiotics, that starkly increases the mortality rate of patients with cystic fibrosis. HMG-CoA reductase (HMGR) is an enzyme that is normally reduces HMG-CoA to produce mevalonate. This is the rate limiting step in the mevalonate pathway which leads to cholesterol and other isoprenoids. However, in BcHMGR, the enzyme works to oxidize mevalonate to HMG-CoA while an alternate pathway is used for IPP biosynthesis. Furthermore, BcHMGR is unusual in that it exhibits double sigmoidal kinetic behavior. This is interesting in that the double sigmoidal curve suggests a morpheein model of allostery where the enzyme structure changes oligomeric states to accommodate for substrate levels. It is believed that BcHMGR will change its oligomeric state as substrate levels change to have optimum kinetics for the given substrate. The exact oligomeric states are unknown, but evidence suggests they are multiples of trimer subunits. Progress toward determining the exact oligomeric states of BcHMGR will be discussed.

Rose, Katelyn (Faculty Sponsor: Dr. Deanna Ojennus, Whitworth University): Possible Role of Calcium Binding Domain in the Stability of X-prolyl dipeptidyl aminopeptidase, **Abstract**: Recently, the structure for the L. helveticus PepX (x-prolyl dipeptidyl aminopeptidase) was determined, in which a calcium binding loop was found. The loop is distant from the active site, thus it was hypothesized that this calcium binding loop evolved to stabilize the enzyme. To test this, calcium or EDTA were added to the enzyme solution, which then underwent thermal denaturation assays to determine if the addition of calcium stabilized the protein to a higher melting temperature, as well as if the removal of calcium via EDTA would destabilize the enzyme to a lower melting temperature. The results showed that PepX thermal denaturation is biphasic; the lower melting temperature was 50□C, and remained unchanged with added calcium, while the higher melting temperature started at 58□C, and increased with added calcium. The addition of EDTA to PepX resulted in a cooperative, rather than a biphasic, melting curve, at 51□C. These findings led us to conclude that the domain(s) involved with the second melting point are thermally stabilized by calcium binding.

Gregory, Justin (Faculty Sponsor: Dr. Jeff Watson, Gonzaga University): Gene Deletion of 3-Hydroxy-3-methylglutaryl coenzyme A reductase (HMGR) in Burkholderia Cenocepacia, **Abstract**: The enzyme 3-Hydroxy-3-methylglutaryl coenzyme A reductase (HMGR) is found in all realms of life from eukaryotes to prokaryotes. In most organisms, this enzyme catalyzes the rate-limiting step in the mevalonate pathway where (S)-HMG-CoA is reduced to (R)-mevalonate using NAD(P)H as the cofactor. The main product of the mevalonate pathway, isopentyl-pyrophosphate (IPP), serves as a precursor for the biosynthesis of several biologically important isoprenoids. The opportunistic lung pathogen, Burkholderia cenocepacia, is unique in that it contains an HMGR that prefers the reverse oxidative reaction using NADH as the cofactor and uses the DXP pathway instead of the mevalonate pathway to generate isoprenoids. As a result, determining the physiological role of this enzyme is of great interest especially with the potential medical implications. This enzyme (BcHMGR) also exhibits behavior characteristic of a morpheein protein with different oligomeric states corresponding to different enzymatic activity. The interconversion among oligomeric states is modulated by pH, substrate concentration, and enzyme concentration. Therefore, the properties and regulation of this enzyme point toward BcHMGR being a part of a metabolic pathway in this bacterium. Here we describe the progression of the creation of a ΔBCAM0531 mutant lacking the BcHMGR gene in order to uncover the physiological role.

Session E Group 1: 2:00-2:50 pm, Environmental Studies

Leon, Julia; Simmons Alex; Bell, Kacie (Faculty Sponsor: Dr. Greg Gordon, Gonzaga University): Snake River Outreach Program, **Abstract**: This collaborative outreach program with the Save Our Wild Salmon Coalition is designed to educate the public about the impact of dams on the Snake River. Through the creation of a virtual, educational outreach program this project seeks to engage the public with environmental issues surrounding dams in Columbia River Basin. The environmental curriculum will include the environmental history of the area and its impact on salmon populations as well as history about the local Palouse and Nez Perce tribes. Through the creation of our curriculum, we hope to create a usable template for future trips and activities that can be run through Save Our Wild Salmon. The development and marketing of this curriculum seeks to increase public awareness and create outdoor recreational opportunities. This outreach program seeks to 1) educate the public about the

benefits of dam removal on the Snake River, 2) create educationalmaterials related to specific locations and issues, and 3) provide resources to stay involved and generatecontinued support for future river restoration projects

Munoz-Maines, Javier; Crosby, Sophie; Tveter, Sean (Faculty Sponsor: Dr. Greg Gordon, Gonzaga University): Snake River History, **Abstract**: Our project's purpose is to look at the dams of the lower Snake River and see how their construction has affected the general well being of the surrounding areas. Our research is based off oral histories of people who used to live on the Snake, to gain a greater understanding of what the river was like prior to the dams. We see that prior to the dam's construction, salmon fisheries were healthy and thriving, but have been interrupted. This in turn has affected native communities who used to be able to live off the river, as well as sports fishing that brought money into the rural communities. We also see that many of the extracurricular activities that took place on the river have been interrupted, such as water skiing, rafting, kayaking, fishing, and hunting. With our research we plan to create an interactive map that shows what was happening in specific areas of the river prior to the dam's construction, as well as give a glimpse of what the river could be like post dam removal. This will include sections of interviews from people who grew up along the river, who will be able to give us a more personable interaction with the river itself.

Ellinwood, Erin; Royse, Georgina; Kintzele, Keara (Faculty Sponsor: Dr. Betsy Bancroft, Gonzaga University): Urban Wildlife Monitoring, **Abstract**: It is important to quantify the biodiversity of an ecosystem because biodiversity is often an important factor when deciding whether or not to conserve an area. Our project will contribute to the conservation of biodiversity by collecting data on species present in the Little Spokane Watershed. The data are collected from six game cameras that are distributed throughout the Little Spokane Watershed. The animals collected from the photographs will be classified by species, age, gender, camera location, and date collected. The information we gather about species presence and abundance will be given to the Inland Northwest Land Conservancy to aid in biodiversity conservation. The data we will collect are crucial because only some of the land Little Spokane Watershed is protected, or owned by the INLC. The remaining land is threatened by urbanization, and if more urbanization were to occur in this area it would most likely cause a decrease in biodiversity.

Marinkovic, Matea; Lalonde, Sarah; Chehab, Sydney; Manthey, Grace (Faculty Sponsor: Dr. Betsy Bancroft, Gonzaga University): Urban Tree Analysis, **Abstract**: Tree canopies have direct implications on the quality of life of people near them, as well as promoting economic benefits by reducing environmental degradation in the forms of water runoff and air pollution. Tree canopy contribution to greenspaces promotes the welfare of all people in the Spokane community, and as such is a priority for the city to address. This research project collected data on the current tree canopy coverage in Spokane to identify communities lacking in tree canopy coverage, according to a city-wide ordinance of at least 30% tree canopy coverage. We used this data to find a set of numerical and economic values related to the carbon benefits, air quality benefits, and hydrological benefits based on the ground cover present. The data collected will culminate in a formal report used to inform tree planting efforts and future policy decisions as well as increasing environmental justice efforts throughout the community.

Session E Group 2: 2:00-2:50 pm, History, Anthropology, Geography & Dance

Henry, Grace (Faculty Sponsor: Dr. Naghme Morlock, Gonzaga University): Experiences of modern anti-Semitism in Spokane, **Abstract**: This study examined the lived experience of those who identify as culturally or religiously Jewish in Spokane. The goal was to highlight the continued existence of anti-Semitism, and identify the less overt forms it takes in modern times. Most people are aware of large macro-aggressions, but the day to day micro-aggressions that Jewish people face in the United States often go unnoticed by others. through. I interviewed 10 people who identify as religiously and culturally Jewish. There was a variance of age, identified gender, and sexual orientation in my participants. This diversity within the people I interviewed helped show the intersectionality that exists within Judaism. In each interview I asked the participants a series of questions about their lived experiences of anti-Semitism. Each person had different stories, and each had different emotions surrounding those experiences. Though they all had different experiences and stories, themes arose between them all. There was a collective experience, a collective fear, and a collective understanding of what it meant for them to be Jewish in the United States in 2020.

From, Delaney (Faculty Sponsor: Dr. Katherine Karr-Cornejo, Whitworth University): Correlation between Spanish Vowel Perception and Production by Spanish Language Learners, **Abstract**: The goal of this study is to determine if there is a correlation between an individual's (a native speaker of English who is learning Spanish as an additional language) ability to correctly perceive a difference between the Spanish vowel sound /u/ and the diphthong /ua/ and their ability to accurately produce the same sounds. The results of this study could have an impact on Spanish pedagogy and how to help students achieve a more native-like accent.

Jones, Logan (Faculty Sponsor: Dr. Kassahun Kebede, Eastern Washington University): Migration, Incorporation and the New Second Generation, **Abstract**: Stories of Success: Narratives of a second-generation Mexican American The second generation of immigrants (def.) have complex cultural repertoire that helps them succeed. These complexities range from how they identify themselves to the possible future opportunities they are afforded to surpass their parents in socioeconomic status and overall quality of life. Research shows that the second generation of post-1960s immigrants are doing well (Pew Research 2020)[1]. However, many of these research and snapshot surveys did not concretely explain what factors contribute to the second generation's success. This paper traces the life of a second-generation Mexican American from childhood to adulthood. In this paper, I documented his family's history from a small village in Mexico to the US, the life provided to him because of his parent's hardships, his personal view on success, and the overall prospect of 'making it' as a Mexican American. His narrative will be compared to the complexities and how what we think we know about this group may not be the full story. [1]Budiman, A. (2020, September 22). Key findings about U.S. IMMIGRANTS. https://www.pewresearch.org/fact-tank/2020/08/20/key-findings-about-u-s-immigrants/

Vye, Jessica; Llewellyn, Micayla (Faculty Sponsor: Dr. Carliann Forthun-Bruner, Gonzaga University): Dance as Intersectionality - Exploring Indigenous Movement and Storytelling, **Abstract**: Dance is a powerful art form. It brings people together, stimulates creativity, stirs up emotions, and fosters community. Throughout COVID-19, dance has remained a strong form of communication. This year, we have served as research assistants for dance adjunct professor, CarliAnn Bruner. Providing an objective observation of the artistic and innovative collaboration, serving as witnesses to the discoveries this intersectional collaborative creative process has yielded. Professor Bruner is currently an MFA Candidate in Dance at the University of Wisconsin-Milwaukee and developing her thesis by setting new dance pieces on Gonzaga University Dance Repertory Company students that explore the intersection of Indigenous worldviews and contemporary dance. By observing the creative process behind these pieces, insight has been gained into using personal experiences to explore, and how one can express or portray emotions through movement. Professor Bruner and the dancers continue to learn how to move together while being forced apart due to the restrictions caused by the pandemic we are currently living through. The mission of the 2020-2021 GURDC is to create dialogue regarding the convergence of dance within our lives. Dance allows us to explore the roots in which we come from and tell our stories.

Cummings, Lark (Faculty Sponsor: Dr. Kassahun Kebede, Eastern Washington University): From Immigration to Integration and Back: Mexican Labor in the US Economy Since 1982, **Abstract**: Beginning in 1982, following the default of the Mexican state on its foreign debts, Mexico began a process of economic restructuring aimed to bring about a form of 'integration' between the Mexican economy and the global (but specifically US) economy. This 'structural adjustment' process, which was first implemented in Mexico but soon spread around the globe, had much less to do with integration (as it is generally understood and communicated, as a process of convergence), and more to do with the retooling of the Mexican economy as a pool of cheap labor for (primarily US) capitalists. This process was accompanied by a related set of policy reforms in the United States, which both a) expanded and intensified the exploitation of immigrant labor by US employers, and b) created the modern Immigration Industrial Complex, which in turn drives the ever-increasing scale and violence of immigration enforcement. I provide critical analysis of published documents to argue these developments are components of coherent economic regime in North America, rooted in the precaritization of workers as a source of capital accumulation, and ultimately deriving from changes in the dynamics of class war in contemporary North America, which today take on an increasingly globalized character.

Session E Group 3: 2:00-2:50 pm, Organic Chemistry & Crystallography

Whitworth, Paloma; DeCocker, Emily (Faculty Sponsor: Dr. Matthew Cremeens, Gonzaga University): Investigating halogen-substituted chalcones, **Abstract**: Chalcones are a naturally occurring molecule consisting of two aromatic rings connected by an α,β-unsaturated ketone. Due to their natural fluorescence, potential pharmaceutical properties, and efficient synthesis, chalcones have become a molecule of interest. Although a variety of chalcone crystal structures has been solved, a larger examination of chalcone crystal structures has not yet been published. This project studies a family of dihalogen substituted chalcones to investigate the steric, electrostatic, and dispersive forces which contribute to the formation of these crystal structures. Hirshfeld surfaces and Crystal Explorer generated energy frameworks are employed in the analysis of this collection. Systematic variation of the size and position of the halogen substituent reveals a varying degree of impact on the overall crystal structure.

Ernst, Lindsey (Faculty Sponsor: Dr. Matthew Cremeens, Gonzaga University): An investigation of the methods for cocrystallization of chalcones to determine patterns of functional group interactions and crystallization methods, **Abstract**: Cocrystals are supramolecular solid forms with multiple molecules in a crystal lattice which can be designed to vary the chemical and physical properties of active pharmaceutical ingredients (APIs), allowing for increased bioavailability and solubility for medicinal treatments. The chemistry of cocrystallization is an area of research that merits further exploration, especially considering the vast scope of potential molecule pairings, crystallization methods, and pharmaceutical applications. We aim to explore the factors that impact cocrystal formation through designing various cocrystallization schemes and varying the substituent molecules, predicted intermolecular functional group interactions, and crystallization techniques. The molecules used in our cocrystallization attempts are chalcones, naturally occurring molecules with the common scaffold of two phenyl rings connected by an α, β-unsaturated ketone functional group. Chalcones have a wide range of medicinal properties, which depend on the substituents attached to the two aromatic rings. The chalcones synthesized and used in our cocrystallization schemes have various combinations of halogen, dimethylamino, and nitro substituents in various positions on the phenyl rings. The results of chalcone-chalcone cocrystallization attempts will provide foundational knowledge to begin identifying trends in cocrystal formation and prompt further research into additional factors that must be taken into account when designing and predicting cocrystal structures.

Watkins, Laurelle; Laroya, Carl Joshua; McTamaney, Ian (Faculty Sponsor: Dr. Trisha Russell, Whitworth University): NMR Spectroscopy and X-ray Crystallography Analysis of Azo Dyes, **Abstract**: The synthesis of azo dyes is a common undergraduate laboratory procedure. It can be done in a combinatorial nature that allows for the production of many colorful dyes using a diazo coupling reaction of various naphthols and anilines. An undergraduate laboratory experiment for the synthesis of azo dyes was expanded with NMR spectroscopic analysis and x-ray crystallography. Over 12 azo dyes were synthesized in a combinatorial fashion, with varying substituents, and analyzed by NMR and x-ray crystallography. The 1D and 2D NMR spectra for the synthesized dyes displayed a sharp, highly deshielded peak (~14-16 ppm), which indicates a tautomeric form of the azo dyes that displays an intramolecular hydrogen bond. The crystal structures indicated that this hydrogen is more closely associated with the nitrogen of the diazo functional group than the oxygen of the phenol group. The collected NMR spectra (1H, 13C, COSY, HMBC, HMQC) and crystal structures provide undergraduate students with data where they may not otherwise have access. This allows students to gain a deeper understanding of the structural features of these azo dyes.

Battaglia, Zachary (Faculty Sponsor: Dr. Matthew Cremeens, Gonzaga University): The Synthesis and Crystallization of a Chalcone Inhibitor of the JAK2/STAT5 Pathway, **Abstract**: The JAK2/STAT5 biological pathway, involving the proteins Janus Kinase 2 and Signal Transducer and Activator of Transcription 5, plays a vital role in a healthy immune response and proper cell development through the activation of interferon gamma activated sequences of DNA. Due to the importance of the pathway to proper biological functioning, the pathway is vulnerable to numerous mutations that can diminish or alter the function of the JAK2/STAT5 pathway, giving rise to diseases such as myelofibrosis. Inhibitors for the JAK2/STAT5 pathway are expensive and so recent attention has been directed towards finding cheaper and more available inhibitors. Tetra-methoxy chalcones substituted with halogens on the alpha carbon, specifically 2-bromo-1-(2,4-dimethoxyphenyl)-3-(3,4-dimethoxyphenyl)prop-2-en-1-one (α-Br-TMC), have been shown to be effective in inhibiting the JAK2/STAT5 pathway. The crystal structure of α-Br-TMC has been previously reported to be a part of the Pca21 space group, but little attention has been directed towards any polymorphism demonstrated by α-Br-TMC. Herein, we report efforts toward the synthesis and crystallization of α-Br-TMC using a range of crystallization techniques, including those of slow evaporation and slow cooling, in order to encourage polymorph generation, with success determined through crystallographic analysis of data obtained via X-ray diffraction.

Gao, James (Faculty Sponsor: Dr. Kraig Wheeler, Whitworth University): Quasiracemic Analysis of Pairings in Norvaline/Valine Systems, **Abstract**: Within crystallography, the interactions between racemic structures are well-documented. Racemates are chiral compounds composed of two enantiomers of a structure with opposite handedness. Molecular recognition occurs due to structural similarity, allowing combination of the two. Of interest to our research is the interactions between molecules in quasi-racemates, structures that differ from racemates in that the substituent groups in combined molecules are not identical. The potential data to be gleaned from quasi-racemates are substantial due to the increased variability possible for structural combination, with applications in materials chemistry. Unlike in racemates, there is potential for synergetic properties of quasi-racemates made possible by substituent differences. The focus of this research was to investigate changes in atom type of substituents on the 4-carbons of benzoylnorvaline and benzoylvaline, the chiral molecules of interest. Objectives were to understand the effect of substituent size and supramolecular bonding pattern on a quasi-racemate's viability and resulting properties. Quasi-racemic component molecules were synthesized and successful quasi-racemate combinations analyzed by crystallography instrumentation, including through an X-ray diffractometer and structural refinement software. This research provides a foundation for alternatives in crystal engineering, characterizing additional cocrystal features not found in racemic-only compounds.

Pounds, Michaela (Faculty Sponsor: Dr. Kraig Wheeler, Whitworth University): Molecular Recognition of Quasiracemic Regioisomers of Difluoro Substituents, **Abstract**: Crystallography and the formation of crystals plays an important role in understanding molecular recognition. Compounds that have a chiral center can form racemic structures and structures of two different compounds with chiral centers can form quasiracemates. The crystals of these racemates and quasiracemates can help us to understand the supramolecular interactions that are formed in hopes for future pharmaceutical understanding and efficiency of drug creation through crystallography. This research focused particularly on how regioisomers form crystals as it has been understood until recently that it is not likely to form. Due to their straightforward synthesis, difluorodiarylamide compounds were used to understand the possibility of quasiracemates using regioisomers. For further analysis, adding an aromatic ring to create a difluoronapthylamide compound was also explored due to its higher stability in forming cocrystals. Through hot stage microscopy and single crystal x-ray diffraction, a variety of cocrystals were evaluated, leading to many unexpected results in understanding the formation of quasiracemic crystals.

Session E Group 4: 2:00-2:50 pm, Biology & Biochemistry

Engley, Andrew (Faculty Sponsor: Dr. Kathleen Leamy, Gonzaga University): Investigating the Effects of Protein Crowding on Ribozyme Kinetics, **Abstract**: Despite being only composed of four different nucleobases, RNA molecules play extremely diverse biological roles, including templates for protein and telomere synthesis, adaptive immunity in bacteria in CRISPR-Cas systems, and as enzymes. The latter is of particular interest, as ribozymes, RNA self-cleaving enzymes, are a specific mechanistic strategy utilized in gene regulation processes. To better understand how catalytic RNA molecules behave in biological systems, this study investigates ribozyme activity in experimental conditions that mimic the environment of the cell. The cell is a crowded space, as 20-40% of the cytoplasm is occupied by macromolecules, such as RNA, proteins, and complexes. Traditionally in the literature, experiments that better characterize the kinetic behavior of ribozymes in cellular mimics have been conducted using neutrally-charged crowder molecules in vitro, such as dextran and polyethylene glycol. These experiments are excellent for analyzing entropically-driven folding. Specifically, these studies help elucidate how steric crowding effects influence RNA folding. However, they do not adequately address enthalpic folding effects. Naturally-occurring biological crowders are much more complex than these simple polymers; biological macromolecules have a variety of functional groups, local charges, and form structure. Therefore, in order to understand biological crowding effects more accurately, this study focuses on determining how ribozymes folds and functions in the presence of biological crowders. The minimal sequence of the hammerhead 16 ribozyme is used as a model system to characterize RNA cleavage kinetics in the presence of protein crowders. For our preliminary experiments, we observed the effect of PEG8000 crowder concentrations on the cleavage rates of this ribozyme. Then, we observed the effects of low-charge protein crowder concentration on ribozyme cleavage.

Wells, Russell; Renschler, Andy; Penner, Scott (Faculty Sponsor: Dr. Michael Sardinia, Whitworth University): Neuroprotective effects of angiotensin IV molecule, dihexa, on 3-nitropropionic acid induced Huntington's disease-like symptoms in rats, **Abstract**: Huntington's disease (HD) is an incurable neurodegenerative disorder that is commonly associated with a midlife onset and rapid progression toward death 12 to 15 years from the time symptoms appear. The genetic disorder is characterized by chorea, cognitive impairments, dementia, depression, and motor

abnormalities with the causation being a mutation in the gene that codes for the huntingtin protein (Htt). In this small-scale study, we sought to test if the neuroprotective, procognitive, and antidementia properties of angiotensin IV molecules, specifically dihexa, could be utilized as a possible treatment for Huntington's disease (HD) in an animal model. Here, we used a mitochondrial toxin, 3-nitropropionic acid (3-NP), to induce HD-like symptoms in rats to investigate the activity of dihexa through behavioral, motor function, brain lesion area, and histopathological analysis. Rats were administered dihexa for several weeks before two acute doses of 3-NP. We found that dihexa improved behavioral and motor function performances of 3-NP induced neurotoxic rats, although not significantly due to a small sample size. We also found that dihexa appeared to prevent the extent of striatal lesion area caused by 3-NP neurotoxicity. This study sheds light on a previously unexplored avenue of Huntington's research and supports the call for future exploration on a larger scale.

Lane, Melanie (Faculty Sponsor: Dr. Kathleen Leamy, Gonzaga University): The Influence of Charged Protein Crowders on Hammerhead Ribozyme Activity., **Abstract**: RNA molecules can fold into complex secondary and tertiary structures which gives them the ability to perform diverse functions within the cell. For example, ribozymes (RNA enzymes) fold into a tertiary structure to generate a catalytic site that can initiate self-cleavage of the phosphate backbone. Functional RNAs are typically studied in dilute solutions of buffer and high concentrations of cations. However, these simple solutions are very different from the environment of the cell where these molecules are found. The cell contains 20-40% molecular crowding, 0.5-2.0 mM Mg2+, and a myriad of small molecules and metabolites. Recent studies have shown that RNAs can fold differently in cells than in simple solutions, which can result in differing functions. Artificial cytoplasms, that mimic the cellular environment, can be used to further understand the folding and function of RNAs in a cellular context. To expand on prior studies, this research uses the minimal hammerhead ribozyme as a model system to understand how ribozyme activity is affected by macromolecular crowding in solution, particularly the effects of charged protein crowders. The results of this research will increase the general understanding of how nonspecific interactions within the cell affect the folding and function of biological molecules.

Hall, Rigel (Faculty Sponsor: Dr. Kathleen Leamy, Gonzaga University): Computational Analysis of Non-Coding Functional RNA Adaptation to High Temperatures, **Abstract**: Bacteria are incredibly resilient and can be found in a variety of extreme environments. One such extreme environment is high temperature conditions. The adaptations of the RNA in thermophilic bacteria are of particular interest because their study can develop a better understanding of RNA structure, the mechanisms of RNA thermodynamic stability, and RNA adaptation. The adaptations of non-coding RNA that allow bacteria to maintain function at high temperatures were investigated by gathering the non-coding RNA sequences from thermophilic and mesophilic bacteria, obtaining growth temperatures for the bacteria, and then analyzing the sequences to determine characteristics. To process the high volume of RNA bacterial sequence data and bacteria growth temperature data, a PHP computer program was developed to complete data collection and analysis. Three functional RNA families were investigated: the TPP riboswitch, the Cobalamin riboswitch, and the GlmS ribozyme. 1509 sequences for the TPP riboswitch, 271 sequences for the GlmS ribozyme, and 1191 sequences for the Cobalamin riboswitch were collected. Sequence length and GC content were analyzed. Across the families, GC content was found to increase as growth temperature increased, indicating it to be an adaptation to increase stability. Sequence length was not indicated to be an adaptation to increase stability.

Thomas, Rhian (Faculty Sponsor: Dr. Christy Andrade, Gonzaga University): Characterizing the Bacterial Diversity in Mosquito Larvae from Spokane Urban Water, **Abstract**: Previously, it has been shown that the mosquito microbiome can have a significant impact on transmission of arboviruses, such as the West Nile virus. This highlights the need to more thoroughly characterize microbial communities within mosquitoes. In this study, we sought to characterize the bacterial diversity of mosquito larvae in urban water collected in Spokane, WA. During the summer of 2019, five different sites were sampled weekly for presence of mosquito larvae for a total of 10 weeks. Cultured bacteria from pooled larvae were assayed to identify bacterial species carried with the mosquitos of Spokane. Once pure culture was established, bacterial DNA was extracted and amplified with 16S rDNA PCR. The resulting DNA was sequenced and edited using the program Codon Code Aligner. Sequences were then submitted for an NCBI BLASTn search to identify the most similar bacterial species. We report here the identity of over 200 cultured bacteria isolated from urban water mosquito larvae. Species represented in this data set include Sphingomonas sp., Aeromonas sp., Yersinia sp., Acinetobacter sp., Pseudomonas sp., Bacillus sp., Rahnella sp., etc. These findings can provide a foundation for understanding the bacterial species present in Spokane mosquitoes.

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