SURCA

SHOWCASE FOR UNDERGRADUATE RESEARCH AND CREATIVE ACTIVITIES

March 25, 2019

SURCA.WSU.EDU

Hosted by WSU Undergraduate Education, SURCA is an Office of Undergraduate Research event. SURCA is part of WSU Showcase Week.

Office of
Undergraduate Education
WASHINGTON STATE UNIVERSITY

SURCA 2019

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Schedule of Events

Monday, March 25, 2019

Posters: M.G. Carey Senior Ballroom, Compton Union Building (CUB)

Awards: CUB Auditorium (Room 177)

Noon–2:00 p.m.	Student presenters hang their own posters
2:00–2:45 p.m.	Judging* without student researchers present
2:45–3:45 p.m.	Judging* with student researchers present; judging forms must be turned in by 3:45 p.m. for tallying
3:30–5:00 p.m.	Public viewing
5:00–5:45 p.m.	SURCA Awards Ceremony (open to all)
5:45 p.m.	Presenters remove posters and pick up judges' feedback sheets

**Judges only have access to the CUB Junior Ballroom where they can complete forms and enjoy refreshments.*

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Committee Members

Talea Anderson	WSU Libraries
Jon Crodle	WSU Undergraduate Education
Andrea Donnenwerth	Global Connections
Lydia Gerber	WSU Honors College
Samantha Gizerian	Neuroscience Program/College of Veterinary Medicine
Jeremy Lessmann	Dept. of Chemistry/College of Arts and Sciences
Beverly Makhani	WSU Undergraduate Education
Anne Peasley	Office of Assessment of Teaching and Learning
Dee Posey	Dept. of Psychology/College of Arts and Sciences
Shelley Pressley	Office of Undergraduate Research/ WSU Undergraduate Education
Daniel Rieck	WSU Undergraduate Education
Mary Sánchez Lanier	WSU Undergraduate Education
Andrei Smertenko	Institute of Biological Chemistry/College of Agricultural, Human, and Natural Resource Sciences
LeeAnn Tibbals	Health Professions Student Center/College of Arts and Sciences
Cindy Williams	WSU Undergraduate Education

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Judges

SURCA thanks the nearly 150 judges who have generously donated their time and expertise to evaluate and give valuable feedback to student presenters. This year's diverse pool of judges includes representatives from:

AECOM (Richland, Wash. office)

Alta Science and Engineering, Inc. (Moscow, Idaho)
(Formerly TerraGraphics)

Alturas Analytics, Inc. (Moscow, Idaho)

Anatek Labs, Inc. (Moscow, Idaho)

Clearwater Paper Corp. (Lewiston, Idaho plant)

Comtech EF Data (Moscow, Idaho)

METER Group, Inc. USA (Pullman, Wash.)

Nez Perce Tribe (Lapwai, Idaho)

Rockwell Automation

Schweitzer Engineering Laboratories, Inc. (Pullman, Wash.)

TerraGraphics Environmental Engineering, Inc. (Moscow, Idaho office)

University of Idaho (Moscow, Idaho)

University of Idaho/Movement Sciences (Moscow, Idaho)

USDA Agricultural Research Service (Pullman, Wash.)

USDA Forest Service/Rocky Mountain Research Station (Moscow, Idaho)

WSU Faculty and Staff Members (current and retired)

WSU Postdoctoral Students

Alphabetical Listing of Judges

Office of Undergraduate Education
Washington State University

Guest Judges

Bacon, Adam, METER Group
Bell, Deborah
Braun, Rob, Comtech EF Data
Buehler, David, Schweitzer Engineering Laboratories, Inc. (SEL)
Christie, Colleen, Univ. Idaho/ Movement Sciences
Fauci, Mary, Nez Perce Tribe
Fischer, Steven
Hoesman, Bill, Clearwater Paper Corp.
Jones, Kevin, Rockwell Automation
Kisha, Ted, USDA-ARS
Lee, Jerry, TerraGraphics Environmental Engineering (ret.)
Lewis-Scholes, Sarah, USDA Forest Service/Rocky Mountain Research Station
Nimmer, Robin, Alta Science and Engineering, Inc.
Rieck, Robert, AECOM
Robichaud, Pete, USDA Forest Service/Rocky Mountain Research Station
Shrope, Nancy (WSU ret.)
Simpson, Julie, Nez Perce Tribe-ERWM Air Quality
Smith, Scott , University of Idaho
Solomon, Gene, Anatek Labs, Inc.
Woods, Robin, Alturas Analytics, Inc.

SURCA Thanks You!

WSU Faculty, Staff, and Post-Doctoral Students

Adegbola, Raphael	Faunce, Ken	Lahiri, Amrita	Schwartz, Elissa
Adesanya, Adekunle	Fricke, Suzanne	Leachman, Jacob	Scudiero, Louis
Akin, Michelle	Fuchs, Rita	Lewis, Kevin	Seehafer, April
Alexander, Kathryn	Gaither, Trymaine	Liu, Hang	Sena, Leslie Jo
Alzan, Heba	Gardner, Courtney	Makin, David	Shah, Devendra
Barry, Tammy	Gerber, Lydia	Mancini, Rock	Sidhu, Gaganjot
Bates, Philip	Ghosh, Prithwi	Manzo-Robledo, Francisco	Siler, Elizabeth
Bennefield, Troy	Gloss, Lisa	Mazur, Ursula	Singh, Kanwardeep
Berim, Anna	Goodman, Alan	Mixter, Phil	Smertenko, Andrei
Boll, Jan	Gowdy-Burke, S.M. Tomie	Mora-Romero, Guadalupe Arlene	Smertenko, Tetyana
Bond, Trevor	Harcy, Victoria	Moroz, Natalia	Smitchger, Jamin
Bond, Robin	Heiden, Zachariah	Moyo, Lindani	Snider, Denise
Borders, Bryan	Helmick, Consetta	Mukherjee, Meenakshi	Snider, Frederick
Bowers, Oliver	Hinz, John	Mus, Florence	Solomon, Samantha
Boyd, Ashley	Humann, Jodi	Naumova, Nataliia	Song, Min Kyu
Cassaniti, Julia	Hwang, Chanmi	Nicol, Erica	Srividya, Narayanan
Checinska Sielaff, Aleksandra	Iftikhar, Romana	Nilsson, Eric	Stratton, Clif
Chilukuri, Bhaskar	Illan, Javier	O'Loughlin, Levi	Sullivan, Tarah
Chingandu, Nomatter	Jack, Chandra	Pedneault, Amelie	Talukdar, Prabhat
Coleman, Elijah	Jarugula, Sridhar	Peschel, Jason	Thammina, Chandra Sekhar
Daffin, Lee	Johnson, Corey	Posey, Dee	Thomas, Michael
Dhaliwal, Amandeep	Kahn, Michael	Rabbitts, Beverley	Tolkatchev, Dmitri
Dhowlaghar, Nitin	Kang, ChulHee	Rieck, Daniel	Waananen Jones, Lisa
DiMario, Robert	Kasimanickam, Ram	Ritter, Sue	Wang, Li Ju
Dong, Wenji	Kelp, Nicole	Rodgers, Kathleen	Wang, Shuoxun
Dowd, Wes	Khot, Lav	Russell, Eric	Weathermon, Karen
Dueben, Rebecca	Kim, Kwanhee	Sanchez, Rachel	Willits, Dale
Duez, Matt	Kisha, Ted	Sankaran, Sindhuja	Willoughby, Jessica
Ellsworth, Patrick	Kistler, Michelle	Saulnier, Jen	Winey, Michael
England, Erica	Koochak, Haniyeh	Schumaker, Mark	Zhu, Lihong
Fahy, Deirdre	Korpany, Katalin		

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Judges Rubric

	ELEMENT	CRITERIA (**check ✓ an appropriate box in *each row***)	Excellent (4 points)	Very Good (3 pts.)	Good (2 pts.)	Partial (1 pts.)	Absent (0 pts.)	Total Points
Poster	**Presentation / Display** Visual presentation of project	Visually compelling and well organized display						
		Attention to detail (i.e., labels, spelling, font type/size)						
Project	**Novel Contribution / Innovative Thinking** Novel or unique idea, question, creative work or approach	Project contributes to or advances the field						
Presenter	**Project motivation and goals** Background and project objective or statement	Provides background motivation that inspired project						
		Identifies significance of project in context with other works						
		Clearly states thesis, hypothesis, idea or goal of project						
	Process / Method Discipline-specific approach to addressing the idea or project	Examines process/approach used in context of other work						
		Explains why the specific process/approach was chosen						
		Describes process or approach used to accomplish project						
	Product / Results A synthesis of what has been done or created to date	Effectively presents product or results completed *to date*						
		Illustrates significance and analyzes implications of product or results to date						
		Next steps, improvements, lessons learned, or future work						
	Oral Communication Oral presentation of the content of the project	Engages audience actively and effectively with confidence						
		Communicates skillfully about the full project						
		Answers inquiries knowledgeably						
		Exhibits a professional demeanor in appearance and communication						
For total points: Calculate points in each row and column. Write grand total in the bottom-right box. (Maximum of 64 pts. possible.)		**Total Points**						

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Sponsors

SURCA and the Office of Undergraduate Research thanks the generous company, individuals, and office for their thoughtful support of WSU undergraduate researchers and this event. The awards for top presentations today are courtesy of:

Alturas Analytics, Inc.

Robert H. ('77 Engineering and Honors) and Mary L. Rieck

Office of the Provost and Executive Vice President

UNDERGRADUATE RESEARCH CLUB | URC

Showcase for Undergraduate Research and Creative Activities 2019

Directory of Entries

Organized first by category, then alphabetically by presenter.

Applied Sciences

Poster No.	Presenter	Title of Abstract
87	**Kelly Anders** Mentor: Mark Nelson	**Fermentation of Differing Particle Sizes of a Dairy Total Mixed Ration**
15	**Hannah Cameron** Mentor: Amber Adams Progar	**Bovine-Avian Interactions on Dairies**
85	**Naomi DuBois** Mentors: Doug Collins and Nathan Stacey	**Increasing Corn Yield Through Cover Crop and Tillage Management**
9	**Chantel Eckland** Mentor: Robert Catena	**Changes in Functional Reach Space Throughout Pregnancy**
97	**Paige Gear** Mentor: Kathy Beerman	**Tamarind – A Regional Food Source in Rural Guatemala Facilitates Iron Fortification of Food Prepared With Lucky Iron Fish**
168	**Alyssa Hampton** Mentor: Ryan McLaughlin	**Effects of Cannabis Vapor Self-Administration on Decision Making in Adulthood**
30	**Tatum Hardy** Mentor: Carolyn Ross	**Development of Foods with Modified Textures for Infants and Children with Feeding Difficulties**
168	**Xitlali Herrera** Mentor: Ryan McLaughlin	**Effects of Cannabis Vapor Self-Administration on Decision Making in Adulthood**
27	**Jodie Kaya** Mentor: Nikayla Strauss	**Evaluating Primary Winter Synthetic Wheat for Resistance to Fusarium Crown Rot**
77	**Courtney Lauer** Mentor: Sian Ritchie	**Comparison of Standard Western Medicine and Traditional Chinese Medicine Treatments for Migraines**

Poster No.	Presenter	Title of Abstract
122	**Grace Lim** Mentor: Ryan McLaughlin	**Prenatal Chronic Cannabis Exposure: Stress- and Emotion-related Behavior**
73	**Heather Lynn** Mentor: Mark Nelson	**Development of an In Vitro Model to Predict In Vivo Digestion by the Pre-ruminant Dairy Calf**
4	**Devon McCornack** Mentor: Wen-Ji Dong	**Paper-based Isotachophoretic Analysis of Cancer-derived Exosomes for Early Cancer Diagnostics**
153	**David Morin** Mentor: Brian Saam	**Field Stability in Unshielded Helmholtz Coils**
4	**Devin Thompson** Mentor: Wen-Ji Dong	**Paper-based Isotachophoretic Analysis of Cancer-derived Exosomes for Early Cancer Diagnostics**
124	**Chase Warren** Mentor: Consetta Helmick	**Genetically Induced Speciation Through the Edit of Z3P**
59	**Jason Wigen** Mentor: Arron Carter	**Genome Wide Association Study of Spectral Reflectance Indicies in Winter Wheat**

Arts and Design

Poster No.	Presenter	Title of Abstract
162	**Davis, Coleman** Mentor: Linda Russo	**Palouse EcoArts Project**
110	**Jaime Kemple** Mentors: Robert Krikac and Michael Sanchez	**Pullman Depot Heritage Center**
34	**Kris Kha** Mentors: Robert Krikac and Lisa Ann Johnson-Shull	**Table of Belonging**
162	**Ellen MacNary** Mentor: Linda Russo	**Palouse EcoArts Project**
110	**Keyaira Mumford** Mentors: Robert Krikac and Michael Sanchez	**Pullman Depot Heritage Center**
34	**Sarah Rosenthal** Mentors: Robert Krikac and Lisa Ann Johnson-Shull	**Table of Belonging**
101	**Malu Santos** Mentor: Lisa Waananen Jones	**A Missing Purple Heart**

Poster No.	Presenter	Title of Abstract (Arts and Design)
34	**Shannon Spilker** Mentors: Robert Krikac and Lisa Ann Johnson-Shull	**Table of Belonging**

Computer Science, Mathematics, Statistics, and Information Sciences

Poster No.	Presenter	Title of Abstract
29	**Elizabeth Allen** Mentors: Nadia Panossian and Dustin McLarty	**Decision Trees and Stumps for Unit Commitment**
82	**Hayden Arcy** Mentor: Nikolaos Voulgarakis	**Coupled Random Walk Models for Cell Motility in Absence of External Signal**
111	**Krista Brutman** Mentor: Bertrand Tanner	**Computational Simulations of Length-dependent Activation in Human Cardiac Muscle**
141	**Heather Gudaz** Mentor: Elissa Schwartz	**Antiretroviral Therapy and the Epidemic of HIV+ End Stage Renal Disease**
165	**Brian Karlberg** Mentor: Howard Davis	**Soltek: Social Media App for Scientists and Engineers**
72	**Maia Whitley** Mentor: Sergey Lapin	**Development of a Mathematical Model for Animal Migration**

Engineering and Physical Sciences

Poster No.	Presenter	Title of Abstract
92	**Sabrina Ali** Mentors: Arda Gozen and Abhishek Gannarapu	**IntelliBra**
94	**Alexander Arger** Mentors: Nick Engdahl and Tyler Fouty	**Establishing Guidelines for Optimal Coarse Band Placement**
174	**Samuel Bigbee-Hansen** Mentors: Mohammadali Azadfar and Michael Wolcott	**A New Approach to the Valorization of Agricultural and Forestry Residues: Promise of Combined Mechanical Size Reduction and Dry Chemical for Pretreatment of Lignocellulosic Biomass**
161	**Stephen Bone** Mentors: Howard Davis and Marie Mayes	**Crimson Medical Solutions**

Poster No.	Presenter	Title of Abstract
176	**Stephen Bone** Mentor: Su Ha	**Applying Efficient Glucose Oxidase to Facilitate Direct Electron Transfer in Biofuel Cells**
126	**Evon Branton** Mentor: Arron Steiner	**Evolution of the Strawberry Volcanics and Phreatomagmatic Eruptions**
26	**Quentin Buck** Mentor: David Field	**Development of an Improved High-Pressure Torsion Die**
174	**Cecile Cardinalli** Mentors: Mohammadali Azadfar and Michael Wolcott	**A New Approach to the Valorization of Agricultural and Forestry Residues: Promise of Combined Mechanical Size Reduction and Dry Chemical for Pretreatment of Lignocellulosic Biomass**
154	**Monika Cewe** Mentor: Bernard J. Van Wie	**Determining Growth Kinetics of Cytotoxic T Lymphocytes in a Bovine System with Applications in Adoptive Immunotherapy Cancer Treatments**
6	**Alan Coe** Mentor: Howard Davis	**GripGlove: Robotic Glove to Improve Hand Function of Those with Impairments**
57	**Dustan Cwick** Mentor: Hang Liu	**Reinforcing Fibers Manufactured from Recycled Cotton with Nanocellulose**
51	**Jayson DeMers** Mentor: Luis Scudiero	**Research and Application of Polymers and Organic Fullerenes on Glass by Langmuir-blodgett Dip Coating: An Alternative Approach to Spin-coating Research**
115	**Collin Doneen** Mentors: Arda Gozen and Anita Vasavada	**Shelf Desk**
89	**Francis Dunne** Mentor: Katie Zhong	**Air Filtration Using Biodegradable Zein Protein**
35	**Kenneth Eversole** Mentor: Lynne Cooper	**Off-planet Manufacturing**
172	**Gent Ferati** Mentors: Hongfei Lin and Shaoqu Xie	**Amine Captured CO_2 Conversion Over Different Noble Metals**
61	**Ryan Fick** Mentor: Lynne Cooper	**Feasibility of Local Power Storage for Renewable Energy**
152	**Trevor Foote** Mentor: Guy Worthey	**Maximum Luminosity of Type IA Supernova as a Function of Distance from Host Galaxy**
23	**Zachary Fritz** Mentor: Howard Davis	**Design of a Surgical Arm Support to Reduce the Risk of Postoperative Peripheral Neuropathies of the Brachial Plexus and Ulnar Nerves**

Poster No.	Presenter	Title of Abstract
1	**Samantha Grindrod** Mentor: Aaron Crandall	**Differentiating Laser Tag**
92	**Caitlin Grover** Mentors: Arda Gozen and Abhishek Gannarapu	**IntelliBra**
102	**Kristian Gubsch** Mentor: Hongfei Lin	**Using Amine-Based CO_2 Capture and Conversion to Produce Formic Acid**
78	**Cory Gunson** Mentor: Peter Pfromm	**Decoupling Food and Fossil Fuel using an Iron Membrane Reactor to Produce Ammonia**
70	**Nicholas Harris** Mentors: Alex Fremier and Ryan Boylan	**Indicators for an Increase in Fallow Farm Ground for the Annual Cropping Agroecological Class in the Inland Pacific Northwest**
91	**Christine Huynh** Mentor: Howard Davis	**ID Me!**
113	**Trong Huynh** Mentors: Hongfei Lin and Shaoqu Xie	**Conversion of 1,8-Cineole to Dimer Products**
91	**Shawyon Jaffarbhoy** Mentor: Howard Davis	**ID Me!**
133	**Brittany Kesic** Mentor: Cliff Berkman	**Phosphoramidate Derivatives as Controlled Release Prodrugs of L-Dopa**
45	**Youjin Kim** Mentors: Howard Davis and Haluk Beyenal	**Electrochemical Sensing Platform for the Detection of Synthetic Opioids**
35	**Ian Laursen** Mentor: Lynne Cooper	**Off-planet Manufacturing**
74	**Stephen Lindahl** Mentor: Ming Xian	**Synthesis and Evaluation of Hydrogen Sulfide Donors**
10	**Katie Lober** Mentors: Nadia Panossian and Dustin McLarty	**Effects of Pregnancy on Forward Reach Task**
164	**Seth McPherson** Mentor: Kelvin Lynn	**Characterization of ACRT-grown CZT for Use in High-resolution Gamma Radiation Detectors**
118	**Scott Ong** Mentors: Teng Li and Shaoqu Xie	**Mechanistic Study of Biphasic Tandem Catalytic Process for Conversion of Carbohydrates to Furan Products**
128	**Rachael Ozmun** Mentor: Peter Pfromm	**Reverse Osmosis and Electrodialysis**

Poster No.	Presenter	Title of Abstract
166	**Alexander Palander** Mentor: Rock Mancini	**Lignin Model Synthesis for Radical Degradation**
6	**Kaitlin Pankratz** Mentor: Howard Davis	**GripGlove: Robotic Glove to Improve Hand Function of Those with Impairments**
53	**Cassandra Phillips** Mentor: Fred Gittes	**A Discrete Feynman Path Integral and Its Use in Analyzing Quantum Mechanical Phenomena**
61	**Camryn Pietila** Mentor: Lynne Cooper	**Feasibility of Local Power Storage for Renewable Energy**
22	**Jordan Raymond** Mentor: Jacob Leachman	**Oxygen Separation in a Vortex Tube with Applied Magnetic Field**
39	**Frankie Roberts** Mentor: Louis Scudiero	**Iron@Iron Oxide@Palladium Core-shell Bimetallic Nanoparticles for Oxidation of Formic Acid and Reduction of Carbon Dioxide**
61	**Alexander Rodriguez** Mentor: Lynne Cooper	**Feasibility of Local Power Storage for Renewable Energy**
37	**Yoni Rodriguez** Mentor: Von Walden	**Experimental Considerations for Testing Low-Cost Air Filtration Systems During Wildfire Events**
61	**Savannah Rogers** Mentor: Lynne Cooper	**Feasibility of Local Power Storage for Renewable Energy**
1	**Kiera Rust** Mentor: Aaron Crandall	**Differentiating Laser Tag**
161	**Tyler Sager** Mentor: Marie Mayes	**Crimson Medical Solutions**
63	**Yousef Saleh** Mentor: Min Kyu Song	**Limiting Nano-Silicon Expansion in Batteries by Coating It with LTO and Graphite as an Anode Material**
68	**Kacie Salmon** Mentor: Jacob Leachman	**Hydrogen-Based Regenerator Alternatives for Cryocooling**
35	**Erik Sandoval** Mentor: Lynne Cooper	**Off-planet Manufacturing**
121	**Jessie Schweitzer** Mentor: Dave Field	**Growth of Carbon Nanotubes Using Novel Techniques**
169	**Chandler Shannon** Mentor: Anita Vasavada	**Effects of Sit-Stand Desks on Postural Sway of the Head and Trunk**
23	**Alexa Simons** Mentor: Howard Davis	**Design of a Surgical Arm Support to Reduce the Risk of Postoperative Peripheral Neuropathies of the Brachial Plexus and Ulnar Nerves**

Poster No.	Presenter	Title of Abstract
138	**Connor Spencer** Mentor: Fred Gittes	**The Landau Theory of Phase Transitions Applied to Chemical and Biological Systems**
35	**Shannon Spilker** Mentor: Lynne Cooper	**Off-planet Manufacturing**
161	**Tanner Stahl** Mentors: Howard Davis and Marie Mayes	**Crimson Medical Solutions**
6	**Chandler Teigen** Mentor: Howard Davis	**GripGlove: Robotic Glove to Improve Hand Function of Those with Impairments**
161	**Mitchell Weholt** Mentors: Howard Davis and Marie Mayes	**Crimson Medical Solutions**
44	**Hannah Zmuda** Mentor: Haluk Beyenal	**Eradication of *Candida albicans* Biofilm Using Electrochemically Produced Hypochlorous Acid**
45	**Hannah Zmuda** Mentors: Howard Davis and Haluk Beyenal	**Electrochemical Sensing Platform for the Detection of Synthetic Opioids**

Humanities

Poster No.	Presenter	Title of Abstract
158	**Sierra Forler** Mentor: Samantha Noll	**Who's Sample Is It? The Ethics Behind Privacy and DNA Databases**
42	**Matt Holman** Mentors: Jennifer Thigpen and Clif Stratton	**Native American Mascots and Race Relations in the United States**
120	**Ryan Moore** Mentor: Lydia Gerber	**Notions of Uyghur Identity Within Xinjiang and Their Development During the Late 20th Century**
149	**Donvin Prasad** Mentor: Noel Vest	**The Dangers and Awareness of Diabetes**
2	**Andrew Ren** Mentor: Lydia Gerber	**Taoism in Modern China**
147	**Kaitlin Srader** Mentors: Faith Price and Trevor Bond	**Preservation of Born-Digital Newsletters from WSU Native Programs**
149	**Kamu Taulelei** Mentor: Noel Vest	**The Dangers and Awareness of Diabetes**

Molecular, Cellular, and Chemical Biology

Poster No.	Presenter	Title of Abstract
137	**Brooke Barton** Mentor: Wipawee Winuthayanon	**The Efficacy and Toxicity of a Protease Inhibitor as a Novel Contraceptive**
60	**Yemeserach Bishaw** Mentor: Bertrand Tanner	**Effects of Mavacamten on Length-dependent Contraction in Human Cardiac Muscle**
75	**Tyler Bjornson** Mentor: Alan Goodman	**Host Genetics Dictates Susceptibility to *Coxiella burnetii* Infection**
109	**Jordan Bolen** Mentors: Rey Carabeo and Amanda Brinkworth	**Examining Transcriptional Activity of the EUO Promoter in Chlamydia and Proximity to the Golgi Apparatus Relative to the Pathogenic Inclusion**
170	**Lauren Braley** Mentor: Tobin Peever	**Development of a Real-time PCR Assay for Accurate Quantification of *Botrytis cinerea* in Processed Red Raspberry Fruit**
54	**Megan Brauner** Mentor: Tanya Cheeke	**Development of a New Method to Quantify Arbuscular Mycorrhizal Fungi from Environmental Samples**
90	**Taylor Brown** Mentor: Rita Fuchs	**Circuit-specific Noradrenergic Regulation of Cocaine Memory Reconsolidation in the Basolateral Amygdala**
19	**Owen Canterbury** Mentor: Michael Varnum	**Novel Model for Blindness Generated Using Inducible CRISPR/Cas9 Genome Editing in Zebrafish**
107	**Pierce Claassen** Mentors: Rey Carabeo and Amanda Brinkworth	**Establishing a Potential Spatial Relationship Between tarP Promoter Activity and Proximity to the Golgi Apparatus in Chlamydia-infected Cells**
56	**Mataya Dick** Mentor: Holly Neibergs	**Identification of Gene Sets Associated with Miscarriage in Holstein Cows**
103	**Amy Dockweiler** Mentor: Cynthia Haseltine	**Detection of R-Loops in Archaea**
84	**Jessica Fisher** Mentors: Andrei Smertenko and Kathleen Hickey	**Reactive Oxygen Species Scavenging Mechanisms Combating Drought Stress in Wheat**
98	**Nicholas Fisher** Mentor: John Browse	**Seed Specific Overexpression of CeFAT5 (*Caenorhabditis elegans*) and Atseipin1 in *Camelina sativa* Reduces Saturated Fatty Acid Content and Limits Oil Reduction**

Poster No.	Presenter	Title of Abstract (Molecular, Cellular, and Chemical Biology)
69	**Petr Gaburak** Mentor: Daniel Mullendore	**Serial Block-face Scanning Electron Microcsopy Preservation Techniques in Plant Tissue**
58	**Sumeen Gill** Mentor: Jon Davis	**Examining the Importance of Hypothalamic Ghrelin Signaling in Cannabis Induced Feeding**
134	**Chelsie Greene** Mentors: ChulHee Kang and Kevin Lewis	**Structural and Biophysical Characterization of EppA**
48	**Henry Harrison** Mentor: Jennifer Watts	**Tissue-specific RNAi of Fatty Acid Desaturase Genes**
143	**Olivia Hayden** Mentor: Alan Goodman	**The *Drosophila melanogaster* STING Homolog (dmSTING) Protects Against *Coxiella burnetii* Infection**
171	**Zachary Howard** Mentor: Alan Goodman	**Using the Drosophila Genetics Reference Panel to Identify Host Factors Associated with *Coxiella burnetii* Infection**
31	**Ousman Jammeh** Mentor: Andrei Smertenko	**Determination of MACET Knockout Mutants in Arabidopsis**
96	**Shelby Jarvis** Mentors: Jesse Bengtsson and John Browse	**The Effect of TMZ on Leaf and Developing Seed of *Camelina Sativa***
171	**Emily Kindelberger** Mentor: Alan Goodman	**Using the Drosophila Genetics Reference Panel to Identify Host Factors Associated with *Coxiella burnetii* Infection**
66	**Courtney Klappenbach** Mentor: Michael Konkel	**The Bacteria That Tricks Your Intestinal Cells in Order to Make You Sick**
75	**Michael Knight** Mentor: Alan Goodman	**Host Genetics Dictates Susceptibility to *Coxiella burnetii* Infection**
136	**Ashley Kophs** Mentors: Asaph Cousins and Robert DiMario	**Understanding the Kinetic Properties of Phosphoenolpyruvate Carboxylase: A Key Enzyme of C4 Photosynthesis.**
93	**Jacqulyn Kuyat** Mentor: Ryan McLaughlin	**Role of Endocannabinoid Signaling in the Lateral Habenula During Flexible Decision Making**
146	**Anh Le** Mentor: Jesse Bengtsson	**Seed Specific Expression of Engineered Synechococcus Elongates DES9 Desaturase in *Camelina sativa* Reduces Saturated Fatty Acids**
12	**Austin Lenssen** Mentor: Andrei Smertenko	**Identification of Novel Genetic Markers for Drought Tolerance in Wheat**

Poster No.	Presenter	Title of Abstract (Molecular, Cellular, and Chemical Biology)
125	**Chance Lewis** Mentor: Hans-Henning Kunz	**Second-site Mutations Suppress Effects Caused by a Loss of K+/H+ Exchange Across the Plastid Envelope Membrane**
125	**Chase Lewis** Mentor: Hans-Henning Kunz	**Second-site Mutations Suppress Effects Caused by a Loss of K+/H+ Exchange Across the Plastid Envelope Membrane**
88	**Sophie Mackinnon** Mentor: Alan Goodman	**Insulin-mediated Immunity During West Nile Virus Infection in *Drosophila melanogaster***
137	**Devinae Mcneil** Mentor: Wipawee Winuthayanon	**The Efficacy and Toxicity of a Protease Inhibitor as a Novel Contraceptive**
86	**Nathan Michellys** Mentor: Michael Konkel	**Beware of Eating Chicken: It Harbors a Bacterium That Is a Major Cause of Foodborne Illness**
130	**Katrina Nielsen** Mentors: Rey Carabeo and Amanda Brinkworth	**Automating Analysis of Transcription in Individual Chlamydiae Using the Fast Fluorescent Timer Reporter**
140	**Jessica Puente Arroyo** Mentor: George Vandemark	**Examining Genetic Diversity Between Commercial Inoculants of *Mesorhizobium ciceri***
24	**Jackson Rieb** Mentor: Alla Kostyukova	**Deletion of the Oligomerization Arm in Pyranose Oxidase**
137	**Jenna Rock** Mentor: Wipawee Winuthayanon	**The Efficacy and Toxicity of a Protease Inhibitor as a Novel Contraceptive**
105	**Sarah Schroeder** Mentor: Chulhee Kang	**Connecting Molecular Structure and Function of Calsequestrin-1 in Echolocating Mammals Through X-ray Crystallography**
52	**Rachel Stout** Mentor: Jennifer Watts	**Exploration of Two Dihydroceramide Desaturase Genes**
81	**Shi Tan** Mentor: Rita Fuchs	**The Role of the Dorsal Hippocampus in Early Stage Memory Reconsolidation**
79	**Kyrah Turner** Mentor: Michael Konkel	**Antibiotic Resistance on the Rise: The Human Intestine Influences the Antibiotic Resistance of a Foodborne Pathogen**
50	**Alexandria Wahl** Mentor: Holly Neibergs	**Two Loci Validated for Miscarriage in Holstein Cattle**
60	**Marissa Watanabe** Mentor: Bertrand Tanner	**Effects of Mavacamten on Length-dependent Contraction in Human Cardiac Muscle**

Poster No.	Presenter	Title of Abstract (Molecular, Cellular, and Chemical Biology)
62	**Emma Wheeler** Mentor: Jon Davis	**Characterizing Ghrelin Secretion, Food Motivated Behavior and Body Weight Gain in Rats Exposed to a Scheduled Feeding Paradigm**

Organismal, Population, Ecological, and Evolutionary Biology

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Showcase for Undergraduate Research and Creative Activities 2019

Abstracts

Poster # 1

Differentiating Laser Tag

Presented by: Samantha Grindrod and Kiera Rust

Mentor: Aaron Crandall **Campus:** Pullman

Major: Mechanical Engineering

Category: Engineering and Physical Sciences

Laser tag is a branch of the entertainment industry that has remained technologically stagnant for over twenty years. Arena owners seek to improve the customer experience, which translates to new and return customers, but fail without modern technology. These events have a high customer acquisition cost and provide little incentive to regularly return.

Opportunities for laser tag lie within building on this core belief of elevated customer experience and overall engagement by updating current laser tag technology, which has failed to keep up with current technology expectations by consumers. Our goal was to revitalize laser tag customer experience by building and implementing both real- time tracking software and modern hardware. Data gathered from the real-time tracking system would enable laser tag venue owners the ability to promote fair gameplay, render player location to spectators for larger-scale laser tag engagement, locate players who need oversight, track player progress, thus driving overall customer experience.

We have developed software that incorporates real-time tracking through both local laser tag gameplay and remotely through a live stream. The software has been able to accurately track and output a laser tag player’s position within three to five inches of actual player location. The software highlight’s features that allow laser tag player’s the ability to track their own player profile via a website as well as allows auto-marshals within the laser arena to enforce game rules.

Poster # 2

Taoism in Modern China

Presented by: Andrew Ren

Mentor: Lydia Gerber **Campus:** Global
Major: Social Sciences: General Studies
Category: Humanities

To many in the modern world, the religious philosophies of Taoism may be redolent of an ancient China that exists only in the shrouded mists of history. The goal of the following research is intended to shed light on the ways in which Taoism is not part of antiquity, but a very ubiquitous part of modern life in China. The research herein is garnered from academic journals related to the topic at hand and from recent news articles that address points relating to Taoism in China. This research serves as evidence that Taoism exists as an unseen force that influences and plays into a part of how modern Chinese live and think, however the research is limited to secondary sources by only referencing journals and news sources as evidence of these undercurrents. A weakness exists in the sense that the claim of the research is not supported by primary documentation and firsthand accounts from citizens in China. What sources are provided do suggest strong influence of Taoist philosophies in Chinese medicine and ecological beliefs. It is hoped that this research provides readers with an understanding of the mostly unseen impact that an ancient religion has on a modern-day society, even if the members of the society do not knowingly prescribe to the tenets of the philosophy.

Poster # 4

Paper-based Isotachophoretic Analysis of Cancer-derived Exosomes for Early Cancer Diagnostics

Presented by: Devon McCornack and Devin Thompson

Mentor: Wen-Ji Dong **Campus:** Pullman

Major: Bioengineering

Category: Applied Sciences

Co-authors: Wen-Ji Dong, Shuang Guo, and Devon McCornack

Cancer is among the major malicious diseases that exhibit a high death rate and impose detrimental effects on life quality of patients. The ability to diagnose cancers early via primary care or at the point-of-care (POC) is of paramount importance because it leads to a significantly improved prognosis and an increase in survival rates. Evidence shows that all cells secrete extracellular vesicles known as exosomes, as important messengers in extracellular communication in both normal and pathological processes. For example, during cancer progression, tumor cells release more exosomes into circulation than normal cells to shuttle signaling molecules (e.g. proteins and miRNAs) to distal recipient cells to reprogram the cells to promote tumor growth and metastasis. Therefore, the tumor-derived exosomes in circulation hold great potential as liquid biopsy tools for noninvasive diagnosis of early-stage cancers. We are developing a technology to bring early cancer diagnoses from central laboratories to POC applications. Our technology integrates cost-effective paper-based fluidics, a robust electro-kinetic focusing technique, and specific immune-detection to achieve high sensitivity and specificity for isolation and analysis of specific cancer-derived exosomes. This novel technology allows for broad panel screening of a sample against multiple analytes to achieve a rapid and sensitive specific diagnosis. Therefore, the technique can have broad translational potentials in management of the patients with malicious diseases, and improve life quality of the patients.

Poster # 5

Ethnostatistics as a Method for Establishing the Importance of Replicating: A Validation of "ADHD, Impulsivity, and Entrepreneurship"

Presented by: Jacob Klopp

Mentor: Rohny Saylors **Campus:** Vancouver
Major: Management
Category: Social Sciences
Co-author: Rohny Saylors

This article introduces ethnostatistics as a method for establishing the importance of a replication study in entrepreneurship. Illustrating this method, we conduct three studies: first we engage in an ethnostatistical analysis of Wiklund, Wei, Tucker & Marino's (2017) seminal article "ADHD, impulsivity and entrepreneurship." In doing so we uncover a number of fundamental issues with both the statistical procedures and rhetoric surrounding the target paper. Specifically, we find internal inconsistency, questionable research practices, and rhetoric contrary to the findings. Following this analysis, we conduct a pure replication of the original paper. Interestingly, despite the many problems found during the ethnostatistical analysis, our second study replicates the target paper in a way which requires none of the questionable research practices, such as item deletion or imputation, and replicates the rhetorical findings in the abstract without replicating the findings contrary to the claims presented in the abstract of the target paper. Finally, we extend Wiklund et al. (2017) by bringing in theoretically relevant alternative explanations such as the big five personality traits – openness to new experience, contentiousness. extraversion, agreeableness, and emotional stability; affect – positive or negative emotions during the day when the scales were taken; and socioeconomic status – education and household free available cash flow. Despite showing a significant influence of each of these alternative explanations, the overall findings of the target article continue to be replicated.

Poster # 6

GripGlove: Robotic Glove to Improve Hand Function of Those with Impairments

Presented by: Alan Coe, Kaitlin Pankratz, and Chandler Teigen

Mentor: Howard Davis **Campus:** Pullman

Major: Bioengineering

Category: Engineering and Physical Sciences

Co-authors: Kaitlin Pankratz and Alan Coe

Ailments ranging from arthritis to paralysis affect millions of people all over the world. Many of these conditions result in weakened hands or reduced function of the hands. This drastically affects a person's ability to perform many tasks of daily living, negatively impacting their independence.

The BioMech team has devised a robotic glove called the GripGlove which serves as an assistive device. Users with hand impairments ranging from incomplete to total loss of hand function can benefit from this device by experiencing increased dexterity and grip strength in their hands. This device will help these individuals live out tasks of daily living with greater independence.

The GripGlove is comprised of small cables which run along the inside of each finger and are connected to a stepper motor, which controls flexion of the fingers. Some of the energy from flexing the fingers is stored in springs that guide the fingers in extension, returning the hand to an open position. A microcontroller and a sensor attached to a functional part of the body will control the stepper motor, and the system will be powered by a rechargeable battery pack capable of powering the device for 24 hours. The signals being input to the sensor are either muscle signals or brain signals, depending on the level of functionality of the user's hand and arm. Use of the device does not require the assistance of a medical professional, further increasing user independence.

After a conservative market analysis, it was deemed that the number of individuals that could benefit from this type of device is over 8 million. The market for the GripGlove is approximately $30 billion and is expected to grow. There are several competitors on the market for similar devices, which is proof that this technology is in demand. GripGlove's competitive advantage is that it will be competitively priced, portable and have a low-profile design, meaning that it will not be overly bulky or complicated, which is a complaint of users of many similar products. The user will be able to use the GripGlove with ease and comfort.

Poster # 7

Uncovering the Mystery Behind University Held Skeletal Collections

Presented by: Patricia Bumgarner, Derrick Gingrich, Nicholas Gottlob, Tiffany Kites, and Ann McCracken

Mentor: Erin Thornton **Campus:** Pullman

Majors: Anthropology, French

Category: Social Sciences

Co-authors: Tiffany Kite, Nick Gottlob, Derek Gingrich, and Patricia Bumgarner

Human skeletal collections are a crucial resource for teaching osteology and comparative anatomy at the university level. Many of the educational skeletons currently housed in universities and museums were procured decades ago prior to the adoption of more rigorous national and international laws regarding the sale and acquisition of human remains. Consequently, many skeletal collections currently held by educational institutions lack information on how, when, and where the remains were acquired. As an example of this, the WSU Department of Anthropology currently houses three modern human skeletons of unknown origin. To determine the likely geographic sources of these skeletons and provide the individuals some semblance of identity, we collected metric and non-metric data to assess skeletal age, sex and likely geographic ancestry. Paleopathological indicators were also used to assess health and lifestyle.

Our results indicate that the WSU skeletal collection contains one of whole female skeleton, one whole male skeleton, and one post-cranial female skeleton that has been paired with the male skull from a different individual. All three individuals died as young or middle-aged adults between the ages of 20 and 45. Despite their young age, the individuals all exhibit extensive physical stress-based pathologies, and dental wear, infection and antemortem tooth loss. This strongly suggests that the skeletons represent impoverished individuals from a low or middle income country (LMIC). Determining the geographic origins of the skeletons was more difficult, but the preponderance of evidence suggests that they are from Asia, with at least of the skeletons likely coming from India. This origin fits well with the documented procurement of large numbers of human skeletons from India prior to 1985. Although the other two skeletons also appear to be Asian in origin, we were unable to identify a more specific geographic area. Despite some uncertainty in our conclusions, the data provide a more accurate picture of who these individuals were and where the skeletons were acquired. This effort not only increases the educational value of these teaching specimens, but also serves to provide a sense of identity to the individuals whose remains are currently curated at WSU.

Poster # 8

Delay Discounting under Response Deadlines

Presented by: Katie Esler and Emily Paup

Mentors: Paul Whitney and John Hinson **Campus:** Pullman

Majors: Marketing, Psychology

Category: Social Sciences

Co-authors: Katie Esler and Amy Nusbaum

Impulsive decisions are defined by the tendency to weight short-term outcomes more heavily than long term outcomes. Impulsive decision making is often assessed by an experimental delay discounting task, which provides a quantitative discounting parameter that represents individual differences in the decreased value of rewards that occur in the future. Differences in delay discounting may help explain why people make seemingly illogical decisions, such as why someone with a substance use disorder decides to drink instead of abstaining from alcohol. While some research assumes that the delay discounting parameter is a fixed, individual difference variable, past research found that participants who had a working memory load discounted rewards more than participants who did not (Hinson, Jameson, & Whitney, 2003). Subsequent research found that delay discounting rates were increased generally with a higher working memory load, but only when choices were framed as a gain instead of a loss (Bailey, Gerts, & Finn, 2018). However, there has not been much work done investigating if there is a connection between impulsive decision making and other variables that could affect decision making, such as the amount of time given to make that decision. The focus of this study was to investigate that connection. We hypothesized that with a shorter amount of time given to consider a delay discounting choice, participants would generally choose the smaller, immediate reward. This could be due to a limited amount of time provided which would activate a system of decision making that is based more on fast, intuitive decisions as opposed to more deliberative, thought out decisions; thus, a short-term reward would be favored (Kahneman, 2011). To test this hypothesis undergraduates performed four tasks including a delay discounting task with deadlines to make choices and other tasks that assessed working memory abilities. The results of this study may help explain the situations in which people make more impulsive decisions, and therefore the results could lead to a better method of treatment for their behaviors such as giving them a longer period to contemplate decisions, hopefully leading to a better quality of life.

Poster # 9

Changes in Functional Reach Space Throughout Pregnancy

Presented by: Chantel Eckland

Mentor: Robert Catena **Campus:** Pullman
Major: Biochemistry
Category: Applied Sciences
Co-authors: Robert Catena and Katie Lober

The goal of this project was to investigate the change in functional reach space throughout the duration of pregnancy. Functional reach space represents the area between your maximum reach distance and the body. Seventeen pregnant women within the range of 16 to 36 weeks gestation were tested in 4-week intervals. Reaching distance was calculated as the distance from glenohumeral to wrist joint center. Measurements were calculated at four different torso heights (glenohumeral, nipple, T12-L1, and L3-4 levels). The depth of the torso at each level was subtracted from the reach distance at that level. Thoracic and lumbar curvature changes throughout pregnancy were tracked with motion capture technology. Reach space at the glenohumeral level showed no significant change. Nipple level showed significant decrease by 5.85% between 24-28 weeks and 28-32 weeks gestation ($p = 0.027$), while significantly increasing again by 6.21% between 28-32 weeks and 32-36weeks gestation ($p = 0.012$). T12-L1 and L3-4 levels exhibited significant decrease in reach space by 8.78% ($p = 0.012$) and 14.4% ($p \leq 0.001$) respectively starting at 24-28 weeks gestation. As the pregnancy progressed, increase in thoracic and lumbar curvatures were observed, which contributed to the increase and decrease of reaching space at different levels. With gains of anterior torso volume and loss of functional reach space, women are forced to interact with objects further away from their body. This creates greater stress on shoulder joints as well as postural muscles. Identifying when change in reach space and altered strength requirements begin, may help us create a guideline for pregnant (workers) to avoid injury.

Poster # 10

Effects of Pregnancy on Forward Reach Task

Presented by: Kathryn Lober

Mentors: Nadia Panossian and Dustin McLarty **Campus:** Pullman
Major: Bioengineering
Category: Engineering and Physical Sciences
Co-authors: Robert Catena, Anita Vasavada, and Chantel Eckland

More than two thirds of women in the United States report employment at some point during their pregnancy. During this time a woman may seek out advice from a medical professional to learn about any recommended modifications to her daily tasks at her place of employment. Over the course of a woman's pregnancy, her anterior torso volume increases. Pregnant women experience an increase in lumbar curvature or 'gestational lordosis' while their baby continues to grow. Consequently, there is an increase in the distance a woman must reach in order to interact with objects. It has been shown that the process of reaching for and interacting with objects in front of the body requires muscles to activate at a higher level to maintain posture. To date, there has been a lack of research focused on whether pregnant women should be expected to have a higher risk of muscle fatigue and loss of balance in occupational tasks that require reaching for objects in front of them. The point of interest in this study is how standing balance and reach tasks change during pregnancy. 30 women were involved; their movement was analyzed at four week intervals from 8 weeks to 40 weeks of gestation. Markers were placed all over the body, Motion Analysis motion capture data is summarized in C. Eckland's SURCA presentation. The focus of this study is quantitative analysis of coordinate systems and three dimensional joint angles of qualitative Motion Analysis motion capture data. Quantitative analysis was performed using Matlab. Analysis will be extended through use of inverse dynamics to calculate joint moment and strength requirements of muscles. In the future, this analysis can be used with musculoskeletal models to calculate individual muscle forces.

Poster # 11

Effect of Physical Characteristics on Estrus Detection in Heifers

Presented by: Casey Beksinski and Chris Mandella

Mentor: Amber Adams-Progar **Campus:** Pullman

Major: Animal Sciences

Category: Organismal, Population, Ecological, and Evolutionary Biology

Co-authors: Casey Beksinski, Amber Adams-Progar, Amy Allen, Youssef Tantawy, Briah Parchment, Lauren Cook, and Hannah Herrington

It is common practice for dairy farmers to use heifer age as the key parameter to monitor when determining when a heifer will first come into estrus. The objective of this study was to determine whether heifer age, height, or body weight is a better predictor of estrus in heifers. Sixteen Holstein heifers housed at the Washington State University Knott Dairy Center were evaluated from 26 weeks of age to 40 weeks of age. Each heifer was equipped with an activity monitor collar that automatically detected estrus in heifers, based on behavioral changes. On a weekly basis, each heifer's height and body weight was recorded. We used PROC CORR, PROC MIXED and PROC GENMOD in SAS to analyze data. The average age at first estrus was 33.12 ± 0.29 weeks. A significant relationship among heifer age, height, and weight was detected ($p < 0.0001$). The age in which heifers first showed estrus was affected by an interaction between heifer height and weight ($p = 0.004$). The number of estrus periods detected for each heifer depended on an interaction between heifer height and weight ($p = 0.04$), but age did not have a significant effect ($p = 0.38$). Overall, we found that heavier and taller heifers came into estrus before their peers. Although age, height, and weight are closely related, height and weight were better predictors of heifer estrus. These results show that by incorporating the height and weight of a heifer instead of just age, farmers are able to more accurately predict the onset of estrus in heifers. Additional variables such as serum progesterone concentrations or body condition scores should also be tested for accuracy in heifer estrus detection.

Poster # 12

Identification of Novel Genetic Markers for Drought Tolerance in Wheat

Presented by: Austin Lenssen

Mentor: Andrei Smertenko **Campus:** Pullman

Major: Landscape, Nursery, and Greenhouse Management

Category: Molecular, Cellular, and Chemical Biology

Co-authors: Andrei Smertenko and Kathleen Hickey

With the world's population continuing to climb and severe weather events occurring on a more routine basis than in the past, there has never been a more critical time to gain greater global food security. One common extreme weather event that is becoming more common is limited water availability (or drought). Drought stress causes significant yield loss in 25% of all arable land. Sustaining agricultural productivity is reliant on the breeding of superior drought resistant crops. Wheat is a staple crop for much of the world's population, and it is more commonly grown on dryland farming (i.e. no irrigation). Conventional methods for improving complex traits, such as drought tolerance, through breeding are time consuming and tedious. Very little research has been done on the cellular level for of crop breeding. Drought stress is known to damage wheat cultivars that are poorly equipped to deal with the stress. One of the key damaging factors are Reactive oxygen species (ROS) that accumulate in the cells of drought-stressed plants causing oxidative damages and compromise plant growth and yield. We base our approach on the knowledge that neutralization of ROS is essential for drought tolerance and that ROS content in cells can be assessed by measuring the abundance of small organelles peroxisomes. The aim of our project is to see if peroxisome abundance can be used to detect drought stress in different wheat varieties. To this end, we tested 5 wheat varieties that are considered to do well under drought stress. Drought was imposed under greenhouse conditions by withholding water until soil volumetric water content reached 0%. Hydrogen peroxide content was measured in total extracts from leaves as an indicator of ROS accumulation. Peroxisome abundance fluctuated throughout the experiment as the soil moisture decreased during the drought; however hydrogen peroxide content in leaves remained relatively stable under our experimental conditions. We conclude that increase of ROS production under drought stress occurs only at high light levels.

Poster # 14

Return-to-play Legislation and Concussions: Are More Youth Leaving the Emergency Department Without Being Seen?

Presented by: Jacquelyn Deichman

Mentor: Janessa Graves **Campus:** Spokane

Major: Nursing (BSN)

Category: Social Sciences

Co-authors: Janessa Graves and Tracy Klein

Purpose: To address the growing incidence of sport-related concussions, all US states have implemented return-to-play (RTP) legislation requiring athletes with suspected concussions to be evaluated by a healthcare provider before RTP. We aimed to examine the association between RTP legislation on rates of youth leaving the emergency department (ED) without being seen (LWBS) for concussion.

Methods: We used nationally representative ED data from the National Electronic Injury Surveillance System (NEISS). Cases were aged 10-18 years old and diagnosed with a sports-related concussion or internal organ injury of the head (common NEISS definition for concussion). The weighted national incidence of LWBS before any state adopted RTP legislation (1/1/2006-12/31/2008) was compared to the time-period after (1/1/2015-12/31/2017). Multivariable logistic regression was used to identify factors associated with LWBS.

Results: Between 2006 and 2017, approximately 1.2 million youth concussions associated with football, basketball, soccer, baseball, softball, cheerleading, ice hockey, lacrosse, and volleyball were treated at US EDs (annual mean 61,706 in 2006-2008; 120,391 in 2015-2017). The incidence of LWBS was 60 per 10,000 visits in 2006-2008, compared to 75 per 1,000 visits in 2015-2017 (25.4% increase). Adjusting for patient and injury characteristics, year was not associated with LWBS. Nonwhite youth, diagnosis of internal organ injuries to the head (vs. concussion), and injuries lacking injury locale information (vs. injuries at recreation places) had significantly greater odds of LWBS, whereas injuries at school had lower odds of LWBS (OR:0.55, 95%CI:0.34-0.91).

Conclusions: The incidence of ED-treated concussions resulting in LWBS has increased over time. The higher frequency of LWBS may be attributable to lower acuity injuries seeking care in the ED (prompted by RTP policies) and increased ED crowding.

Significance: To date, no study has examined rates of LWBS among youth with sports-related concussions. Future research should examine impacts of RTP legislation on ED utilization and costs.

Poster # 15

Bovine-Avian Interactions on Dairies

Presented by: Hannah Cameron

Mentor: Amber Adams Progar **Campus:** Pullman
Major: Animal Sciences
Category: Applied Sciences
Co-authors: Tyler Caskin, Karen Steensma, and Amber Adams-Progar

The number of wild birds, especially European starlings (*Sturnus vulgaris*), increases on dairy operations during the winter months. These birds establish night roosts in dairy barns during the cold weather because the barns provide a warm shelter and a plentiful feed supply. European starlings can cause as much as $200,000 of annual damage on a dairy farm by consuming cattle feed, transmitting pathogens, and potentially influencing cattle behavior. The objective of this study was to determine how wild bird density at the feed bunks of dairies affects cow well-being by: 1) recording bovine and avian behavioral interactions on Washington dairies; 2) collecting bird fecal samples to test for the presence of pathogens; and 3) evaluating nutritional components of cattle feed pre- and post-bird depredation. We hypothesized that lactating cows would exhibit more aversive and aggressive behaviors, as well as less feeding behaviors, as the density of birds at the feed bunks increased. Behavioral data was recorded using on-farm video cameras on five Washington dairies (n = 14 total pens). Instantaneous scan sampling of 1-minute intervals was used to record cow intra-species and cow-bird inter-species aggressive and aversive behaviors. Other variables recorded included the percentage of head gates used per pen, the density of birds at each feed bunk, and the number of cows eating at any given time. Results were analyzed using PROC GENMOD in SAS. Locations differed in the density of birds present ($P < 0.001$) and percentage of head gates used by cows ($P < 0.0001$). There was a 4.48% increase in bird density for each cow at feed, as well as an increase in cow-bird aggression ($P < 0.0001$). The results from this study help dairy farmers understand how wild birds influence dairy cattle well-being and will lead to the development of more effective bird deterrence methods for dairy farms.

Poster # 16

Effect of Regrouping on Social and Estrus Behaviors in Holstein Heifers

Presented by: Amy Allen and Lauren Cook

Mentor: Amber Adams-Progar **Campus:** Pullman

Major: Animal Sciences

Category: Organismal, Population, Ecological, and Evolutionary Biology

Co-authors: Amy Allen, Chris Herrington, Casey Beksinski, and Youssef Tantawy

The efficiency of visual estrus detection in cows on dairies ranges between 50% and 70%. This means that if a dairy relies on visual observations to detect estrus, then the dairy will miss up to 50% of the cows in estrus. Technology, such as activity monitoring collars, is used to detect changes in behavior that identify estrus in cows. The collars do not have the ability to differentiate between estrus-related and social-related behaviors. An increase in social behaviors could be mistakenly recorded as estrus behaviors.

The objective of this study was to determine how regrouping dairy heifers affects heifer behavioral patterns. At six months of age, nine Holstein heifers were assigned to one of two groups, novel group (n = 3 heifers) or existing group (n = 6 heifers). The existing group heifers were housed in one large pen, while the novel group heifers were housed in one small pen for one month. The novel group heifers were then moved into the large pen with the existing heifers. All heifers were continuously recorded with video cameras for 7 days pre-regrouping, the day of regrouping, and 7 days post-regrouping. The number of observations for each behavior (feeding, grooming, and activity) was recorded at 5-minute intervals. PROC MIXED in SAS was used to statistical analyze data.

Novel group heifers spent less time eating post-regrouping than pre-regrouping ($P < 0.0001$). Existing group heifers spent more time grooming other animals post-regrouping than novel group animals ($P = 0.001$). Novel group heifers were more active post-regrouping than pre-grouping ($P = 0.02$) and more active than existing group heifers ($P = 0.03$) post-regrouping. The results from this study show that regrouping affects heifer behavior. The next step is to compare video camera-recorded and activity collar-recorded behavior. These results could be used to improve activity collar accuracy and develop management practices to minimize the negative impact of regrouping on novel heifer behavior.

Poster # 17

Nisei At War: The 100th Infantry Battalion/ 442nd Regimental Combat Team

Presented by: Kyle Reed

Mentor: Jennifer Thigpen **Campus:** Pullman

Major: Social Studies Teaching

Category: Social Sciences

The generation that fought during World War II is known as the "greatest generation." Those who fought for freedom and security throughout the world. Or worked in factories to support those who were fighting abroad. One group within this generation, has been mostly forgotten, yet fought for more than just freedom. They fought to prove themselves as Americans. The Japanese-Americans who fought in the 100th Infantry Battalion/ 442nd Regimental Combat Team were regarded as "enemy aliens" by the United States government and were not trusted to be effective soldiers by the military. Restricted from military service until 1943, these men not only proved their racist critics wrong; they also earned the respect; and gratitude from their fellow white soldiers who they fought next to and saved during times of great chaos during the horrors of war.

The 100th Infantry Battalion/ 442nd Regimental Combat Team was awarded 9,486 Purple Hearts, 4,000 Bronze Stars, 560 Silver Stars, 52 Distinguished Service Crosses, and 1 Medal of Honor along with many other awards and commendations adding to over 18,000 after World War II. In 2000 President Bill Clinton upgraded twenty Distinguished Service Crosses to the Medal of Honor after a U.S. Army investigation determined that Japanese-Americans were discriminated against by white officers and thus denied the higher commendations they deserved. The Nisei (second generation Americans born to Japanese-immigrants), fought against oppression abroad while dealing with the reality of their families being oppressed and forced behind barbed wire at home. When the 522nd Artillery Battalion of the 442nd Regimental Combat Team helped to liberate the Dachau concentration camp, they were hailed as heroes by those whom they liberated. At the same time in the U.S., they were still seen as possible agents of Japan. The Nisei proved their skeptics wrong by showing that they were one of the most effective and patriotic fighting forces in the European Theater during World War Two. The actions of the 100th Infantry Battalion/ 442nd Regimental Combat Team should not be forgotten to time. They personify what it means to be an American and to fight for freedom and security.

Poster # 18

The Clock Continues Ticking in Polar Bears: Circadian Rhythmicity of Free-Ranging Polar Bears

Presented by: Colby Weil

Mentor: Heiko Jansen **Campus:** Pullman

Major: Neuroscience

Category: Organismal, Population, Ecological, and Evolutionary Biology

Co-authors: Jasmine Ware, Karyn Rode, Charles Robbins, Tanya Leise, and Heiko Jansen

The circadian (~24h) rhythm of an organism is a function of an endogenous clock that mediates daily behaviors and is heavily influenced by environmental cues, such as the day:night cycle. For populations in high latitude environments, where light conditions are seasonally dynamic and can be constant, it has been shown that the circadian rhythms of several indigenous species can be altered while others persist. It is unknown, however, to what effect these dynamic conditions have on the rhythmicity of polar bears whom also live on a moving substrate, ice. This longitudinal study employed the use of satellite radio-collars to collect activity data on adult female polar bears over a five-year period. It was found that polar bears expressed rhythms of activity peaking at roughly 2pm each day on average. In addition, the duration of activity was quite constant throughout the year. There was one exception found in the month of April where the polar bears shifted their most active period to just before dawn. April coincides with the birthing period of seal pups, the polar bears' primary food source. We speculate that the retention of rhythmic activity, limited to only ~12h per day, is a result of a strict need to manage energy stores. With dwindling access to the Arctic ice, this ability to balance energy intake and expenditure may be disrupted. As a result, polar bears may experience reductions in body condition that have already been observed in similar populations.

Poster # 19

Novel Model for Blindness Generated Using Inducible CRISPR/Cas9 Genome Editing in Zebrafish

Presented by: Owen Canterbury

Mentor: Michael Varnum **Campus:** Pullman

Major: Biochemistry

Category: Molecular, Cellular, and Chemical Biology

Co-authors: Michael Varnum, Tshering Sherpa, Pete Meighan, and Lin Fang

Cyclic nucleotide-gated (CNG) channels help convert light responses in photoreceptor cells into electrical signals that are ultimately interpreted as vision. Heritable defects in *CNGA3* and *CNGB3* genes have been linked to the development of degenerative retinal diseases such as achromatopsia, progressive cone dystrophy, and macular degeneration. In order to investigate mechanisms underlying cone photoreceptor dysfunction, we have generated zebrafish models using CRISPR/Cas9 genome-editing technology to target zebrafish *CNGA3* orthologs: *cnga3a* and *cnga3b*. We recently employed an inducible editing system, via heat shock promoter-driven expression of Cas9 and constitutive expression of single guide RNAs (sgRNAs), to temporally restrict gene disruption. This allows for normal development of healthy zebrafish retinas and working vision (at 5 days post fertilization) prior to mutation of *cnga3a* and *cnga3b*. Successful editing was confirmed by mismatch cleavage using T7 endonuclease I, and by DNA sequencing. Effects on vision were monitored using optomotor response visual performance assays and electroretinogram recordings. Without induced Cas9 expression, visual responses of sgRNA-expressing larvae were indistinguishable from wild-type controls. We found that visual performance dropped starkly within three days after induction. The unexpectedly rapid timeframe for loss of vision suggests that degradation/turnover of cnga3a and cnga3b proteins cannot be explained entirely by canonical pathways involving photoreceptor phagocytosis. Furthermore, our results indicate that the dramatic visual phenotype of cnga3a/cnga3b-edited zebrafish does not depend alone on disruption of retinal development; cnga3a and cnga3b appear to be essential for cone-dependent vision.

Poster # 20

Night Out Task: Think Out Loud Predicting Prospective and Retrospective Memory Abilities

Presented by: Nhu Huynh

Mentor: Maureen Schmitter-Edgecombe **Campus:** Pullman

Majors: Biology, Neuroscience, Psychology

Category: Social Sciences

Co-authors: Reanne Cunningham and Maureen Schmitter-Edgecombe

Intro: Improving our understanding of subtle functional changes that can occur with age could inform early interventions to mitigate the effects of functional decline. Most neuropsychological tests have been developed to assess specific cognitive domains, but few are predictive of everyday functional abilities. The Night Out Task (NOT) is a naturalistic assessment of everyday functioning that requires participants to perform 8 activities in preparation for an evening out (e.g., making tea, gathering change for a movie). The task requires complex multitasking, much like the kinds of activities individuals engage in every day (e.g., cooking). Multi-tasking involves planning, retrospective memory, and prospective memory (Burgess et al, 2000).

Method: Twenty-six healthy middle-aged adults completed the NOT as well as the Prospective and Retrospective Memory Questionnaire (PRMQ). Participants were instructed to think aloud while completing the NOT and what they said was transcribed and thematically coded using a coding scheme to identify utterances related to planning and self-monitoring.

Results: Using linear regression analysis, summative scores of utterances related to self-monitoring and planning (Plan/Monitor Score) accounted for approximately 20% of the variance in PRMQ scores, even after accounting for number of words uttered in the first step ($F(1, 24) = 4.395$, $p < 0.05$, F change = 8.75). This analysis revealed an inverse directionality for this relationship, indicating that healthy middle-aged adults who reported poorer PRMQ scores were engaging in more self-monitoring/planning verbalizations.

Discussion: The findings suggest that middle-aged adults may compensate for subtle changes in everyday memory abilities by using compensatory strategies. The plan/monitor score from the NOT think aloud data was not related to any of the major scores on the NOT (i.e., Accuracy, Time, Efficiency), which is also in alignment with this interpretation. That is, monitoring/planning should help individuals compensate and thereby perform better if they need it, but others who do not need additional support should still perform well without it.

Poster # 21

Development of a Survey to Investigate Study Abroad Destination Choice

Presented by: Nam Nguyen

Mentor: Chad Gotch **Campus:** Pullman

Majors: International Business, Marketing

Category: Social Sciences

Co-author: Chad Gotch

Many students nowadays consider study abroad during their undergraduate studies. I wish to learn why certain study abroad destinations are more common, and to understand the different factors that influence destination choice. This study comprises two complementary efforts to produce a high-quality survey instrument to investigate the factors that influence study abroad destination choice. The first phase of this study used the cognitive interviewing technique to identify sources of response error in the construction of a survey instrument. As the interviewer, I sat down with a respondent and asked the respondent to verbalize what they were thinking as they completed the survey items. This process provided a window into how respondents perceived, interpreted, and formed a response to survey items. Additional follow-up questions gauged reaction to the survey and solicited recommendations for improving it. The second phase of the study involves pilot testing a survey revised after the cognitive interview findings. Representatives of the study population will be invited to complete a paper version of the survey voluntarily. Item responses will be analyzed to guide further revisions. Eighteen (18) cognitive interviews were conducted, recorded and transcribed. Each item from the interview was coded and assigned one of the following five themes: missing, misaligned, confusing, arduous, and success. Out of 32 items, 17 items received a "success" code greater or equal (≥) 90% of the time and can be identified as highly-functioning items. The 15 remaining items went thorough consideration for revisions, and six categories of revision were explored: leave as is, eliminated, moved, phrasing revision, splitting revision, and exemplify revision. The survey has been revised and prepared in a professional, paper format for the second phase of the study. By completing these study phases, the research team will produce a tool for collecting high-quality data that significantly inform our understandings of how undergraduate students make study abroad destination choices. This research will assist study abroad advising, program development, and contribute to the research on the relationship between destination and impact on global learning.

Poster # 22

Oxygen Separation in a Vortex Tube with Applied Magnetic Field

Presented by: Jordan Raymond

Mentor: Jacob Leachman **Campus:** Pullman

Major: Mechanical Engineering

Category: Engineering and Physical Sciences

Co-authors: Carl Bunge and Jacob Leachman

The large scale and efficiency of air separation units remain key barriers towards modular, distributed liquid oxygen systems. Identifying new physical separation mechanisms, or novel combinations of established methods, could enable the development of smaller, more modular air separation systems. In this paper we investigate the combination of centrifugal separation with paramagnetism of liquid oxygen in a vortex tube. The magnetic field is applied via externally mounted 1.5 T bar magnets along the length of the hot end of the vortex tube. Various calibrated air and argon-oxygen mixtures are tested. Inlet vortex tube fluid conditions are varied from 80-90 K and 303.4-337.8 kPa. Gas chromatography analysis on the calibrated air samples shows the magnetic field gradient on the vortex tube produced a 68% increase in oxygen separation compared to the non-magnetic trials. Comparisons are made to competing oxygen separation methods. The results indicate a potential to increase oxygen purity and yield in a more compact form factor.

Poster # 23

Design of a Surgical Arm Support to Reduce the Risk of Postoperative Peripheral Neuropathies of the Brachial Plexus and Ulnar Nerves

Presented by: Zachary Fritz and Alexa Simons

Mentor: Howard Davis **Campus:** Pullman

Major: Bioengineering

Category: Engineering and Physical Sciences

Co-author: Zachary Fritz

Improper positioning of a patient's arms during surgical procedures leaves them at risk of developing postoperative neuropathies, which are often caused by prolonged stretching, compression or pressure on the nerve pathways in the arm. The most common neuropathies involve the brachial plexus and ulnar nerves in the arm. Less frequently, neuropathies of the radial and median nerves occur. These injuries can lead to a loss of sensation in the arm, as well as impaired motor function. Peripheral neuropathies of the arm are most likely to occur during cardiac, chest, and breast surgeries, where the patient's arms are abducted for an extended period of time. Research has shown that ulnar neuropathies can occur in up to 18% of all cardiac surgery patients. Additionally, according to an American Society of Anesthesiologists closed claims analysis, ulnar nerve injuries account for over 15% of all malpractice claims filed.

The current procedures for arm positioning during surgeries do not provide a reliable way of positioning and repositioning the patient's arms that ensures neuropathy will not occur. In order to prevent neuropathies of the brachial plexus and ulnar nerves, we are developing a device that will be used to assist surgical teams in positioning patient's arms in the operating room. This device will allow the surgical team to easily position a patient's arms preoperatively and reposition the patient's arms intraoperatively, while eliminating the uncertainty of positioning. It will be able to angle up and down as well as move in an adducting/abducting motion providing more mobility than the previous design of arm boards, as they are stationary. The device will also save time during surgical procedures, allowing the surgical team to concentrate on more vital aspects of the patient's operative procedure.

Poster # 24

Deletion of the Oligomerization Arm in Pyranose Oxidase

Presented by: Jackson Rieb

Mentor: Alla Kostyukova **Campus:** Pullman
Major: Bioengineering
Category: Molecular, Cellular, and Chemical Biology
Co-author: Kyle Swain

Enzymes such as glucose oxidase and pyranose oxidase (POx) are industry standards today in areas such as food processing, biofuel cells, and enzymatic biosensors. These enzymes are commonly produced in yeasts, but current research has demonstrated the potential for exciting new properties by expressing these proteins in *E. coli.* This project involved removing the oligomerization arm, subcloning, expressing, and, purifying of the subsequent mutant POx. By removing the oligomerization arm from pyranose oxidase, we aim to terminate a tetramer formation so the enzyme should be reduced from a tetramer to a dimer/monomer. POx has an electrochemical potential of the enzymes to produce electrons as a result of glucose oxidation and by reducing the pyranose oxidase to a dimer/monomer, the mutant POx has a reduced overall size which reduces the distance between the electrode and the electrode surface of the enzyme. This will help in the development of next generation enzyme electrodes that allow more direct electron transfer. Anticipated applications include improved biofuel cells and enzymatic glucose biosensors for diabetic patients.

Poster # 25

The Sound of One Hand Texting: Examining the ParadoxBetween Mindfulness Meditation Apps and Problematic Smartphone Use.

Presented by: Charles Nevin

Mentor: Lee Daffin **Campus:** Global
Major: Psychology
Category: Social Sciences

A 2018 Pew Research report on digital technology asserts that devices used to access social media have plateaued among Americans. Further, among those between the ages of 18-49, 91% of Americans are reported to own smartphones. Given such widespread saturation of this technology, it should come as no surprise that popular trends like mindfulness meditation--designed to reduce stress and improve overall well-being--have sprung up with hundreds of available apps for download.

Given such levels of saturation and studies which have linked cell phone use with attentional deficits, poorer working memory performance, weakened tendencies in delay of gratification, and poorer GPA among students, the purported benefits on the efficacy of mindfulness-based phone apps may be significantly diminished contrary to what has been reviewed in the popular literature.

A search of available literature was conducted through WSU's online library 'Search IT' in conjunction with the PsycInfo and ERIC databases using keywords such as: mindfulness, mHealth, meditation, smartphone app, self-efficacy, stress, anxiety, and digital placebo.

This study begins with a review of relevant literature on the negative psychosocial effects of smartphone usage including related topics such as: task switching, attentional distraction, academic performance, anxiety, nomophobia, and fear of missing out (FOMO).

A divergent body of literature to be examined in this review concerns mindfulness meditation apps. The section is divided into two sets of studies: a set concerned with numerous experiments performed with the popular Headspace app, and a set of studies performed with less popular but comparably efficacious mindfulness meditation apps such as 'myCompass', 'Destressify', and 'VGZ Mindfulness Coach.'

A significant number of methodological issues are highlighted and discussed such as lack of accountability for digital placebo effect, lack of standardized outcome measures for mindfulness, and lack of empirical evidence on long-term efficacy of mindfulness app interventions.

This review concludes with a summary of evidence for both negative affect of smartphone use; evidence of positive affect for mindfulness meditation apps; and an illustration of the diverging dichotomy along with recommendations for future research to resolve dissonant evidence.

Poster # 26

Development of an Improved High-Pressure Torsion Die

Presented by: Quentin Buck

Mentor: David Field **Campus:** Pullman
Major: Mechanical Engineering
Category: Engineering and Physical Sciences
Co-authors: Maryam Jamalian and Mehdi Hamid

High-pressure torsion (HPT) is a severe plastic deformation process that involves high amounts of pressure applied in the axial and torsional direction. This process creates a composite of high-strength and ductility, in polycrystalline materials. The process involves deforming metal between dies which rotate, inducing extreme amounts of deformation. The previous dies for HPT were not efficient in retrieving the sample after testing so a new pair of dies needed to be made. These dies were made with a removable top so the tested sample could be easily removed. After some preliminary tests, the dies were found adequate for using in HPT experiments. The first research experiment conducted with new dies was to study the effects of HPT at ambient temperature on micro-structural evolution and mechanical properties enhancement in pure copper. The aim is to introduce gradient microstructure, with various statistical distributions of grain size and grain orientations to examine their effect on strength and ductility. To this end, extruded cylindrical pure copper subjected to HPT for 1, 2, and 3-turns resulted in grain refinement down to the grain size of 500 nm. The results demonstrated that increasing the shear strain leads to (1) ultra-fine grain (UFG) generation at deformed coarse-grain boundaries, (2) an increase in the fraction of recrystallized grains and high angle grain boundaries, and (3) a homogenous structure in the last step. The highest level of gradient structure through the thickness was observed after 1-turn, which leads to the best combination of strength and ductility.

Poster # 27

Evaluating Primary Winter Synthetic Wheat for Resistance to Fusarium Crown Rot

Presented by: Jodie Kaya

Mentor: Nikayla Strauss **Campus:** Pullman

Major: Agricultural Biotechnology

Category: Applied Sciences

Co-authors: Nikayla Strauss and Kimberly Garland-Campbell

A common problem faced by many wheat breeders around the world is maintaining the genetic diversity needed to find new varieties that are both high yielding and resistant to biotic and abiotic stress. One example of biotic stress important in the Pacific Northwest (PNW) is Fusarium Crown Rot (*Fusarium pseudograminearum* and *Fusarium culmorum*). Fusarium Crown Rot (FCR) is a soil-borne fungal pathogen that affects the vascular tissues of wheat and can reduce yields by 35%. No resistant genes have been identified in any of the known cultivars. As a result, breeders have begun using synthetic wheat to create new varieties with potential resistance to this disease. Synthetic wheat is a cross between a tetraploid species of wheat (*Triticum durum*) and *Aegilops tauchii* and is a tool used in breeding to introduce novel genes into the genome of already adapted cultivars. In this study we evaluated 20 winter synthetic wheat lines for resistance to FCR. We grew the synthetic lines in 4 replications in a growth chamber and inoculated them with lab cultured fusarium. After screening each plant, we found that there were varying levels of resistance in the group of 20 synthetics. The individuals that had strong resistant will be analyzed using exome capture and crossed with elite varieties which will enhance FCR resistance in PNW varieties.

Poster # 28

Sensorimotor Deficits in Children with Subclinical ASD/ADHD Predicting Levels of Cognitive Functioning

Presented by: Haven Warwick

Mentor: Tammy Barry **Campus:** Pullman

Major: Psychology

Category: Social Sciences

Co-authors: Tammy Barry and Austin Lau

Background: Children with autism spectrum disorder (ASD) and attention-deficit/hyperactivity disorder (ADHD) display varying types and degrees of sensorimotor deficits particularly at young ages. Although sensorimotor deficits are not specifically part of the diagnostic criteria for the either disorders, previous research demonstrates the prominence of such dysfunctions. When considering the additive impact of sensorimotor difficulties in children with developing ASD or ADHD, there is the potential for levels of sensorimotor difficulties to be associated with further decreased other cognitive delays. As such, this study examines whether subclinical ASD and ADHD symptoms (SAAS) and child sensorimotor ability jointly predict cognitive functioning in an academic setting.

Method: A subset of $N = 1.080$ children from the archival Family and Child Experiences Survey (FACES), which draws from a nationally representative, stratified sample of students in Head Start programs across the United States, was used in our analyses. A hierarchical regression analysis was conducted in which cognitive functioning was regressed on child gender, child age, and yearly family income in block one, knowledge of literary conventions and counting ability in block two, and sensorimotor ability and SAAS in block three.

Results: Findings indicated that child age, knowledge of literary conventions, and counting proficiency were significant predictors of cognitive functioning. Furthermore, SAAS and child sensorimotor ability were each significant unique predictors of cognitive functioning above and beyond the other predictors.

Conclusions: Our findings provide evidence towards support of our hypotheses: 1) there was a significant negative relation between SAAS and cognitive functioning and 2) there was a significant positive relation between sensorimotor ability and cognitive functioning. These findings are consistent with previous literature on the influence of sensorimotor deficits among children with ASD and ADHD in relation to cognitive functioning. Despite the presence of sensorimotor dysfunction observed at early ages for the disorders, sensorimotor dysfunctions are not utilized as part of diagnosing ASD or ADHD. As such, one future direction for research is to examine the potential diagnostic utility of sensorimotor dysfunctions, as sensorimotor impairment may be useful in predicting cognitive deficits, which may imply a more chronic or severe trajectory for ASD or ADHD.

Poster # 29

Decision Trees and Stumps for Unit Commitment

Presented by: Elizabeth Allen

Mentors: Nadia Panossian and Dustin McLarty **Campus:** Pullman

Major: Mechanical Engineering

Category: Computer Science, Mathematics, Statistics, and Information Sciences

Co-authors: Nadia Panossian and Dustin McLarty

Microgrid deployments have increased recently in response to new technological innovations and additional demands for reliability and flexibility. Optimal unit commitment can improve reliability, resilience, and reduce operating costs through increased efficiency. The unit commitment problem deals with finding the most efficient method of ensuring a sufficient energy supply to meet demand in a given time. A method is needed which can accurately solve the unit commitment problem with high computational efficiency. This project applies the machine learning method of decision trees and stumps to replicate solutions of the burdensome mixed-integer unit commitment problem. Decision trees are a simple machine learning method which uses a series of binary thresholds to reach a solution, and a decision stump is the first threshold, which provides the highest information gain, without further branching. After appropriate training the decision tree accuracy ranges from 93% to 96%. Decision stumps represent the most critical single layer of a decision tree. Trimming 3900 to 5000 decision tree layers to a single stump resulted in a 4% to 8% drop in accuracy but reduced the computational burden of model training from 224 seconds to 25 seconds.

Poster # 30

Development of Foods with Modified Textures for Infants and Children with Feeding Difficulties

Presented by: Tatum Hardy

Mentor: Carolyn Ross **Campus:** Pullman
Major: Food Science
Category: Applied Sciences
Co-authors: Carolyn Ross and Benjamin Bernhard

Many parents of children who have food related problems have identified texture sensitivities as being one of the main contributors, particularly among children with Down Syndrome. It has been previously reported that about 80% of children with Down Syndrome have oral motor delays, which is likely the reason for the high prevalence of texture challenges. Some food textures may be much more difficult than others for a child to handle, depending on their diagnosis. This results in problems such as refusal of certain foods, inability to hold food down, or difficulty consuming a wide variety of foods. Because adequate food is essential to the development of young children, these problems can become quite significant, especially when they result in a lack of nutritional variety in the child's diet. This study aims to explore the responses of children (ages 11-58 months with a diagnosis of Down Syndrome) to various textures. The study began with the parent video-taping their child being presented with foods of various textures. The parent observed their child's reactions and answered a series of survey questions about the child's liking of the samples. The videos were then reviewed by trained coders who used a video coding scheme to interpret the child's reactions. Through this two-way data collection process, it can be determined which textures are generally liked or disliked children with Down Syndrome. With this information, new food products can be developed that accommodate for the texture sensitivities of these children, making it easier for parents to provide their children with something nutritious that the child both enjoys and can consume with ease.

Poster # 31

Determination of MACET Knockout Mutants in Arabidopsis

Presented by: Ousman Jammeh

Mentor: Andrei Smertenko **Campus:** Pullman

Major: Chemical Engineering

Category: Molecular, Cellular, and Chemical Biology

Co-authors: Andrei Smertenko and Sharol Schmidt

Arabidopsis thaliana is the first plant genome to be fully sequenced. Currently, at least 30,000 gene T-DNA knockout mutant lines for *Arabidopsis* exist. A T-DNA knockout mutant inactivates a gene by inserting foreign DNA into the gene and thus disrupts transcription. T-DNA inserts are indexed to obtain multiple mutant alleles for majority of *Arabidopsis* genes. However, not all T-DNA inserts lead to a full gene knockout. During my summer internship, I was working under supervision of graduate student Sharol Schmidt, who uses T-DNA insertional mutants to characterize knockouts of genes encoding the microtubule-associated protein family called MACET. The goal of my project was to verify that these T-DNA lines were true knockouts using reverse-transcriptase polymerase chain reaction (RT-PCR) with primers flanking the T-DNA insertion site. The process was initiated by the extraction of RNA from the leaf of T-DNA mutant plants using an RNA extraction kit. Complimentary DNA (cDNA) was then synthetized from the RNA using a reverse transcriptase enzyme. cDNA was used as a template with various primers upstream and downstream on the T-DNA insertion sites. Failure to amplify cDNA upstream or downstream of the T-DNA insertion site indicates a lack of transcription and thus a true gene knockout. I tested T-DNA insertions in F3 and F4 generations of double and triple mutants of MACET homologues. The results were inconclusive as we were unable to optimize conditions for all flanking primers. In addition, contamination of RNA by genomic DNA led to DNA amplification or false positives. In the future, higher yielding RNA extractions could be treated with DNase enzyme to remove contaminating genomic DNA.

Poster # 32

The Multisensory Mechanisms Underlying the Sense of Embodiment in Virtual Reality

Presented by: Stacey Ahuja

Mentor: Lee Daffin **Campus:** Global

Major: Psychology

Category: Social Sciences

Co-author: Lee William Daffin, Jr.

Background: Recent studies utilizing virtual reality technology have provided convincing evidence that our perception of an immutable holistic body is remarkably malleable and easily influenced. The question of how healthy human minds are able to experience the illusory ownership of virtual body parts or entire virtual bodies is usually studied under the concept of *sense of embodiment* (SoE). Although there is general agreement that SoE consists of three components (i.e., sense of ownership, sense of agency, and sense of self-location), these components are largely studied in isolation and there are conflicting reports about the relationships among them.

Aim: The aim of this review is to synthesize the literature on the three components of SoE and to 1) create a cohesive framework for how each component contributes to SoE; and 2) identify the sensory cues that are most salient to each of the three components.

Method: Studies were accessed via the electronic databases PubMed, PsycINFO, PsycARTICLES, and SearchIT. Searches included combinations of the terms "embodiment," "virtual reality," "mediated reality," and "embodied." Only peer-reviewed studies utilizing mediated reality technology were considered for inclusion, and forty-five published studies were ultimately reviewed. The results are grouped and discussed according to each of the three components of SoE.

Findings: Although there was substantial agreement with respect to the components of SoE, new conceptualizations were identified, and the concept of presence was identified as being an additional factor contributing to SoE, suggesting a potential need to broaden the scope of the SoE concept. The components of SoE appear to behave in a context-specific manner; and in the absence of studies that manipulate and control all of these components simultaneously, their relationship cannot be determined with any certainty.

Conclusion: On the basis of these findings, suggestions for future research are offered, including the suggestion that future studies manipulate and control all of the components of SoE in one experiment. Results of such studies would be of multidisciplinary interest and help to elucidate how the human brain integrates cues from distinct sensory systems to achieve a sense of embodiment in virtual and other mediated environments.

Poster # 33

The Evolution of Plastic Expression as an Explanation of Invasion Success

Presented by: Madison Armstrong

Mentor: Mark Dybdahl **Campus:** Pullman

Major: Biology

Category: Organismal, Population, Ecological, and Evolutionary Biology

Co-authors: Mark Smithson and Mark Dybdahl

Invasive species pose major threats to biodiversity and cause extensive ecological disruption and economic damage (Lee, 2002). The question remains how invasive populations attain their success in novel environments. Evolutionary and plastic responses of individuals may lead to adaptations and affect invasion success. Environmental conditions can influence phenotypic variation independently of genetic change, a phenomenon known as phenotypic plasticity (Fierst 2011). Plasticity of life history traits may be favored if it enables the organism to inhabit a large range of environmental conditions (Schlichting, 1986). Phenotypic plasticity is especially valuable in asexual organisms due to the nature of limited genetic differences in their lineages. It was previously thought that asexual organisms could only specialize in certain niches due to limited genetic variation, however many asexual species have been successful invaders across environmental gradients, such as certain South Atlantic coral species and the New Zealand mudsnail (*Potamopyrgus antipodarum) (*Capel et al., 2017*).* A major unanswered question is how phenotypic plasticity plays a role in trait variance and how it may be responsible for success at invasion of different habitats in the absence of genetic variation. The New Zealand mudsnail is a widespread asexual invader across the US and is a useful model organism for understanding the role of plasticity in invasion success.

Our long-term goal is to assess the evolution of plastic expression in an invasive species, and how plasticity may be contributing to invasion success. The objectives of this is proposal are to examine whether shell shape variation among populations is adaptive and to understand the importance of plasticity in fitness-related traits in newly established sites of invasion. The central hypothesis of this study is that phenotypic variance exists within many US1 populations across the US and results in fitness differences due to adaptive plasticity. To test this hypothesis, we characterized the shell shape variation in a monoclonal population across the US and then measured performance effects in divergent populations in a water flow experiment, or "snail race". We have found that shell shape variation is significantly variable across US1 populations and that variation in performance exists in the divergent populations.

Poster # 34

Table of Belonging

Presented by: Kris Kha, Sarah Rosenthal, and Shannon Spilker

Mentors: Robert Krikac and Lisa Ann Johnson-Shull **Campus:** Pullman
Majors: Accounting, Strategic Communication
Category: Arts and Design

Originally tasked with creating a *bench* that would foster a sense of belonging on campus, a cross disciplinary group of students explored countless iterations of ideas which eventually led them to creating a *table*. A bench is a transitory place, an impermanent stop on the path to a destination. The Asterix table that resulted from the collaboration is a destination in itself. It is an experience, a place where there is no distinct head of the table, where everyone present is equal. The Asterix table is a place where people come together to converse, to work, to relax, to exchange.

The members of the team are Shannon, who is focusing on Business and Communication; Kris, who is majoring in Animal Sciences; and Sarah, who is in Interior Design & Construction. Our diversity of experience is our greatest asset - it has enabled us to create a unique piece of furniture to be installed in the SPARK building on the WSU Pullman campus circa Fall 2019. Our sense of belonging as students has been strengthened through the creation of this table and we hope to strengthen not only the Pullman community, but the WSU community at large.

The team is a part of the Creative Corridor program that engages students from all backgrounds in learning through a pedagogy of making. The Creative Corridor program catalyzes a different form of learning than that which takes place in traditional learning spaces. It builds Makers: students who can learn and teach in equal measure, students who can manifest their knowledge through physical and digital works of art and science. Through engaging in iterative, creative, and critical thinking, these students deliver original, meaningful ideas to the world. As the Asterix Table Team, our hope would be to one day see our table design in classrooms, offices, and other locations to encourage a sense of belonging and foster collaboration. This poster will document the creative and collaborative process of this creative project from inception to working prototype.

Poster # 35

Off-planet Manufacturing

Presented by: Kenneth Eversole, Ian Laursen, Erik Sandoval, and Shannon Spilker

Mentor: Lynne Cooper **Campus:** Pullman

Majors: Accounting, Strategic Communication

Category: Engineering and Physical Sciences

Future permanent space outposts, whether on Mars, the Moon, or an asteroid, will rely on supplies from Earth. Our research develops a supply chain model that integrates the three components of getting needed supplies from Earth to an off-planet outpost on the surface of Mars. These components include: transportation methods, 3D printing technology for manufacturing, and the use of in-situ materials to augment Earth-produced supplies.

When the supply chain stretches from Earth to Mars transportation costs are the driving factor. The mass of the shipment are the main cost driver for transportation (expressed as $/kg). Our model evaluates different transportation methods for shipping materials from Earth to Mars' surface. As a part of the transportation analysis, we incorporate the effects of launch cycles and travel time to determine strategies to restock supplies.

It will be impossible to bring everything that these outposts need, therefore the outposts must have access to advanced manufacturing technology, such as 3D printing. Raw printing materials could then be shipped to Mars, allowing 3D printers to produce various tools, medical supplies, replacement parts, and other necessities as opposed to shipping these items from Earth. The use of off-planet 3D printers will allow items to be produced on short notice instead of having to wait for supplies to be replenished.

As the off-world manufacturing becomes more developed, the supply chain must ensure printing supplies are readily available. If in-situ materials can be used, they could augment Earth-supplied materials. This would reduce the amount of material to be shipped from Earth, in turn reducing costs. For our analysis, we investigated the technical feasibility of using augmented printing materials in 3D printers, and the technologies in development to extract in-situ material from the surface.

For our project, we created a supply chain model and tested our assumptions using current and predicted future technologies. We evaluated multiple scenarios to discover opportunities to reduce costs and improve efficiency.

Poster # 36

The Relationship on Diet and Depression

Presented by: Jennifer Lewis

Mentor: Lee Daffin **Campus:** Global
Major: Psychology
Category: Social Sciences
Co-author: Lee Daffin

A comprehensive literature review of research on the relationship between diet and depression was conducted. Diet is categorized by unhealthy and healthy dietary patterns and the reported patterns of significant depressive symptoms. A connection between the Mediterranean diet, inflammation, and depression is also made. The goal of the research is to identify a possible way to reduce the increasing rates of depression both within the United States and internationally with the assistance of everyday life factors. Recommendations are made for future research.

Poster # 37

Experimental Considerations for Testing Low-Cost Air Filtration Systems During Wildfire Events

Presented by: Yoni Rodriguez

Mentor: Von Walden **Campus:** Pullman

Major: Biochemistry

Category: Engineering and Physical Sciences

The purpose of this study is to create a scientifically sound and cost-effect solution to decrease the environmental health risks of particulate matter (PM) in low-income and rural communities. Numerous studies have shown positive associations between PM < 2.5 (0.2 to 1 micrometer) exposure (wildfire events) to respiratory and cardiovascular diseases. This study will utilize standards set by The American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) to design a testing apparatus that allows for the classification of these low-cost filtration systems. PM removal and the cost will serve as the metrics for the domain. To simulate PM exposure, a Constant Output Atomizer that generates aerosols with an average diameter between 0.02 - 0.3 micrometers will be used to inject aerosols into a sample chamber. The chamber will be divided into two sections by the low-cost filtration systems which will serve as the testing apparatus to determine efficiency.

Poster # 38

Causes, Effects, and Implications of Parenting Behavior and Style

Presented by: Chelsea Little

Mentor: Lee Daffin **Campus:** Global

Major: Psychology

Category: Social Sciences

The effects of parenting behavior and style on child outcomes have been demonstrated in numerous studies. This review will evaluate several of these studies, but will begin by asking the questions, 'What factors affect parents, and what are they being told when they seek to educate themselves? What are the causes behind the style and behaviors of parents?' This review will analyze how parenting styles have changed over time, and look at the impacts on parenting behavior, especially focusing on parenting literature. Parents are being given particular messages, and have also been influenced by each other, their knowledge, their personality, and their own children. Five books on parenting were reviewed to gather seven central tenets expressed about parenting. These same tenets were then evaluated according to the four parenting styles concept proposed by Baumrind, as this is the foundation of much parenting styles literature and research. Nineteen journal articles about parenting style and effects, along with implications for effects on parents were gathered from peer-reviewed literature, and evaluated with respect to findings and definitions of parenting styles and behaviors. It is important that parenting books offer parents advice that is consistent with the outcomes being seen through more formalized research. This review works to demonstrate the relationship between the two sets of writing: formalized research on parenting and prominent parenting literature.

Poster # 39

Iron@Iron Oxide@Palladium Core-shell Bimetallic Nanoparticles for Oxidation of Formic Acid and Reduction of Carbon Dioxide

Presented by: Frankie Roberts

Mentor: Louis Scudiero **Campus:** Pullman

Major: Chemistry

Category: Engineering and Physical Sciences

Co-authors: Louis Scudiero and Wei Jyun Wang

Converting carbon dioxide (CO_2) into greener chemicals such as fuels has been the focus of research groups for the past 100+ years. Palladium nanoparticles have been of interest as catalyst because it can both oxidize formic acid and reduce CO_2 to formic acid at low overpotential with high efficiency, and the nature of nanoparticles ensures a large surface area for electrochemistry. Despite the good electrochemical activity toward formic acid and the low overpotential and relatively high efficiency for CO_2 reduction, Pd displays poor stability due to a fast surface CO poisoning. Our hypothesis is that by synthesizing bimetallic catalysts with a transition metal as core and palladium as shell the electrochemical oxidizing and reducing properties will be enhanced. One choice for the core metal is iron since it is readily available and relatively cheap. In this work, Fe@FeOx nanoparticles were first synthesized using a modified method that was proposed by Scott et al. These nanoparticles were then characterized by x-ray photoelectron spectroscopy (XPS), transmission electron microscopy (TEM) and studied by cyclic voltammetry (CV) and chronoampemetry (CA). XPS and TEM data confirm the core-shell structure of the particles and their successful coating with palladium (Fe@FeO_x@Pd NPs). These nano-catalysts show an increased current density toward formic acid oxidation than that of just palladium nanoparticles (Pd NPs). Preliminary testing of these nano-catalysts show promise for the electrochemical CO_2 reduction into formic acid. These results will make possible the design and fabrication of a regenerative and sustainable system that will convert the by-product (CO_2) of a direct formic acid fuel cell (DFAFC) to fuel, formic acid. This could potentially become a viable renewable portable energy source.

Poster # 40

Test Anxiety and Performance on Proctored and Non-Proctored Exams in Online Classes Study

Presented by: Sydney Wright

Mentor: Lee Daffin **Campus:** Global

Major: Psychology

Category: Social Sciences

Co-author: Lee Daffin

The purpose of this study is to see if a brief intervention to reduce test anxiety decreases the performance gap on proctored and non-proctored exams. This study follows students from Washington State University that are enrolled in one of the 11 psychology classes. Participants were exposed to three conditions – control (C), expressive writing (EW), and unrelated writing group (UW). We hypothesize that if students are experiencing worry and anxiety related to taking an exam, a brief intervention in which they express their thoughts and feelings about taking the exam should lower their overall anxiety and increase performance in keeping with the arousal theory of motivation. As such, there may still be a difference in performance on proctored and non-proctored exams, but we hypothesize this gap will be reduced.

Poster # 41

Viruses and Plant Species Identity Alters Behavior of Predators and Prey in an Aphid-legume System.

Presented by: Dana Roach

Mentor: David Crowder **Campus:** Pullman

Major: Wildlife Ecology and Conservation Sciences

Category: Organismal, Population, Ecological, and Evolutionary Biology

Co-authors: Robert Clark and David Crowder

Herbivorous insects significantly influence agricultural systems, as primary consumers and vectors of plant pathogens. Carnivorous insects play an important role in controlling herbivorous insect populations and herbivore-vectored pathogens. Previous research has revealed the impacts of host-plant characteristics on predator-prey interactions, illustrating the importance of interspecific variation. However, plant pathogens are increasingly appreciated as an additional source of host-plant variation that complements interspecific variation, but these are rarely considered simultaneously. We therefore conducted an experiment in which we varied host-plant species and viral status to determine the influence of these traits on predator-prey interactions between ladybird beetles and pea aphids. Our greenhouse experiment consisted of monitoring predator foraging behavior, aphid predation events by ladybird beetles, and aphid behavioral response to ladybird beetles. This experiment was conducted using 3 different legumes (pea, vetch, and lentil) under two viral treatment types (infected and uninfected). We discovered that ladybird beetle foraging effort varied by plant species, and that virus presence reduce predation event frequency. Aphid fleeing behavior was mediated by both plant species and viral status; in some cases, dramatically altering movement behavior of aphids on pea and vetch, but not lentil. Our experiments reveal that intraspecific variation in the form of viral status alter the biological interactions between ladybird beetles and pea aphid. Thus, we suggest that in ecosystems where herbivorous insects serve as biological vectors for plant pathogens, viral status must be considered to better understand how bottom-up effects impact predator-prey interactions.

Poster # 42

Native American Mascots and Race Relations in the United States

Presented by: Matthew Holman

Mentors: Jennifer Thigpen and Clif Stratton **Campus:** Pullman
Major: History
Category: Humanities

One of the most glaring forms of accepted racism in the United States today is the usage of Native American mascots in sports. While many other aspects of institutionalized racism have been combated in recent years, Native American mascots are still present in nearly every American professional sport. Yet their use today is controversial. That controversy has evolved significantly over the past 100 years, just as race relations in the United States have shifted dramatically over the same time period. My research interprets the ways in which the creation, and in some cases removal, of Native American mascots are representative of the changes in race relations over the last century. I have looked into specific cases regarding mascots in the NCAA, NFL, MLB, and NHL teams in order to investigate the reasons why they chose Native American mascots, how they were used, as well as to determine if they are still used today. For my research, I located court cases regarding the use of Native American mascots and imagery usage at high school, collegiate, and professional levels to trace the use of mascots as symbolic of changing race relations in the United States. There were several key mascots to my research; Chief Wahoo of the Cleveland Indians and the Washington Redskins. Chief Wahoo's creation, rise to fame, controversy, and eventual removal offers a perfect parallel for the ways race relations have evolved over the years in the United States. The Washington Redskins organization exemplifies the modern controversy over Native American mascots, with their support and opposition coming from various groups of peoples. In the twentieth and twenty-first centuries, Americans have become increasingly concerned with accurate and positive representations of minority groups. The movement towards the end of racist mascots can be interpreted as demonstrative of changing race relations in the United States.

Poster # 43

Academic Achievement and Optimism

Presented by: Savanna Ford

Mentor: Lee Daffin **Campus:** Global

Major: Psychology

Category: Social Sciences

A student's commitment to school is often time-consuming and trying. This review studies different achievement strategies that students use to attain higher grades, including strategic optimism and defensive pessimism, along with coping mechanisms, such as behavioral and claimed self-handicapping, in relation to achievement strategies. The focus on strategic optimism as an achievement strategy denotes a generally high success rate for students' academic improvement, with special attention on race and ethnicity, social class, and status promoting optimism and higher grades associated to different social circumstances.

Poster # 44

Eradication of *Candida albicans* Biofilm Using Electrochemically Produced Hypochlorous Acid

Presented by: Hannah Zmuda

Mentor: Haluk Beyenal **Campus:** Pullman

Major: Bioengineering

Category: Engineering and Physical Sciences

Co-authors: Abdelrhman Mohamed, Yash Raval, Robin Patel, Douglas Call, and Haluk Beyenal

Within the healthcare field, chronic wounds are a rising problem that are difficult to treat. A chronic wound is classified as a wound that does not go through the normal healing process. This healing process is often delayed due to presence of biofilm, which includes pathogenic bacterial and/or fungal cells suspended in a self-secreted substance, extracellular polymeric substance, that provides protection from various environmental factors and chemicals, including traditional antibiotics. Our group has developed a novel device that electrochemically generates biocides to eradicate biofilm and promote wound healing in wound beds. Our previous work demonstrated that a polarized electrochemical scaffold (e-scaffold) can generate continuous low concentrations of hypochlorous acid (HOCl) near wound surfaces and effectively eradicate bacterial biofilm. The goal of this study was to assess the anti-biofilm activity of a HOCl-producing e-scaffold against *Candida albicans* biofilm. For this study, *C. albicans* was grown in either an acrylic-bottom six well plate (*in vitro* model), or on the surface of a tissue punch extracted from a germ-free pig's ear (*ex vivo* model). *In vitro* biofilm was exposed to HOCl-producing e-scaffolds for different time-periods; after 24 hours of continuous exposure, no viable colonies were observed compared to the control (5.28 ± 0.034 $\log_{10}$ CFU/cm^2; $p < 0.0001$). *C. albicans* biofilms grown on porcine dermal explants also had no viable colonies after 24 hours whereas control explant biofilms had 4.29 ± 0.057 $\log_{10}$ CFU/cm^2 ($p < 0.0001$). When exposed to polarized e-scaffold for 24 hours, the number of viable mammalian cells decreased (35.6 ±6.4%) compared to explants exposed to nonpolarized e-scaffolds (not generating HOCl) ($p < 0.02$). The described HOCl-producing e-scaffold is a potential novel antifungal agent-free strategy to treat *C. albicans* biofilms in chronic wounds.

Poster # 45

Electrochemical Sensing Platform for the Detection of Synthetic Opioids

Presented by: Youjin Kim and Hannah Zmuda

Mentors: Howard Davis and Haluk Beyenal **Campus:** Pullman

Major: Bioengineering

Category: Engineering and Physical Sciences

Co-authors: Youjin Kim, Adan Schafer Medina, Haluk Beyenal, and Howard Davis

Between the years of 1999 and 2017, the number of overdose deaths due to opioids has more than quadrupled in the United States. One reason for the rise in opioid related death is the increased lacing of synthetic opioids in illicit substances, including heroin, cocaine, oxycodone, and 3,4-Methylenedioxy methamphetamine (MDMA). Synthetic opioids, such as fentanyl and carfentanil, are more potent than natural opioids, such as heroin. Synthetic opioids pose a threat to users and first responders alike because of absorption through the skin. Upon skin contact and/or inhalation of the synthetic opioids, the recipient can experience acute adverse health effects such as respiratory depression, nausea, and lethargy. Traditional devices that can detect the trace amounts of synthetic opioids in bulk illicit substances are restricted to the laboratory setting because of their size and weight, can only indicate the presence of synthetic opioids, and take hours to process. We propose the use of an electrochemical sensing platform to detect trace amounts of synthetic opioids in bulk illicit substances. The benefits of using an electrochemical sensor is that the system can be made portable with rapid processing (minutes vs hours), and the concentration of the synthetic opioid can be quantified.

This work consists of proof-of concept results to show that a screen-printed carbon electrode can be used as the platform to detect trace amounts of 2-(4-isobutylphenyl) propanoic acid (Ibuprofen). Ibuprofen is the substance used for a proof-of-concept test because of its availability for research without the requirement of a DEA license. When a range of potentials are applied to the working electrode on a screen-printed carbon electrode, ibuprofen will undergo an oxidation reaction and be sensed at the electrode surface. A calibration curve will correlate the observed charge to the concentration of ibuprofen over the range of 0.0 - +2.0 $V_{Ag/AgCl}$ using square pulse voltammetry. Once the system calculates the concentration, it will be displayed for the user. Displaying the concentration of synthetic opioids present in a bulk sample will enable first responders to make informed choices when handling samples and treating overdose victims with overdose-reversal medication such as naloxone.

Poster # 46

An Isotopic Examination of Dietary Niche Partitioning Between *Lynx canadensis* and *Lynx rufus* in a Range Edge Environment

Presented by: AnnMarie McCracken

Mentors: Erin Thornton and Daniel Thornton **Campus:** Pullman

Majors: Anthropology, French

Category: Organismal, Population, Ecological, and Evolutionary Biology

The boreal forests of the Pacific Northwest and southern Canada represent the southern range limit of lynx (*Lynx canadensis*: a dietary specialist subsisting primarily on snowshoe hare), and the northern range limit of bobcats (*Lynx rufus*: a dietary generalist). Lynx are a threatened species that has experienced southern range contractions over the last several decades due to habitat loss, overharvesting, and climate change. Meanwhile, bobcat populations have expanded northward, potentially increasing their competition with lynx. In this project, I used stable isotope analysis ($\delta^{13}C$ and $\delta^{15}N$) to understand the degree of reliance of past and present lynx and bobcat populations on snowshoe hare (*Lepus americanus*) and their dietary breadth and partitioning.

The following predictions were tested through these analyses:

1) In a range edge area of both species (northern Washington/southern British Columbia), lynx will show low $\delta^{13}C$ and $\delta^{15}N$ consistent with specialization on snowshoe hare, while bobcats will show higher $\delta^{13}C$ and $\delta^{15}N$ indicative of a broader diet

2) In a range edge area where lynx were recently extirpated (eastern Washington), bobcats will exhibit greater consumption of snowshoe hare (i.e., lower $\delta^{13}C$ and $\delta^{15}N$) in response to increased availability of this resource after lynx were removed from the landscape.

This research documents how morphologically similar specialist and generalist species partition prey in a range edge environment, and their ability to adjust diets under changing conditions. This informs the reasons behind differential resilience of specialists and generalists to anthropogenic change.

Poster # 47

Decreasing N_2 Fixation in *Lobaria oregana* Is Likely Caused by Anthropogenic Emissions

Presented by: Elise Bugge

Mentor: R. Dave Evans **Campus:** Pullman

Major: Environmental and Ecosystem Sciences

Category: Organismal, Population, Ecological, and Evolutionary Biology

Co-authors: R. Dave Evans, Meaghan Petix, and Bruce McCune

Nitrogen (N)-fixation is the dominant natural source of N in Pacific Northwest ecosystems, but low N_2-fixation rates result in N limitations to net primary productivity. However, anthropogenic emissions of N have increased globally due to agriculture and burning of fossil fuels. Long term N deposition has adverse effects such as eutrophication, soil acidification, and loss of biodiversity. In Pacific coastal ecosystems, epiphytic lichen communities are a dominant source of N_2-fixation, but exceedance of the critical load of N from deposition may decrease N_2-fixation by epiphytic lichens. Here, we test the hypothesis that atmospheric N deposition from anthropogenic sources is decreasing N_2-fixation by the cyanolichen, *Lobaria oregana*. We tested the hypothesis by measuring the N stable isotope composition ($d^{15}N$) of herbarium lichen specimens from 1899 to current day. A $d^{15}N$ of 0 ‰ indicates N_2-fixation, negative values represent agricultural emissions while positive values indicate N originating from fossil fuel emissions. Lichen $d^{15}N$ suggests N_2-fixation was the dominant source of N until the 1970's. A large increase in $d^{15}N$ in the 1970's corresponds to the completion of I-5 and rapid development along the I-5 corridor. Lichen $d^{15}N$ values that correspond to fossil fuel emissions have steadily increased to present, but large spatial variation exists due to localized sources. This suggests that over the short term, anthropogenic N deposition is causing a decrease in N_2-fixation by *Lobaria oregana*. The long term consequences are a likely shift from N sensitive, to N tolerant species.

Poster # 48

Tissue-specific RNAi of Fatty Acid Desaturase Genes

Presented by: Henry Harrison

Mentor: Jennifer Watts **Campus:** Pullman
Major: Genetics and Cell Biology
Category: Molecular, Cellular, and Chemical Biology
Co-authors: Jennifer Watts and Jason Watts

Unsaturated fats in the diet are essential to maintaining human health. In contrast, the typical American diet is high in saturated fats, which are linked to cardiovascular issues, strokes, and elevated risk of heart attack. Unlike humans, the roundworm *Caenorhabditis elegans* can synthesize all its own polyunsaturated fatty acids (PUFAs) through fatty acid desaturation and elongation. This allows us to study the physiological effects of specific unsaturated fatty acids after RNA interference (RNAi) is used for systemic genetic knockdown of fatty acid desaturase genes *fat-1* and *fat-4.* To understand RNAi susceptibility, we used *C. elegans* mutant strains with RNAi activity localized to specific tissues such as skin, muscle, intestine, and germ line. Preliminary results indicate that desaturase activity occurs in intestinal tissues and in the germ line, but not in muscle tissues. These studies will reveal which animal tissues are most important for the production of unsaturated fatty acids. While these studies are highly relevant to mammal physiology, they cannot be easily performed in mammals, and thus *C. elegans* is used as a model organism to understand how desaturated fat levels affect cellular signaling and maintaining overall health.

Poster # 49

Implementation of a New Patient Zoning System in the Emergency Department and the Relationship with Overall Length of Stay

Presented by: Sydney Pham

Mentors: Celestina Barbosa-Leiker and Victoria Sattler **Campus:** Spokane

Major: Nursing (BSN)

Category: Social Sciences

Co-authors: Vicky Sattler and Celestina Barbosa-Leiker

Background: Overcrowding is recognized as a problem in emergency departments (EDs) throughout the United States. Results of overcrowding include increased overall length of stay (LOS) and is a contributing factor to adverse patient outcomes and decreased patient satisfaction. LOS is impacted by various factors including patient throughput. It has also been shown that certain patient populations have a longer LOS compared to others. For instance, psychiatric patients have a longer LOS compared to non-psychiatric patients. The purpose of this project is to examine LOS and associated measures before and after implementation of a new patient zoning system. We hypothesize that the new zoning system decreased LOS and associated measures.

Methods: Managers in the Providence Sacred Heart Medical Center (PSHMC) adult emergency department recognized that an increase in the number and LOS for psychiatric patients decreased the availability of beds for other patients and potentially increased their overall LOS. The ED management implemented a change in the patient zoning in an effort to improve patient flow and increase the number of beds available to treat patients. Patients with a chief complaint that was psychiatric or mental health in nature were excluded from being seen in the new zone. Only patients with medical complaints and were triaged with an intermediate acuity level were seen in the new zone. This study is a secondary data analysis project using data that will be securely extracted from the EPIC database using a HIPPA compliant REDCap database.

Analysis: Individual-level data will be collapsed across the week resulting in week-level data for the 6-month period prior to the implementation of the new ED zoning (October 2017) and 6 months after (March 2018). The mean times for each week for the project time period will be included in the dataset: Door to triage, Door to provider, Door to room, Door to disposition, and Total LOS. An interrupted time series analysis will be conducted in Feb 2019.

Results: The medical center is expected to benefit from understanding the relationship between design changes in the adult ED and patient overall length of stay.

Poster # 50

Two Loci Validated for Miscarriage in Holstein Cattle

Presented by: Alexandria Wahl

Mentor: Holly Neibergs **Campus:** Pullman

Major: Animal Sciences

Category: Molecular, Cellular, and Chemical Biology

Co-authors: Mataya Dick, Jennifer Kiser, Joao Moraes, Gregory Burns, Thomas Spencer, and Holly Neibergs

In dairy cattle, most pregnancies that are lost occur prior to day 35 of gestation although an additional 7-10% of pregnancies are lost late in gestation. The objective of this study was to identify the loci associated with miscarriages after day 35 of gestation in Holstein heifers and cows that conceived to their first artificial insemination (AI). This study consisted of Holstein heifers (n = 561) that were raised together in a single facility and Holstein cows (n = 526) that were raised in six central Washington dairies. Sixty-two heifers (11%) and 28 primiparous cows (5%) miscarried between 35 days of gestation and term. Miscarried cattle were genotyped using the Illumina BovineGGP50 BeadChip (43,938 single nucleotide polymorphisms or SNPS), while cattle that calved were genotyped with the Illumina BovineHD BeadChip (777,000 SNPs). There were 43,984 BovineGGP50 SNPs shared with the BovineHD BeadChip and used for a genome wide association analysis (GWAA). A 36 kilobase region surrounding SNPs associated with miscarriage was investigated for positional candidate genes. After quality control for SNPs and animals, 529 heifers (59 miscarried and 470 that calved) and 37,954 SNPs remained for the analysis and 517 cows (28 miscarried and 489 that calved) and 40,195 SNPs remained for GWAA. An uncorrected P-value threshold was used to identify loci moderately ($1 \times 10^{-5} > P > 5\times10^{-7}$) or strongly ($P < 5\times10^{-7}$) associated with miscarriages. For heifers, 6 loci were moderately and 12 loci were strongly associated with miscarriage after day 35, while 3 loci were moderately and 4 loci were strongly associated with miscarriage in cows. Two of the strongly associated loci (BTAX and BTA11) were shared in heifers and cows. The disruption of the functions of many of the 24 identified positional candidate genes results in insufficient or lack of embryonic development and/or fetal growth. The identification of loci and genes associated with miscarriage across life stages provides a foundation for further study of the roles of these genes in fertility and an approach to reduce the economic losses associated with miscarriages in the dairy industry.

Poster # 51

Research and Application of Polymers and Organic Fullerenes on Glass by Langmuir-blodgett Dip Coating: An Alternative Approach to Spin-coating Research

Presented by: Jayson DeMers

Mentor: Luis Scudiero **Campus:** Pullman
Major: Chemistry
Category: Engineering and Physical Sciences
Co-author: Luis Scudiero

The growing concerns over environmental damage caused by the continued, and increasing, usage of Greenhouse gas producing fossil fuels has required more research to be done in alternative energy sources. Solar cell technology has been in use for decades but continues to be only a small part of the total amount of necessary energy production around the world. Part of the problem with proliferating solar cell technology is the cost of producing solar cells with the superconductive materials requiring reagents that are rare and costly to produce and have environmental impact concerns of their own. With the desire to expand solar energy and the need for an alternative superconductive material, research into polymer based organic methods has been a focus for a new approach. Current research into polymers such as poly-(3-hexylthiophene-2,5-diyl) (P3HT) or poly-(3-octylthiophene-2,5-diyl) (P3OT) as an electron donors and phenyl-61-butyric acid methyl ester (PCBM) as an electron acceptor requires applying the species to substrate material, such as glass or indium tin oxide (ITO), for superconductive research. However, much of that research of applying thin-layer organic species is done via a spin-coating method, which is not applicable on the industrial level. The purpose of this research was to use a different approach, via Langmuir-Blodgett isothermal study, at both room and elevated temperatures, to determine the viability of applying thin-layer organics via dip-coating. Data suggested that warmer temperature dip-coating methods showed a higher concentration, and therefore greater absorption of light energy, of thin-layer organic application to glass.

Poster # 52

Exploration of Two Dihydroceramide Desaturase Genes

Presented by: Rachel Stout

Mentor: Jennifer Watts **Campus:** Pullman
Major: Biochemistry
Category: Molecular, Cellular, and Chemical Biology
Co-authors: Jason Watts and Jennifer Watts

Sphingolipids are an essential component for optimal health within the body. Their various roles are determined by the structural diversity observed within the class. Sphingolipids are composed of a sphingosine base with an acyl chain which forms a ceramide and various head groups. Simple ceramides and sphingosine-1-phosphate are significant players in cell signaling processes such as autophagy, inflammation, and apoptosis; sphingomyelin plays a critical role in the formation of myelin sheaths within the mammalian brain. All ceramides contain a double bond at the C4 carbon which is added by dihydroceramide desaturase, yet the role of this conserved structural component is still unclear. Therefore, we will study the role unsaturated sphingolipids play in *Caenorhabditis elegans* using two strains that have deletion mutations within two dihydroceramide desaturase genes called *ttm-5* and *F33D4.4*. We generated a double mutant which is predicted to knockout dihydroceramide activity entirely. All strains were viable, indicating that dihydroceramides can substitute in place of ceramides. Lipidomic analysis revealed that *F33D4.4* and the double mutant had the most significant loss of unsaturated ceramides and we found decreased lifespans in the mutant strains. Currently, we are exploring how ceramide loss effects the reproduction and growth rate of *C. elegans.* This work may help us better understand the lipid contribution to complex processes by determining the influence this double bond has on the overall function of ceramides.

Poster # 53

A Discrete Feynman Path Integral and Its Use in Analyzing Quantum Mechanical Phenomena

Presented by: Cassandra Phillips

Mentor: Fred Gittes **Campus:** Pullman

Major: Physics and Astronomy

Category: Engineering and Physical Sciences

Co-author: Fred Gittes

The Feynman path integral is an interesting approach to calculating quantum mechanical results. It is a method to get to the time dependent propagator without having to use the Hamiltonian H and calculating its eigenvalues and eigenfunctions. This is done by constructing all possible paths between two points and summing over these paths. A very important property of the propagator is unitarity, as the probability must add to 1. Usually, the spatial dimension (often x) is continuous and discretizing is a disadvantage as it approximates an already approximated solution, increasing error. In general, discretizing also breaks unitarity. However, if we consider an intrinsically discrete and unitary system, there are appealing features, one of which is the fact that the paths are generated by matrix operations. The discrete steps also then have physical meaning. This approach overlaps with quantum mechanical random walks.

Poster # 54

Development of a New Method to Quantify Arbuscular Mycorrhizal Fungi from Environmental Samples

Presented by: Megan Brauner

Mentor: Tanya Cheeke **Campus:** Tri-Cities

Major: Biology

Category: Molecular, Cellular, and Chemical Biology

Co-authors: Ursel Schuette and Jim Bever

Mycorrhizal fungi form symbiotic relationships with the majority of plant species and play an important role in maintaining healthy ecosystems. Arbuscular mycorrhizal (AM) fungi gain carbon from symbiotic associations with plant roots and improve plant growth by providing increased access to water and nutrients. Although AM fungi are prevalent in roots and soil, quantifying them from environmental samples remains challenging. One of the reasons for this is that a single AM fungal cell can have multiple nuclei, resulting in multiple operational taxonomic units or 'species' per cell. For my undergraduate research project at WSU, I am testing a new method aimed at quantifying AM fungi from environmental samples. To do this, I extracted DNA from three AM fungal species- *Claroideoglomus candidum*, *Gigaspora margarita*, and *Acaulospora spinosa* and prepared a mock community with different proportions and densities of each species. I used a two-cycle PCR to first isolate the AM fungal DNA and then tagged individual molecules with a unique barcode in a second PCR. After the second round of PCR, samples will be pooled and sequenced using the Illumina MiSeq platform. Based on the initial concentrations of each AM fungal species in the mock community, I expect to see a linear relationship between initial sample concentrations and relative abundance of each AM fungal species detected after sequencing. *This research aims to test if a new molecular technique using two-cycle PCR will be able to accurately quantify AM fungi where proportions and densities from the initial community are known. If successful, this method can be used to quantify AM fungi in samples taken from environments that have unknown concentrations*.

Poster # 55

A Systematic Review of Prevention and Educational Programs to Promote Healthy Adolescent Sexual and Romantic Relationships: Where Are the Parents?

Presented by: Hannah Heizer

Mentor: Kathleen Rodgers **Campus:** Pullman

Majors: Human Development, Psychology

Category: Social Sciences

For many people, the first romantic experiences are during the teen years. This has spurred many programs to encourage teens to partake in abstinence or safe sex behaviors. Most sexual education programs for teens focus on biological aspects of sexual development, with limited parental involvement and little discussion of sexuality within a romantic-relationship context (Lindau, Tetteh, Kasza, & Gilliam, 2008). The objective of this project is to conduct a systematic literature review of prevention programs promoting healthy adolescent relationships that have been empirically evaluated that include some parental involvement. With my faculty mentor, I will assess current research on sex education or programs about teen romantic relationships that involve parents and will identify gaps in the literature. Results will recognize future paths for research regarding parent-teen communication about healthy sexual and romantic relationships.

This poster will demonstrate steps taken to conduct the literature review described above following Galvin's (2017) systematic review procedures. These include, (1) determining key-words and subjects typically used in the research of focus, (2) ways these terms were located and decided upon, (3) results from searches using the WSU electronic library system, Google Scholar, Centers for Disease Control and any other useful tools such as Web of Science, and (4) my approach to organizing articles in to categories for analysis. I will compare articles, identify major findings, and explore differences among research findings. I will include my own interpretation of what contributes to the literature and where there are gaps in the research. The project will be impactful to practitioners and parents because it will inform healthy relationship research and programming efforts to teach relationship boundaries to adolescents.

References

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Poster # 56

Identification of Gene Sets Associated with Miscarriage in Holstein Cows

Presented by: Mataya Dick

Mentor: Holly Neibergs **Campus:** Pullman

Major: Animal Sciences

Category: Molecular, Cellular, and Chemical Biology

Co-authors: Alexandria Wahl, Jennifer Kiser, Joao Moraes, Gregory Burns, Thomas Spencer, and Holly Neibergs

Late term miscarriages occur in 7-10% of cattle pregnancies. The causes of these miscarriages are poorly understood and represent significant financial losses. The objective of this study was to identify genes and gene sets associated with late term miscarriage in Holstein cows. This study consisted of 526 primiparous cows from six dairies in central Washington, which conceived to their first artificial insemination (AI). Of the 526 cows pregnant at day 35 of gestation, 498 cows calved and 28 cows miscarried. Cows that calved were genotyped using the Illumina BovineHD BeadChip (777,000 SNPs) and cows that miscarried were genotyped using the GeneSeek BovineGGP50 BeadChip (48,268 SNPs). 43,984 SNPs were shared between the two BeadChips and used for the gene set enrichment analysis using SNPs (GSEA-SNP). A total of 4,389 gene sets were evaluated from PANTHER, KEGG, GO, Reactome and Biocarta databases. For 19,723 genes, the most significant SNP surrounding each gene (18 kilobases 3' and 5') was selected as the gene proxy. Enriched gene sets were those with a normalized enrichment score ≥ 3. Two gene sets, lipid catabolic process (NES = 3.4) and glycine, serine and threonine metabolism (NES = 3.0), were enriched for late term miscarriage and contained a total of 19 leading edge genes. Both gene sets have functions that impact pregnancy success in mice and humans. The leading edge genes identified provide insights into the genes that work together that effect late term miscarriages and leads to a better understanding of the mechanisms of pregnancy. Similarly, an understanding of the DNA variants associated with miscarriages offers the dairy industry tools to select cattle that are less likely to have late term miscarriages through genomic selection.

Poster # 57

Reinforcing Fibers Manufactured from Recycled Cotton with Nanocellulose

Presented by: Dustan Cwick

Mentor: Hang Liu **Campus:** Pullman

Major: Materials Science and Engineering

Category: Engineering and Physical Sciences

Co-author: Hang Liu

This research will be about recycling cotton waste for brand new fibers via wet spinning and using nanocellulose to reinforce the new fibers produced from cotton waste. Cotton, a natural cellulose resource, is a major fiber used for apparel and home textiles. With the increasing consumption, the generated post-consumer cotton waste increases accordingly. Currently, approximately 95% of cotton waste ends up in landfill/incinerators. This is a huge waste of this excellent cellulose natural resource. In addition, the anaerobic decomposition and burning of cellulose generate substantial amount of greenhouse gases and toxic chemicals/odors that harm the environment and human health. The goal of this research is to utilize nanocellulose as a biodegradable filler instead of the commonly used non-biodegradable fillers to reinforce textile fibers. The main objective of this project is to study how to incorporate nanocellulose into the cotton waste solution evenly without causing the nanocellulose to dissolve, and to see how nanocellulose influences the wet spinning process. These reinforced fibers will be analyzed physically, thermally, and mechanically using Scanning Electron Microscopy, Differential Scanning Calorimetry, Thermogravimetric Analysis, and tensile testing.

Poster # 58

Examining the Importance of Hypothalamic Ghrelin Signaling in Cannabis Induced Feeding

Presented by: Sumeen Gill

Mentor: Jon Davis **Campus:** Pullman

Major: Neuroscience

Category: Molecular, Cellular, and Chemical Biology

Co-author: Jon Davis

Cannabis is the most widely used illicit drug worldwide. In this context, vaporization is the most common route of cannabis administration. Data from our lab indicates that vapor cannabis exposure increases meal frequency while decreasing meal size. Increasing appetite can help patients with cancer or AIDS who often suffer from anorexia. In addition to meal size, data indicates an increase in plasma levels of the appetite-stimulating hormone, ghrelin, following cannabis exposure. Once ghrelin is released from the gastrointestinal (GI) tract, it acts on the ghrelin-1a receptors (GHSR-1a) in the CNS to stimulate appetite. Preliminary experiments from our lab indicate that blockade of ghrelin secretion, or blockade of GHSR-1a activity reduces cannabis induced feeding. Importantly ghrelin targets agouti related peptide (AgRP) neurons in the hypothalamus to stimulate appetite. The goal of this project is to determine if ghrelin signaling in AgRP neurons regulates cannabis induced feeding. To do this, we will utilize genetic loss of function (LOF) mice that lack GHSR-1a exclusively on AgRP neurons (AgRP-GHSR $^{fxl/fxl}$). We will expose AgRP-GHSR $^{fxl/fxl}$ and wild type (WT) mice to vapor cannabis, and measure subsequently measure food intake.

Poster # 59

Genome Wide Association Study of Spectral Reflectance Indicies in Winter Wheat

Presented by: Jason Wigen

Mentor: Arron Carter **Campus:** Pullman

Major: Agricultural Biotechnology

Category: Applied Sciences

Co-authors: Jayfred Godoy, Arron Carter, and Dennis Lozada

Technologies for plant breeding are constantly advancing to aid breeders in producing more durable, high yielding cultivars for production. With genotyping becoming more accessible and high-throughput phenotyping becoming more advanced, breeders are receiving information to aid in selection. With the use of a CROPSCAN, a multispectral radiometer, spectral reflectance data was collected from a diverse panel of winter wheat cultivars across six environments which consisted of the 2017 and 2018 growing seasons in Lind and Pullman, WA and Pendleton, OR. Spectral data was collected at heading date and at mid-grain fill, along with flowering date, plant height, and grain yield. Several spectral reflectance indices (SRIs) were calculated from the data collected. Using several statistical analyses programs such as R studio and JMP Genomics, a genome wide association study was conducted. Of the over 600 SNPs that showed significance in the six environments, 14 were for the same trait across multiple environments. Of the 14 stable SNPs found, six were related to SRIs and eight were related to agronomic data. Several of the SRIs were also correlated with grain yield potential. These findings can assist wheat breeders in selecting better cultivars before they are even planted based on if they have the favorable SNP correlated with the SRIs. Grain yield needs to improve to feed the ever-growing population and breeders are constantly facing challenges to produce better cultivars. High-throughput phenotyping along with genotyping data will provide a step towards increasing yields and more durable crops.

Poster # 60

Effects of Mavacamten on Length-dependent Contraction in Human Cardiac Muscle

Presented by: Yemeserach Bishaw and Marissa Watanabe

Mentor: Bertrand Tanner **Campus:** Pullman

Major: Microbiology

Category: Molecular, Cellular, and Chemical Biology

Co-authors: Yemeserach Bishaw, Peter Awinda, Maya Guglin, Kenneth Campbell, and Bertrand Tanner

Cardiac muscle contraction plays a vital role in healthy physiological function, allowing the heart to pump blood around the body. Much has been learned about cardiac muscle physiology from animals, but there are some important differences between rodent cardiac muscle contraction (such as with mice and rats) vs. larger mammals (such as humans). Examples of these differences include heart rate, volume of blood ejected from the heart during each heartbeat, etc., and the differences may limit a scientist's ability to test translational biomedical research solutions for heart disease in humans. To begin bridging these gaps from rodent models of disease to human heart failure, we have recently begun testing characteristics of cardiac muscle contraction using human cardiac tissue samples from organ donors.

Normally, as cardiac muscle is stretched (thereby increasing sarcomere length) the muscle becomes more sensitive to intracellular calcium and produces greater force (or tension). The increase in Ca^{2+}-sensitivity of contraction and maximum tension generation are two responses known as length-dependent activation. These stretch responses play an important role in the Frank-Sterling Law of the Heart at the organ level, which enables the stroke volume to increase in response to a higher blood volume in the left ventricle. This is important because it balances cardiac pumping to match blood flow demands of the body, although our understanding of the molecular contributions to this response remain limited.

Mavacamten is a small molecule known to inhibit activity of the thick-filament motor protein myosin. Myosin is responsible for generating the force and shortening of the muscle during contraction. In previous experiments, Mavacamten has been shown to stabilize the super-relaxed state of myosin; the myosin OFF state, where myosin cannot bind with actin (along thin filaments) to generate force. Recent studies suggest that the myosin OFF state may be destabilized by stretch and contribute to length-dependent activation. Therefore, we used Mavacamten to modulate the OFF-ON equilibrium as we stretched the human cardiac muscle. Our results suggest that Mavacamten decreases maximum tension, while maintaining or even amplifying Ca^{2+}-sensitivity of length-dependent activation.

Poster # 61

Feasibility of Local Power Storage for Renewable Energy

Presented by: Ryan Fick, Camryn Pietila, Alexander Rodriguez, and Savannah Rogers

Mentor: Lynne Cooper **Campus:** Pullman

Majors: Political Science, Strategic Communication

Category: Engineering and Physical Sciences

Co-authors: Alexander Rodriguez, Camryn Pietila, and Ryan Fick

The use of wind and solar energy in the United States is limited because power generation only occurs when the sun is shining or the wind is blowing. The power grid does not incorporate energy storage, so there are no mechanisms to save green energy for later use and costs are passed on to consumers. All consumers must pay market-value for electricity. As a result, consuming electricity during on-peak consumption hours can cost up to three times as much[1].The power grid is therefore highly dependent petroleum, coal, and nuclear power to meet energy demand. Until storage is incorporated into the power grid, green energy cannot be used at its highest potential.

Our goal is to determine the fiscal, technical, and market feasibility for the local storage of energy on both utility (e.g., the power company) and commercial (e.g., individual business) scales. We have developed a model of potential storage solutions based on current technology incorporating probabilistic modeling of wind and solar energy production for both diurnal and seasonal demand cycles.

With local storage, utility companies can increase their use of renewable energy generation and reduce grid dependency on fossil fuels. Furthermore, commercial entities (i.e., individual businesses) can implement peak shaving strategies which would allow for the purchase of inexpensive off-peak stored energy, thereby significantly decreasing energy costs.

Widespread local energy storage is important to updating our national power grid. Local storage will provide grid resilience against natural disasters and the physical technology necessary to transition our power grid into a “smart grid”, where energy can be sold to and from individuals at competitive prices. With the ability to store energy on a day-to-day basis, regions rich with renewable resources will be able to increase their percent consumption of renewables, moving away from fossil-fuels. In order to fully capitalize on renewable resources, cost-effective energy storage is critical.

[1] https://www.portlandgeneral.com/residential/power-choices/time-of-use/time-of-use-pricing

Poster # 62

Characterizing Ghrelin Secretion, Food Motivated Behavior and Body Weight Gain in Rats Exposed to a Scheduled Feeding Paradigm

Presented by: Emma Wheeler

Mentor: Jon Davis **Campus:** Pullman

Majors: Genetics and Cell Biology, Neuroscience

Category: Molecular, Cellular, and Chemical Biology

Co-authors: Julianna Brutman, Sumeen Gill, and Jon Davis

In the United States, obesity is a significant unmet health concern that costs roughly $147 billion to treat annually. The development of an obese phenotype is hypothesized to be linked to changes in both physiology and psychology. Physiological appetite hormones serve as mediators between an organism's environment and the brain. Previous data from our lab indicate that palatable food exposure increases the secretion of the appetite hormone ghrelin, prior to scheduled meals and that this process regulates binge intake of palatable food in rodents. Moreover, we find that ghrelin secretion augments food-motivated behavior and hedonic feeding in rodents. These results suggest that food environment can change physiology and psychology to promote obesity.

It is contended that the efficacy of ghrelin signaling decreases as body weight increases. The implication of this finding is that ghrelin no longer able to stimulate appetite in obese individuals. The current study was designed to determine how feeding schedule and body weight gain impact secretion of ghrelin and food motivated behavior. To do this, male Long Evans rats (n=6/group) were exposed to a nutritionally complete high fat diet (HFD) for 8 hours a day (7am-3pm) and served as the diet-induced obese group (DIO). An additional meal fed (MF) group received access to standard rodent chow for 4 hours only (7am-11am) and were restricted for the remaining 20 hours. Control rats were maintained on *ad libitum* rodent chow throughout the study. Following one month of scheduled feeding, we collected blood to measure plasma ghrelin. Next, all rats were trained to make operant responses for 45mg sucrose pellets using a Bussey Rodent Touch Screen System.

Results indicate that both DIO and MF rats consumed a significant amount of food in the first 4 hours of exposure relative to control rats. Notably this affect persisted throughout the study. Under these conditions both DIO and MF rats displayed increased premeal ghrelin. Interestingly, MF rats displayed significant increases in operant responding to sucrose relative to control and DIO rats. Collectively, these results suggest that gastric secretion of ghrelin and food motivated behavior can be uncoupled by body weight gain.

Poster # 63

Limiting Nano-Silicon Expansion in Batteries by Coating It with LTO and Graphite as an Anode Material

Presented by: Yousef Saleh

Mentor: Min Kyu Song **Campus:** Pullman

Major: Mechanical Engineering

Category: Engineering and Physical Sciences

Lithium ion batteries are one on the main sources of energy that we rely on. However, our energy demand is always increasing, and current Lithium ion batteries need to improve to meet demands. Right now, Graphite is the most commonly used anode material. Even so, Graphite will only ever have the low theoretical capacity of 375 mAh/g. The focus of this research is to attempt to improve the anode used in Lithium ion batteries. The unconventional anode that is tested is made of Nano-Silicon coated with Lithium Titanate. Nano-silicon was used because of its high theoretical Capacity of 3572 mAh/g. Nano-silicon also has low cyclability due to large volumetric change about 300% during charging and discharging processes. For this reason, in this study, lithium titanate is used as a protective coating to increase the cyclability of the Nano-Silicon. Lithium Titanate is one of the most stable compounds that can endure more than 2000 cycles without degrading. Unfortunately, Lithium Titanate has a huge disadvantage as it has low theoretical capacity of 175 mAh/g. By combining both Nano-silicon and Lithium Titanate, it is expected that higher capacity and longer cyclability can be achieved. Control samples produced consisted of different weight percentages of Nano-silicon and Graphite such as 0%, 5%, 20%,40%,100% of Nano-silicon in the composite anode electrode. In addition to the control sample, Nano-silicon and Lithium Titanate composites were also created for comparison to the control sample. The battery cycling test will be performed to obtain the actual capacities of the composite electrodes and evaluate their cycling performance. It is expected that the cyclability and the capacity of the Nano-silicon and LTO composite will increase compared to the control sample.

Poster # 64

Feeding Glucose to Hibernating Brown Bears (*Ursus arctos*) Triggers Changes in Gene Expression

Presented by: Courtney Jensen

Mentor: Joanna Kelley **Campus:** Pullman

Major: Zoology

Category: Organismal, Population, Ecological, and Evolutionary Biology

Co-authors: Michael Saxton, Brandon Evans Hutzenbiler, Heiko Jansen, Charles Robbins, and Joanna Kelley

Brown bears (*Ursus arctos)* experience fascinating physiological changes to survive seasonal fluctuations in food availability and temperature. During hibernation, brown bears become insulin resistant, considerably reduce their metabolic rate, and do not eat or defecate for 4-7 months. Brown bears regain activity and insulin sensitivity in May while they scavenge for plants and hunt fish or small mammals. As fall approaches, brown bears enter hyperphagia, which is characterized by a drastic increase in food consumption and storage of excess fat to survive wintertime. Due to the extreme physiology of brown bears, they are an excellent model for studying prevalent human metabolic diseases (e.g., type 2 diabetes mellitus). We predicted that feeding dextrose to brown bears for ten days during hibernation will trigger changes in gene expression that are involved in metabolism regulation. Adipose tissue was biopsied 24 hours after the final dextrose feeding, and RNA was extracted for sequencing. We identified that 528 genes were significantly differentially expressed when compared to hibernation adipose samples from another study. Of these, 312 genes were upregulated post-dextrose feeding (significantly increased in expression) and 216 genes were downregulated (decreased in expression). Upregulated genes were found to be associated with carbon metabolism (citric acid cycle, degradation of fatty acids) and biosynthesis of amino acids, suggesting that ingesting sugar during seasonal insulin resistance results in the activation of metabolic pathways. Genes that were downregulated post-dextrose include insulin-independent glucose transporter (GLUT1) and MYL2 (cardiac muscle contraction) which are both linked to . Further investigation of these differentially expressed genes may provide additional insight into how brown bears maintain insulin resistance and metabolic processes during hibernation. Understanding the physiological mechanisms of hibernating brown bears may contribute to research towards human metabolic diseases such as type 2 diabetes mellitus.

Poster # 66

The Bacteria That Tricks Your Intestinal Cells in Order to Make You Sick

Presented by: Courtney Klappenbach

Mentor: Michael Konkel **Campus:** Pullman

Majors: Genetics and Cell Biology, Microbiology

Category: Molecular, Cellular, and Chemical Biology

Co-authors: Nick Negretti and Michael Konkel

Many bacteria that attack your intestine and make you sick must bind to the cells that line your gastrointestinal tract, leading to the symptoms of diarrhea, nausea, fever, vomiting and cramping. Bacteria often manipulate host cells to alter their normal cell behavior and cause disease. *Campylobacter jejuni* is a bacterial pathogen that causes gastroenteritis (inflammation of the intestine) in humans. *Campylobacter* species are the leading bacterial cause of foodborne illness in the United States and the third most common bacterial cause of hospitalization for gastroenteritis. For *C. jejuni* to cause disease, it must invade the epithelial cells lining the intestine. Focal adhesions are dynamic cellular structures connecting intracellular actin bundles to the extracellular matrix, and due to their major role in sending and receiving signals they are prime targets for bacterial manipulation. We hypothesize that *C. jejuni* manipulates focal adhesions in order to alter host cell signaling to prime host cells for invasion. To test this hypothesis, focal adhesion composition and size were visualized and quantified during *C. jejuni* infection of cultured cells using immunofluorescence and confocal microscopy. The footprint size of paxillin (a scaffolding and signaling protein at focal adhesions) was measured in fixed cells. Changes in host cell adhesion strength (time to detach in the presence of trypsin) and motility were investigated by low magnification time-lapse microscopy. We observed that the focal adhesion footprint size increased significantly during *C. jejuni* infection and that the relative amount of phosphorylated paxillin at focal adhesions increased. Epithelial cell adhesion to the substrate was increased during infection, and host cell motility was decreased. These results support the hypothesis that *C. jejuni* interacts with and manipulates focal adhesions during host cell invasion. Our results show that *C. jejuni* attaches to the cells that line your intestinal tract and prevents the cells from being washed away during infection. Identifying the ways that pathogens cause disease is the first step in developing treatments to lessen the severity and duration of illness.

Poster # 67

Methow Valley Deer Project

Presented by: Shayleh Shamrock

Mentors: Caren Goldberg and Jeff Manning **Campus:** Pullman

Major: Wildlife Ecology and Conservation Sciences

Category: Organismal, Population, Ecological, and Evolutionary Biology

Central Washington's Methow Valley is known for its large population of mule deer (*Odocoileus hemionus*). Urban areas in the valley, such as Winthrop, appear to contain high deer densities compared to rural areas, and reasons for this are not clearly understood. Urban areas contain diverse ornamental plantings, wind breaks, and reduced predation risk by large carnivores. If urban deer are able to acquire all the resources they need from relatively small areas within an urban setting, they should have smaller home ranges than rural deer. To investigate this, I analyzed the relationship between deer home range size and distance from the center of Winthrop. From June through August 2018, I radio-tracked 14 collared mule deer to triangulate their locations. On average, I collected data on 2-3 deer a day, both in the mornings and evenings. Many of the collared individuals could be seen throughout various areas of town, especially during crepuscular hours. I estimated the 95% kernel home range size of each deer, and measured the closest distance between the edge of each home range and the center of Winthrop. Using linear regression, I found no evidence that home range size varied with distance from town, indicating that resources in urban areas may not reduce deer home range sizes. High densities of deer in urban areas may instead be due to increased numbers of overlapping home ranges. While I did not find support for my hypothesis that urban deer would have smaller home range sizes than rural deer, more than half of the estimated home ranges (57%) overlapped State Route 20, indicating that resource acquisition by these deer require frequent highway crossings that may expose them to increased risk of deer-vehicle collisions.

Poster # 68

Hydrogen-Based Regenerator Alternatives for Cryocooling

Presented by: Kacie Salmon

Mentor: Jacob Leachman **Campus:** Pullman

Major: Mechanical Engineering

Category: Engineering and Physical Sciences

Co-author: Jacob Leachman

As cryocooler technology has evolved and improved, reliance on heavy and rare metals as crucial regenerative materials has increased. Regenerators are a crucial component of cryocoolers and are the primary limit to the efficiency of cryocooler systems. Current cryocooler regenerator materials commonly incorporate lanthanide metals for high regenerative heat exchange and more efficient cooling. They offer unique advantageous regenerator qualities but are also very expensive. Lead and stainless steel are relatively inexpensive alternatives utilized before these materials, but they are less effective than the lanthanide metal materials as temperatures decrease and lead is unfavored due to its toxicity. We hypothesize that utilizing physisorbed hydrogen on metal open frameworks as a cryocooler regenerator material for a novel hydrogen gas cryocooler could be a viable alternative to current options. Catalyzed hydrogen conversion between para and ortho configurations can create a large effective heat capacity that could possibly provide competitive regenerator performance compared to lanthanide metal regenerators, offering a much more cost-effective solution.

Poster # 69

Serial Block-face Scanning Electron Microcsopy Preservation Techniques in Plant Tissue

Presented by: Petr Gaburak

Mentor: Daniel Mullendore **Campus:** Pullman

Major: Biology

Category: Molecular, Cellular, and Chemical Biology

Co-authors: Michael Knoblauch and Daniel Mullendore

Serial block-face scanning electron microscopy (SBFSEM) is a powerful technique capable of generating three-dimensional, high-resolution information of biological cellular ultrastructure. 3D cellular reconstruction is paramount to our understanding of how structure relates to function in complex organisms. SBFSEM was pioneered 15 years ago to visualize neural connections in rodent cortical tissue. The preparation method used for this study was designed for this specific tissue type to generate adequate preservation and contrast for SBFSEM. Little advancement in tissue preparation has been made since this pilot study. Furthermore, the original fixation protocol with only slight modifications is currently employed on a host of differing tissue types, including higher plant organs. We find when plant cells are fixed using animal fixation protocols that suites of artifacts are induced, including, but not limited to, plasmolysis and low-resolution images due to electron charging. In our lab, we routinely treat plant and animal tissues differently as plant cell ultrastructure can be more difficult to maintain when compared to animal tissue. We have completely reworked the SBFSEM fixation protocol to accommodate plant tissues making high-resolution image acquisition in high vacuum possible.

Poster # 70

Indicators for an Increase in Fallow Farm Ground for the Annual Cropping Agroecological Class in the Inland Pacific Northwest

Presented by: Nicholas Harris

Mentors: Alex Fremier and Ryan Boylan **Campus:** Pullman
Major: Environmental and Ecosystem Sciences
Category: Engineering and Physical Sciences
Co-author: Ryan Boylan

Record high precipitation events have become more frequent on the Palouse Basin (Huggins, 2018). With excess precipitation, soil moisture levels increase and farmers may be forced to fallow farm ground in areas traditionally known for annual cropping. Fallow crop ground in the annual cropping region can cause economic burden for farmers and adverse environmental effects leading to increases in soil erosional losses and flooding. In 2011, more than 35,000 acres of wheat farms in both Whitman and Latah counties were fallow due to crop insurance claims for excess moisture, cold wet weather, and flooding. With an increase in spring precipitation and a rise in farms fallowing fields, farms in both counties are examined for characteristics that identify fields prone to fallow under a changing precipitation regime.

To accomplish this, geographic information system (GIS) software was used to delineate fields for 2011 and 2017. Two study groups were established for the two years examined. The first group consisting of fields that were fallow for both years and a second group of fields that were not fallow for either years. Ninety fields were found to be fallow for both years while 612 fields were found to not fallow either years. Using the soil survey geographic database (SSURGO), physical characteristics for each field in each group were collected. These characteristics include dominant soil type, depth to bedrock layer, depth to water table, available water storage, hydraulic conductivity, and average slope. Along with physical characteristics, other parameters, such as crop type the preceding year and annual precipitation, were also measured. A classification and regression trees analysis were performed on both groups to determine prominent physical characteristics for fields going fallow compared to those not fallow in 2011 and 2017. The physical indicators determined in this analysis could provide insight into possible risks for fallow in the annual cropping region with the potential of increasing spring precipitation.

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Poster # 71

Diversity in Microbial Mutualists Benefit Plant Growth

Presented by: Katelyn Sedig

Mentor: Stephanie Porter **Campus:** Vancouver

Major: Biology

Category: Organismal, Population, Ecological, and Evolutionary Biology

Co-authors: Zoie Lopez, Christian Love, Miles Roberts, Kyle Nguyen, Jordan Schinke, Cameron Green, Kathleen Ibarreta, and Stephanie Porter

A diversity of soil microbes associate with plants. Those that are mutualists can provide critical limiting resources or services to host species in exchange for host resources. Experiments demonstrate that individual strains of mutualistic microbes vary dramatically in the fitness benefits they confer to their hosts. However, most hosts associate with many strains of microbes simultaneously and we lack a systematic assessment of how multiple symbiont strains impact host growth compared to each strain singly. We ask, are the effects of multiple symbiont strains on plant fitness equal to the mean of individual symbiont effects, or could there be positive or negative synergies among symbionts on plant fitness? Positive synergies could occur if hosts preferentially allocate resources to more beneficial strains or if strains provide complementary benefits to a host. Negative synergies could occur if competition among symbionts is detrimental to symbiotic outcomes or if less beneficial strains are more competitive for colonizing a host. To determine which scenario is broadly supported in the literature, we used a meta-analysis of 28 published studies on the legume-rhizobium symbiosis, spanning 18 plant species, and 26 published studies on the plant-mycorrhizal symbiosis, spanning 33 plant species. We show that inoculation with multiple microbe strains tends to provide a greater benefit to host fitness than the strains singly, though this pattern is stronger for rhizobia than for mycorrhizae. Consistent with their designation as mutualists, the fitness benefit of inoculation with these symbiotic bacteria and fungi is positive, with the benefit of rhizobia being greater for plants than the benefit of mycorrhizae. These results suggest that symbiont diversity has positive impacts on plant fitness, and that the benefit of diversity is different in the rhizobial and mycorrhizal mutualism.

Poster # 72

Development of a Mathematical Model for Animal Migration

Presented by: Maia Whitley

Mentor: Sergey Lapin **Campus:** Pullman

Major: Computer Science

Category: Computer Science, Mathematics, Statistics, and Information Sciences

Co-authors: Sergey Lapin, Zachary Hilliard, and Lynn Schreyer

-Due to changing environmental factors including climate change, urbanization, deforestation, and other forms of habitat loss, the migration paths of mammals are being altered. To protect these species, conservation decisions such as where to set aside protected habitats or construct wildlife crossings over highways, must be made. For these decisions to have effective outcomes, it's necessary to understand through which areas the mammals travel currently and where they are expected to travel given an anticipated alteration in environmental conditions (such as the construction of a highway). Mathematical modeling serves as an important tool in making these predictions. Various models exist, some of which are based on partial differential equations (PDEs). Our model is based on a new interpretation of the Cahn-Hilliard equation, which we use to incorporate variables for push or pull factors from a specific area, considerations of herd cohesion, and difficulty of traversal through a given terrain. To validate this model against data from wildlife tracking collars, we obtain terrain data for a given region. To begin, we utilize geospatial information systems (GIS) software to extract elevation data from digital elevation model (DEM) files. We then use meshing software to break this region down into elements. Currently, we are developing a program to interpolate elevations of the elements and determine matrices that represent the ease of traversal in each direction for each element. Once we have these matrices, they will be received as inputs for our in-house software used to model our adapted Cahn-Hilliard equation for migration paths.

Poster # 73

Development of an In Vitro Model to Predict In Vivo Digestion by the Pre-ruminant Dairy Calf

Presented by: Heather Lynn

Mentor: Mark Nelson **Campus:** Pullman

Major: Animal Sciences

Category: Applied Sciences

Co-authors: Kelly Anders and Mark Nelson

Milk and calf starter are an essential part of the young dairy calf's diet serving as the sources of nutrients before development of ruminal fermentation. Two of the most popular options for fluids the calves can be fed are unpasteurized, whole milk or milk replacer. Greater diet digestibility by the calf means greater nutrient intake, which, especially in its critical first few weeks, can set the stage for the animal's overall health and efficiency. Due to the cost and time in making in vivo digestibility measurements, this study's objective was to develop an in vitro model of in vivo digestibility in the pre-ruminant calf. Milk and calf starter in the same proportions as fed at the Washington State University Knott Dairy Center (about 0.19 and 0.35 g DM, respectively) were weighed into 50 ml polyethylene centrifuge tubes (3/ treatment). To model the abomasum, 10 ml of 0.1 N HCl containing 0.5 g pepsin and 0.275 g rennin/L was pipetted into the tube and incubated at 39 C for 1 hr. Next, to model the small intestine 0.05 mL of 1 N NaOH was pipetted into each tube to neutralize pH followed by the addition of 13.5 ml of 4.2 or 8.4 g/L pancreatin and 0.084 g/L ox bile in 0.5 M KH2PO4 incubated at 39 C for 6 or 12 hr. The second study was an in vivo digestion trial, using acid insoluble ash as an internal marker, with three dairy calves from the Dairy Center to test the accuracy of the in vitro model created. No differences in in vitro disappearance (average 68.85 ± 0.80 %) were detected for pancreatin concentration ($p = 0.48$) or incubation time ($p = 0.69$). In vivo DM digestibility of the milk/ calf starter mixture by young calves averaged 74.95 ± 6.88 %. The best-fit linear regression equation was in vivo DM digestibility = 1.09 in vitro disappearance ($R^2 = 0.99$; $p < 0.01$). This in vitro model will allow rapid, inexpensive evaluation of milk replacer or whole milk, with calf starter, that results in maximum digestion in the pre-ruminant calf.

Poster # 74

Synthesis and Evaluation of Hydrogen Sulfide Donors

Presented by: Stephen Lindahl

Mentor: Ming Xian **Campus:** Pullman

Major: Chemistry

Category: Engineering and Physical Sciences

Hydrogen sulfide (H_2S) has traditionally been known as a toxic gaseous molecule, however recent studies have suggested in low concentrations, H_2S could show physiological benefits such as the regulation of blood pressure. The synthesis of α-silyloxy thiols with variable H_2S release profiles could increase the ability to safely administer low concentrations of H_2S to patients. This project was split into two parts; both parts will be presented. The first of these was to develop novel H_2S donor compounds and characterize their release rates. The synthesis of the donor compounds was completed through a single step reaction by combining an alkyl or aryl aldehyde, a silyl chloride compound, and H_2S (g). The second was to develop fluorescent probes for cell work through a multiple step synthetic process, in which a fluorophore is combined to a unique selenium sulfur (-Se-S-) compound to recognize H_2S.

Poster # 75

Host Genetics Dictates Susceptibility to *Coxiella burnetii* Infection

Presented by: Tyler Bjornson and Michael Knight

Mentor: Alan Goodman **Campus:** Pullman

Major: Microbiology

Category: Molecular, Cellular, and Chemical Biology

Co-authors: Marena Guzman, Marina Martin, and Alan Goodman

Coxiella burnetii is a gram negative, obligate, intracellular bacterium and is the causative agent of Query (Q) fever in humans. Q fever presents flu-like symptoms in humans and is considered a Category B bioterrorism agent by the CDC because of its low infectious dose and aerosolized transmission. In this project, we utilized an attenuated BSL2 strain of *C. burnetii*, Nine Mile Phase II clone 4/RSA439. This attenuated strain causes pathogenesis in *Drosophila melanogaster* and activates an innate immune response. Here, male and female flies from the *Drosophila* Genetic Reference Panel (DGRP), a cohort of wild-caught fly lines with fully sequenced genomes, were injected with either *C. burnetii* or a phosphate buffer solution as control. Rates of mortality were observed over a 30-day period, and hazard ratios were calculated for both males and females as metric of susceptibility. Hazard ratios are used as input for a genome-wide association study (GWAS). This analysis will use the known genome sequence of each of the DGRP fly lines to identify candidate genes that are associated with susceptibility of *D. melanogaster* to *C. burnetii* infection. Identifying candidate genes that function in immunity in *D. melanogaster* will aid our understanding of innate immunity in humans, as nearly 75% of human genes implicated in disease have a functional ortholog in flies. After validating a set of candidate genes that affect survival to infection, the mechanistic function of the genes will be assessed. Ultimately, the goal is to determine how human orthologs of our identified genes affect the host response during *C. burnetii* infection. Using these results, we can identify targets for therapeutic intervention, bacterial infection and against Q fever.

Poster # 76

Microbial Population Dynamics Between Cooperative and Non-cooperative *Azotobacter vinelandii*

Presented by: Amanda Antoch and Cassidy Peru

Mentor: Chandra Jack **Campus:** Pullman

Major: Biochemistry

Category: Organismal, Population, Ecological, and Evolutionary Biology

Co-authors: Chandra Jack and Maren L. Friesen

An increasing global population poses a challenge of how to meet the demands for food production while also reducing reliance on environmentally harmful synthetic nitrogen. By leveraging our knowledge of biological nitrogen fixation (BNF) from legume-rhizobia mutualisms, we can enhance production of the cereal crops using free living diazotrophs like *Azotobacter vinelandii*, thus reducing the need for chemical fertilizers. Microbe populations exhibit cheating and cooperation, which is when a microbe benefits another, but the receiver doesn't offer any benefit in return thus altering the evolutionary fitness of both organisms. This can be applied to the interactions between strains of *A. vinelandii.* We will perform competition experiments using 50:50 ratios of WT *A. vinelandii* and a non-fixing strain where we will look at changes in the frequency of strains in the population over time with and without nitrogen. We predict that in the presence of nitrogen, the strains will be equally represented due to similar fitness levels as a result of the decreased need to fix nitrogen. Without nitrogen the non-fixing strain will have higher fitness and thus be overrepresented in the population due to its ability to utilize nitrogen fixed by WT *Azotobacter*. We will also compare other ratios, such as 10:90 and 30:70, to determine if the initial frequency changes the population outcomes. By identifying how competition affects population frequency over time, we can maximize the benefits of the pairing between non-legumes and free living diazotrophs such as *A. vinelandii* and apply it to enhance cereal crop production and reduce the use of chemical fertilizers.

Poster # 77

Comparison of Standard Western Medicine and Traditional Chinese Medicine Treatments for Migraines

Presented by: Courtney Lauer

Mentor: Sian Ritchie **Campus:** Pullman

Major: Biology

Category: Applied Sciences

Co-author: Sian Ritchie

Migraines present in the form of a recurrent, throbbing headache which can be debilitating and result in the impediment of work, driving, conversations, and day-to-day life. Annual reports of migraines have increased yearly, suggesting more and more individuals are plagued by these intense episodes of debilitation, yet there has been little attention to migraines as a major public health issue (Zhou, 2013). Two different treatment approaches include Western medicine (WM) and Traditional Chinese medicine (TCM). These different medicine types vary significantly in definition, diagnosis, and treatment of migraines. Western medicine focuses on utilizing medical doctors and healthcare professionals to define and diagnosis a migraine, and treatment is based on novel research which leads to approaches that include prescription medications. Whereas Traditional Chinese medicine is a non-orthodox approach which incorporates Eastern medicine specialists to define and diagnosis a migraine, and treatment is based on ancient practices including acupuncture and herbal medicine. The objective of this study was to compare standard Western medicine and Traditional Chinese medicine treatments for migraines in terms of methods, efficacy, side effects, and patients' response. Practitioners of WM and TCM were interviewed and their approaches to migraine treatment were investigated. It was found that while the definition of migraine was very different in these two approaches, there was some overlap in treatment options discussed. Both medicine types determined it was essential to make lifestyle changes and several providers suggested acupuncture as a treatment. It was found that neither type of medicine is superior. Migraines are complex and vary from person to person and frequently cannot be solved and cured with one stop to either specialist in any medical field.

Key words: Migraine, Western medicine (WM), Traditional Chinese medicine (TCM)

Poster # 78

Decoupling Food and Fossil Fuel using an Iron Membrane Reactor to Produce Ammonia

Presented by: Robert Gunson

Mentor: Peter Pfromm **Campus:** Pullman

Major: Chemical Engineering

Category: Engineering and Physical Sciences

Grid-scale storage of intermittent renewable electricity from wind turbines and solar cells, paired with ready back-conversion to a useful form of energy is an enabling technology to increase the competitiveness of renewable energy.

Permanent chemical bonds would be an attractive storage mode for electricity. Electricity can be used in electrolysis of water to produce hydrogen. Hydrogen, however, is notoriously difficult to store and transport. Storage and transport of ammonia (NH_3) on the other hand is simple, inexpensive, and well established nationwide due to the fertilizer industry. Besides its use as a fertilizer, ammonia can be used as a fuel in internal combustion engines, fired in turbines or industrial furnaces, split catalytically to recover hydrogen, and turned into electricity in fuel cells. The overall conversion from renewable electricity to ammonia would have an estimated energy efficiency of 63%, with three quarters of the energy losses due to electrolysis of water.

The current industrial ammonia synthesis process is only economical at very large scale with several days for startup or shut down. Here, a new rugged, nimble, and down-scaleable process to synthesize ammonia from renewable energy-derived hydrogen is explored to enable grid scale storage of electrical energy.

The first obstacle to ammonia synthesis is activation (splitting) of nitrogen molecules that are held together by one of the strongest chemical bonds known. Results show that gaseous nitrogen molecules are activated at about 1300^{o}F by manganese through splitting of nitrogen molecules into atoms, forming stable bulk manganese nitrides (Mn_xN_y). Published work demonstrates that a vanadium membrane can transport nitrogen atoms, and ammonia can be formed at the surface of the vanadium where hydrogen meets the emerging nitrogen atoms. Iron would transport nitrogen atoms much faster than vanadium, but it does not split nitrogen molecules for activation.

The hypothesis is that manganese deposited on a thin iron membrane will split nitrogen molecules into atoms at about 1300^{o}F and form manganese nitride. The nitrogen atoms will diffuse from a manganese layer through the underlying iron membrane and meet hydrogen on the opposite membrane surface to form ammonia.

Poster # 79

Antibiotic Resistance on the Rise: The Human Intestine Influences the Antibiotic Resistance of a Foodborne Pathogen

Presented by: Kyrah Turner

Mentor: Michael Konkel **Campus:** Pullman

Major: Biochemistry

Category: Molecular, Cellular, and Chemical Biology

Co-authors: Colby Corneau, Nick Negretti, Jacob Antony, and Michael E. Konkel

Introduction: Antibiotic resistance is a major threat to human health. The World Health Organization has placed *Campylobacter jejuni* on the high-priority pathogens list to develop new antibiotic therapies due to increasing emergence of antibiotic resistance. The increasing prevalence of antibiotic resistance requires understanding of the factors that lead to resistance acquisition. *C. jejuni* is a Gram-negative, highly-motile bacterium that is the leading cause of gastroenteritis in the United States, accounting for 1.2 million cases annually. *C. jejuni* commonly infects the human intestinal tract through consumption of undercooked poultry, unpasteurized milk, and contaminated water. The symptoms of *C. jejuni* infections include diarrhea, fever, nausea, vomiting, and in rare cases, Guillian-Barré Syndrome, a form of flaccid paralysis. In the human intestine, bile is secreted into the small intestine to aid with digestion. Bile also serves as a defense against the colonization of disease-causing bacteria, including *C. jejuni*. High levels of the bile salt sodium deoxycholate, found in the human intestine, are known to inhibit *C. jejuni* growth.

Hypothesis: We hypothesize that in response to deoxycholate exposure, *C. jejuni* acquires mutations in its genome that promote its survival in the hostile environment of the human intestine.

Methods: A *C. jejuni* clinical strain was serially passaged in growth medium supplemented with increasing levels of sodium deoxycholate. Following continued passage, the *C. jejuni* 'adapted' isolates were isolated and then analyzed for the presence of point mutations in DNA gyrase subunit A (*gyrA*) gene. Point mutations in *gyrA* confer resistance to the antibiotic ciprofloxacin.

Results: *C. jejuni* deoxycholate-adapted isolates acquired mutations in the quinolone resistance-determining region within *gyrA* that differed from the non-adapted counterparts. Mutations in Theronine-86 were prevalent in non-adapted isolates, while adapted isolates had a higher prevalence of mutation in Aspartate-90.

Conclusions: Future work will analyze the mechanism of mutational shift in *C. jejuni* deoxycholate-adapted and non-adapted isolates. Additionally, the ability of these adapted isolates to colonize chickens (the natural host for this bacterium) will be tested. Analyzing the ability of *C. jejuni* to adapt to and survive in bile will allow for a greater insight into the adaptive evolution of highly pathogenic bacteria.

Poster # 80

Proposed Research: Correlation Between Age Disparities and Continuation of Traditions

Presented by: Aracely Mendoza

Mentor: Anne Pisor **Campus:** Pullman

Major: Anthropology

Category: Social Sciences

Co-author: Anne Pisor

Although many depict the disappearance of cultures as objectively detrimental, research suggests that failure to preserve cultural traditions can be a choice, and some suggest that young individuals are less likely to maintain traditions. Is whether cultural traditions persist or disappear indeed affected by such secular change? Using ethnography and survey to study age dynamics within U.S. Latinx communities, this study aims to understand how age groups partake in the perpetuation of their traditions; for example, must the younger cohorts maintain their culture's traditions for a tradition to persist? I expect to observe that, as younger members of these communities come into more direct contact with majority group outsiders, they will be less likely to maintain the traditional practices of their natal cultural group. Results of this study will better inform our understanding of shifting cultural practices in the context of cultural contact.

Poster # 81

The Role of the Dorsal Hippocampus in Early Stage Memory Reconsolidation

Presented by: Shi Tan

Mentor: Rita Fuchs **Campus:** Pullman

Major: Neuroscience

Category: Molecular, Cellular, and Chemical Biology

Co-authors: Jennifer Wang, Jessica Higginbotham, Taylor Brown, Jaclyn Roland-McGowan, and Rita Fuchs

Drug relapse is a major public health problem given that mortality related to cocaine overdose has been steadily increasing in recent years (NIDA, 2017). Exposure to a cocaine-associated context results in the destabilization of context-cocaine associative memories. Such labile memories must undergo protein synthesis and gene transcription-dependent reconsolidation into long-term memory stores in order to be maintained over time. Interference with memory reconsolidation weakens drug-associated memories, and thus it may reduce the probability of drug relapse. Our laboratory has shown that the dorsal hippocampus (DH) plays an important role in cocaine-memory reconsolidation, likely by maintaining labile memories while these memories are reconsolidated in another brain region. Thus, neural activity in the DH is critical during early-stage memory reconsolidation. To test this hypothesis, we assessed the effects of transient optogenetic inhibition of the DH during the first hour of memory reconsolidation on cocaine memory integrity as measured based on the propensity for drug context-induced cocaine seeking. Male rats received intravenous catheters, bilateral adeno-associated viral (AAV) infusions into the DH, and optic fibers. The AAVs were used to express the inhibitory opsin, halorhodopsin (eNpHR3.0) and yellow fluorescent protein (eYFP) or eYFP alone in the DH. The rats were trained to lever press for cocaine reinforcement (0.15 mg/ml per infusion, IV) in a distinct chamber during approximately ten daily sessions. They then received seven daily extinction training sessions in a different chamber, where lever presses were not reinforced. Next, the rats were assigned to groups that were exposed to the cocaine-paired context (memory reactivation designed to trigger memory reconsolidation) or remained in their home cages (no memory reactivation) for 15 minutes. Immediately after this, rats received either intermittent laser stimulation (10mW, 5 sec on/1 sec off, one-hour session) or no stimulation. Approximately 72 hours later, cocaine-seeking behavior (non-reinforced lever presses) was assessed in the previously drug-paired context. Optogenetic inhibition of the DH during the first hour of reconsolidation attenuated subsequent drug context-induced cocaine-seeking relative to all control manipulations. This finding is consistent with the idea that the DH facilitates early-stage reconsolidation of context-cocaine memories that are required for stimulus control over drug seeking.

Poster # 82

Coupled Random Walk Models for Cell Motility in Absence of External Signal

Presented by: Hayden Arcy

Mentor: Nikolaos Voulgarakis **Campus:** Pullman

Majors: Chemistry, Mathematics

Category: Computer Science, Mathematics, Statistics, and Information Sciences

Co-authors: Kellan Tomen and Nikolaos Voulgarakis

There is a veritable mountain of research on the behavior of cells in response to stimuli such as food sources, light, or noxious signals, but models for the action of cells in absence of these cues is much less explored. This was the crux and goal of our research: how do cells behave and make decisions without an obvious signal to act on?

In this project, we developed a novel stochastic process based on coupled random walks that reproduces most of the cell motility properties that have been observed experimentally. By performing statistical analysis on the simulations, we have generated a series of distributions which illustrate the benefits and limitations of our approach. Here, we present the statistical analysis of our numerical simulations in one-dimension and two-dimensions and directly compare the predictions of our approach with available experimental evidence. This study is only the beginning of the research on a whole, with many parameters which still need to be explored, and more complicated models generated.

Poster # 83

Impact of College Students Help-seeking Attitudes and Perceived Social Support on College Psychological Service Utilization

Presented by: Kelly Ngigi

Mentor: Michael Cleveland **Campus:** Pullman

Majors: Human Development, Psychology

Category: Social Sciences

Co-author: Michael Cleveland

University mental health services have experienced a recent increase in demand. It is unclear whether this growth is due to a rise in prevalence of disorders or a rise in students seeking professional help. Some colleges have implemented peer support prevention and intervention programs to meet increased need. The goal of implementing these programs is to alleviate the demand on psychological support staff as well as to provide students with an additional support service.

This study examines the relationship between help-seeking attitudes and service utilization among college students. A sample of university students will complete a survey that includes established measures of help-seeking attitudes and perceived social support and campus psychological service utilization. Demographic characteristics will include sex, race/ethnicity, first-generation, and international student status. Data analyses will proceed in a stepwise manner. First the association between help-seeking attitudes and service utilization among the entire sample will be examined. Moderation analyses will test if the association between help-seeking attitudes and service utilization differs by demographic characteristics. The last step will examine if students' perceived social support also moderates the association between help-seeking and service utilization

This study has clear implications for future planning of university services. Increased demand for counseling and psychological services must be addressed in a manner that will best serve students as well as best fit within the limitations and capacity of mental health services on campuses. The utilization of peer support interventions has the potential to alleviate the demand along with educating the student population. Our results will inform efforts to effectively develop and implement such types of interventions.

Poster # 84

Reactive Oxygen Species Scavenging Mechanisms Combating Drought Stress in Wheat

Presented by: Jessica Fisher

Mentors: Andrei Smertenko and Kathleen Hickey **Campus:** Pullman
Major: Genetics and Cell Biology
Category: Molecular, Cellular, and Chemical Biology
Co-author: Andrei Smertenko

Wheat is a global staple food crop because it is the most significant source of protein in our diets. However, wheat production is being threatened by drought. The frequency and intensity of drought events are predicted to intensify as a consequence of the climate change. Therefore, drought poses a major risk to food security. One of the simplest solutions to the drought problem is irrigation. However, a growing decline in water availability, makes this option impractical in the majority of regions. A better solution to address drought-induced food security risks is through breeding of drought tolerant wheat varieties. For breeding programs, a significant challenge remains the high genetic complexity of drought-tolerance trait. Drought severely affects yield due to the inhibition of photosynthesis.Under drought stress, plants synthesize abscisic acid hormone from roots where it travels to the shoots and causes stomata closure, limiting carbon dioxide gas exchange. Excess light energy cannot be used for photosynthesis and results in production of toxic reactive oxygen species (ROS), which deteriorate plant health. Plants deploy ROS scavenging system to detoxify ROS. Some scavengers can be found in a small organelle called the peroxisome. We can use peroxisome abundance as a proxy for internal ROS concentration.Peroxisomes abundance in cells increases under stress in response to ROS. Phenotyping ROS scavenging on a population level remains impossible due to chemical complexity of both ROS and their scavengers. For this reason, genetic markers of ROS scavenging are currently not utilized in breeding programs.In this research project, we will correlate different ROS scavenger activity with peroxisome abundance in wheat. We hypothesize that peroxisome proliferation is an adaptive stress response that protects cells from oxidative damages caused by accumulation of ROS under drought. In this project we measured impact of drought on the activity of key ROS scavenging enzymes catalase, ascorbate peroxidase, guaiacol peroxidase and superoxide dismutase, and also peroxisome abundance in five spring wheat varieties: Drysdale, Hollis, Patwin515, Lolo, and IDO0686. Our work will determine contribution of wheat ROS scavenging mechanisms to drought tolerance and facilitate identification of the genetic markers of ROS scavenging.

Poster # 85

Increasing Corn Yield Through Cover Crop and Tillage Management

Presented by: Naomi DuBois

Mentors: Doug Collins and Nathan Stacey **Campus:** Pullman
Major: Wildlife Ecology and Conservation Sciences
Category: Applied Sciences
Co-authors: Liz Myhre and Taylor Enns

Conservation agriculture aims to balance agricultural production with environmental protection. Management strategies like cover cropping and reduced tillage are currently promoted as methods to meet these demands. By combining various cover crops with different reduced tillage practices, adequate soil nutrients may be available for a subsequent cash crop, like corn. In our study, two cover crops (rye and vetch) were planted during the fall of 2017 utilizing three different methods: (1) cover crops were planted individually, (2) cover crops were planted as a mix, or (3) cover crops were planted using a precision planter. Following overwintering during the spring of 2018, cover crops were evaluated for biomass production and then terminated using a flail mower. Prior to corn seeding and to evaluate the combined effects of cover crop and tillage, research plots were either spade- or strip-tilled, which resulted in five cover crop and tillage combinations. The five combinations included: vetch only strip till, rye only strip till, rye and vetch precision planting strip till, rye and vetch mixed planting strip till, and rye and vetch mixed planting spaded. In addition, we split the plots further so that some received supplemental nitrogen and others did not. Corn plants were harvested from each plot in two, 6 meter sections and evaluated for biomass and ear production (weight and number) and soil samples were collected to a depth of 30 centimeters. Data has yet to be fully compiled, but preliminary analysis suggests increased yields in fertilized plots, with variation dependent upon the cover crop/tillage combination. Soil nutrient analysis is on-going.

Poster # 86

Beware of Eating Chicken: It Harbors a Bacterium That Is a Major Cause of Foodborne Illness

Presented by: Nathan Michellys

Mentor: Michael Konkel **Campus:** Pullman

Major: Biochemistry

Category: Molecular, Cellular, and Chemical Biology

Co-authors: Prabhat Talukdar, Nicholas Negretti, and Michael Konkel

Introduction: *Campylobacter jejuni*, a bacterium that normally colonizes chickens, is one of the leading causes of gastrointestinal disease in humans in the United States. Infection can lead to Guillain-Barré syndrome (GBS); an autoimmune disorder that damages the peripheral nervous system leading to paralysis. During infection, *C. jejuni* targets intestinal epithelial cells, attaching to and invading the cells in order to evade the host immune response. Both *C. jejuni* virulence factors and host cell proteins are crucial in bacterial internalization. The host cell protein cortactin is a common target of bacterial pathogens as it is an actin-binding protein and regulates the dynamics of the host cell actin cytoskeleton.

Hypothesis: We hypothesize that *C. jejuni* manipulates the cell signaling process and cytoskeleton structure of the host cells for maximal invasion. More specifically, the activation or phosphorylation of cortactin is necessary for the maximal cellular invasion of *C. jejuni*.

Methods: In this study, we focus on the role of cortactin phosphorylation in *C. jejuni* invasion by generating cortactin knock-down cells (low expression of protein) and constructing phospho-mimetic plasmid vectors (aminoacids that act as the phosphorylated form). The cortactin knock-down cells were analyzed by performing immunoblots with anti-cortactin antibody, binding and internalization assays with *C. jejuni*, and fluorescence microscopy of actin stained cells.

Results: Cortactin knock-down cells demonstrated significant reductions in cortactin levels compared to the normal cells. There was no significant difference in binding of *C. jejuni* to knock-down cells versus normal cells, but the number of *C. jejuni* that invaded knock-down cells was less than normal cells. Through fluorescence microscopy, we found that cortactin knock-down cells showed less finger-like structures surrounding the bacteria (membrane ruffling) than in normal cells. Overall, our study demonstrated that cortactin plays an important role in *C. jejuni* invasion of intestinal epithelial cells.

Importance: Our ultimate goal is to decipher the *C. jejuni* internalization process into the host cells. Understanding the disease-causing mechanism of *C. jejuni* is necessary for successful intervention of *C. jejuni* infection and disease.

Poster # 87

Fermentation of Differing Particle Sizes of a Dairy Total Mixed Ration

Presented by: Kelly Anders

Mentor: Mark Nelson **Campus:** Pullman
Major: Animal Sciences
Category: Applied Sciences
Co-authors: Heather Lynn and Mark Nelson

Over the last thirty years in the United States, dairy cattle numbers decreased and milk production per cow doubled. Diets for dairy cows must be fermentable to provide nutrients and precursors needed for milk production especially due to the increased nutrient needs of today's high producing dairy cattle. The purpose of this study was to determine differences in *in vitro* fermentability of four different particle size fractions, using a Penn State Particle Separator, of the lactating dairy cow diet fed at Washington State University's Knott Dairy Center. This separator is used by dairies to estimate long fiber particles in a diet to aide in microbial synthesis of milk precursors and increase rumen motility to decrease ruminal acidosis. Particles were separated (as-is basis) into upper sieve (greater than 1.905 cm; 14.6 %), middle sieve (between 0.7874 and 1.905 cm; 29.2 %), lower sieve (between 0.4064 and 0.7874 cm; 45.6 %) and bottom pan (less than 0.4064 cm; 10.4 %). Particles were fermented at 39° C in an *in vitro* system using a ruminal fluid-artificial saliva mixture for 96h. *In vitro* gas emission data were fit to the model of Ørskov and McDonald (1978); gas emission, mL = a + b (1-e^(-c*t); where a was gas emitted from the soluble fraction, b was gas emitted from the insoluble fraction, c was the rate of gas emission and t was incubation time, hrs. Gas emitted from the soluble fraction (variable a) was much greater ($P < 0.05$) than the other sieves probably due to greater soluble starch. Gas emitted from the insoluble fraction (variable b), was lowest ($P < 0.05$) from the upper sieve samples followed by the bottom pan and the lower and middle sieves probably due to the upper sieve's high fiber content. However, the rate of gas emission did not differ ($P > 0.10$) among sieve samples. In conclusion, the lower sieve had the highest fermentability followed by the bottom pan, middle and upper sieves. These results will be useful in development of healthy, balanced, complete diets for lactating dairy cows.

Poster # 88

Insulin-mediated Immunity During West Nile Virus Infection in *Drosophila melanogaster*

Presented by: Sophie Mackinnon

Mentor: Alan Goodman **Campus:** Pullman

Majors: Genetics and Cell Biology, Microbiology

Category: Molecular, Cellular, and Chemical Biology

Co-authors: Laura Ahlers, Chasity Trammell, and Alan Goodman

West Nile virus is a disease that appeared in the United States in 1999 and has since spread through the country, appearing in Washington in 2006. Acute infection presents as flu-like symptoms, and two-thirds of cases lead to neurological damage ranging from encephalitis to paralysis. Currently, there is no vaccine to prevent infection nor any specific medical treatments for those infected. Stopping transmission from the mosquito vector to humans would be an effective mode of preventing this disease. In order to accomplish this, understanding the immune mechanisms used by the mosquito during infection is needed yet is not well characterized in the context of West Nile virus. To study the insect innate immune response, our lab uses the fruit fly *Drosophila melanogaster* as a model due to the evolutionarily conserved nature of these pathways as well as the established genetic power of *Drosophila.* Our lab uses Kunjin virus, which as an attenuated strain of West Nile that permits our studies to be conducted within a BSL-2 setting using viable insect models. Previously, our lab discovered that the insulin response pathway is important for the survival of fruit flies during West Nile virus infection. We are currently investigating the mechanisms by which the insulin response pathway contributes to immunity against West Nile virus. Our results support a model in which insulin-mediated antiviral protection was achieved by a mechanism other than the established FoxO-mediated RNAi pathway. Our research will delineate how insect vectors control and mediate their infection response. These results can be used in creating therapeutic solutions that would reduce the effects of infection as well as block it from infecting humans.

Poster # 89

Air Filtration Using Biodegradable Zein Protein

Presented by: Francis Dunne

Mentor: Katie Zhong **Campus:** Pullman
Major: Materials Science and Engineering
Category: Engineering and Physical Sciences
Co-author: Jinwen Zhang

With increasing pollution over the last century air quality in many parts of the world has become unhealthy for those who consume it. In order to counteract this issue air condition systems and air filtration masks made from synthetic fibers are used to produce healthy air with very little chemical or particulate matter pollution. After the filters are worn they are thrown out and result in a considerable amount of waste. In order to try to replace this technology with a more eco-friendly option, Zein protein microfibers were manufactured using an electrospinner. This process led to a filter that had a pressure drop and particulate filtration efficiency equal to or better than that of current commercial air filters today. The primary benefit of these protein-based air filters is that they are biodegradable and could drastically reduce the ecological impact of air filtration systems.

Poster # 90

Circuit-specific Noradrenergic Regulation of Cocaine Memory Reconsolidation in the Basolateral Amygdala

Presented by: Taylor Brown

Mentor: Rita Fuchs **Campus:** Pullman

Major: Neuroscience

Category: Molecular, Cellular, and Chemical Biology

Co-authors: Jessica Higginbotham, Jaclyn Roland, Jennifer Walters, Jobe Ritchie, Jennifer Wang, and Rita Fuchs

After retrieval, cocaine-associated memories become flexible and susceptible to modification before being re-stabilized through the process of memory reconsolidation. Thus, interference with cocaine memory reconsolidation is thought to be a way to prevent drug relapse. Our lab has shown the basolateral amygdala (BLA) is critical for the memory reconsolidation of cocaine-associated memories. Furthermore, other research has implicated a role for noradrenergic neurotransmission in the BLA in Pavlovian aversive and appetitive memory reconsolidation. A potential source of critical noradrenergic input to the BLA is the locus coeruleus (LC). However, the extent to which LC to BLA inputs become activated during memory reconsolidation is not known. To examine this question using an animal model of drug relapse, rats received unilateral microinfusions (0.7µL) of a retrograde tracer (cholera toxin subunit B) into the BLA in order to visualize afferent cell bodies in the LC. The rats were trained to self-administer cocaine in a distinct environment and extinguish in a distinctly different environment. After extinction, the rats were briefly re-exposed to the drug-paired context in order to reactivate cocaine memories and trigger memory reconsolidation or remained in their home cages (controls). Levels of c-fos immunoreactivity in the LC were quantified. Expression of c-fos in LC neurons projecting to the BLA increased following re-exposure to the drug-paired context relative to the home cage. This suggests connections between the LC and BLA are activated during memory reconsolidation and may potentially be manipulated to weaken drug memories and consequently drug relapse in cocaine users.

Poster # 91

ID Me!

Presented by: Christine Huynh and Shawyon Jaffarbhoy

Mentor: Howard Davis **Campus:** Pullman

Major: Bioengineering

Category: Engineering and Physical Sciences

Patients spend time answering repetitive questions every time they visit a health care provider. They must also wait for receptionists to check and process the paperwork as well as update the physician. According to the Center of Disease Control, around 990.8 million physician visits occur per year in the United States. This means that each person visits the physician's office around three times. Our product will target the bridge between patient interaction and hospital staff. Our solution is to develop a bioscanner that will register your fingerprint and connect it to a database that will pull your updated files and send it to the physician and let them know that you have been checked in and that you are ready for the appointment. You will be able to access your files and review them and update information as necessary. We will be using a Raspberry Pi 3 to recreate the RaspiReader for our purposes. This will require data acquisition as well as the development of a Python image processing tool.

Poster # 92

IntelliBra

Presented by: Sabrina Ali and Caitlin Grover

Mentors: Arda Gozen and Abhishek Gannarapu **Campus:** Pullman
Major: Materials Science and Engineering
Category: Engineering and Physical Sciences
Co-authors: Sabrina Ali and Abhishek Gannarapu

Exclusive breastfeeding for 4-6 months is considered as gold standard for infant nutrition. However, nursing mothers in the US stop breastfeeding at an early stage due to various reasons including perceived milk insufficiency. Currently there are no easy, day-to-day method to measure milk production and output during breastfeeding. Traditional techniques such as stable isotope or 24-hour infant weigh-back techniques are not suitable for measurements in-home.

To address this concern, we developed a wearable device, “IntelliBra”, capable of quantifying milk production and infant milk consumption in real-time with no interference with the breastfeeding experience. The IntelliBra measures volume change of the breast and correlates the volume change to the amount of milk produced or consumed. The IntelliBra sensor is designed to be spanned on to a nursing bra and confirm to the breast as its shape changes under production or consumption. It consists of sensors made of soft silicone precursors, whose elastomeric properties provide comfort for the user and makes it suitable for mold-casting. This mold-casting is the first step in the fabrication process. The sensor has a hollow channel in which electrical leads are inserted to interface with external electronics. In addition to the leads, conductive ionic liquid is injected into the channel. As the sensor stretches or relaxes depending on the breast volume change, the channel filled with conductive ionic liquid shape changes, thereby changing the resistance of the sensor. This resistance change is directly correlated to the volume change of the breast. The performance of the first IntelliBra prototype was evaluated in vitro on a mock-mother testing setup hosting silicone breast replica infused with controlled volumes of water.

Our initial results indicate that IntelliBra prototype can measure volumes of water as low as 5 ml, provided the temperature is monitored and incorporated in the signal processing algorithm.

The project is currently in the clinical trial phase. In these trials, the sensors are tested on nursing mothers who pump into a hospital grade breast pump. As the project continues, we hope to identify a simpler method to creating the sensors and improve on the design of the sensor.

Poster # 93

Role of Endocannabinoid Signaling in the Lateral Habenula During Flexible Decision Making

Presented by: Jacqulyn Kuyat

Mentor: Ryan McLaughlin **Campus:** Pullman

Majors: Biology, Neuroscience

Category: Molecular, Cellular, and Chemical Biology

Co-authors: Hayden Wright and Ryan McLaughlin

Cognitive flexibility refers to our ability to adapt behavioral strategies in the face of new and unexpected conditions in the environment. The lateral habenula (LHb) plays a key role in cognitive flexibility for two reasons. First, it has reciprocal projections with the ventral tegmental area and tightly constrains dopamine transmission, which plays a crucial role in this process. Second, inactivation of the LHb causes an impairment in cognitive flexibility in preclinical animal models. Our laboratory has recently uncovered an important role for the endocannabinoid system in controlling LHb activity. In the current study we are seeking to examine the role of cannabinoid type 1 receptors (CB1R) in the LHb of Sprague Dawley rats. To accomplish this aim, we will first surgically implant cannula bilaterally into the LHb of 38 male rats that, once fully recovered from surgery, will be trained to press a lever associated with the delivery of a cue light to obtain a sugar pellet reward. After this rule is learned, rats will be tested for their ability to shift strategies by having to disregard the cue light and instead use an egocentric spatial strategy (i.e., always press the left lever). Fifteen minutes prior to testing, rats will receive a site-specific microinjection of the CB1R antagonist Rimonabant (RIM; 0.15 µg/0.1 µL), the CB1R agonist WIN 55,212-2 (WIN; 0.5 µg/0.1 µL) or a vehicle control solution. We predict that rats receiving intra-LHb injections of WIN will require more trials to learn the set shifting task compared to vehicle-treated rats. Moreover, we predict that intra-LHb injections of RIM will improve performance in this task compared to vehicle. Completion of this work will increase our understanding of the neural substrates that give rise to cognitive flexibility and may provide insight into the neural mechanism underlying cognitive flexibility deficits in humans.

Poster # 94

Establishing Guidelines for Optimal Coarse Band Placement

Presented by: Alexander Arger

Mentors: Nick Engdahl and Tyler Fouty **Campus:** Pullman
Major: Civil Engineering
Category: Engineering and Physical Sciences
Co-author: Tyler Fouty

Of the 3,175 fish passage culvert owned by WSDOT, 60% of them are considered barriers for fish passage (WDFW 2009). Restoring fish passage is a key priority as stated in the Salmon Recovery Act (1998), and the Forests and Fish Act (1999). Approximately 800 of these structures will be replaced by the year 2030, yet robust guidelines are nonexistent for the placement and setup of coarse bands in stream simulation culverts. These coarse bands are narrow bands of coarser sediment placed within the streambed to enhance stream stability and passage. The Washington Department of Fish and Wildlife (WDFW) requires the use of coarse bands in stream simulation culverts under 4% gradient (Barnard et al. 2013). The experiments were conducted in a large flume located in Albrook Laboratory (Washington State University). The flume was filled with sediment and tested using three different flow levels: baseflow, medium flow, and a five-year flood equivalent. Cross-section measurements were made along the length of the control surface before and after each flow. These baseline measurements were compared to the same stream setup with the addition of two coarse bands placed one channel width apart perpendicular to flow. The same measuring approach was used and repeated experimenting with coarse bands at 2 and 3 channel widths apart. Using MATLAB and excel as analysis tools, we hope to see a reduction in sediment transport that meets the needs of WSDOT. The results will suggest that the addition of coarse bands of equal size placed one to three channel widths apart meet the required thresholds and present the necessary guidelines to construct this simulation design.

Poster # 95

Life Happens: An Examination of the Reasons Why Students Withdraw from Courses

Presented by: Amanda Tomchick

Mentor: Erica Austin **Campus:** Pullman

Major: Strategic Communication

Category: Social Sciences

Successful completion of a degree is contingent on passing the courses required for graduation. Unproductive credits, ones that do not count towards graduation, impedes a student's ability to graduate on time. This research aims to understand why withdraw from courses at Washington State University. The Office of the Provost arranged to collect data from all WSU students that removed themselves from courses in Spring 2018 and Fall 2018. At WSU, dropping a class is when students remove themselves from a course between the first day of classes and the drop without a penalty deadline, typically week 5. Withdrawing from a course is when students remove themselves from a course between the drop without a penalty deadline and the withdraw deadline, typically week 13. The current literature on the topic has not assessed a census of course drops and withdraws at an institution where providing a reason for their removal is necessary.

After statistical analysis of the census data, researchers found the top three reasons students dropped courses was class/job schedule conflict, course not needed for program, and overwhelmed by course load. The top reasons students withdrew from course was concern about low overall GPA, failing course or assignments, mental/emotional health, overwhelmed by course load, and GPA concerns for financial aid.

Using the preliminary findings from the census researchers created a survey that further investigates why students choose to leave their courses. In addition, the survey asks students about their understanding of WSU academic policy. Results from the survey will be completed by end of February.

Poster # 96

The Effect of TMZ on Leaf and Developing Seed of *Camelina Sativa*

Presented by: Shelby Jarvis

Mentors: Jesse Bengtsson and John Browse **Campus:** Pullman
Major: Genetics and Cell Biology
Category: Molecular, Cellular, and Chemical Biology
Co-authors: Jesse Bengtsson and John Browse

Brassica oil seed crops such as camelina sativa and Brassica napus represent an important source of vegetable oil. These crop species also offer the opportunity to produce novel oils which have an industrial value such as the hydroxy fatty acid ricinoleic acid. Past work using Arabidopsis thaliana as a model as shown that accumulation of these novel fatty acids results in reduction in fatty acid synthesis along with potential for congruent degradation of fatty acids via a process called beta oxidation. Beta oxidation is the process by which a plant uses oil stored in the seed to generate energy needed for establishment and development. It is also the means by which mammals break down fatty acids, and the target of several heart drugs. One drug Trimetazidine prevents the action of the last step of beta oxidation the action of a keto 3 thiolase. We have applied Trimetazidine to Arabidopsis thaliana to establish a tool for integrating beta oxidation in plants which accumulate novel fatty acids.

Poster # 97

Tamarind – A Regional Food Source in Rural Guatemala Facilitates Iron Fortification of Food Prepared With Lucky Iron Fish

Presented by: Paige Gear

Mentor: Kathy Beerman **Campus:** Pullman

Major: Zoology

Category: Applied Sciences

Co-authors: Kathy Beerman, Steven McGeehan, Carolyn Ross, Beata Vixie, and Ana Maria Rodriguez-Vivaldi

Iron deficiency anemia (IDA) remains one of the most common, yet treatable, nutrition-related health problems in developing countries. Lucky Iron Fish (LIF), a new approach to IDA remediation, is used to fortify food with iron. When boiled in acidified water for 10 minutes, the LIF releases iron into the water. Subsequently, the food absorbs the iron from the iron-enriched water, increasing the iron content of food. Consuming food prepared with LIF substantially contributes to overall daily iron requirements.

To effectively use LIF, water must be acidified to an optimal pH (4.0). Fruits such as lemons and limes are commonly used to acidify water, but these resources are not always available. Therefore, it is important to identify regional foods that can be used for the purpose of acidification. The goal of this study was to test tamarind as a potential acidifying agent to be used with LIF and its subsequent effect on taste acceptability of food. First, the amount of tamarind needed to reach pH 4.0 was determined. Next, total iron release was measured when LIF were boiled for 10 minutes in tamarind-acidified water. Total iron content of black beans and rice prepared with and without LIF was then measured. Once the acidifying properties of tamarind were delineated, a taste panel was conducted to determine the acceptability of treated black beans and rice.

The results of this study demonstrated that tamarind (7 g) effectively acidifies water to an optimal pH for use with LIF. Total iron released when treated water was boiled for 10 min with LIF was 18.86 mg/L, which was significantly higher than untreated water (0.28 mg/L). Total iron content of untreated and treated beans was 9.54 mg/g and 18.8 mg/g, respectively. Similarly, the total iron content of untreated and treated rice was 7.0 mg/g and 17.7 mg/g, respectively. Taste differences between untreated and treated foods were not detected, although treated foods were notably firmer in texture. In conclusion, tamarind effectively acidifies water and adequately facilitates iron release from LIF. Although differences in taste were not detected, the altered texture may be a consideration.

Poster # 98

Seed Specific Overexpression of CeFAT5 (*Caenorhabditis elegans*) and Atseipin1 in *Camelina sativa* Reduces Saturated Fatty Acid Content and Limits Oil Reduction

Presented by: Nicholas Fisher

Mentor: John Browse **Campus:** Pullman

Major: Biochemistry

Category: Molecular, Cellular, and Chemical Biology

Camelina sativa is an up and coming oil seed crop which contains saturated fatty acids. The nutritional value of the Camelina sativa seeds can be improved by decreasing the amount of saturated fatty acids and increasing the amount of unsaturated fatty acids. Past work in Arabidopsis has shown that the Caenorhabditis elegans desaturase CeFAT5 reduces the amount of 16:0 (Palmitic acid) while increasing the amount of 16:1 (Palmitoleic acid) but at the cost of reducing total seed oil content. The Seipin1 gene in Arabidopsis has been shown to effectively recover oil in oil deficient plants. When both CeFAT5 and Seipin1 were expressed in Camelina, out of the 30 seed lines analyzed, each transgenic line contained more unsaturated fatty acids than the wild type average, thus improving both the nutritional and industrial value. There appeared to be no significant correlation between total oil content and expression of the transgenes using CeFAT5 activity as a proxy for expression, indicating that the loss of total oil due to CeFAT5 may have been recovered due to Seipin.

Poster # 99

Converting Genotype-phenotype Maps into Trees to Visualize Fitness Peaks

Presented by: Douglas Schuett

Mentor: Mike Harms **Campus:** Pullman

Major: Biochemistry

Category: Organismal, Population, Ecological, and Evolutionary Biology

Studying protein evolution is essential for understanding how, for example, antibiotic resistance arises. The current method for visualizing this process is through a genotype phenotype map. However, as the number of possible mutations increase, the connections between genotypes in the sequence space become impossible to visualize. My project aims to develop software that will convert the space into a tree to allow better visualization of the connectivity of the space. This conversion begins with a fitness cutoff process where genotypes below the fitness cutoff are 'killed' off. As this process continues, my software will determine which genotypes are still connected and will do further separation there. At this point I have run two types of simulations: Mount Fuji (set up to visualize one peak landscapes) and House of cards simulations (set up to visualize multi-peak landscapes). My software has the ability to be run on experimental maps and determine which type of landscape is occurring. Most of the experimental maps have a single fitness peak, indicating that the spaces are strongly connected. The only time these breakups occur is when a large percentage of the map has the same phenotypes, or at the tail end of a sequence space indicating a false summit. In the future, I optimize the algorithm to make it run faster, and eventually test much larger maps. As of now, I have run simulations on up to 12 site maps. I would like to eventually test a 15 site map to see if the single fitness peak landscape holds, or if multi-peak landscapes become more prevalent. My tool will allow for quick analysis of genotype-phenotype maps to determine the type of fitness peaks.

Poster # 101

A Missing Purple Heart

Presented by: Maria Luisa Santos

Mentor: Lisa Waananen Jones **Campus:** Pullman

Major: Journalism and Media Production

Category: Arts and Design

I did a multimedia project on 95-year-old Joe Meiners, one of the last surviving member of D-Day and the Battle of the Bulge. His story is nothing short of amazing. During World War II, he was shot at, almost bled to death then became deaf and blind. During the presentation, I will be including pictures and a video of Mr. Meiners.

Joe's original job was an Army engineer, but that changed when they landed on the beach in Normandy. A two-star general order him and a partner to be medical personal and they were instructed to only pick up "soldiers that you know will survive."

Joe described his anxiety as the convoy of troops approached Normandy, "there was absolute silence. The only thing you can hear was the rumble on the landing craft, heaving sighs or some guys crying…we were going to the unknown," Meiners said. Once the doors of the landing craft opened, German soldiers fired at his platoon. "What was really bad about it was crossing [the beach]" Joe described the sand and water as "red from the blood of the wounded and dying."

At one point, Joe saw a wounded solider on the sand that he described as "…laying with his insides out on the sand." He said, "I looked, and I could see his heart, it was beating, and he was still talking to us." Joe and his partner knew that this individual would not survive, and as they passed him, the wounded solider pleaded with Joe saying "Please, please take me too." Joe and his partner had to make a choice to leave the dying solider in order to save other personnel. Joe said that image still haunts till this day. "I cried myself and I can't forgive myself for doing that, it was a very helpless feeling to walk away…so much of that is imbedded in my mind and I still have terrible nightmares."

Poster # 102

Using Amine-Based CO_2 Capture and Conversion to Produce Formic Acid

Presented by: Kristian Gubsch

Mentor: Hongfei Lin **Campus:** Pullman

Major: Chemical Engineering

Category: Engineering and Physical Sciences

Co-authors: Kristian Gubsch, Yao Yao, and Hongfei Lin

Global climate change is one of the most significant threats to the future existence of life as we know it on Earth. Increased CO_2 emissions contribute greatly to this change in our environment so it is very important to develop more sustainable technology that limit the overall anthropic carbon footprint. One of these emerging sustainable technologies is CO_2 capture and conversion which is an efficient way to both reduce emissions as well as stimulate the economy. The main focus of the research conducted this summer is improving the overall efficiency of the conversion of CO_2 to calcium formate. This project is significant in helping limit CO_2 emissions because the process, once efficient, can be used as an incentive for corporations with large amounts of CO_2 emissions to capture and convert these emissions to valuable chemicals, such as calcium formate, which will benefit both the environment and their business. Furthermore, every chemical used in this process is environmentally-safe. Calcium formate has many practical applications including the use as a cement additive, livestock feed preservative, a de-icing agent, and flue-gas desulfurizer. The goal of this research project is to separate formic acid from the reaction solution, produced from the reaction of CO_2 and H_2 with a palladium on activated carbon catalyst, then convert the formic acid to other useful chemicals such as calcium formate or methyl formate.. The yield of the formic acid can be determined using high-performance liquid chromatography (HPLC) and the percent yield is dependent on variables in the reaction including time, temperature, pressure, stir rate, and dosage of the catalyst. Through the experimental adjustment of these dependent variables, a combination may be found that will convert CO_2 to formic acid, and ultimately calcium formate, at an overall rate close to one hundred percent.

Poster # 103

Detection of R-Loops in Archaea

Presented by: Amy Dockweiler

Mentor: Cynthia Haseltine **Campus:** Pullman
Major: Microbiology
Category: Molecular, Cellular, and Chemical Biology
Co-author: Cynthia Haseltine

During the process of cellular transcription, double-stranded DNA is often subjected to extreme stress due to the repeated zipping and unzipping of genomic regions. This stress can subsequently lead to the undesirable accumulation of transcriptional errors including deletions, insertions, and mismatches. One particularly susceptible point for errors occurs when the homologous RNA transcript is paired with exposed single-stranded DNA, forming what is known as an R-loop. The base pairing of RNA to DNA forms a DNA:RNA hybrid, which protects the exposed DNA from degradation while it serves as the transcriptional template. R-loops have been previously observed in eukaryotic as well as prokaryotic cells but have not yet been shown in the third, understudied domain of life, the archaea. Archaea are prokaryotic microbes that are often found in extreme environmental niches including thermophilic habitats that would be expected to be challenging for maintaining genomic integrity. The work in this study aims to demonstrate the presence of R-loops in the hyperthermophilic acidophile *Sulfolobus solfataricus*. *S. solfataricus* thrives in terrestrial hot springs that are not only high temperature but also extremely acidic. Three distinct isolates of *S. solfataricus* were examined for R-loop formation through detection of DNA:RNA hybrids. Cells were propagated in standard growth medium with the addition of maltose or arabinose, which results in transcriptional induction of *malA* or *ara*, respectively. Whole-cell DNA:RNA hybrids were isolated through an immunoprecipitation method and the abundance of hybrids at these specific genomic loci was determined. Production of R-loops at these specific sites under inducing conditions effectively demonstrates transcriptional activity and begins to establish a framework for the role of DNA:RNA hybrid formation and persistence in archaeal genome stability under extreme growth conditions.

Poster # 104

FoMO: It's Not Just a Millennial Problem

Presented by: Megan Wong

Mentor: Chris Barry **Campus:** Pullman

Major: Basic Medical Sciences

Category: Social Sciences

Introduction: Fear of Missing Out (FoMO) is described as "the desire to stay continually connected with what others are doing" and feeling worried that others are having having a good time without them. (Przybylski et al.,2013, p.1841). Previous research demonstrated that adolescents who had more social media accounts demonstrated more anxiety and depressive symptoms but only if they reported relatively high FoMO (Barry, Sidoti, Briggs, Reiter, & Lindsey, 2017). Because FoMO is particularly tied to high engagement in social media (Oberst et al.,2017) and because different generations have had different degrees of experience with social media, there may be cohort differences in FoMO. Moreover, the correlates of FoMO, such as loneliness, self-compassion, and self-esteem may have implications for psychological well-being. The present study was the first to consider these relations across different age groups of participants.

Methods: The sample consisted of 419 responses from across the United States, from four age cohorts. Specifically, there were 118 participants ages 14-17, 100 aged 24-27, 100 ages 34-37, and 100 ages 44-46. All participants completed measures of FoMO, loneliness, self-esteem, self-compassion and social-media use.

Results: There were no cohort differences in overall FoMO, $F(3) = 1.91$, $p = .13$. However, across cohorts, FoMO was negatively correlated with self-esteem, $r = –0.27$, $p < .001$, as was self-compassion, $r = –0.22$, $p < .001$. Loneliness was positively correlated across all cohorts with FoMO, $r = .45$, $p < .001$.

Discussion: The results of the study indicate that FoMO is not tied to generation/age. Rather, it is correlated with personal self-perception. Specifically, having low self-esteem and low self-compassion, as well as high levels of loneliness were related to FoMO. Thus, it seems that FoMO is most often felt by those individuals who do not think positively of themselves and/or who feel socially isolated. Thus, fostering self-compassion (e.g., increasing social or personal setbacks as an opportunity for growth, increasing acceptances of one's experiences; Neff, 2003), preoccupation with the experiences of others (e.g., FoMO) which may be exacerbated through social media use could be reduced.

Poster # 105

Connecting Molecular Structure and Function of Calsequestrin-1 in Echolocating Mammals Through X-ray Crystallography

Presented by: Sarah Schroeder

Mentor: Chulhee Kang **Campus:** Pullman

Major: Bioengineering

Category: Molecular, Cellular, and Chemical Biology

Co-author: Kevin Lewis

Linking genomic changes to phenotypic differences can lead to a greater understanding of how certain phenotypes evolved. Echolocating mammals exhibit an unusually high number of parallel substitutions in fast-twitch muscle fiber proteins, proteins found in superfast muscle. Superfast muscle has been shown to allow echolocating and preying among echolocating mammals such as some bats, toothed whales, and dolphins. The Ca^{2+} storage/buffer protein, calsequestrin-1 of the little brown bat (*Myotis lucifugus*) and the common bottlenose dolphin (*Tursiops truncatus*) functionally converged in its ability to form Ca^{2+}-sequestering polymers at lower calcium concentrations, which may contribute to the more rapid calcium transients required for superfast muscle function. To connect the sub-microscopic structure and function of these conserved substitutions (Glu/Asp1 to Gln1, Ala81 to Thr81, and Leu129 to Phe129) to their macroscopic function in superfast muscle, we crystallized both bottlenose dolphin and little brown bat recombinant calsequestrin-1 in the presence of relatively low and high Ca^{2+} concentrations and were able to visualize how these substitutions affect calsequestrin-1's structure on an atomic scale. By establishing Ca^{2+}-binding curves through equilibrium dialysis and ICP-OES Ca^{2+}, we connected the structural data to its altered function. We then compared dolphin and bat calsequestrin-1 to calsequestrin-1 from the house mouse (*Mus musculus*), a small, non-echolocating animal.

Poster # 106

When Does Too Much Feedback Lead to Poor Decisions?: The Role of Confidence

Presented by: Courtney Cox

Mentors: Paul Whitney and John Hinson **Campus:** Pullman

Major: Psychology

Category: Social Sciences

Co-authors: Amy Nusbaum and Anthony Stenson

Previous studies have shown that more feedback on decisions can paradoxically lead to worse performance. One hypothesis is that overconfidence may account for this phenomenon. This study uses the Framed Gambling Task to evaluate whether feedback quantity affects confidence, and thus gambling task performance. Past work from our lab has demonstrated that getting extra feedback on decisions does not result in a linear increase in performance, and instead actually decreases performance relative to a control group. This performance deficit was found despite participants having accurate knowledge of the outcomes, as reported by knowledge probes.

Based on the finding that participants with good knowledge still performed poorly, knowledge of outcomes is not the only important factor in making good decisions on the FGT. This suggests that additional factors, such as the confidence one has in their knowledge, may influence decisions. It is possible that those in the partial feedback group may be less confident in their knowledge, due to not seeing feedback on each trial, while those in the foregone feedback group may be overconfident due to seeing so much feedback. Overconfidence may lead to quicker or less thought out decisions, leading to a poor performance on the task. The overall objective of this study is to evaluate whether confidence in outcomes can explain the gap between accurate knowledge of outcomes and performance on the FGT. I predict that there will be a main effect of feedback on FGT performance, such that the partial and foregone conditions will perform worse than the control condition, replicating the prior unpublished work; a main effect of feedback on confidence, such that the partial feedback group may have a “just right” amount of confidence and knowledge of the task and outperform that of the foregone feedback group, and a main effect of confidence on skin conductance response, a physiological marker of arousal, such that those with low confidence will have higher levels of physiological arousal than those with high confidence.

Poster # 107

Establishing a Potential Spatial Relationship Between tarP Promoter Activity and Proximity to the Golgi Apparatus in Chlamydia-infected Cells

Presented by: Pierce Claassen

Mentors: Rey Carabeo and Amanda Brinkworth **Campus:** Pullman
Major: Microbiology
Category: Molecular, Cellular, and Chemical Biology
Co-authors: Terran Gilbreath, Katrina Nielsen, Rey Carabeo, and Amanda Brinkworth

Chlamydia trachomatis is a bacterial pathogen which requires a host cell to live and reproduce. It can cause a sexually transmitted infection that may, in recurring and chronic cases, elicit sterility and pelvic inflammatory disease, despite host immunity and antibiotic treatment. *Chlamydia* development involves two bacterial forms, the reticulate body, which is infectious, and the elementary body, which is metabolically active and non-infectious. Chlamydia development requires a precise transcriptional program that is modulated by the nutritional state of the pathogen. Nutrient acquisition is related to the interaction of the Chlamydia-containing vacuoles. Here, we monitored the spatial relationship between the Golgi apparatus, the vacuole, and the transcriptionally active subpopulation of Chlamydiae residing in the same vacuole. Current methods of detecting time and magnitude of gene expression are laborious, costly and relatively non-specific. Our lab has successfully utilized Fast Fluorescent Timer, a gene which codes for a protein that fluoresces blue during folding and is red when fully mature. Given that the protein can be excited at two different wavelengths of light, we are able to compare the ratio of blue to red protein, allowing us to quantify the relative levels of gene expression induction and repression. We have monitored gene expression of *tarP*, which is an important virulence factor mediating pathogen invasion of host cells. While previous studies have shown that *tarP* is highly transcribed at 18-24 hours post-infection, we have found that there are multiple time-points outside of the 18-24-hour interval when promoter activity is increased. Through this analysis, we have observed that individual bacteria regulate transcription differently within sectors of the inclusion. We hypothesize that these differences in promoter activity correlate with the location of the Golgi relative to the chlamydial inclusion. By using this reporter system with multiple chlamydial promoters, we will continue to map and analyze differences of expression of key development genes, and how these transcriptional changes relate to the location of nutrient-laden organelles. Disrupting inclusion-organelle interaction would be a novel antibacterial strategy.

Poster # 108

Exploring How Adolescent Females Express Self-Esteem Through Clothing

Presented by: Maria Wanner

Mentor: Chanmi Hwang **Campus:** Pullman

Major: Apparel, Merchandising, Design and Textiles

Category: Social Sciences

Co-author: Chanmi Hwang

Adolescence is a unique period of time consisting of physical, psychological and social development (Hopkins, 1983). As female bodies change, the fit of clothing also changes. These adolescent girls need clothing that fits right and fits their style because clothing is an important factor in peer acceptance during the adolescent years (Cannon et al., 1952; Lennon et al., 2017). The tween market, catering to girls ages 9-13, is diminishing as tweens as a whole encompass a vast range of styles (Garcia, 2016). However, having access to a variety of styles provides adolescent females the opportunity to explore their personality. As adolescents transition from childhood to adulthood, they experience an increased awareness of self (Harter, 1999). Self-esteem issues are prominent amidst these transitions (Harter 1999), which makes the communication of struggles and concerns important (Rhee et al., 2003; Jackson et al.; Joinson, 2004). In addition to these issues, communication skills are declining due to the increased dependence on technology for communication (Blair, 2017). The purpose of this study is to explore how adolescent females express self-identity through clothing. The study includes a mixed-method design to explore adolescent females' clothing needs: an online survey was distributed to adolescent females and a content analysis of merchandise styles offered by leading tween brands was conducted. The results showed that the participants had difficulties in finding well-fitting clothing and aesthetics that meet their needs during the adolescent years. This study provides insight into the needs of the adolescent consumer that are currently lacking in the apparel industry.

Poster # 109

Examining Transcriptional Activity of the EUO Promoter in Chlamydia and Proximity to the Golgi Apparatus Relative to the Pathogenic Inclusion

Presented by: Jordan Bolen

Mentors: Rey Carabeo and Amanda Brinkworth **Campus:** Pullman
Major: Microbiology
Category: Molecular, Cellular, and Chemical Biology
Co-authors: Terran Gilbreath, Katrina Nielson, Rey Carabeo, and Amanda Brinkworth

Chlamydia trachomatis is one of the most prevalent sexually transmitted diseases in the world. These infections can become chronic despite antibiotic treatment and host immune responses. *Chlamydia* changes its development under stress to increase its chances of survival, thus new antimicrobial drugs that target these stress responses are necessary. *Chlamydia* has two phases to its life cycle. The elementary body is the metabolically inactive, infectious form, while the reticulate body is the metabolically active, non-infectious form. We hypothesize that the transcriptional program, and by extension the activity of developmentally regulated promoters in *Chlamydia* might be influenced by the positioning of nutrient-laden organelles relative to the inclusion. To address this, we monitored the transcriptional activity of the euo promoter at the level of individual chlamydial organisms residing within the same vacuole, using a novel fluorescence-based reporter called the Fast Fluorescent Timer (FFT). FFT fluoresces initially in the blue spectrum and matures over time to fluoresce in the red spectrum, allowing us to monitor the induction and subsequent repression of transcription from the euo promoter. FFT is extremely advantageous to use, because we can examine single chlamydial organisms in real-time throughout their life cycle. We can also use FFT to analyze differences in gene expression in various areas of the inclusion and with respect specific host cell organelles. We found that FFT expression driven by the *euo* promoter verified the accepted transcriptional induction early in chlamydial development. We also observed previously undescribed *euo* promoter activity later in development. With the utility of FFT validated, we will interrogate variations in transcriptional activity in the chlamydial population within the same inclusion, and correlate heterogeneity with the relative position of organelles that are known to deliver nutrients to the inclusion. We will extend this approach to other chlamydial promoters that are responsive to nutrient availability to gain a comprehensive picture of transcriptional activity during growth under normal and nutrient-limited conditions. This research enables understanding of transcriptional differences that underpins *Chlamydia* development, and may reveal potential targets for development of anti-chlamydial drugs.

Poster # 110

Pullman Depot Heritage Center

Presented by: Jaime Kemple and Keyaira Mumford

Mentors: Robert Krikac and Michael Sanchez **Campus:** Pullman
Major: Interior Design
Category: Arts and Design
Co-author: Jaime Kemple

Interdisciplinary design work is key to building healthier and more satisfying cities that address social justice and environmental welfare. Such complexity requires learning how to communicate with, and take advantage of, the various perspectives and expertise of multiple stakeholders and professional fields.

The Rural Community Design Initiative (RCDI) partnered with Whitman County Historic Society and community stakeholders to envision a plan for the restoration and renovation of the Pullman Depot Heritage Center. An interdisciplinary group of WSU students in Architecture, Landscape Architecture, and Interior Design worked collaboratively to translate an array of ideas and goals into a cohesive vision, expressed through diagrams that communicate the potential of the site to the stakeholders and potential financial donors.

This work began in the community "classroom". A designer's work is intended to be a dialog between people and place. An understanding of the relationship between the community and the site comes best from engaging directly with the stakeholders involved. This was achieved through a series of meetings and design charrettes where students interacted directly with community members in order to synthesize the various potentials into a plan that addresses not only current needs and wants, but future potential uses on the site.

Further development through additional design charrettes allowed students to learn from their peers and faculty in other design fields. The result is a plan that benefits the whole of the community, by creating connections to surrounding sites, by integrating experiences between indoor and outdoor spaces, and by planning for the health and welfare of the local waterways and ecosystems.

Community projects, such as the Pullman Heritage Depot, strengthen WSU's position in the Pullman community by ensuring that the university is continuing to add value to the city of Pullman and uphold its mission as a land grant institution. Students are afforded the opportunity to increase field experience, communicate more effectively with city leaders and project stakeholders, and practice valuable civic engagement. Civic engagement promotes a deeper understanding of the responsibility designers have to the community and to future generations, allowing them to create more meaningful design.

Poster # 111

Computational Simulations of Length-dependent Activation in Human Cardiac Muscle

Presented by: Krista Brutman

Mentor: Bertrand Tanner **Campus:** Pullman

Major: Mathematics

Category: Computer Science, Mathematics, Statistics, and Information Sciences

Co-authors: Bertrand Tanner, Peter Awinda, Kenneth Campbell, and Maya Guglin

Cardiac muscle contraction is important for life in all mammals, including humans. Two critical proteins that enable contraction are actin and myosin. Many actins bind together to form the basis of the thin-filament, and many myosins bind together to form the basis of the thick filament. These filaments then form the muscle sarcomere. Myosin heads extend from the thick filaments, and these myosin heads use energy from ATP hydrolysis to generate force. For contraction to occur, actin and myosin bind together to form cross-bridges, and this cross-bridge force production lead to the thin-filaments sliding past thick filaments, and thus, muscle shortening in the heart to pump blood around the body.

One important aspect of cardiac muscle function is the Frank-Starling Law of the Heart. This law states that an increase in blood flow and greater filling of the ventricle just before contraction leads to an increase contraction and greater stroke volume of the heart. Length-dependent activation of contraction is a molecular-level response that contributes to the Frank-Starling Law. Two aspects of length dependent activation that arise when cardiac muscle is stretched are: i) the tissue becomes increasingly sensitive to Ca2+ ions and ii) the tissue generates more maximal tension (= force/area of tissue).

Recent measurements from our laboratory were gathered to characterize length-dependent activation of contraction at two different sarcomere lengths using human cardiac tissue samples from organ donors. Computational simulations of muscle contraction, performed using Myosim (a cross-bridge modeling software application), were then used to investigate the underlying cross-bridge contributions to length-dependent activation. Specifically, we fit the computational predictions to the experimental data, which allowed us to simulate human cardiac muscle contraction as [Ca2+] and sarcomere length varied. Moving forth, we plan on expanding our simulations to investigate other biophysical perturbations of contractile function in human cardiac muscle. This computational research is significant because it will allow for future theoretical tests and numerical experiments to investigate an array of cardiac conditions without the necessity of human donor tissue (which can be difficult to regularly obtain).

Poster # 112

If You Don't Do Something... What Are You Doing as a Teacher?: Exploring Teachers' Perspectives on Equity-Based Teaching Practices

Presented by: Angel Bonilla

Mentor: Ashley Boyd **Campus:** Pullman

Majors: English, History

Category: Social Sciences

The study began with a series of semi-structured interviews that were aiming to explore themes and implications that emerged throughout. I had a conversation with two educators (one English, one history) that teach in the same high school in SW Washington. The purpose of each interview was to explore: how teachers defined equity-based pedagogies in their own words; how cultural relevant/responsive pedagogies are utilized in their classrooms; and what outcomes they identified or how they knew their pedagogies were effective. Interviews ranged from 45 to 50 minutes each, and they were recorded with an audio recorder and transcribed, upon consent obtained and permission granted by WSU's Institutional Review Board.

After interviews took place, preliminary coding was utilized to analyze and synthesize themes that arose during each interview. Transcription and qualitative coding of the data allowed common themes that emerged amongst both interviews to be analyzed. Once each interview was coded and analyzed, common themes were used to find the similarities and differences that emerged in the interviewees' application and perceived outcomes of their equity-based teaching practices. After evaluation, I prepared a presentation that addressed common themes and implications that surfaced.

In November, 2018, I had the opportunity to present my research findings at the annual convention of the National Council of Teachers of English (NCTE) in Houston, Texas. As part of a session titled *The Future is Now: Exploring 21st-Century Teaching Ideas with the Next Generation*, undergraduate and master's level teacher candidates, as well as novice educators led roundtable presentations that explored 21st-century teaching ideas (Cultural Relevant Pedagogy) and research driven teaching practices. After roundtable presentations, presenters distributed their copies of their presentations and outlines of their research.

Poster # 113

Conversion of 1,8-Cineole to Dimer Products

Presented by: Trong Huynh

Mentors: Hongfei Lin and Shaoqu Xie **Campus:** Pullman
Major: Chemical Engineering
Category: Engineering and Physical Sciences
Co-authors: Hongfei Lin and Shaoqu Xie

1,8 – cineole, which is an oxygenated terpenoid, is major constituent of Eucalyptus essential oil. Eucalyptus trees are grown abundantly in China and Australia, and the essential oil can be prepared via steam distillation or biosynthesis approach. In energy production industry, oxygenated terpenoids such as 1,8 – cineole are considered to be important fuel precursors. Deoxygenation of those terpenoids has potential to produce chemicals and high–density fuels that can be used for jet fuels or diesel propulsion. This study focused on homogenous acid catalytic conversion of 1,8 – cineole to dimer products. Acids considered were H_2SO_4, H_3PO_4, CH_3COOH, and CF_3COOH. The experiment suggested that higher pK_a acids at lower pH environment yields more dimer products. Biphasic reaction was also carried out since biphasic environment had shown better separation of inorganic/organic products. Factors such as temperature and reaction time were studied to determine their effects of the reaction. Reaction was tested at 80^{o}C, 90^{o}C, and 100^{o}C, while the reaction time varied between 30 minutes to 3 hours. Longer reaction time and higher reaction temperature led to higher conversion of 1,8 – cineole and better yield of dimer products. At the optimal reaction conditions, conversion of 1,8 – cineole was nearly 100% with the yield of dimer products to be over 35%. This research provides information regarding potential to convert 1,8 – cineole to dimer products, which has potential to be used as effectively renewable jet fuels.

Poster # 114

Estimation of Neutral Recombination Rates in *Streptococcus pneumoniae*

Presented by: Kathryn MacKay

Mentor: Omar Cornejo **Campus:** Pullman

Major: Zoology

Category: Organismal, Population, Ecological, and Evolutionary Biology

Co-author: Omar Cornejo

Horizontal gene transfer (HGT) is the process by which bacteria can import DNA from other organisms. One potential outcome is the incorporation of the acquired DNA into bacterial chromosomes through recombination. It is widely known that naturally transformable bacteria have the ability to transfer DNA between clones, which allows new phenotypes to arise without incorporation of a mutation. The process of HGT is important because antibiotic resistance can be shuffled around in bacteria populations, facilitating its spread, even in the absence of useful drugs. Yet, *post-mortem* identification during epidemiological studies have contributed to the conclusion that most antibiotic resistance arises via HGT in bacteria. Once a gene is acquired via HGT, selection can rapidly increase its frequency in the population making it difficult to differentiate between the contribution of HGT versus selection to rapidly-spreading phenotype. There is an increasing need to quantify the neutral rate of recombination in bacteria; We propose to estimate recombination in a Gram-positive, naturally transformable bacteria, *Streptococcus pneumoniae*. *S. pneumoniae* is a species responsible for upper respiratory tract infections in children and the elderly, and multiple antibiotic resistance is on the rise in this species. Thus, it is of paramount importance to quantify the rate and putative impact of recombination in *S. pneumoniae*. We will use two strains of *S. pneumoniae*: a rifampicin-resistant (Rif^+) and streptomycin-sensitive (Sm^-), and a rifampicin-sensitive (Rif^-) and streptomycin-resistant (Sm^+). We will inoculate chemostats, devices that allow continuous culture of bacteria, with both strains of *S. pneumoniae*. We will count the number of parental Rif^+Sm^-, $Rif^-Sm^+$and recombinant Rif^+Sm^+, using selective plating in Todd Hewitt yeast 5%, blood 5% agar with either Rifampicin, Streptomycin or both antibiotics. We will maintain appropriate controls, using chemostats inoculated with single strains and estimate the chance that double resistant bacteria arises via mutation alone. For the estimation of recombination rates, we will use derivatives on a system of ordinary differential equations describing the population dynamics of the aforementioned strains in the chemostat. This model could potentially aid in the detection and prediction of the spread of antibiotic resistance among medically-relevant bacterial populations in future research.

Poster # 115

Shelf Desk

Presented by: Collin Doneen

Mentors: Arda Gozen and Anita Vasavada **Campus:** Pullman

Major: Mechanical Engineering

Category: Engineering and Physical Sciences

I am designing a desk that has height variability that drops close to the ground and can be lifted up to a bit below shoulder height for many ergonomic options, to allow the user to be able to stay mobile through variable amounts of time spent sitting, standing, kneeling, laying, and yoga poses, with the goal of decreasing sedentary lifestyle while also being productive with computers, writing/drawing, reading a book, and whatever else one would do at this space. To sit in one position at working for hours, sometimes with endless amounts of fidgeting, struggling to maintain structural integrity in our back and neck, is far from optimal. To have a more holistic approach to ergonomics and a workstation can lead to far better physical wellbeing, leading to increased mental clarity and focus. This compounded with the aspect of organizing things for using in the shelving that allows for many areas to place things with great potential for customization and streamlined processes, will allow for an all in one workstation for getting things done. The benefits of this can be compounded with the use of an application for keeping track of our time, energy, focus, goals, etc., as well as possible templates for the organization of finances and household items. This frame is made out of Bosch tubing and the application is in the early stages of development, with an uncertain correlation between everything and what the end goal is with features.

Poster # 116

Metabolic Fuel Switching in Grizzly Bears

Presented by: Madeline McPhee

Mentor: Heiko Jansen **Campus:** Pullman

Major: Basic Medical Sciences

Category: Organismal, Population, Ecological, and Evolutionary Biology

Co-authors: Brandon Hutzenbiler, Kristina Manis, and Heiko Jansen

Bears utilize fat during hibernation as their sole source of energy. However, as many bears in zoos are fed during the winter months we tested the hypothesis that a single macronutrient, carbohydrate, could serve as a enough fuel for bears during hibernation and thus cause them to stop using stored fats as fuel. The fed bears (N=7) received dextrose for 10 days at 53% (Jan. 2018) and 100% (Jan. 2019) of their expected daily energy cost. Unfed bears (N=4) serve as controls. Blood samples were collected from both groups of bears several days before the feeding trial began and on the day after the feeding ended. Bear tissues can use free-fatty acids (FFA) and ketones as energy sources in addition to glucose. Hibernating grizzly bears do not normally eat for 4-5 months and thus exhibit a type of starvation relying on stored fat for energy. The energy from fat is derived via a process called lipolysis. Lipolysis which takes place mostly in fat tissue (adipose) is very efficient and yields ATP (energy), glycerol, and water, in addition to FFA. However, the liver can also produce fuel ketones, through a process known as ketogenesis. In this study, I compared FFA, glycerol, and ketone concentrations in blood between the fed and unfed bears over two hibernation periods and two energy levels. Glycerol concentrations decreased with increasing energy intake reflecting a decrease in lipolysis. Concentrations increased over the same time period in unfed bears. Ketone (beta hydroxybutyrate) concentrations also decreased in proportion to the amount of energy being replaced and increased in unfed bears. FFAs also decreased but not as dramatically, potentially indicating that FFAs may have been produced by adipose. This could reflect increased adipogenesis as a result of increased insulin sensitivity following feeding. The results of this study reveal that bears can utilize carbohydrates during hibernation as an alternative fuel source during hibernation. These results may have implications for zoos when considering the feeding of bears during hibernation.

Poster # 117

Prevalence of Iron Deficiency Anemia in Rural, Underserved Communities in Guatemala

Presented by: Brooklin Devine

Mentor: Kathy Beerman **Campus:** Pullman

Major: Nutrition and Exercise Physiology

Category: Social Sciences

Co-authors: Kathy Beerman, Ana Maria Rodriguez-Vivaldi, and Brett Devine

Iron deficiency anemia (IDA) remains a serious health challenge worldwide, predominantly affecting women and children, especially those living in poverty. According to the World Health Organization, IDA is particularly prevalent in countries where quality and diverse foods are either not affordable or accessible. The prevalence of IDA in underserved populations is largely unknown. This is because it can be difficult to gain access among those living in isolated communities. The goal of this study was to examine prevalence data related to iron status collected in Guatemala by a team of researchers over a 3-year period (2016-2018). A systematic review was conducted to assess the prevalence of IDA among those living in eleven remote communities and to profile those with the lowest and highest prevalence rates.

Researchers conducted mobile 1-day medical clinics in rural settlements with scant resources in terms of access to clean water or electricity. There were no eligibility requirements to participate in this study, other than being 5 years of age or older. Iron status (hemoglobin and hematocrit) and anthropometric (weight and height) measures were taken. Study results were compared to data published by global health resources. Whereas the Pan American Health Organization estimated the prevalence of IDA among women aged 15-49 years to be 20%, this study found the prevalence to be 41%. The group with the highest prevalence of IDA (n=44; 59%) was pregnant women.

It is important to note that this study reached a population that is difficult to access; that is adults and children living in rural regions of Guatemala. Thus, the high prevalence of IDA observed suggests that IDA is a health problem of greater magnitude than previously reported. Currently, IDA is considered a moderate public health problem in Guatemala, with reported prevalence rates ranging from 21.4% to 38.3%. By comparison, the occurrence of IDA among adults and children (≥5 years of age) tested in this study was significantly higher. In conclusion, this research shows that IDA remains a serious public health problem in Guatemala and is likely to be underreported, particularly in rural, impoverished regions.

Poster # 118

Mechanistic Study of Biphasic Tandem Catalytic Process for Conversion of Carbohydrates to Furan Products

Presented by: Scott Ong

Mentors: Teng Li and Shaoqu Xie **Campus:** Pullman

Major: Chemical Engineering

Category: Engineering and Physical Sciences

Co-authors: Jianghao Zhang, Chuhua Jia, Junming Sun, and Yong Wang

A biphasic tandem catalytic process (biTCP) is a generalized “one-pot” synthesis approach to produce hydrophobic biofuels or biobased chemicals from relatively hydrophilic biomass feedstocks. In this work, we report our findings on employing the biTCP to convert fructose into chemicals such as 2,5-dimethyltetrahydrofuran (DMTHF) and 2,5-dimethylfuran (DMF). DMTHF is a good substitution for gasoline due to its excellent combustibility and high energy density. Conversion of sugars into biofuels is typically designed to be a two-step process due to the interactions between dehydration and hydrogenolysis reactions. The biTCP was used so that the fructose can be converted to DMTHF in a “one-pot” synthesis where dehydration and hydrogenolysis happen concurrently. The reaction mechanism was explored, and the key intermediates were identified during the conversion of fructose to DMTHF. The catalytic effects of the different catalysts, H2SO4 and Pd/AC (partitioned in water and organic phases respectively) were explored. The effect of various organic solvents and process conditions were systematically studied to maximize the production yield of DMTHF. In this study, the highest yield of dimethyltetrahydrofuran (DMTHF), 69.7%, was achieved in the water-diethyl ether biphasic catalytic system at 130^{o}C in 12 hours. In addition, the effect of the co-solvent, dimethyl sulfoxide (DMSO), which modulated the distribution of furan products, was also investigated.

Poster # 119

Reversing Insulin Resistance in Hibernating Grizzly Bears

Presented by: Tina Wang

Mentor: Heiko Jansen **Campus:** Pullman

Major: Neuroscience

Category: Organismal, Population, Ecological, and Evolutionary Biology

Co-authors: Brandon Hutzenbiler, Kristina Manis, and Heiko Jansen

Insulin resistance is associated with Type II diabetes (T2D), metabolic syndrome, and can accompany periods of food deprivation. T2D affects about 10% of the US population. The insulin resistance has seen numerous treatments developed, but none are entirely effective. Thus, the mechanisms underlying insulin resistance are not entirely understood. Insulin sensitivity alternates in grizzly bears (*Ursus arctos horribilis*) between their active season (fed state) and hibernation (unfed state). In other words, insulin resistance in bears is naturally reversible. They become insulin resistant during hibernation to conserve energy in the winter and are sensitive during the spring and fall active periods. To determine if the insulin resistance is due to a lack of energy intake, we tested the hypothesis that feeding bears during hibernation would restore insulin sensitivity. Bears (N=7) were fed only a single macronutrient, carbohydrate, in the form of dextrose daily for 10 days at two levels of energy. A control group of bears (N=4) were unfed. Blood samples were collected at different times during hibernation to measure glucose, insulin, and glucagon levels before and after feeding. Using the oral glucose tolerance test (OGTT), we show that the fed bears' insulin sensitivity had been partially restored irrespective of how much energy was replaced. This was verified when comparing a 2-hour blood glucose levels following an oral glucose administration where blood glucose returned to levels intermediate to active and hibernation levels. This difference was seen despite basal glucagon and insulin levels did not significantly change compared to the control unfed group. We conclude that the pancreas and liver are functioning during hibernation because hibernating bears are not hypoglycemic. However, insulin sensitivity in hibernating bears is not entirely dependent on energy levels and may reflect cell autonomous changes as has been observed in cell culture. Understanding the mechanisms behind the bear's ability to modulate insulin resistance could potentially clarify treatments for metabolic disorders in humans such as obesity and type II diabetes.

Poster # 120

Notions of Uyghur Identity Within Xinjiang and Their Development During the Late 20th Century

Presented by: Ryan Moore

Mentor: Lydia Gerber **Campus:** Pullman

Major: Political Science

Category: Humanities

Creating a recent international outcry, “Re-education camps” in Xinjiang are being used by the Chinese government to quell dissent in this Uyghur-plurality region of the People’s Republic of China. While such extreme tactics are not unseen as a tool of control by Chinese government, the intricacies of the Uyghur identity have seriously concerned the government through their development in the past few decades, reaching a critical point that set up the controversies of today during the 1990s. During the last two decades of the 20th Century, the notions of self-identity among Uyghurs in Xinjiang have changed through the influence of various geopolitical events in Central Asia and the political response of the People’s Republic of China to these developments. In this paper, the nature of Uyghur identity as a part of China is explored, establishing a baseline status from 1950 to 1979 in which Xinjiang remained under strong Chinese control. Exploring different primary and secondary sources from the 1980s and 1990s, this project demonstrates how considerable geopolitical changes in Central Asia, starting with the Soviet Invasion of Afghanistan in 1979 contributed to the shifting of Uyghur identity. Eventually, these trends start to culminate in calls in Xinjiang for Uyghurs self-determination, which lead to the tensions and crackdowns by the Chinese government today. Initially isolated by the closed border policy by the Chinese government, Uyghurs initially viewed themselves as a fundamental part of the multicultural and multiethnic policy of a united China. An increase in engagement with Central Asian neighbors and Pakistan contributed to changing view of Uyghur identity as a primarily Islamic and Turkic people. This project argues that the impact of the geopolitical changes that impacted the Uyghurs in Xinjiang fundamentally changed the role of the minority in China, resulting in the current crisis of today. Given the continued intent of the Chinese government to maintain control in Xinjiang and the Uyghurs within, a policy that unintentionally influenced some of the changes in the Uyghur cultural orientation expressed in this project, the current crisis in Xinjiang can been seen clearly through the historical lens of a changing Uyghur identity.

Poster # 121

Growth of Carbon Nanotubes Using Novel Techniques

Presented by: Jessie Schweitzer

Mentor: Dave Field **Campus:** Pullman

Major: Materials Science and Engineering

Category: Engineering and Physical Sciences

Carbon nanotubes have been discovered as one of the strongest materials to date. Problems still lie with finding an effective and efficient process of growth. In a series of experiments, carbon nanotubes have been grown using novel techniques. The hot, carbon bearing gas was eliminated from these experiments because it is the cause of the growth of short and damaged carbon nanotubes in CVD experiments. The most efficient way to characterize the carbon nanotubes is by scanning electron microscopy. The SEM utilized a field emission gun to emit a beam. A tungsten filament is subjected to a high electric field in order to emit electrons. Due to the samples being nonconductive, the electrons were accelerated to 5 or 10 keV. The electron beam is then sent through to two condenser lenses which demagnifiy the beam before it hits the specimen. When the beam hits the surface, several types of electrons are scattered. The carbon nanotubes were imaged in ultra-high resolution mode, so the secondary electrons were collected by the in-lens detector to create signal. High resolution was an important factor in imaging. This was achieved through a small aperture size and short working distance. The carbon nanotubes were imaged with a magnification from 10-40 kx. Most carbon nanotubes were able to be first observed at a magnification of 10 kx. Carbon nanotubes were seen in all areas of the sample and at a variety of lengths. No preferences were found in growth patterns. The carbon nanotubes ranged in degrees of tortuosity. Some carbon nanotubes had very low tortuosity, others had very high tortuosity and were tangled around themselves. The carbon nanotubes grew at random between experiments and no trends in growth were identified.

Poster # 122

Presented by: Grace Lim

Mentor: Ryan McLaughlin **Campus:** Pullman
Major: Psychology
Category: Applied Sciences
Co-authors: Timothy Freels and Hayden Wright

The legalization of cannabis across the nation has led to an increase in the chronic use of cannabis among pregnant women. Prenatal exposure to chronic cannabis use may lead to behavioral effects on the offspring. However, the extent to which prenatal cannabis exposure affects emotional behavior in offspring is unknown. The objective of the study is to analyze the effects of prenatal cannabis exposure on a variety of stress- and emotion-related endpoints in offspring that may correlate with the developmental alterations of the brain. Behavioral tests will be conducted on rats to examine whether alterations in emotional behavior emerge in offspring exposed to cannabis vapor during gestation. The knowledge gained from these studies can then be used to educate pregnant mothers of the potential risks involved.

Poster # 124

Genetically Induced Speciation Through the Edit of Z3P

Presented by: Chase Warren

Mentor: Consetta Helmick **Campus:** Pullman

Major: Genetics and Cell Biology

Category: Applied Sciences

By editing the genes which decide the zona pellucida's sperm binding proteins, specifically ZP3, in a mammalian zygote which will develop into a female using CRISPR technology, one can decide which species' sperm will be able to fertilize the fully developed organism's egg. Editing this gene to accept that of species which is mechanically unable to reproduce with the edited organism will create a new species, only able to reproduce with edited males effectively differentiating the organism into a new artificial species. The implications of this edit are world changing and can be applied anywhere from dog breeders making thier dogs a species to preventing genetically engineered species from reproducing outside the lab to allowing the sustained survival of a ressurected extict species.

Poster # 125

Second-site Mutations Suppress Effects Caused by a Loss of K+/H+ Exchange Across the Plastid Envelope Membrane

Presented by: Chance Lewis and Chase Lewis

Mentor: Hans-Henning Kunz **Campus:** Pullman

Major: Biology

Category: Molecular, Cellular, and Chemical Biology

Co-authors: Chance Lewis and Hans-Henning Kunz

In the model plant *Arabidopsis thaliana*, K^+/H^+ exchange across the chloroplast inner envelope membrane is facilitated by two important transporters, designated KEA1 and KEA2. The *kea1kea2* double mutant, which lacks these two carriers, shows very poor growth, yellowish color towards the base of the leaves, and drastically reduced photosynthesis. The phenotype is only present if the plant loses both copies of the genes through T-DNA insertions or other loss-of-function mutations. In our lab we treated homozygous mutant seeds with ethyl methanesulfonate (EMS), a highly mutagenic compound. In the M2 generation we successfully identified EMS mutant plants with strongly recovered photosynthetic capacity (Fv/Fm). As these individuals still contained the T-DNA insertions that render KEA1 and KEA2 dysfunctional, loss or gain of function of an additional gene must have caused a reversion of the phenotype. We focused our interest on two lines, 6B and 18A. These lines were backcrossed into the *kea1kea2* mutant progenitor, and the heterozygous F1 progeny was allowed to set seed via self-pollination. In the F2 generation, individuals with recovered photosynthesis (about 25%) were chosen for bulk sequencing analysis to determine the causal mutation among the myriad of EMS C to T changes. The assumption was that the causal mutation would segregate recessively, as most causal mutations cause truncated, loss of function proteins and both alleles typically need to be knocked out to see a phenotypic change. Recently, we have identified a chromosomal area of interest for each line by using the SHOREmap bioinformatics tool. In the next months we hope to confirm the causative mutations by using T-DNA lines isolated in loci of interest and introgressed into *kea1kea2* mutants to test their capacity to rescue loss of K^+/H^+ exchange across the plastid envelope.

Poster # 126

Evolution of the Strawberry Volcanics and Phreatomagmatic Eruptions

Presented by: Evon Branton

Mentor: Arron Steiner **Campus:** Pullman

Major: Earth Sciences (Geology)

Category: Engineering and Physical Sciences

Co-author: Arron Steiner

The mid-Miocene Strawberry Volcanics in northeastern Oregon erupted through multiple volcanic vent locations between ~16.2 to 12.5 Ma. Here we investigate the geochemical variations, eruptive conditions and style of a single mafic pyroclastic unit near one of the proposed vent sources. Field mapping indicates the pyroclastic flow reached ~69.5 m in height before transitioning to lava flows. This deposit shows a series of magmatic pulses from which larger bombs up to 90 cm in size are deposited within a matrix of palagonite lapilli and ash. 12 episodic eruptions took place to form this pyroclastic deposit. Observed bombs sags and palagonite weathering suggest that water was present during the eruption. Geochemical analysis of the pyroclastic deposit indicate that these erupted as tholeiitic basaltic andesites with ~55 wt%. SiO_2. The lavas capping the pyroclastic flow transition to calc-alkaline andesites with ~60 wt% SiO_2. Incompatible trace elements become progressively enriched from the bottom to the top of the pyroclastic deposit (e.g. Zr 165 – 213 ppm; La 27 – 35 ppm; Yb 2.1 – 2.9 ppm) possibly due to fractional crystallization.

Poster # 127

Infant Temperament Affects Toddler Language Development

Presented by: Linnea Davison

Mentor: Maria Gartstein **Campus:** Pullman

Major: Psychology

Category: Social Sciences

Co-authors: Haven Warwick, Joshua Underwood, Maria Barrera, Hannah Kimbel, Haley Stinson, Bailey Caruso, Tamara Allard, and Maria Gartstein

An extensive literature links language problems with behavioral difficulties and academic underachievement. Peterson et al. (2013) found that language delays contribute to the development of behavior problems such as inattention-hyperactivity. Importantly, language performance at 10 months was significantly correlated to cognitive and educational dysfunction 10 years later - academic achievement in the 4th grade (Hohm, Jennen-Steinmetz, Schmidt, & Laucht, 2007).

Emerging literature links temperament to language development. Laake and Bridgett (2014) found that infants' Positive Affectivity (PA) at 10 months was predictive of future language. Similar results emerged when temperament and language development were measured concurrently at 12 months (Karrass & Braungart-Rieker, 2003). The sub-dimensions of PA were further predictive of expressive language (Laake & Bridgett, 2014). It has been suggested that this relationship is a function of infants higher in both PA and approach behaviors using emerging expressive language to elicit more interactions, thus supporting their language development (Laake & Bridgett, 2014). The present study is focused on PA related temperament dimensions, isolating fine-grained contributing factors, deemed important based on prior research and examining these earlier in infancy.

Participants were mothers and infants from Eastern Washington/Northwestern Idaho. Mothers completed the Infant Behavior Questionnaire-Revised (Gartstein & Rothbart, 2003), responding to questions regarding infant temperament, at 8 and 12 months of age. Scales associated with the Surgency factor: Activity, Smiling & Laughter, High Intensity Pleasure, Perceptual Sensitivity, Approach, and Vocal Reactivity were considered. Evaluation addressing language development was conducted at 24 months of age via the Child Behavior Checklist (Achenbach & Rescorla, 2000).

Results provide evidence of infant temperament contributing to language development. Length of phrases positively correlated with PS and APP at 8 and 12 months, and VR at 8 months (Table 1). Infants' vocabulary score was positively correlated with PS at 8 months and 12 months, and APP at 12 months. Further hierarchical multiple regression analyses indicated that ACT and APP at 8-months uniquely predicted phrase length, whereas PS and APP of 8-month infants contributed to later vocabulary scores. PS at 12-months predicted vocabulary scores, after accounting for covariates and other PA attributes.

Poster # 128

Reverse Osmosis and Electrodialysis

Presented by: Rachael Ozmun

Mentor: Peter Pfromm **Campus:** Pullman

Major: Chemical Engineering

Category: Engineering and Physical Sciences

For the process of reverse osmosis, an aqueous solution is pressurized and pumped through a semipermeable membrane. The water molecules diffuse across the membrane while larger molecules like salt and types of organic material cannot flow through the membrane. Reverse osmosis can only be operated at pressures higher then the osmotic pressure of the solution being used. With any pressure below the osmotic pressure the chemical potential is not high enough to produce permeate. The osmotic pressure is the amount of pressure required to overcome the tendency of a solute to diffuse from a higher to a lower concentration. In a reverse osmosis a high feed flow rate will have less salt loss and faster water removal.

Poster # 129

Use of University Resources and Self-Reliance among Foster Youth

Presented by: Jose Velazquez

Mentor: Jean Beaman **Campus:** Pullman

Major: History

Category: Social Sciences

Recent studies have documented various adversities foster youth experience within a university setting. According to a study by Angelique Days, foster youth have a higher chance of dropping out within their first year in college compared to low-income first-generation college students. Previous studies have suggested that low retention rates are attributable to mental health problems and developmental experiences within foster care. Existing literature also suggests that foster youth often have higher levels of self-reliance. This self-reliance may support foster youth while in foster care, but high levels of self-reliance while in college may become a barrier for this already vulnerable population. In this project with the assistance of my research mentor Dr. Jean Beaman, I developed a quantitative survey focusing on the relationship between self-reliance and utilization of university resources. Self-reliance is measured from the Self-Reliance Inventory (SRI), and uses of resources range from tutoring, counseling, advising services. I hypothesize that former foster youth who are within their first year in college would exhibit higher levels of self-reliance with a minimal use of university resources. This is in comparison to former foster youth in their fourth year in college who should exhibit lower levels of self-reliance and a higher use of university resources, due to the notion that as foster youth progress through college their levels of self-reliance would decrease. This study can potentially contribute to developing a holistic approach in working with former foster youth, specifically addressing obstacles with high levels of self-reliance in navigating in a college setting.

Poster # 130

Automating Analysis of Transcription in Individual Chlamydiae Using the Fast Fluorescent Timer Reporter

Presented by: Katrina Nielsen

Mentors: Rey Carabeo and Amanda Brinkworth **Campus:** Pullman

Major: Microbiology

Category: Molecular, Cellular, and Chemical Biology

Co-authors: Terran Gilbreath, Deshae McNeil, Rey Carabeo, and Amanda Brinkworth

As the most reported STI in the United States, *Chlamydia trachomatis* infections are a huge public health problem. While over half of all *C. trachomatis* genital infections are asymptomatic and cleared naturally, some infections can become chronic and cause major complications such as pelvic inflammatory disease and ectopic pregnancy. Persistence of disease in some individuals may be explained by *Chlamydia's* unique biphasic life cycle. *Chlamydia* invades epithelial cells in its infectious form, the elementary body (EB). Then it differentiates into its replicative form, the reticulate body (RB). Finally, *Chlamydia* differentiates back into EBs to spread the infection. Our understanding of the molecular basis of this distinct lifecycle is based on data from bacterial populations, which include mixtures of both EBs and RBs. Transcription in individual *Chlamydiae* has yet to be studied. Using the innovative fast fluorescent timer (FFT), a protein that folds into a transient blue fluorescent form and matures within a matter of hours to a stable red fluorescent form, we are able to detect new (blue) and old (red) transcription events in individual bacteria. By quantifying a blue-to-red output ratio of FFT driven by specific chlamydial promoters, we can also reveal fluctuations in promoter activity in real-time. This reporter system has previously been used only in eukaryotic cells. My project specifically defines parameters for detecting and comparing FFT fluorescence for chlamydial promoters throughout development. Using the program ImageJ for analyzing confocal images, we created a workflow for detecting FFT fluorescence in individual bacteria. In early infection, *Chlamydia*-containing-vesicles called inclusions, contain few bacteria. Thus fluorescence data must be obtained from many inclusions to enable statistical analysis, while only a few late inclusions need to be quantified. We also generated macros, a set of instructions that programs like ImageJ can follow, for each step of the workflow to automate image processing and analysis. We revealed previously unappreciated heterogeneity in promoter activity within single inclusions, including differences between the interior and periphery of the inclusion. These findings extend our understanding of chlamydial development and continuation of this work may reveal new antimicrobial strategies for targeting chlamydial survival.

Poster # 131

Biochemical Stress Levels in Living Copepods

Presented by: Asiamay Diaz

Mentor: Wes Dowd **Campus:** Pullman

Majors: Spanish, Zoology

Category: Organismal, Population, Ecological, and Evolutionary Biology

Tidepool copepods (*Tigriopus californicus*) have a reddish-brown pigment that provides the animal with physiological functions such as protection from ultraviolet radiation. The pigmentation arises from conversion of a chemical in the diet to astaxanthin; therefore, dietary levels of the precursor could be important in physiological performance of copepods. The pigmentation also is an antioxidant. Therefore, this molecule may function in other forms of realistic variation of environmental stressors such as varying dissolved oxygen levels and temperature. The goal of this project is to measure how much of this antioxidant is present as well as whether the molecule is oxidized (responding to stress) or reduced. This would provide a non-lethal indicator of the animal's stress level. Confocal microscopes can quantify these parameters by exciting the pigmentation at a specific wavelength and measuring accurately the time lag for the light to be returned as a different color. The research will be conducted by exposing one animal with a constant diet to various combinations of stress and observing which stressors (or combinations of stressors) induce a change in fluorescence indicating an increase in stress. If successful, this tool could be used to monitor biochemical stress levels in living copepods under a variety of conditions.

Poster # 132

Robot Activity Support (RAS): Comparing Younger and Older Adults' Feedback

Presented by: Justin Frow

Mentor: Nisha Raghunath **Campus:** Pullman

Majors: Neuroscience, Psychology

Category: Social Sciences

Co-authors: Nisha Raghunath, Maureen Schmitter-Edgecombe, Christopher Pereyda, Shivam Goel, and Diane Cook

It is important to understand the attitudes and expectations of older and younger adults when designing a useful, reliable, and appealing assistive robot. Although older adults are the targeted users of these technologies, younger adults often assist in technology design, selection, and purchase, thus highlighting the importance of knowing whether the viewpoints of the age groups differ. Participants were twenty-six younger adults (undergraduate students) and twenty-six older adults between the ages of 53 to 88 (M = 70.5, SD = 10.12). Participants interacted with the Robot Activity Support (RAS) system robot in a smart-home environment that used an ambient sensor system to recognize three scripted activities (preparing to walk a dog, taking medication with food, and watering plants). The robot automatically approached after an error was detected and offered to show participants a video of the missed step in the task, a video of the full task, or guide them to a forgotten object. Responses of younger and older adults to questionnaires that assessed predicted success of everyday use, satisfaction and usability ratings (i.e., the Subjective Assessment of Speech System Interfaces, Questionnaire for User Interface Satisfaction, Post-Study Usability Questionnaire) revealed no significant differences in reactions to the system. Age groups also did not significantly differ in reported technology self-efficacy and both groups identified the missed step video as the most helpful prompt type. Younger adults did however overestimate the likelihood of older adults wanting a robotic system like RAS in their homes ($p < 0.01$). These results indicate that younger adults, who often design and introduce technology to older adults, have similar ratings of assistive robotic technology, but may overestimate the desire of older adults to use the technology. This contradicts some of the stereotypes that older and younger adults have different views of technology, shows the importance of designing with users, and bodes well for designing robots for a population of older adults that is growing and expected to have fewer caretakers per older adult.

Poster # 133

Phosphoramidate Derivatives as Controlled Release Prodrugs of L-Dopa

Presented by: Brittany Kesic

Mentor: Cliff Berkman **Campus:** Pullman

Major: Biochemistry

Category: Engineering and Physical Sciences

Co-authors: Feyisola Olatunji and Cindy Choy

Parkinson's disease (PD) is an incurable neurodegenerative disease that currently affects about 10 million people worldwide. PD mainly affects dopamine-producing neurons in the substantia nigra leading to decreased levels of dopamine which causes symptoms like tremors, bradykinesia, limb rigidity, and balance problems. Dopamine itself cannot cross the blood-brain barrier so starting in 1968, Levodopa (L-Dopa) was used to treat PD symptoms since it has the ability to cross the blood-brain barrier. Once L-Dopa crosses the blood-brain barrier its carboxylic functional group is cleaved thus releasing dopamine in the brain. Unfortunately, L-Dopa has a short biological half-life (around 1-1.5 hours) and in more advanced cases of PD where dopaminergic neuronal cells are depleted, long-term motor complications develop which is termed "dyskinesia". In the Berkman lab, we are developing a once-a-day L-Dopa double prodrug that will have a long circulation half-life to achieve slow release of L-Dopa in systemic circulation.

Herein, we have reported a series of L-Dopa Phosphoramidates and their subsequent L-Dopa release half-lives at pH 7.4 and 3. The kinetics data supports our hypothesis that a proximal carboxylic acid can promote hydrolytic release of L-Dopa under mildly acidic conditions, and hence, demonstrates the tunability of this L-Dopa-Phosphoramidate scaffold for slow controlled-release application in treating Parkinson's disease.

Poster # 134

Structural and Biophysical Characterization of EppA

Presented by: Chelsie Boro

Mentors: ChulHee Kang and Kevin Lewis **Campus:** Pullman

Major: Chemistry

Category: Molecular, Cellular, and Chemical Biology

Co-authors: Kevin M. Lewis, Steven A. Sattler, Luying Xun, and ChulHee Kang

Ethylenediaminetetraacetate, better known as EDTA, is a chemically stable compound whose widespread use has led to its persistence in the environment as potentially toxic EDTA-metal complexes. Being a ubiquitous environmental pollutant, finding a means by which we can clean up EDTA pollution in the environment is imperative. One way to remove EDTA is through bioremediation in which a unique microbial process is harnessed, such as the *epp-emo* pathway from *Chelativorans sp.* BNC1. To these ends, we characterized the relationship between the structure and function of EppA, an EDTA-binding periplasmic protein.To obtain the molecular structure of EppA, we crystallized the protein and analyzed the structure using X-ray diffraction. We then used molecular docking to dock EDTA and chemically-related chelators to the structure, showing that they bind with EppA's putative ligand-binding cleft. To confirm their binding experimentally, isothermal titration calorimetry was used. EppA's high affinity for chemically similar chelators suggests that other proteins further down the catabolic pathway may be useful for degrading a wider range of chelators than previously thought or can otherwise be engineered to do so. This makes the *epp-emo* EDTA-degradation pathway of *Chelativorans sp.* BNC1 a powerful tool for combating pollution.

Poster # 135

Examining Mindfulness and Body Image in the Context of Yoga

Presented by: Veronica Garcia

Mentor: Anne Cox **Campus:** Pullman
Major: Sport Science
Category: Social Sciences
Co-author: Anne Cox

Negative body image has been associated with low self-esteem, eating disorders, and mental illness. Many young girls are dissatisfied with their bodies, even at an early age, and this has been shown to continue and worsen over time. Researchers have studied the effect of physical activity on body image, but results are mixed, and few have examined the reasons why it might be effective. The purpose of this study was to examine the relationships of mindfulness and self-compassion to body appreciation and body surveillance in women during a 16-week yoga course. It was hypothesized that higher state mindfulness and self-compassion would predict decreases in body surveillance and increases in body appreciation over the 16 weeks. It was also hypothesized that there would be an increase in trait mindfulness, self-compassion, and body appreciation, and a decrease in body surveillance throughout the course. The study included 147 female participants (M_{age} = 20.28). Self-report surveys were administered to participants during week one, and then again in week 16 to assess trait mindfulness, self-compassion, body appreciation, and body surveillance. Surveys assessing state mindfulness were administered every two weeks for a total of seven surveys. Average scores of state mindfulness were used in the main analyses. All correlations between variables were significant and in anticipated directions. State and trait mindfulness, self-compassion, and body appreciation all related positively to each other, and they all negatively related to body surveillance. In looking at whether mindfulness and self-compassion predicted body surveillance and body appreciation, we found that higher state mindfulness and self-compassion related to decreases in body surveillance and increases in body appreciation. Interestingly, trait mindfulness was not a significant predictor in either case. Understanding these relationships is essential so that women can begin to work on implementing strategies that will support more positive body image.

Poster # 136

Understanding the Kinetic Properties of Phosphoenolpyruvate Carboxylase: A Key Enzyme of C4 Photosynthesis.

Presented by: Ashley Kophs

Mentors: Asaph Cousins and Robert DiMario **Campus:** Pullman

Major: Genetics and Cell Biology

Category: Molecular, Cellular, and Chemical Biology

Co-authors: Robert DiMario and Asaph Cousins

Current crop yields are insufficient for the growing population and must increase to meet future food demand. Increasing crop production is a major challenge considering the amount of arable land is decreasing. Photosynthetic enhancement provides a solution for the deficits in current crop yields. Many crop plants perform C_3 photosynthesis, a process that relies on the passive diffusion of CO_2 into leaves. However, some crop plants perform C_4 photosynthesis where anatomical and biochemical adaptations actively concentrate CO_2 within leaves. These developments make C_4 photosynthesis more efficient than C_3 photosynthesis during high temperatures and drought. The first irreversible step of C_4 photosynthesis is catalyzed by phospho*enol*pyruvate (PEP) carboxylase (PEPC) which generates oxaloacetate from PEP and bicarbonate (HCO_3^-). PEPC's affinity for HCO_3^-has been shown to affect C_4 photosynthesis under CO_2 limiting conditions. Therefore, PEPC optimization could enhance C_4 photosynthesis under conditions that limit CO_2 concentrations inside leaves. While there has been positive selection for C_4 PEPC amino acids, it is still unclear which amino acid changes provide PEPC kinetic differences. Previous work showed that PEPC used in C_4 pathways have certain conserved amino acid substitutions that resulted in kinetic properties more suitable for powering C_4 photosynthesis. In this study, we highlight how the conserved C_4 amino acid residues, A755 and S774, affect HCO_3^-affinity of PEPC from the C_4grass, *Setaria viridis*. Whole-plasmid PCR was used to revert the two residues in the *S.viridis* PEPC back to the conserved C_3 amino acids, specifically A755S and S774A. Plant PEPC enzymes were over-expressed and purified from a PEPC-less *Escherichia coli* line. The membrane-inlet mass spectrometer was then used to measure the HCO_3^- affinity (K_{HCO3}; K_m for HCO_3^-) of the wild-type *S. viridis* PEPC and mutant PEPCs. Characterizing the kinetic properties of diverse C_4 PEPC will help determine the best way to optimize PEPC kinetics to improve the photosynthetic properties, and further output, of C_4 crop plants.

Poster # 137

The Efficacy and Toxicity of a Protease Inhibitor as a Novel Contraceptive

Presented by: Brooke Barton, Devinae McNeil, and Jenna Rock

Mentor: Wipawee Winuthayanon **Campus:** Pullman

Major: Biochemistry

Category: Molecular, Cellular, and Chemical Biology

Co-authors: Gerardo Herrera, Thanh Beedle, and Wipawee Winuthayanon

Current marketed spermicides, commonly based on the compound nonoxynol-9 (N9), have a high failure rate of 28%.[1] They also have been found to disrupt the integrity of the vaginal epithelium, leading to easier and increased transmission of sexually transmitted infections.[2] The need to improve current marketed spermicides, lowering failure rates while aiming to better protect the vaginal epithelium, leads to the purpose of this study. This project focuses on the compound 4-(2-aminoethyl) benzenesulfonyl fluoride hydrochloride (AEBSF) as a potential effective, yet less damaging, contraceptive gel to be used as a pre-intercourse suppository. AEBSF works by inhibiting the action of a serine protease known as kallikrein-related peptidase 3 (KLK3), which is an enzyme responsible for the process of semen liquefaction and therefore allowing for sperm motility and the possibility of fertilization.[3-4] AEBSF intends to halt the transition of sperm to a motile state, from its original gel state, by inhibiting the function of KLK3, effectively preventing fertilization. This study used a mouse model to test the efficacy of AEBSF as a reversible contraceptive and a sperm motility inhibitor as well as to test the toxic effects it has on the vaginal epithelium after both acute and long-term exposures. Preliminary data showed that the mice were significantly less likely to become pregnant upon use of AEBSF when compared to the negative control, supporting its efficacy as a contraceptive. The sperm motility studies have shown a concentration-dependent decrease in the average velocities of sperm when incubated in increasing concentrations of AEBSF. Both acute and long-term exposures to AEBSF have shown significantly less vaginal epithelial cell death when compared to a current marketed spermicide, with similar toxicity profiles to that of the negative control.

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Poster # 138

The Landau Theory of Phase Transitions Applied to Chemical and Biological Systems

Presented by: Connor Spencer

Mentor: Fred Gittes **Campus:** Pullman

Major: Physics and Astronomy

Category: Engineering and Physical Sciences

Co-author: Fred Gittes

In physics, Landau's mean field theory is used to describe first and second-order phase transitions in cooperative systems, such as magnetic spins. In chemical reactions, however, cooperativity is often used in a different sense. Here, we clarify the distinction between these two usages, and furthermore explore how the notion of cooperativity in physics may be introduced into chemical reactions by judicious use of activity coefficients. Such chemical reactions are shown to behave in a manner analogous to a first-order magnetic phase transition. The essential condition is that reactant and product species are able to interact with one another. The formation of micelles and the binding of diatomic oxygen molecules to the hemoglobin protein are examined. From the results of this theory, proposals for driving systems to exhibit phase transition-like behavior and speculations on the creation of artificial biological molecules are made.

Poster # 139

Testing the Stress-induced Susceptibility Hypothesis: Correlating Environmental Stressors to Ranavirus Prevlance over Time in the Athabasca Oil Sands Region

Presented by: Tino LoGerfo

Mentor: Erica Crespi **Campus:** Pullman
Major: Zoology
Category: Organismal, Population, Ecological, and Evolutionary Biology
Co-authors: Erica Crespi, Danna Schock, Travis Seaborn, and Bernardo Traversari

Chronic exposure to stressors is known to suppress immune function in vertebrates, making them more susceptible to pathogens. However, it is difficult to relate specific stressors experienced in natural populations to disease prevalence or intensities of infections. In this study had two aims. First, we examined wood frog populations in the Athabasca Oil Sands region of northern Alberta, CA, to assess the relationship between water quality and severity of ranavirus infections in wood frogs, one of 3 amphibian species in northern North America. We sampled tadpoles through metamorphosis in 8 wetlands that varied in water quality characteristics, 4 of which had been previously surveyed in 2015. We correlated water quality variables that are thought to be stressors, including salinity, heavy metals and polyaromatic hydrocarbons (PAHs), with mean body size, development stage, ranavirus prevalence and severity of infection. We found that ranavirus prevalence at each site varied across years, except that it was consistently high in one pond with the highest salinity and PAH levels. In 2018, we discovered that ranivirus prevalence varied from 0-87.5% across the sites studied, while all sites were consistently high in 2015. Ranavirus infections tended to be most severe in late-staged tadpoles than in early-staged tad poles or those collected after metamorphosis, which is consistent with stage dependent ranavirus patterns observed in other studies, as late stage tadpoles appear most susceptible to ranavirus infections. We also detected that ranavirus infection intensity did not vary with body size. The second aim of the study was to determine whether we can non-invasively measure ranavirus infection status and severity of infection using environmental DNA assays. At 3 sites, we sampled tadpoles, placed them in dechlorinated tap water, then measured ranavirus DNA in the water. We found that ranavirus can be detected in water in proportion to the concentration in tadpoles, suggesting that wildlife managers and scientists can use this method to detect ranavirus prevalence in the field without having to sacrifice animals. Continued monitoring of these populations with the use of the non-invasive assay validated in this study will yield a greater understanding of the relationships between environmental stressors and wood frog-ranavirus dynamics across the landscape and over time.

Poster # 140

Examining Genetic Diversity Between Commercial Inoculants of *Mesorhizobium ciceri*

Presented by: Jessica Puente Arroyo

Mentor: George Vandemark **Campus:** Pullman

Majors: Microbiology, Spanish

Category: Molecular, Cellular, and Chemical Biology

Chickpea (*Cicer arientum*) is one of the seven 'founder crops' first domesticated 12000-8000 years ago and is in the legume family. An important factor contributing to the success of chickpeas as a global food crop for several millennia is its ability to promote biological nitrogen fixation through symbiotic associations with *Mesorhizobium ciceri.* Most growers in the U.S. apply commercial *M. ciceri* to seed prior to planting. Little is known about strains of *M. ciceri* used to develop commercial inoculants. The objective of this study was to examine genetic diversity among bacterial strains isolated from different commercial seed inoculants of *M. ciceri*. Four commercial inoculants were examined, two liquid formulations and two products formulated with peat. DNA was extracted from 25 pure colonies isolated from each product and 16s rRNA was amplified and sequenced to determine species identity of each isolate. Greater microbial diversity was detected from peat-based formulations than liquid formulations. Future studies will examine if population structure of different commercial inoculants can be associated with effectiveness of inoculants to colonize chickpea roots and fix biological nitrogen.

Poster # 141

Antiretroviral Therapy and the Epidemic of HIV+ End Stage Renal Disease

Presented by: Heather Gudaz

Mentor: Elissa Schwartz **Campus:** Pullman

Major: Mathematics

Category: Computer Science, Mathematics, Statistics, and Information Sciences

Previously, a mathematical model of the dynamics of HIV+ infection in the End-Stage Renal Disease (ESRD) population was developed to assess impact of antiretroviral therapy (ART) on the progression of patients with AIDS to the development of ESRD. In this model, the data were collected from the Centers for Disease Control and Prevention (CDC) and the United States Rental Data System (USRDS) from years 1991 to 2002 focusing on black individuals in the United States. The model was constructed to predict the prevalence of HIV+ ESRD incorporating the current rate of growth in AIDS prevalence. Linear and exponential trends were considered in this model. The models were then modified to include more recent data on AIDS prevalence and ESRD, which included years 1991 to 2015. From the new data, a new rate for population growth was established. The previous models were repeated with the new rate for both linear and exponential trends. Next, a logistic model was tested that involved a population cap of ten million people. The system of equations used for this model was analyzed for stability as well. For both population growth rates, there was a decrease in number of AIDS patients compared to the previous results.

Poster # 142

Center of Mass Motion Changes During the Sit-to-stand Through Pregnancy

Presented by: Sandra Alejandre

Mentor: Robert Catena **Campus:** Pullman

Major: Sport Science

Category: Organismal, Population, Ecological, and Evolutionary Biology

Co-author: Robert D. Catena

Pregnant women experience physiological changes over the course of several months, which are thought to affect their standing balance. Previous studies have eluded to the STS being a symmetric action through pregnancy, without investigating movement outside of the sagittal plane. Our hypothesis was that as pregnancy progresses, women's motion would become increasingly asymmetric due to the rapid increase in volume in the abdomen area. We examined how the center of mass (COM) motion changes in the STS over the course pregnancy in asymmetric lateral COM motions in STS and, how does the forward motion strategy change during pregnancy to complete the STS. We completed the analysis of 15 women, tested from 16 to 36 weeks. Their body anthropometry was measured to determine the individual masses of 13 body segments. They then had reflective markers placed on the them and performed STS, tracked by a 10-camera motion capture system. STS cycles were split into 2 phases, before (STS1) and after (STS2) the moment of seat-off. During STS1, we measured back angle flexion and side-bending. During STS2, we measured the angular motion between the COM and vertical, around the center of pressure (COP) in the sagittal and coronal planes. Four-week intervals of gestation were used as the independent variable and the dependent variable were change over time measured with a repeated-measures general linear model analysis, and follow-up pairwise comparisons with *Bonferroni* adjustments (alpha = 0.05).

AP spine flexion range of motion (ROM) ($F = 7.23$, $p < 0.001$) and maximum spine flexion increased ($F = 15.06$, $p < 0.001$). We believe that the change in strategy was adopted to provide enough momentum to push off the chair. During STS2 the start COM with respect to COP angle decreased ($F = 19.349$, $p < 0.001$). COM falling behind the COP could lead to a fall if they do not start with enough velocity. During STS1, women stayed symmetrical when in contact with the chair, and in STS2 the ROM decreased ($F = 2.662$, $p = 0.033$). Our results provide new perspectives on adaptation of the STS through pregnancy. The increase in the symmetry could be due to the wider stance used in later months of pregnancy to increase stability.

Poster # 143

The *Drosophila melanogaster* STING Homolog (dmSTING) Protects Against *Coxiella burnetii* Infection

Presented by: Olivia Hayden

Mentor: Alan Goodman **Campus:** Pullman

Major: Biochemistry

Category: Molecular, Cellular, and Chemical Biology

Co-authors: Marena Guzman and Alan Goodman

The Gram-negative bacterium *Coxiella burnetii* is the causative agent of Query (Q) fever in humans and coxiellosis in livestock. There is currently no vaccine against Q fever available in the United States, therefore new therapeutic approaches are needed to reduce infection in reservoir animals, such as ticks, and control the spread of *C. burnetii* to humans. Our lab has demonstrated that the fruit fly insect, *Drosophila melanogaster* is a suitable animal model for studying *C. burnetii* infection. In addition, our lab has shown that *Drosophila* contain a STING ortholog (dmSTING) that functions similarly to human STING in mediating infection. Specifically, both human and fly STING sense bacterial cyclic dinucleotides to stimulate an immune response. Preliminary data indicate that *C. burnetii* produce cyclic dinucleotides during their lifecycle. Therefore, we hypothesize that STING stimulates an immune response during *C. burnetii* infection. We show that STING-null flies have significantly higher mortality to *C. burnetii* infection compared to control flies, but that bacterial replication is not different. We also show that STING interacts with Dredd, a caspase that activates immunity and programmed cell death pathways. Next, we will analyze mortality rates of STING/Dredd double knock-out flies during *C. burnetii* infection as well as bacterial replication. Altogether, our project shows that STING plays an important role in the immune response during *C. burnetii* infection, and that we may uncover a new mechanism by which protection occurs through the caspase Dredd.

Poster # 145

The Chronotypes of Pine Siskins (*Spinus pinus*) Vary with the Timing of Expression of Migratory Behavior

Presented by: Jeffrey Rittenhouse

Mentor: Heather Watts **Campus:** Pullman

Major: Biology

Category: Organismal, Population, Ecological, and Evolutionary Biology

Co-authors: Ashley Robart and Heather Watts

Like many organisms, birds exhibit daily and seasonal rhythms of behavior. Birds show daily sleep-wake cycles that are driven by a biological clock that measures a period of about 24 hours—a circadian rhythm. Circadian rhythms entrain to day light, but individuals show variation in their daily activity patterns, called chronotypes, with some individual waking earlier (‘morning larks’) and others waking later (‘night owls’). Because light also interacts with the circadian rhythm to induce seasonal behaviors, it has been hypothesized that differences in chronotype will be reflected in differences in the timing of seasonal events across individuals within a species. Previous tests of this hypothesis have focused on reproductive timing in birds. Here, we focused on whether variation in daily timing leads to variation in migratory timing. To test this hypothesis, we quantified chronotype and the onset of the expression of spring migratory behavior in a captive songbird, the pine siskins (*Spinus pinus*), held under naturally changing photoperiods. If the hypothesis is correct, then 1) birds should show clear chronotypes, indicated by repeatable differences between individuals in the timing of activity patterns; and 2) chronotype and the onset date of migratory behavior should be associated for individual birds. We determined the onset of migratory behavior based on the date on which a bird began expression of nocturnal restlessness—activity indicative of migratory behavior in captive birds. We assessed chronotype for each night after a bird became migratory as the time at which a bird would end its period of rest and commence nocturnal restlessness. Using linear mixed models to test our predictions, we found that the onset of daily nocturnal activity was significantly repeatable, indicating consistent chronotypes. We also found a significant association between the onset date of migration and the daily onset time of nocturnal activity, suggesting a relationship between chronotype and seasonal migratory timing. However, future research will be needed to determine if this is a causal relationship. Further knowledge of the mechanisms contributing to variation the timing of seasonal behaviors will be important for anticipating how species are likely to respond to changing climatic conditions.

Poster # 146

Seed Specific Expression of Engineered Synechococcus Elongates DES9 Desaturase in *Camelina sativa* Reduces Saturated Fatty Acids

Presented by: Anh Le

Mentor: Jesse Bengtsson **Campus:** Pullman

Major: Biochemistry

Category: Molecular, Cellular, and Chemical Biology

Co-authors: Jesse Bengtsson, Shuangyi Bai, and John Browse

Camelina sativa (false flax), even though is not a prominent plant seed, but has been used in Europe as an oilseed since the middle ages. Camelina seed is known for its high amount of omega-3 fatty acids, which makes it suitable for use as a nutritional supplement and as an industrial supplement. This project was proceeded to find out a potential source of unsaturated fat and polyunsaturated fatty acids (as known as 'healthy' dietary fat) using Cyanobacterial D9 fatty acid desaturase from *Synechoccocus* elongates, an enzyme that can remove hydrogens from fatty acids. Directed evolution which mimics the process of natural selection was the main method used at the beginning of the project. A genetic mutation that results in a favorable amino acid was successfully determined using this method. One such change, Q240R was found to give a dramatic increase in total desaturation activity. DES9* variants expressed in Camelina and driven by the seed-specific phaseolin promoter resulted in a reduced proportion of saturated fatty acids in the seed oil along with a generally more favorable fatty acids profile.

Poster # 147

Preservation of Born-Digital Newsletters from WSU Native Programs

Presented by: Kaitlin Srader

Mentors: Faith Price and Trevor Bond **Campus:** Pullman

Major: Sociology

Category: Humanities

My project involves the preservation of born-digital newsletters from the Washington State University Native American Programs. I worked with Faith Price, the Director of Native American Programs and my fellowship mentor, to gather all of the digital files, then partnered with the WSU Libraries to write descriptive metadata for the files. After reviewing the metadata, the files will be added to the WSU Research Exchange. The Research Exchange is the institutional repository for Washington State University—a space designed to preserve and share scholarship produced at this institution. All faculty members, staff, students, and affiliates of the university are invited to share their research in any digital format, including articles, book chapters, working papers, technical reports, conference presentations, datasets, images, media, and more.

Depositing the files in the Research Exchange will provide long-term digital preservation. The files may be viewed by searching the site or linking to unique identifiers.

My project will serve as a model for other areas on campus who have digital files they wish to preserve.

Poster # 148

Maximizing Positive Youth Development Through Nutrition Interventions

Presented by: Anaderi Iniguez

Mentor: Elizabeth Weybright **Campus:** Pullman

Major: Human Development

Category: Social Sciences

Over the years nutrition intervention programs have gained popularity as an effective tool to manage child obesity and maximize positive youth development. However, child obesity rates are still increasing and research has demonstrated that children predisposed to obesity are at risk of developing long term health complications, such as diabetes and are more likely to experience obesity as an adult. Therefore, nutrition interventions are an essential tool for youth to develop the necessary health behaviors at a young age that they will need throughout their lifespan to live healthy lives. Research has demonstrated that teens who teach nutrition education adopt the skills and knowledge they teach the younger youth. Similarly, we expect to see improvement in teens making healthier choices after they have completed the nutrition intervention program.

The current study evaluates the effectiveness of a nutrition education program by looking at teen teacher nutrition knowledge and healthy behavioral change. The sample includes pre and post surveys of 46 adolescents (M_{age} = 15.5 years old; 67% female; 52% Hispanic; 41% White Non-Hispanic) . A paired sample t-test was ran for each variable of interest in order to determine if there was a significant difference from pre to post. The variables of interest include the knowledge of making healthy food choices, what makes a balanced diet, and what foods to eat ever. The other two variables include behaviors of eating more fruits and vegetables as well as drinking more water.

Significant improvements from pre to post were found in knowledge of making healthy food choices (t= 3.38, $p < 0.001$, $df = 44$, one-tailed), what makes up a balanced diet ($t = 4.56$, $p < 0.001$, $df = 45$, one-tailed), and what foods they should eat daily ($t = 4.33$, $p < 0.001$, $df = 43$, one-tailed). Other significant improvements were found in behaviors of eating more fruits and vegetables ($t = 2.66$, $p < 0.01$, $df = 45$, one-tailed), and drinking more water ($t = 2.14$, $p < 0.05$, $df = 45$, one-tailed). These results demonstrated that the teen-teaching component should be disseminated throughout nutrition interventions to produce optimal results. Furthermore, future studies should examine the potential benefits and outcomes of incorporating a teen-teaching component in other positive youth development interventions.

Poster # 149

The Dangers and Awareness of Diabetes

Presented by: Donvin Prasad and Kamu Taulelei

Mentor: Noel Vest **Campus:** Pullman
Major: Biology
Category: Humanities

The United States is one of the most overweight countries in world with over 100 million living with diabetes or prediabetes, according to a new report in 2017 released by the centers of disease control and prevention (CDC) that's over 9% of the U.S. population. Certain areas of the nation have higher prevalence of diabetes and this could be due inaccessibility to the proper resources for healthy food options and the fear of going outside in high crime rate areas to be active can cause people to be driven to leading unhealthy lives leading to high chance of acquiring diabetes. There are 2 types of diabetes, type 1 is hereditary and is a caused by the inability of the pancreas to produce insulin. Type 2 can also be hereditary but is mostly caused by the inability of the body to use the insulin produced by the pancreas, which is usually due to overeating and the cells are put into overdrive and can't operate as effectively as before. We viewed data from state of obesity and saw that southern states had the highest prevalence of diabetes and the correlation may be due to their lifestyle so to further the investigation we wanted to see what is the difference to make such a big difference in diabetic rates between states. Top 10 states that have high diabetic rates lie within the southeastern states which is a very alarming averaging at a rate of about 13.5%. Harvard research has shown that cooking methods in the south and type 2 diabetes show a strong correlation between one another.

Poster # 150

First-Semester-College-Student Risk Factors and Risky Behaviors: Differences by Generation Status and Student Sex

Presented by: Makayla Norman and Matthew Sionson

Mentors: Kyle Murphy and Laura Hill **Campus:** Pullman

Major: Psychology

Category: Social Sciences

Co-authors: Makayla Norman, Kyle Murphy, and Laura Hill

Introduction: First-generation college students (FGS), relative to non-first-generation students (NFGS), are at greater risk for lower academic performance and retention rates – a link independent of socio-economic status and demographics. Risk factors and risky behaviors that affect college student performance and retention are known to differ by student sex but are inadequately studied among FGS. The present study builds on existing knowledge by identifying differences in 1) levels of student risk factors (e.g., parental attitudes favorable to drug use), and 2) student risk behaviors (e.g. substance use), by generation status and student sex in the first semester of college.

Hypotheses: We expected to detect group differences in both risk factors and risk behaviors, by generation status and student sex, independently and in interaction. We also expected to find differences in risk behaviors after controlling for risk factors.

Method: Our sample (330 students college students [Mage = 18.04; 78.2% Caucasian; 32.8% FGS; 62.4% female] in their first semester) is from an ongoing, longitudinal study (pre-college summer – first two years of college) of parent-college student dyads. We conducted t-tests to examine differences in risk factors and a two-way analysis of covariance (ANCOVA) to assess differences in risk behaviors (i.e., substance use, consequences, sexual behavior) by group and by interaction of generation by student sex, above and beyond the influence of risk factors.

Results: There were significant differences within groups on both covariates and outcomes, such that FGS reported greater levels of various risk factors; NFGS reported more binge-drinking; males reported more risk factors and behaviors overall. Generation status and student sex predicted multiple substance use behaviors, controlling for risk factor covariates; the interaction was not significant for any outcome.

Conclusions: Excluding the interaction, present study findings support our hypotheses, are consistent with existing literature on college student males vs. females and contributes to knowledge about FGS and NFGS differences. Implications from the present study can inform prevention interventions and parent-based programs. Research directions include application of longitudinal methods in assessment of the extent to which early identification of risk factors and behaviors account for variation in academic outcomes and retention.

Poster # 151

Does Disease-resistance Tradeoff with Symbiotic Function in Domesticated Soybean?

Presented by: Jordan Schinke

Mentors: Stephanie Porter and Niall Miller **Campus:** Vancouver

Major: Biology

Category: Organismal, Population, Ecological, and Evolutionary Biology

Co-authors: Zoie Lopez, Angeliqua Montoya, Emily Helliwell, Miles Roberts, Kyle Nguyen, Niall Millar, WSUV 2018 Ecology 372 class, and Stephanie Porter

The process of domesticating crop plants improves many qualities of staple food crops, such as crop yield and pathogen resistance. Crop species can undergo evolutionary tradeoffs during domestication, where certain traits are artificially selected for result in the degradation of other functions. Artificial selection on agriculturally beneficial traits can result in crops that shunt resources to early, large yield traits, while sacrificing allocation to costly symbiosis traits. Pathogen defense traits also represent an important class of favored traits that can tradeoff with symbiotic function, as both pathogen resistance and symbiotic functionality with soil microbes utilize similar molecular pathways. We performed a greenhouse experiment to test 1) whether domesticated soybean, *Glycine max*, is less responsive to rhizobial inoculation than its wild progenitor species, *Glycine soja,* and 2) whether susceptibility to the pathogen *Xanthomonas axonopodis pv. glycines* (Bacterial Pustule Disease) tradesoff with responsiveness to symbiotic soil bacteria among *G. max* cultivars. Undergraduates from the 2018 Ecology 357 class at Washington State University Vancouver, grew 460 plants of 22 different *Glycine* genotypes in a randomized block design, with selected genotypes of *G.max* varying in the degree of susceptibility to Bacterial Pustle. Plants were either inoculated with *Bradyrhizobium japonicum* USDA 110 symbionts, or left uninoculated to measure the growth response to symbiosis. Students harvested plants five weeks after planting and measured shoot dry weight and nodule biomass. Our results confirm that growth in *G.max* is less responsive to the rhizobial symbiosis than its wild progenitor. However, we found that resistance to Bacterial Pustule in *G. max* is positively correlated with the responsiveness of growth to rhizobial inoculation. While symbiotic function appears degraded in *G. max,* this does not appear to be due to a tradeoff due to selection for disease resistance.

Poster # 152

Maximum Luminosity of Type IA Supernova as a Function of Distance from Host Galaxy

Presented by: Trevor Foote

Mentor: Guy Worthey **Campus:** Pullman

Major: Physics and Astronomy

Category: Engineering and Physical Sciences

Co-author: Guy Worthey

One of the most important parameters in cosmology is the Hubble constant, which provides the rate at which the universe is expanding, and its accuracy is therefore also of high importance. In order to calculate the Hubble constant, astronomers have utilized two different methods, one using light curve data from Type IA supernovae, the other using measurements of the Cosmic Microwave Background (CMB). The problem is the two values don't agree with one another, even when considering both values' estimated uncertainty. The difference between the two values is about nine percent, which begs astronomers, to take a closer look at both methods and critique the methods of calculation and error analysis. The reason Type IA supernova have been used as a benchmark for calculating the Hubble constant, is due to their small variations in luminosity from one another. In the recent past this assumption has been called into question, and it is to this end that we collected Type Ia supernovae and host galaxy survey data to compare maximum luminosity of Type IA supernovae as a function of its distance from its host galaxy and therefore, by proxy, its metallicity. The results show no direct correlation between metallicity and peak brightness, but did show that across 22 different Type IA supernova, the variation in maximum luminosity was 122.0%. These findings remove one potential source of systematic error in the local Hubble constant calculation, but show evidence of a potential issue with the community's assumption about Type IA supernovae having uniform maximum luminosities.

Poster # 153

Field Stability in Unshielded Helmholtz Coils

Presented by: David Morin

Mentor: Brian Saam **Campus:** Pullman

Major: Physics and Astronomy

Category: Applied Sciences

Co-authors: Sheng Zou, Chamithri Adikarige, Zahra Armanfard, Trevor Foote, and Brian Saam

Many table-top AMO experiments require magnetic field stability, e.g., for precise measurement of resonance frequencies and resonance shifts. This is often achieved with a very small or nominally zero field, where the entire apparatus is shielded with several layers of expensive mu metal. Spin-exchange optical pumping (SEOP), by contrast, often practically requires a larger (tens of gauss) field that defines a laboratory quantization axis and mitigates low-field spin-relaxation effects. We routinely stabilize unshielded Helmholtz coils to better than a part in 105 at 30~G in a ≈ 10 Hz bandwidth, and achieve a few parts in 106 late at night with less external interference [1]. In this work, we compared several stabilization techniques based on driving the inductive load with a commercially available (CV/CC) power supply. These include using the supply in current-control mode (worst result); and using it in voltage-control mode coupled one or more of (1) a stable sensing resistor in series with the coils, (2) an external comparator driving the gate of a FET in series with the coils, and (3) the output voltage generated by a commercial magnetometer fed directly to the power supply sensing inputs.

Poster # 154

Determining Growth Kinetics of Cytotoxic T Lymphocytes in a Bovine System with Applications in Adoptive Immunotherapy Cancer Treatments

Presented by: Monika Cewe

Mentor: Bernard J. Van Wie **Campus:** Pullman

Major: Chemical Engineering

Category: Engineering and Physical Sciences

Co-authors: Kitana Kaiphanliam, Bill Davis, Mahmoud Elnaggar, Gaber Abdellrazeq, Baran Arslan, and Bernard Van Wie

Cancer is the second leading cause of death in the United States after heart disease. Popular treatments such as chemotherapy and radiotherapy are non-targeted, where healthy cells are as susceptible to death as malignant cells. Cancer research efforts have shifted to a systemic, targeted treatment that utilizes our body's own immune system—immunotherapy. A promising form of immunotherapy is adoptive cell therapy (ACT) using cytotoxic T lymphocytes (CTLs), which have been proven to effectively target and destroy cancer cells in malignant tumors. One of the major hurdles in using CTLs is regulating cell production; therapy requires rapid expansion of a large number of cells *in vitro* prior to being administered to a patient, and the patient will go through several treatments. In order to optimize cell production, a kinetic model can be used to estimate the growth rate based on concentrations of substrates such as glucose and metabolites such as lactate and ammonium. It is well known that increasing lactate and ammonium ion concentrations will affect the growth rate by lowering the environment's pH. To date, there has not been extensive research on the kinetic modeling of CTLs. The main goal of this study is to develop a kinetic model for CTLs isolated from a bovine system for rapid expansion in a bioreactor. This will be achieved by determining the specific growth rate, consumption rate of glucose, critical concentrations of ammonium and lactate and their rates of formation. Initial experiments will be conducted using a human cancer cell line.

Poster # 156

Changes in Carrying Capacity and Growth Rate Drive the Trade-off Between Nickel Tolerance and Growth in Mesorhizobium

Presented by: Miles Roberts

Mentor: Stephanie Porter **Campus:** Vancouver

Major: Biology

Category: Organismal, Population, Ecological, and Evolutionary Biology

Co-authors: Angeliqua Montoya, Zoie Lopez, and Stephanie Porter

Anthropogenic pollutants such as heavy metals contaminate many soils today and, in response, soil-dwelling bacteria have evolved to better tolerate these toxic substances. Soil bacteria participate in many of the natural chemical processes that sustain ecosystems and plant productivity; however, it is unclear whether tolerance to environmental toxins trade-off with these ecosystem-enhancing traits. Trade-offs occur when improving one trait comes at a cost to another trait and are common drivers of evolution in plants and animals but are not well-described in many species of wild bacteria. For wild *Mesorhizobium* bacteria, tolerance to the heavy metal, nickel, trades off with the ability to grow in the absence of nickel. However, it is not known whether this response is due to changes in their growth rate, lag time (i.e. the delay that occurs before bacteria begin to actively grow) or carrying capacity (i.e. the maximum population size that can be stably sustained in a given environment). To investigate this question, we grew *Mesorhizobium* strains of varying nickel tolerance in nickel-rich and nickel-poor media and used a bacterial growth model to estimate the growth rate, lag time, and carrying capacity for each strain in these media. We predicted that strains isolated from nickel-rich soils would be more tolerant to the effects of nickel than strains isolated from nickel-poor soils because strains from nickel-rich soils have likely evolved to be more prolific in nickel-rich environments. We confirm that nickel inhibited the growth of most strains, consistent with nickel's toxicity, but this effect was not more pronounced in strains from nickel-poor soils. More interestingly, nickel strongly inhibited the carrying capacity and growth rate of most strains but did not extend lag time. This trend suggests that nickel contamination may slow the rate at which *Mesorhizobium* benefit ecosystems and that their remaining benefits will be donated over an extended period of time. Future experiments will expand upon these results to address more specific questions regarding how heavy metal tolerance trades off with other traits in wild bacteria.

Poster # 158

Who's Sample Is It? The Ethics Behind Privacy and DNA Databases

Presented by: Sierra Forler

Mentor: Samantha Noll **Campus:** Pullman

Major: Genetics and Cell Biology

Category: Humanities

With increasing accessibility to at home DNA testing kits, the ability to find out your ancestral heritage is easier than ever. But at what cost to you and your family's privacy? Cold cases are now being solved by using 3rd and 4th cousin's DNA samples who have legally consented to uploading their information to a police database. Other concerns have been voiced about exploitation of migrant family separated at the US Mexican border. The company 23 & Me said it would provide DNA testing kits to try and reunite families. Some saw this as the company using the families to help gain a more complete database which tend to be lacking in minority samples. Along with the lack of communication and transparency there is also the issue that children under age could not consent to giving a DNA sample. That is why this study aims to apply Kantian ethics to examine the issues of privacy, profiling, and access to three types of DNA databases, for the everyday American citizen. These types include commercially available (23 and Me), local law enforcement (police departments), and federal agency (FBI's. Combined DNA Index System (CODIS)). The goal of this literature review is to provide knowledge about current ethical considerations and practices in working with DNA databases, and to inform policy makers and the general public on how these practices impact communities.

Poster # 159

The Effects of Post and Pre-conditioning Hyperbaric Oxygen on Morphine Conditioned Place Preference in Male Mice

Presented by: Nickolas Camarata

Mentor: Raymond Quock **Campus:** Pullman

Major: Sport Science

Category: Organismal, Population, Ecological, and Evolutionary Biology

Co-authors: Raymond Quock and Abigail Brewer

With the death toll from opioid overdose in the U.S. exceeding more than 47,000 in 2017 and projected to climb higher according to the National Institute on Drug Abuse (2017), there needs to be a treatment or preventative measure implemented to curb the trend. Hyperbaric oxygen (HBO_2) has limited approved uses from the Federal and Drug Association (2013) that include decompression sickness and wound healing. Unlisted, however, is the treatment of drug dependence, specifically concerning opioids. The use of HBO_2 is breathing 100% oxygen in a hyperbaric chamber that is pressurized above sea level pressure. Previous research has demonstrated that treatment with HBO_2 can suppress physical signs of naloxone-precipitated withdrawal in morphine-dependent mice. The aim of the proposed research is to determine whether HBO_2 might also reduce psychological preference for morphine in a classic conditioned place preference (CPP) paradigm. In this study, mice were placed in a three-choice model chamber. Morphine was paired to one side of the chamber and saline to another, leaving a neutral space in the middle. HBO_2 was introduced either as a prevention or treatment for trials. The former meant that mice were given HBO_2 before injections that paired the drug to the environment while the latter had HBO_2 provided after drug injections. Results demonstrated that preference was achieved using morphine for males, but at non-significant values. In a similar study completed with more animals, females were closer to achieving significance. There could be a sex difference between male and female response to morphine CPP, consistent with other reports in literature, such as Cicero et al. (2002) and Mirbaha et al. (2009). Additionally, HBO_2 did not reduce male preference scores, contrary to the hypothesis. To conclude, this preliminary study utilizing a single dose of morphine in a small population of male mice failed to demonstrate efficacy of HBO_2 as an intervention in morphine CPP.

Poster # 160

Injury Prevention on Washington State Dairy Farms

Presented by: Brandy Foust

Mentor: Amber Adams-Progar **Campus:** Pullman
Major: Microbiology
Category: Social Sciences
Co-author: Amber Adams-Progar

An investigation into handling training methods on dairy farms revealed that workers with minimal large animal experience often receive insufficient animal handling training. A lack of experience with large animals coupled with insufficient training facilitates conditions unsafe to workers and animals. Goals of this study included conducting a statewide survey of dairy farmers to understand current safety training methods on dairies and developing an interactive cattle handling training program that integrates desired program characteristics. We distributed a dairy worker survey to 34 dairy producers at the Washington Dairy Industry meeting in December 2018. The survey included questions related to farm demographics, current safety training materials, and needs for future safety training materials. Data were analyzed using PROC CORR in SAS.

Farm size was not correlated with the amount of time dairy producers would devote to an effective cattle handling training program ($P = 0.17$). The number of farm locations a dairy producer owned and the amount of time they would devote to an effective cattle handling training program also was not significantly correlated ($P = 0.66$). Finally, the number of non-family employees and the effectiveness of current training resources was not significantly correlated ($P = 0.85$). Aside from differences in farm demographics, common desired expectations for future training programs were demonstrated. Most respondents (82%) believe that at least half their staff would benefit from Spanish training materials. Training sessions ranging from 30 minutes to an hour, were favored by 79% of respondents. Ninety percent of respondents whom reported 75-100% of their staff having daily contact with cattle also had a herringbone or parallel milk parlor, indicating these farms may benefit most from offering an effective cattle handling training program.

Integrating survey results, we developed a 45-minute interactive cattle handling training program offered in English and Spanish. Future research will focus on comparing the interactive cattle handling training program to commonly used video-based handling training programs. By looking at the immediate and long-term knowledge gained by dairy workers, we can determine whether an interactive or passive learning format is more beneficial to their comprehensive cattle handling knowledge and, ultimately, their safety.

Poster # 161

Crimson Medical Solutions

Presented by: Stephen Bone, Tyler Sager, Tanner Stahl, and Mitchell Weholt

Mentors: Howard Davis and Marie Mayes **Campus:** Pullman
Major: Strategic Communication
Category: Engineering and Physical Sciences
Co-authors: Tyler Sager, Tanner Stahl, and Stephen Bone

Intravenous (IV) line entanglement and mislabeling is an overwhelming problem in today's healthcare space. Intensive care unit (ICU) nurses are tasked with tracking anywhere from 2 to 12 IV lines per patient that they see and are expected to keep an organized, safe environment for every patient they serve. There has been many cases of IV lines getting tangled around infants necks leading to asphyxiation as well as labeling errors that lead to death of the patient.

With over 500,000 ICU nurses in the United States having to solely use medical tape as their labeling method, we feel that a new device is needed to help these nurses better serve their patients. Our companies goal is to create innovative, noninvasive medical devices with our first device being an IV line organizer. Our device has full labeling capacity as well as the ability to group IV lines together to limit the entanglement issues. Replacing the current labeling method of medical tape with our device will help nurses work more efficiently and have a better peace of mind when it comes to worrying about if their IV lines are setup correctly. It will also save hospitals money on insurance fees that come up due to errors that IV line entanglement and mislabeling can bring. Overall, a new device that groups and labels IV lines will prove to be cost-savings for hospitals and also bring a new level of safety to patients everywhere.

Poster # 162

Palouse EcoArts Project

Presented by: Coleman Davis and Ellen MacNary

Mentor: Linda Russo **Campus:** Pullman

Majors: English, Neuroscience

Category: Arts and Design

Co-authors: Coleman Davis and Anna Young

The "Palouse EcoArts Project" involves connecting ecological information with artistic expression through various forms of media and personal narrative. The biological diversity within the Palouse goes beyond rolling farmland, although many people believe it is just that. The Palouse, the geological area in which Washington State University resides, is bordered by the Snake River, beautiful prairies of both invasive and endangered grasses, and the wild forests of Idaho. The project itself opts for a microenvironmental movement, that highlights specific habitats throughout the Palouse, and connects them through a greater ecological understanding of the area, as well as through artistic expression found within the Palouse community. Looking at the landscape through lenses created by local artists will grant us a closer connection with our surrounding natural areas that often go overlooked. As Aldo Leopold once said from his famous Land Ethic, "A thing is right when it tends to preserve the integrity, stability, and beauty of the biotic community," and I am hopeful that this project will be a great step in a direction towards the preservation of our surrounding wilderness.

Poster # 163

Joint Influence of Physical Activity and Quality of Sleep on Pregnancy-Related Anxiety

Presented by: Emma Wilsie

Mentor: Christopher Connolly **Campus:** Pullman

Major: Sport Science

Category: Social Sciences

Co-authors: Christopher Connolly, Zoe Wright Osborn, Maria Gartstein, and Sara Waters

Pregnancy-related anxiety (PRA) is experienced by many women, given the physical and psychosocial challenges common during pregnancy and the prospect of childbirth. Some health behaviors, such as physical activity and quality of sleep (QS), are related to decreased PRA, but their joint influence is unclear. **PURPOSE:** We examined the individual and joint influences of physical activity behaviors and QS on PRA among pregnant women at two locations. **METHODS:** Third-trimester pregnant women (N=33) participated in a series of measurements between 28-36 weeks gestational age. Participants answered questions recalling their moderate and vigorous physical activity (min/wk) for prepregnancy, in the first and second trimesters, and concurrently. Moderate to vigorous physical activity (MVPA) was calculated for prepregnancy and for each trimester. Participants also wore a validated physical activity monitor (Modus StepWatch) for one week, and average steps/day were calculated. QS was evaluated with the Pittsburgh Sleep Quality Index (PSQI), calculating a global score. The Pregnancy Related Anxiety Questionnaire (PRAQ-R) was used to assess women's anxiety regarding childbirth and the health of the baby. Median split was used to categorize PRA as "high" [≥15.0 PRA scale] or "low" [<15.0]. Mann-Whitney U-tests were used to compare the distribution of MVPA for all timepoints, steps/day, and also QS between high and low PRA participants. Hierarchical logistic regression determined the joint influence of MVPA and quality of sleep on PRA. **RESULTS:** Mann-Whitney U-tests showed lower PRA participants had significantly superior third trimester global QS scores [p=0.048]. Likewise, global QS scores were related to increased odds of high PRA [β=1.34, 95% CI: 0.99-1.80]. Average steps/day and self-reported MVPA prior to pregnancy and at all pregnancy timepoints were not related to PRA. Hierarchical analyses did not reveal an interactive effect of steps/day and QS or MVPA and QS on PRA as hypothesized. **CONCLUSION:** Lower QS is related to higher PRA during the third trimester of pregnancy. Physical activity was not related to PRA and interactive effects with QS on PRA were not found. Larger samples are needed to confirm these findings.

Poster # 164

Characterization of ACRT-grown CZT for Use in High-resolution Gamma Radiation Detectors

Presented by: Seth McPherson

Mentor: Kelvin Lynn **Campus:** Pullman

Major: Materials Science and Engineering

Category: Engineering and Physical Sciences

Co-authors: Saketh Kakkireni, Santosh Swain, and Kelvin Lynn

Gamma radiation detectors are heavily utilized in industry today, from medicine to nuclear physics many insights can be gained from being able to record the gamma radiation signal emitted during many physical processes. Cadmium zinc telluride (CZT) is a material of choice for room-temperature radiation detection owing to its low-background and good electron-transport properties. CZT has been previously used in NASA's astronomical Gamma-ray telescopes and is also being proposed in future projects (AMEGO, requiring ~17,000 CZT bars). The primary barrier to widespread utilization of CZT over older, conventional detectors is its high cost. WSU has been working on an alternate growth method for the low-cost production of CZT, namely Accelerated Crucible Rotation Technique (ACRT). Recently, WSU has been successful in obtaining industrial quality CZT using the ACRT method and is further optimizing the growth process to improve the single-crystal yield, which subsequently means lower costs. The ACRT grown material is cut into bars and fabricated into the Frisch-collar configuration. The bars are then tested under electron-only (Frisch-grid) configuration to assess their quality. A balance must be struck between single-crystal yield and the electrical properties of the CZT. Using the data obtained from the Frisch-grid testing, a correlation may be established between growth technique, quality, and yield of the single-crystal CZT.

Poster # 165

Soltek: Social Media App for Scientists and Engineers

Presented by: Brian Karlberg

Mentor: Howard Davis **Campus:** Pullman

Major: Bioengineering

Category: Computer Science, Mathematics, Statistics, and Information Sciences

Co-authors: Sam Schreiber and Howard Davis

Scientific work has evolved to rely on a plethora of online resources including search engines, social media, forums, and technology news channels.[1] This phenomenon has been confirmed in interviews with Washington State University scientists, engineers, and technical professionals. An important theme is that pain-points exist around utility and trust in navigating these myriad channels to achieve professional success and that an opportunity clearly exists for a new channel explicitly targeted at streamlining the process while fluidly integrating the existing channels. Further, solving problems in this space represents access to gaining share in an established multibillion-dollar market.[2] Our proposed solution is a browser-based social media style channel that draws features from multiple platforms and includes a project-support tool that is customizable to each user. The front-end or user interface will be a modern, streamlined style. Users choose a profession where all of the possible professions form a hierarchy used to measure the relatedness between professions. Profession assignments become more focused the further down the hierarchy tree and more generic further up the hierarchy tree thus allowing users to choose their level of focus in the social network. The level of focus affects the recommendation other users for a user to follow. The system architecture is scalable to millions of users.

1. Brossard D. New media landscapes and the science information consumer. 2013. doi: 10.1073/pnas.1212744110.
2. Social media in marketing: A review and analysis of the existing literature - ScienceDirect. 2019. doi: 10.1016/j.tele.2017.05.008.

Poster # 166

Lignin Model Synthesis for Radical Degradation

Presented by: Alexander Palander

Mentor: Rock Mancini **Campus:** Pullman
Major: Chemistry
Category: Engineering and Physical Sciences
Co-authors: Maryam Davaritouchaee, Rock Mancini, and Austin Ryan

Renewable energy and chemicals are becoming an increasing focus as global resources become scarcer. Lignin, a byproduct of ethanol fermentation, is a renewable source of fuel and organic compounds. Lignin is extracted from trees and stalky plants and is difficult to break down. Lignin traditionally was burned as a renewable energy to generate electricity. Beyond this, lignin's chemical structure makes it an alternative source to petroleum chemicals. It has many applications, but further development requires better ways to convert the molecules to a more useful form.

This project contributes to breaking down naturally occurring lignin. Extracted lignin is a huge chemical; and finding a weak link in lignin would allow researchers to break it up into more manageable pieces. Lignin is chemically decomposed by microbes—bacteria, fungi and other decomposers. The hypothesis in this experiment is to use the same chemistry as microbes do, to degrade extracted lignin. The chemistry used involves the use of radicals, highly reactive—destructive—molecules that can break down lignin. This enables lignin to be divided into smaller pieces; an essential step before transforming it into other chemicals.

To test the effectiveness of these reactive radicals on lignin and develop efficient mechanisms, this experiment built a model that mimics the structure of lignin. Lignin is too large to be studied practically, so the model will need to be a smaller piece of the larger lignin structure that can be studied in a lab. This paper details the synthesis of a model for lignin, to be degraded by radical treatment. The specific research in this project required following an existing and published procedure, which resulted in our experiment, making the same structure. The goal was to replicate the model compound from this pre-existing literature and develop new methods of radical targeting. The experiment details successful synthesis of the desired molecule. The model was isolated from starting materials through several synthetic steps. Analytical data supporting the synthesis of the lignin model will be presented in this report and future radical testing will develop procedures to degrade the model and lignin.

Poster # 167

Environmental, Economic, and Ethical Local Perspectives on Third World Interventions from Ecuadorian Population

Presented by: Hilary Zuniga

Mentors: Michael Goldsby and Caitlin Bletscher **Campus:** Pullman

Majors: Environmental and Ecosystem Sciences, Philosophy

Category: Social Sciences

Co-authors: Caitlin Bletscher and Michael Goldsby

Most of what we know regarding the outcomes and perspectives of third world interventions from either a development agency or a developed country, comes from research that focuses on perspectives from the interveners. Intervention defined in this research as an attempt to aid in an environmental or economic sector of the third world country by implementing solutions. The goal of these programs claims to be to help with either the development of the country, or the welfare and livelihood of locals from a particular region. This study will examine the correlations between existing literature and results from implemented solutions in third world countries, and how they compare to the local perspectives of local Cotacachi Ecuadorians from agencies such as Green Empowerment. Their perspectives on their environmental and economic well-being will be analyzed and compared to the successfulness of the goals set by development agencies. A sample of adult locals will be interviewed on their view points on their well-being and that of their natural environment before and after the presence of a developing agent. The effectiveness of outside interventions when it comes to economic and environmental well being of third world countries will be assessed as well as the ethical dilemmas that come with what is seen as a moral responsibility. Identifying the effectiveness and ethics behind development in third world countries is crucial in understanding whether good is truly being done other than harm.

Poster # 168

Effects of Cannabis Vapor Self-Administration on Decision Making in Adulthood

Presented by: Alyssa Hampton and Xitlali Herrera

Mentor: Ryan McLaughlin **Campus:** Pullman

Major: Animal Sciences

Category: Applied Sciences

Co-authors: Alyssa Hampton, Timothy Freels, and Ryan McLaughlin

As more states across the country continue to accommodate for the legalization of cannabis, the social stigma and perceived harms associated with cannabis use continue to decline. The use of cannabis during sensitive developmental periods particularly during adolescence has become a major public health concern because of its long-term effects on cognitive function remain largely unknown. Given that adolescence is a critical period for the development of brain regions implicated in higher-order cognitive functioning, this study sought to investigate possible behavioral deficits in cognitive flexibility and decision making in adult rats that volitionally consumed cannabis during the adolescent period. Male and female Sprague-Dawley rats (n=10-12/sex/group) were trained to self-administer vaporized cannabis extracts high in delta-9-tetrahydrocannabinol (THC), cannabidiol (CBD), or a vehicle solution containing 80% propylene glycol and 20% vegetable glycerol form postnatal (PND) day 35-55. ON PND 65, rats began training in an automated attentional set-shifting task designed to assess alterations in behavioral flexibility. Additionally, an effort discounting task was used to evaluate the effects of adolescent cannabis use on effort-based decision making in adulthood. Preliminary results indicate that female rats self-administered more THC-rich vapor than males during adolescence. In the attentional set-shifting task, female rats that self-administered CBD-rich vapor made more regressive errors when compared to rats in the vehicle group. There was no effect of adolescent cannabis self-administration on effort-based decision making in either sex. The implications of these data suggest that female rats self-administer more THC-rich cannabis vapor during adolescence and that females may be at a greater risk for developing cognitive dysfunction later in adulthood. In addition, they support the validity of cannabis vapor self-administration model to further investigate the effects of cannabis use on behavioral and cognitive outcomes. Keywords: Cannabis, THC, CBD, vapor self-administration, behavioral flexibility, effort-based decision making.

Poster # 169

Effects of Sit-Stand Desks on Postural Sway of the Head and Trunk

Presented by: Chandler Shannon

Mentor: Anita Vasavada **Campus:** Pullman
Major: Bioengineering
Category: Engineering and Physical Sciences
Co-authors: Anita Vasavada and Ed Havey

Sit-stand workstations are a rising trend in the workplace. These new workstations advertise themselves as a way to increase postural variability, which has been observed to be helpful for musculoskeletal health. Postural sway analysis is a quantitative measurement of the motion of body segments and represents the body's ability to maintain balance. This study aimed to quantify postural sway of the head and neck during the use of a sit-stand workstation. We hypothesized that the use of sit-stand workstations would lead to greater postural sway of the head and trunk in the standing position.

Ten subjects (6F, 4M) were brought into the lab. Inertial measurement units (IMUs) were placed on their on their heads and trunks to measure their acceleration and angular velocity. The subjects then worked on tasks simulating typing (typing master) or clicking (Geoguessr) at their own pace to replicate an office environment. Work was done in a randomly selected posture for 45 minutes, either seated or standing. After the first session the subjects rested for a minimum of 20 minutes to alleviate fatigue, and finally worked in the other position for another 45 minutes.

Data showed no significant differences between the postural sway of seated or standing postures in the head or the trunk ($p < 0.1$). However, the different tasks that the subjects performed were separated, and clicking tasks were 20-30% lower than typing tasks in both postures ($p < 0.01$).

Since this study measured no difference between postural sway in the head and neck for either posture, reports of lower incidence of neck pain by users may be due to a different form of dynamic work such as muscular activity of the neck, or may be due to static factors such as forward head posture, which is linked with neck pain. The differences in task show that what a person is working on has a larger impact on the way they stay balanced than if they are sitting or standing. Further research is required to find a link between user satisfaction and sit-stand workstations.

Poster # 170

Development of a Real-time PCR Assay for Accurate Quantification of *Botrytis cinerea* in Processed Red Raspberry Fruit

Presented by: Lauren Braley

Mentor: Tobin Peever **Campus:** Pullman

Major: Biology

Category: Molecular, Cellular, and Chemical Biology

Co-authors: Olga Kozhar, Tobin Peever, and Kiwamu Tanaka

The fungus *Botrytis cinerea* causes gray mold of several species of plants including raspberries and other small fruit in Washington and is the most important disease of small fruit worldwide. The Howard Mold Count (HMC) has been used to estimate fungal contamination of processed foods including the quantification of *B. cinerea* and other fungi in processed raspberries for over 100 years. Due to limitations in this technology, it is currently unclear if the HMC used in raspberry processing facilities provides an accurate assessment of contamination by *B. cinerea* and/or other fungi associated with raspberry flowers and fruit. Development of a real-time, quantitative PCR assay (qPCR) would provide a complementary approach to the HMC and could theoretically provide greater sensitivity and specificity compared to the HMC. Such an assay would also allow us to relate *B. cinerea* colonization in the field to contamination of processed raspberries. We propose to develop a qPCR assay to measure *B. cinerea* in processed raspberry fruit and compare the results of this assay to the HMC under real-world conditions.

Poster # 171

Using the Drosophila Genetics Reference Panel to Identify Host Factors Associated with *Coxiella burnetii* Infection

Presented by: Zachary Howard and Emily Kindelberger

Mentor: Alan Goodman **Campus:** Pullman

Major: Biochemistry

Category: Molecular, Cellular, and Chemical Biology

Co-authors: Zachary Howard, Marena Guzman, Ziying Liu, Stephen White, and Alan Goodman

Coxiella burnetii is a Gram-negative, obligate intracellular, macrophage-tropic bacterium and the causative agent of the zoonotic disease Q fever. Association between host genetic background and the development of *Coxiella* infection has been demonstrated both in humans and animals; however, specific genes associated with susceptibility to infection remain largely unknown. In this study, we used the *Drosophila* Genetics Reference Panel (DGRP) to identify host genetic variants that affect host susceptibility to *C. burnetii* infection. Following infection of each DGRP line with *C. burnetii*, we monitored mortality rates and calculated hazard ratios with respect to mock (PBS) infection. We then used hazard ratios from both male and female flies as the input phenotype for a genome-wide association study (GWAS). Nine out of seventeen genome-wide suggestive variants identified from female hazard ratios were located on chromosome 2R in the gene *schnurri*. *Schnurri* is a zinc-finger transcription factor, orthologous to the human *HIVEP2* gene, that has been implicated in bone morphogenetic protein (BPP) signaling, which was demonstrated to regulate immune response to *Salmonella* infection in *Drosophila*. Three genome-wide suggestive variants on chromosome 3L identified from male hazard ratios were located in two genes with Rho guanyl-nucleotide exchange factor (GEF) activity, *Puratrophin-1-like* and *RhoGEF64C*. Indeed, various other intracellular bacterial pathogens are known to target Rho GEFs during infection. Candidate genes from the analyses will be validated through the knockdown of each gene to determine how the individual gene affects *C. burnetii* infection. Future work will ask how orthologous genes identified in our screen function during *Coxiella* infection in mammalian models. Our findings will have broad-ranging impacts by identifying host factors that when dysfunctional confer susceptibility to *Coxiella* infection. These results will be important for better prediction of pathogen spread in domestic ruminant reservoirs and disease progression in humans.

Poster # 172

Amine Captured CO_2 Conversion Over Different Noble Metals

Presented by: Gent Ferati

Mentors: Hongfei Lin and Shaoqu Xie **Campus:** Pullman
Majors: Biology, Chemical Engineering
Category: Engineering and Physical Sciences
Co-authors: Shaoqu Xie and Hongfei Lin

The conversion of CO_2 to methanol not only prevents further release of CO_2 into the atmosphere, it also provides a source of energy itself. Catalysts are required to speed this reaction up and make it possible at reasonable conditions. So far, the catalysts used for this conversion reaction have been mainly homogeneous and require high temperatures and pressures. Heterogeneous noble metal catalysts are more stable than homogeneous catalysts and are more easily filtered out of solutions. The goal of this research was to utilize a heterogeneous noble metal catalyst that would aid in the conversion of CO_{2-} to methanol under milder conditions. The most effective catalyst tested was palladium on a carbon support. This catalyst requires a lower temperature of 150^{o}C to optimize its performance and a pressure of 70 bar. While this temperature is significantly lower than the current industry standard, the yield of 3% methanol is low. This reaction also showed a high sensitivity to water resulting in a detrimental effect in the methanol yield. Future goals for this project will be the synthesis of a multi-functional catalyst that will increase yield and have the ability to absorb water to lower the sensitivity to water seen with the palladium carbon catalyst.

Poster # 173

Perceptions of Adulthood: Differences Amongst Youths in Alternative and Public High Schools

Presented by: Leonard Covarrubias

Mentor: Monica Johnson **Campus:** Pullman

Major: Psychology

Category: Social Sciences

This study examines perceptions of what it means to be an adult between high school youths from alternative high schools and public high schools. While public high schools are culturally normative institutions where adolescents are not only educated but prepare for adulthood, alternative high schools are seen as institutions at-risk students attend and where they are given a last-chance in attempts in obtaining a high school education. It is unclear whether students from alternative high schools have similar understandings of what it means to be an adult compared with students in traditional high schools. A literature review will be conducted, along with an examination of student demographics across each school types. Research articles regarding adolescent transition into adulthood, racial and ethnic demographic differences of the perceptions of adulthood, and young-adult's perceptions of culturally meaningful markers will be used to compare the perceptions of adulthood amongst the students. Demographics of the students within each types of schools will be brought in to understand possible differences across each school type.

Poster # 174

A New Approach to the Valorization of Agricultural and Forestry Residues: Promise of Combined Mechanical Size Reduction and Dry Chemical for Pretreatment of Lignocellulosic Biomass

Presented by: Samuel Bigbee-Hansen and Cecile Cardinalli

Mentors: Mohammadali Azadfar and Michael Wolcott **Campus:** Pullman

Major: Civil Engineering

Category: Engineering and Physical Sciences

Co-authors: Samuel Bigbee-Hansen, Mohammadali Azadfar, and Michael Wolcott

Lignocellulose is an attractive renewable and nonedible starting material, generated in considerable quantities from forestry and agricultural activity globally. To date, significant advances have been achieved regarding the development of pretreatment methods suitable for the deconstruction of lignocellulose to its main constituents cellulose, hemicellulose and lignin. Removal of lignin, as a heteropolymeric aromatic compound, is essential for the accessibility of hydrolytic enzymes, which produce valuable monomeric sugars from cellulose and hemicellulose for further use such as biofuels production. The initial energy cost associated with the size reduction and pretreatment of lignocellulosic biomass are major constituents that should be valorized. The recommended particle size should be less than 3 mm for effective accessibility and hydrolysis of cellulose. Due to heterogeneous structure of lignocellulosic biomass, the mechanical size reduction includes generally several steps that are coarse comminution which results in organ dissociation (from meter to centimeter) with cutting or crushing processes; intermediate grinding (from centimeter to millimeter) at the tissue scale, with shearing or impact processes; then fine grinding at the tissue scale between 50 and 500 micron; and finally ultra-fine grinding, below the cell scale (<20 micron). The hypothesis of this work is driven from the recognition that the combination of mechanical stresses and dry bases at the histological scale aptitudes of one-pot production of particles in the size ranges of fine-ultrafine (micron) and enhancement of sugar recovery. Here we show how the results of co-milling forest residues with alkali metal hydroxides and carbonate bases support our hypothesis. For example, particle size analyzer and Pyrolysis-gas chromatography/mass spectroscopy provide a clear view about effect of sodium hydroxide, potassium hydroxide, sodium carbonate, and potassium carbonate on samples, reducing both particle size and overall milling time, and at a specific base concentration and time interval, significant changes in the structure due to the selective breakage of lignin structure. Using ion chromatography, we will present evidence that this method is capable of enhancing sugar recovery, significantly.

Poster # 175

Roots, Vocab, and Recall: The Effects of Word Roots and Order Received in Learning Vocabulary

Presented by: Stephanie Johnstone

Mentor: Lee Daffin **Campus:** Global

Major: Psychology

Category: Social Sciences

The purpose of this experiment is to determine whether root words and the order information is received aids in learning vocabulary. Ten, lesser known, words with Greek or Latin roots were used in two experimental groups and one control group. Each group had the word, a sample sentence, and definition. The experimental groups also contained root words, the order of information changed between the groups. In one the roots preceded the full words and the other they followed. The participants were 400+ undergraduate students, they were split randomly and equally by the survey website. The read the words and assisting information three times, answered some demographic questions and then answered three to four sets of questions about the words and their meanings, that were meant to test their ability to recall. *(Results to come.)* This could aid instructors in teaching vocabulary, math, or any other information that can be broken down, should the order received hold any significance.

Poster # 176

Applying Efficient Glucose Oxidase to Facilitate Direct Electron Transfer in Biofuel Cells

Presented by: Stephen Bone

Mentor: Su Ha **Campus:** Pullman

Major: Bioengineering

Category: Engineering and Physical Sciences

Co-author: Su Ha

Enzymatic biofuel cells can use blood sugar to power implantable biological devices. Enzymatic biofuel cells are too large to be efficiently implemented into the human body. Increasing the efficiency of electron transfer from the enzymes to the electron acceptor will reduce the size of the biofuel cell. Glucose oxidase (GOx) from *Penicillium amagasakiense* (PA) can be produced in *Escherichia coli* in a non-glycosylated form (nPA GOx), which has shown potential for direct electron transfer when used in a biofuel cell, due to the decreased distance between the cofactor and the electron acceptor. Direct electron transfer is essential to an efficient biofuel cell because it increases electron transfer efficiency. A study has shown that chemical deglycosylation of GOx (dGOx) reduces its size enough to allow for direct electron transfer between the enzyme and the electrode. nPA GOx has greater activity than dGOx which could produce a more efficient biofuel cell when applied to the same system. Initial tests showed direct electron transfer between the enzyme cofactor and the electrode in the absence of glucose. In the presence of glucose there was no increase in current, indicating that the enzymes breaking down glucose were not directly transferring electrons to the electrode. To facilitate direct electron transfer, the enzyme purification and biofuel cell conditions were adjusted. The enzyme sample was filtered using multiple methods to isolate and purify the enzyme. The biofuel cell conditions were adjusted by changing the enzyme application methods and solution composition. The testing showed that the enzyme sample was not pure and had free cofactor which was interacting with the electrode.