PROCEEDINGS

OF THE

OREGON ACADEMY OF SCIENCE

JOINT MEETING WITH SIGMA XI COLUMBIA-WILLAMETTE CHAPTER

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JOINT MEETING WITH SIGMA XI COLUMBIA-WILLAMETTE CHAPTER

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THE OREGON ACADEMY OF SCIENCE

Keynote Address

Green Chemistry: Phosphorus Recovery from Degradation of Pesticide & Herbicide Neurotoxins

Louis Kuo
Lewis & Clark College
Professor of Chemistry

We are pleased to announce our plenary speaker is Dr. Louis Kuo, Professor of Chemistry at Lewis & Clark College and winner of the OAS Outstanding Oregon Scientist (2019).

Louis has established research programs in both the field of organometallic chemistry and of bioorganic chemistry. In the field of environmental toxin remediation, Louis's group primarily studies the application of transition metal complexes in the treatment of phosphorus- and sulfur-containing toxins in contaminated water. Louis's mechanistic work on the hydrolysis of organophosphates with metallocenes has been called foundational to the field by other preeminent researchers in that area. His research group also investigates the relationship between metal ions and RNA enzymes. Louis has received steady funding from the National Science Foundation, the Petroleum Research Fund of the ACS, the Research Corporation and the Medical Research Foundation of Oregon. His independent career has produced two patents and 20 papers featuring undergraduate co-authors. Louis is known as an outstanding mentor to undergraduates at Lewis & Clark both in the classroom and the research lab.

OREGON ACADEMY OF SCIENCE
LIFETIME ACHIEVEMENT AWARD

The OAS Lifetime Achievement Award is designed to recognize a retired or Emeritus Oregon Scientist who has made significant transformative contributions to a field of science while performing work at an Oregon university, state agency, or company.

Awardees

2019 Charles Kimmel

OUTSTANDING OREGON SCIENTIST AWARD

The Oregon Academy of Science's Outstanding Oregon Scientist Award is bestowed in recognition of significant research contributions to the natural, physical, or social sciences, notable reputation in science education, and meaningful applications of science research. Recipients of this award must have been Oregon residents during the time they made the distinguished contributions for which they are recognized.

2020 Outstanding Oregon Scientist Award

Bradley J. Cardinal

Bradley J. Cardinal is a Professor of Kinesiology at Oregon State University and has worked there since 1997. Bradley also serves as Director of the OSU Graduate Program in Sport and Exercise Psychology and holds an Affiliate appointment in the School of Psychological Science. Outside of OSU, Bradley currently serves as the Past-President and Executive Committee member of the National Academy of Kinesiology and serves the U.S. Department of Health and Human Services as Chair of the President's Council on Sports, Fitness, and Nutrition Science Board. Bradley's scholarly work focuses on physical activity education across the lifespan in an attempt to understand why people do or do not engage in physical activity and other positive health-related behaviors. His original research has appeared in over 200 peer-reviewed articles during his 29+ year career. Bradley has received numerous awards and recognitions in the U.S. and abroad for his career's work, including most recently being elected a Fellow in the American Psychological Association. Finally, for his research and teaching activities, Bradley has received the OSU Alumni Association Distinguished Professor Award and the Elizabeth P. Ritchie Distinguished Professor Award.

Awardees
2020 Bradley Cardinal
2019 Louis Kuo
2018 Niles E. Lehman
2017 Marshall Gannett
2016 Mas Subramanian
2015 Vincent T. Remcho
2014 Scott F. Burns

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2008 Andrew Fountain
2007 Richard Ellis
2006 David C. Johnson, James D. White
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1998 Gertrude Rempfer
1997 William G. Loy
1996 A. Morrie Craig
1995 Michael Posner, Paul Slovik
1994 Jane Lubchenco
1993 Lynwood W. Swanson
1992 Beatrice Epperson
1991 Jack Ward Thomas
1990 C. Melvin Aikens
1988 Lewis Schaad
1987 Linus Pauling
1986 Paul Lutus
1984 Arthur J. Boucot
1983 Carl E. Bond
1982 Howard Vollum
1981 Ernst Dornfield
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1977 Robert Coleman
1976 Harold Enlows, Paul Elliker, Paul Weswig
1975 John Allen, Ralph Badgley, Ewart Baldwin, Winthrop Dolan, William Rockie, Howel Williams
1974 Larae Dennis, Joel Hedgpeth, Thomas P. Thayer, Norman S. Wagner, Aaron C. Waters
1973 George Birrel, Harold J. Evans, Anton Postl, Lloyd W. Staples
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1971 Andrew Moursund, Loren McKinley, Homer G. Barnett, Stephen Shelton
1970 James J. Brady, Bert Christensen, E. Ebbinghausen, Ralph W. Macy, Cecil R. Monk, Leo F. Simon
1969 Ira S Allison, Frank M. Beer, A.A. Groening, James A. McNab
1963 E. A. Gilillan
1962 Joe Chamberlain, F. Gilchrist, Earl Gilbert, Arthur F. Scott, Edward S. West
1959 Walter Dyke, Henry P. Hansen, Alex Walker

1958 Phil F. Brogan, Vernon Cheldelin, Samuel L. Diack
1957 Luther S. Cressman, Leo Isaac, Adolph Kunz, E.E. Osgood
1956 Edwin T. Hodge, Ralph R. Huestis, E.J. Krause, J.P. Mehlig, Harry B. Yocum
1955 W.J. Kroll, F.W. Libbey, W.E. Milne
1954 Leo Friedman, Alonso W. Hancock, Willibald Weniger
1953 W.P. Boynton, Olaf Larsell, Rosalind Wulzen
1952 Helen M. Gilkey, L.E. Griffin, Ethel I. Sanborn
1951 Stanley W. Jewett, Morton E. Peck, J. Hugh Pruett
1950 A.A. Knowlton, Thornton Munger, Warren D. Smith
1949 F.L. Griffin, A.R. Moore, Earl L. Packard

OUTSTANDING EDUCATOR AWARDS

The Oregon Academy of Science's Outstanding Educator Awards are for Oregon educators with demonstrated records of excellence in teaching in any of the subject areas represented by the Academy. Recipients of the award must have been Oregon residents during the time they made the distinguished contributions for which they are recognized. Past recipients of the Outstanding Educator Award are listed below.

Outstanding Educator Awards – Higher Education

Awardees

2019 Todd Duncan & Stephanie Salomone
2018 Jacquie Van Hoomissen
2017 Richard L. Nafshun
2016 Corinne Manogue & Tevian Dray
2015 David Foster
2014 Angela Hoffman
2013 Robert T Butler
2011 Lauren Roscoe, Jim Hartman
2010 Charles (Kip) Ault, Jean Ames
2009 Charles Kunert
2008 April Ann Fong
2007 Tamina Toray
2003 Kenneth M. Doxsee

Outstanding Educator Awards – K-12

Awardees

2019 Sarah Hocken & Kathleen Thomas
2018 Cara Benfield, Adam Kirsch, Shari Read
2017 W. Jason Niedermeyer
2016 Bradford Hill
2015 Stuart Perlmeter
2014 Kerry Morton

2013 Kathryn McDermott
2011 Lauren Roscoe, Jim Hartman
2010 Jean Eames
2009 Michael Geisen
2008 Terry Tucker
2007 Daniel Jamsa
2006 Peter Langley
2003 Ralph Schubothe
2002 David Damcke
2001 Patty Toccalino, Kathleen Wick, & Samual L. Diack
2000 Becky A. Houck & Richard Dunca
1999 Dwight Kimberly & Bill Lamb
1998 Rose Hemphill, Joel Kuyper & Diane Neslon
1997 Mary Omberg & Terry Favero
1996 Edith Anderson & Pamela Lopez
1995 Ford Morishita
1994 Roy Chambers, Andrea Hylsop, Elizabeth Nirschel, & Jan Heaton
1993 Stephen Boyarsky
1992 Bea Epperson

OREGON ACADEMY OF SCIENCE
BIOLOGY

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ORAL PRESENTATIONS

Characterizing gliosis in a short stroke model

Hannah Bartlett[1], Anusha Mishra[2] / [1]Department of Biology, George Fox University, Newberg, OR 97132; [2]Department of Neurology and Knight Cardiovascular Institute, Oregon Health & Sciences University, Portland, OR 97239.

Astrocytes are a key component in mediating the neurovascular coupling (NVC) of the neurovascular unit (NVU) in the brain. Brain injury and disease can induce an inflammatory response that includes astrogliosis, which in severe cases can cause continued damage. Historically, 60-minute transient middle cerebral artery occlusions (tMCAO) have been used in rats and mice to study the inflammatory response in post-stroke brains; however, tMCAO creates an unrealistically large infarct inconsistent with infarct-size in human post-stroke brains. Accordingly, the objective of this study was to develop a more authentic stroke model, with which astrocyte response to injury could be studied more accurately. Rats were given a 30-minute middle cerebral artery occlusion (MCAO), and their brains were harvested one day later. Immunohistochemistry (IHC) staining with Iba1, GFAP, and vimentin were used to examine the resulting astrogliosis and microgliosis. Analysis revealed the infarct region to be confined to the striatum. This covers a much smaller region than the 60-minute model, and thus lends a more realistic stroke model. IHC staining revealed that the 30-minute model generated microgliosis solely in the striatum, while astrogliosis was induced in both the striatum and cortex. In previous experiments, astrogliosis and microgliosis were observed concurrently, as it was not known that they could be disaffiliated. This research opens the possibility of new research using the 30-minute stroke model to study the effects of astrogliosis isolated from microgliosis in post-stroke brains, thereby leading to a greater understanding of its specific role in the process.

Investigating the redox sensitivity of MITF-m

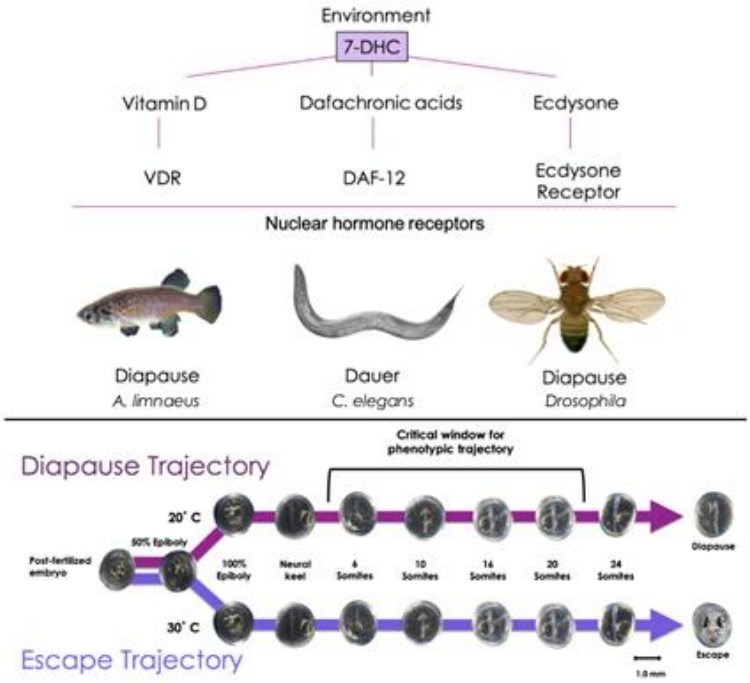
Rachel Berryman[1], Chelsey Kline[2], Sancy Leachman[2], Pamela Cassidy[2] / [1]Biology Department, Linfield University, McMinnville, OR. [2]Dermatology Department, Oregon Health & Sciences University, Portland, OR, 97239.

The Melanocyte-specific Microphthalmia associated transcription factor (MITF-m) serves as a master regulator in the differentiation and proliferation of melanocytes. Two splice variants of MITF-m have been identified, differing only by a sequence of 18 base pairs. These protein variants have been observed at various levels of expression in metastatic melanomas however the mechanisms regulating variant expression are currently unknown. Previous research by the Leachman/Cassidy lab indicates that MITF-m is susceptible to reversible redox modification, as well as reduced function following inhibition of the antioxidant thioredoxin reductase 1. These observations have led us to hypothesize that the redox sensitivity of MITF-m may be crucial to the function of this protein. Given that these splice variants of MITF-m differ by one cysteine residue, they may be differentially sensitive to redox conditions in the cell, contributing to altered expression levels and subsequent function in melanomas. Consequently, the objective of this research is to compare the redox sensitivity of the MITF-m variants and identify associated binding partners, in order to elucidate the regulation and comparative roles of these protein variants in normal melanocytes and melanomas.

Vitamin D Pathway Influences Developmental Trajectory in Annual Killifish Embryos

Erin M Davis[1] and Jason E Podrabsky[1] / [1]Department of Biology, Portland State University, Portland, OR 97207.

Deciphering the mechanisms by which organisms sense and react to environmental cues is an essential part of understanding embryonic development where stress can have both detrimental and adaptive effects. Embryos of the annual killifish, *Austrofundulus limnaeus*, enter a state of diapause to endure extreme conditions typical of their environment. Entrance into and escape from diapause are regulated by vitamin D_3 signaling in a temperature-dependent manner. This pathway is homologous to DAF-12 signaling in *C. elegans* and ecdysone signaling in *Drosophila*, both of which regulate metabolic dormancy through conversion of a common precursor molecule, 7-dehydrocholesterol. Here we describe the effect of vitamin D_3 metabolites and inhibitors of heat shock proteins (HSPs) on the exit of embryos from diapause. Active vitamin D_3 induces development in diapausing embryos. Inhibitors of HSP90 block the action of vitamin D_3 in activating development, while inhibitors of HSP70 accelerate the process. We also present bisulfite sequencing data that suggests changes in DNA methylation may underly the effect of vitamin D_3 on release of embryos from diapause. Further, through parallel exposures with zebrafish embryos, this project explores the potential role of vitamin D signaling as a conserved mechanism among fishes to regulate developmental progression and integrate environmental cues into major life history decisions. Future study may provide evidence for this pathway as an evolutionarily ancient mechanism for sensing and responding to environmental changes in vertebrates.



Effects of Plasminogen on Macrophage Immune Function

Kelsie Davis[1], Sara Rosario[2], Paige Bergstrom[2], Paul Mueller[2], Nathalie Pamir[2] / [1]Department of Biology, University of Portland, Portland, OR, [2]Knight Cardiovascular Institute. Oregon Health & Science University, Portland OR.

Foam cell formation, an inflammatory and atherogenic process, starts with uptake of excess low-density lipoproteins (LDL) by macrophages at the artery wall. High density lipoprotein (HDL) and plasminogen (PLG) can limit lipid laden macrophage formation by promoting cholesterol efflux through ATP-binding cassette subfamily A member 1 (ABCA1). Macrophage cholesterol regulation is linked to the inflammatory response which in turn can participate in atherogenesis. Thus, we investigated the impact of plasminogen -ABCA1 interaction on macrophage immune response. Our central hypothesis is that PLG interacts with ABCA1 to modulate the expression of inflammatory cytokines in macrophages. We differentiated THP1 macrophages to either a pro-inflammatory state (M1) with interferon gamma (50ng/mL) and LPS (100ng/mL) or an anti-inflammatory state (M2) using Interleukin 4 (25ng/mL), stimulated ABCA1 expression with an LXR agonist, and treated cells with either PLG or HDL. While HDL treatment had no significant impact, plasminogen treatment decreased the gene expression of Interleukin 10 (IL10) 54.6%, Interleukin 1β (IL1β) 51.1%, Tumor Necrosis Factor α (TNFα) 35.8%, and Toll like Receptor 4 (TLR4) 46.4% ($P<0.05$) strictly in M1 macrophages. These results suggest that plasminogen through ABCA1 reduces inflammatory gene expression in proinflammatory macrophages. In plaque macrophages, the plasminogen-ABCA1 axis might provide atheroprotective qualities by reducing inflammation.

Differential gene expression in right versus left liver lobes

Ruben Estrada and Elizabeth DuPriest / Division of Natural Sciences and Health, Warner Pacific University, Portland, OR 97215.

Differential gene expressions in the right vs. left liver lobes could be a powerful tool to analyze and differentiate specific liver lobe functions, which differ due to unequal blood distribution during fetal development. The objective of this study was to assess PPP2CA and HMGCS1B gene expression in the left versus right liver lobes of juvenile pigs exposed to maternal low protein diet (exacerbates lobe blood flow differences in utero) compared to a normal maternal diet. RNA was isolated from left or right liver lobe from 3-5-mo-old microswine offspring and reverse transcribed. Resulting cDNA was amplified by PCR after determining optimal cycle number to show differential expression. PCR products were run on 2% agarose gel and the bands were analyzed using FIJI image analysis software. The results show no significant difference between PPP2CA gene expression of matched left versus right liver lobes, though there seems to be a trend of higher PPP2CA gene expression in the left lobe compared to right lobe. The results also reveal that offspring of mothers fed a low protein diet had significantly higher hepatic PPP2CA mRNA levels than offspring of mothers fed a normal protein diet. Results for HMGCS1B are still pending. In conclusion, there was significantly higher PPP2CA gene expression in maternal low protein diet compared to normal protein diet, but we have not yet shown differential PPP2CA gene expression based on liver lobes; additional studies with more samples will clarify the answer.

Environmental factors affecting growth and cardenolide production in native milkweed species

Courtney M. Gima, M. Wallace, M. Mealy, S. She, L. Dizney / Biology Department, University of Portland, Portland, OR 97203.

The Western monarch butterfly population has drastically decreased over the last three decades, declining from 4.5 million in the 1980s to 28,429 in 2019, a 99.4% reduction. A significant reason for their population decline is due to the lack of native milkweed upon which monarchs are entirely dependent during the egg and caterpillar stages. Monarchs, unlike most other insects, are able to tolerate the toxin milkweed produces, known as cardenolide. In fact, monarchs sequester the cardenolide in their tissue, making them unpalatable to many predators during the caterpillar and adult stages. Few studies have been conducted on the two species of milkweed native to the Willamette Valley, showy (*Asclepias speciosa*), and narrow-leaf (*Asclepias fascicularis*), and none have been conducted in the Willamette Valley. We set out to examine how milkweed growth parameters and cardenolide production are affected by two environmental factors: shade and biodiversity. Historically, milkweed were found mostly in sunny areas but their tolerance to shade is unknown. Research suggests that increased biodiversity may increase productivity in plant species. We therefore predicted that milkweed would grow best with full sun and in areas with other native plant species. Furthermore, we predicted that full sun and native companion plants would affect cardenolide production.

Into the understory: Can forest canopies protect seedlings from drought-induced mortality?

Joanna Gunther[1] and Paige E. Copenhaver-Parry[1]/ [1]Department of Biology, George Fox University, Newberg, OR 97132.

Broad-scale forest mortality has been observed over the past decade in association with increased climate change-induced drought, particularly in western U.S. forests. While predictions generally indicate continued increases in regional forest mortality, forest vulnerability to drought will likely vary with species composition, forest structure, and variation in local demography. In particular, establishment and survival of seedlings—processes necessary for long-term forest persistence—will likely be key determinants of the effects of drought on forests. Seedling vulnerability to drought may be attenuated by the buffered below-canopy microclimate created by dense forest canopies. This study evaluated whether forest canopies can attenuate drought-induced seedling mortality in western Oregon forests by quantifying seedling survival rates over an extreme drought year in relation to canopy cover, understory vegetation cover, and seedling age. Seedling survival was monitored across a network of five long-term monitoring plots spanning a large climatic gradient extending from the Oregon coast to the eastern slope of the Cascade Range. A hierarchical Bayesian binomial regression model was constructed to quantify the relationship between seedling survival and canopy cover, understory vegetation cover, and seedling age. The models revealed no significant relationship between canopy cover and seedling survival, yet the observed survival rates were inconsistent with a direct drought impact. Western hemlock—a drought-intolerant species—showed relatively low mortality (40%) while Douglas-fir mortality was complete (100%), likely due to limited light availability to these shade-intolerant seedlings. This suggests that the forest canopy modulates understory conditions in more complex ways than those represented by current models.

Advancing neoepitope predictions through a proteasomal processing algorithm

Ellysia Li[1], Reid Thompson[2], Benjamin Weeder[2] / [1]Department of Biology, Pacific University, Forest Grove, OR, 97116; [2]Department of Computational Biology, Knight Cancer Institute, Oregon Health and Sciences University, Portland, OR 97239.

Increased interest in personalized cancer treatments cancer has heightened the demand for programs to predict cancer markers like neoepitopes: novel peptide sequences the immune system uses to distinguish cancer cells. One method to increase the performance of a neoepitope program is to improve the predictions of its upstream pre-processing events, including proteasomal cleavage. Proteasomal cleavage is the digestion of proteins by a large protein complex known as the proteasome; it is the first step to processing neoepitopes. While some tools for proteasomal cleavage prediction are already available, the current choices are largely outdated and have not seen any major updates in recent years. We thus propose an updated method and model of predicting proteasomal cleavage where, given a specific amino acid and its surrounding sequence context in the parent protein, we can accurately predict whether that position will be cleaved by the proteasome. Our first steps to starting this project were to find and extract the majority of public data on proteasome processing available, taking initiative to develop the new model.

The role of LRP1 and inflammation in macrophage motility

Evangeline Matley[1], Paul Mueller, PhD[2], Sergio Fazio, MD, PhD[2] / [1]Division of Natural Sciences and Health, Warner Pacific University, Portland, OR 97215; [2]Knight Cardiovascular Institute, Oregon Health & Science University, Portland, OR 97239.

Atherosclerosis is the leading cause of death worldwide as it is the underlying disease of many common vascular complications such as myocardial infarction and stroke. Recent studies have demonstrated that plaque regression is possible, though the mechanisms of regression are unknown. Further, previous research suggests that the egress of macrophages via the CCR7 motility pathway is the primary mechanisms of plaque regression and is amplified in inflammatory (M1-like) macrophages in the absence of lipoprotein receptor-related protein 1 (LRP1). The objective of this research is to determine the role of LRP1 on M1-like and anti-inflammatory (M2-like) macrophage motility, as well as determine whether motility is dependent on the CCR7 chemotaxis pathway. Our data appear to show that LRP1(-/-) macrophages have higher motility than wild type; M1-like macrophages appear to show higher motility than naïve (M0) and M2-like macrophages; and the combination of CCR7's ligands CCL19 and 21 seems to increase motility, suggesting activation of CCR7 pathway. Importantly, this data highlights the role of LRP1 on the M1-like phenotype in macrophage motility, as well as the role of CCR7 as a motility pathway. Understanding motility pathway(s) in macrophages can provide insight into how we may approach therapies aimed at accelerating atherosclerotic lesion regression.

Combining small-molecule tyrosine kinase inhibitors to effectively target BCR-ABL1-dependent and independent resistance mechanisms in chronic myeloid leukemia

Noah R. Merz[1,2,4], Anna Reister Schultz[1,2], Christopher A. Eide[1,2,5], Sunil K. Joshi[1,2], Richard D. Press[1,3], Cristina E. Tognon[1,2,4], Brian J. Druker[1,2,4] / [1]Knight Cancer Institute, [2]Division of Hematology Medical Oncology, [3]Department of Pathology, Oregon Health & Science University, Portland, OR 97239; [4]Department of Biochemistry and Molecular Biology, Lewis & Clark College, Portland OR 97219; [5]Howard Hughes Medical Institute, Portland, OR 97239.

Chronic myeloid leukemia is an aggressive myeloproliferative disorder characterized by an overproduction of white blood cells. It is caused by a chromosomal rearrangement between BCR (breakpoint cluster region), and the tyrosine kinase ABL1 (Abelson proto-oncogene 1) resulting in a fusion gene that encodes for the novel oncoprotein BCR-ABL1; a constitutively active tyrosine kinase. BCR-ABL1 is an ideal target for treatment because of its requisite role in driving CML and the fact that it is present in all CML cells but not normal cells. Imatinib is a small-molecule tyrosine kinase inhibitor (TKI) that competitively binds to the ATP-site on BCR-ABL1, significantly reducing the survival of CML cancer cells without harming the normal cells. Although treatment with imatinib has dramatically improved survival rates of CML patients, around 17% of patients develop resistance to the drug within five years. The majority of imatinib resistance is derived from mutations within the tyrosine kinase domain of BCR-ABL1, preventing imatinib from successfully binding. Although this accounts for the majority of imatinib resistance, a number of resistance cases stem from alternative activating mutations of BCR-ABL1 independent pathways. This study involved multi-drug viability assays on cell lines transfected with resistant BCR-ABL1 mutations or activating mutations in an alternative gene NTRK2, previously identified in the Druker lab. This study of both BCR-ABL1-dependent and -independent resistance mechanisms suggests rationally guided TKI combination therapy as a potential approach to address multiple types of resistance in CML.

The role of endolysosomal trafficking in DLX 5/6 interneuron development

Andrew Neumann[1,2], Sarah Santiago[1], Anthony Paul Barnes[1], Jim Smart[2] / [1]Knight Cardiovascular Research Institute, Oregon Health and Science University, Portland, OR 97239; [2]Biology Department, George Fox University, Newberg, OR 97132.

In the mammalian cortex, interneuron migration is a highly orchestrated event, requiring interneurons to properly receive and navigate extracellular signals. Rab GTPases are a family of proteins which play vital roles in cellular trafficking pathways. Disruptions to these proteins have been associated with neurological disorders. Rab7A is a small GTPase which functions in both the autophagic and endolysosomal pathways, acting as a regulator of membrane trafficking and vesicle fusion. We used two Rab7A transgenic mouse lines to study Rab7A loss in developing neural progenitor cells and select populations of interneurons. We found that Rab7A loss in neural progenitor cells perturbs the endolysosomal and autophagic pathways, resulting in gross brain defects such altered interneuron distribution. We further report that Rab7A loss reduces specific cortical interneuron populations as well as increasing other cell populations. Our data suggests that Rab7A plays a role in proper migration of cortical interneuron populations. This work reveals a role for Rab7A in cortical development via cortical interneuron migration.

The spatial fingerprint of climate effects on forest recruitment

Claire Retter and Paige E. Copenhaver-Parry / Department of Biology, George Fox University, Newberg, OR, 97132.

Mismatches between the fine spatial scales at which ecological processes operate and the coarser scales at which climate data are often available are increasingly recognized as a limitation to projections of climate change impacts on species. Recruitment has been implicated as a bottleneck in tree population dynamics, and may be decoupled from coarse-scale climate due to the buffering effect of the forest canopy. The goal of this study was to determine whether seedling recruitment patterns of Douglas-fir and western hemlock are better explained by fine-scale, below-canopy climate than coarse-scale climate. We addressed this objective by utilizing site-level climate data from a network of meteorological stations located in closed-canopy forests extending from the Oregon coast to the crest of the Cascade Range. Biologically-relevant climate variables were evaluated against Daymet data in a series of hierarchical Bayesian Poisson regression models to quantify the relationships between climate and seedling densities. Model performance was compared across models calibrated on below-canopy climate data versus Daymet data. Model fit was high for all climate covariate combinations, yet climate parameters consistently demonstrated non-significant effects on seedling counts, and no s difference was detected between models fitted with site-level or regional climate data. Much of the variance in seedling counts was explained by whether or not seedlings were directly observed in their year of germination. Overall, these results suggest that recruitment dynamics may be largely decoupled from climate. This is consistent with a growing consensus that forest structure and density-dependence may modulate the effects of climate on recruitment.

Glucose-induced obesity increases susceptibility to cataracts via deamidation of lens crystallins

Kayla Sorrick, Emanuel Montanez, Damian Ball, Sarah Comstock / Department of Math and Science, Corban University, Salem, OR, 97317.

A mouse model of sugar-induced obesity (SIO) was used in this study to investigate the roles that obesity and sugar intake play in the development of age-related cataracts. Cataract formation is associated with several different pathways ultimately resulting in the aggregation of lens proteins called crystallins. Crystallins are extensively modified with aging and cataract development and research is still ongoing to determine how these modifications may result in cataracts. We have investigated the role that sugar-induced obesity (SIO) plays in aging of lens proteins by researching protein quality control mechanisms in an obese mouse model. Proteostasis is an inclusive classification that involves mechanisms that work concertedly to maintain the function of proteins within the cell. However, the capacity to recognize damaged proteins declines in aging cells which leads to accumulation of abnormal proteins, resulting in age-related pathologies like cataracts. Our findings indicate that sugar consumption leading to obesity results in an upregulation of lens chaperone proteins and the accumulation of PTMs, specifically deamidation of Asn and Gln residues of lens crystallins.

Sensing malignancy: expanding upon the nematode scent detection test

Morgan Thompson[1], Ally Yoshioka[1], Noemi Sarabia Feria[1,2], Josiah Wagner[2], Suzanne Estes[1] / [1]Biology Department, Portland State University, Portland, OR 97201; [2]Cancer Early Detection Advanced Research Center, Oregon Health & Science University, Portland, OR 97239.

With the growing prevalence of cancer worldwide, research has increasingly focused on methods of early detection to improve health outcomes for affected individuals. Toward development of a highly reliable yet cost-effective system, Hirotsu et al. (2015), developed the "Nematode Scent Detection Test" (NSDT), which utilizes the attraction of *Caenorhabditis elegans* nematodes to various tissue samples from cancer patients to detect multiple types and stages of cancer. However, it is currently unknown which G-protein coupled receptors (GPCRs), and/or ligands interacting with theses receptors, cause this attractive behavior in *C. elegans.* By determining the GPCRs and ligands responsible, we can develop a detection system that no longer requires the use of an animal. To lay the groundwork necessary to achieve these goals, our work sought to: 1) validate and improve the NSDT for samples derived from a wider variety of patient types (e.g., tobacco smokers) and cancer and benign disease types than those tested by Hirotsu; 2) determine whether nematodes' chemotactic response to cancer is strain- or species-specific; and 3) utilize the NSDT to measure *C. elegans'* chemotactic response to candidate compounds. We found that *C. elegans* could reliably distinguish the urine of individuals with liver cancer from that of healthy individuals and those with benign liver disease. I will also present data on *C. elegans'* ability to distinguish healthy from prostate cancer-derived samples, and whether these responses are either strain- or nematode-species specific. These results will inform ongoing work to discover the ligand-GPCR interactions responsible for *C. elegans'* olfactory response.

Transmission patterns of *Wolbachia* bacteria within *Bembidion* beetle hosts.

Woodey Greer, Keri Togami / Department of Biology, Pacific University Oregon, Forest Grove, OR, 97116.

Wolbachia is a highly versatile endosymbiotic bacterium that infects approximately 20-75% of the surveyed insects worldwide, including arthropods and nematodes. Its adaptability stems from the bacterium's ability to hold various symbiotic relationships depending on the *Wolbachia* strain and its host. As a result of its ability to manipulate host populations, *Wolbachia* as well as other bacterial endosymbionts have grown in interest for its potential biocontrol for agricultural pest and disease management. Host-symbiont studies that focus on the evolutionary history of *Wolbachia* within a highly specious host genus may illustrate how the *Wolbachia*-infected mosquito population will evolve over time. Although *Wolbachia* bacteria have been studied in a vast number of arthropods and insects, research on a highly specious genus of Coleoptera has yet to be reported. This study focuses on *Bembidion* beetles, an expansive genus that has thousands of described species and is a potential candidate for both vertical and horizontal modes of *Wolbachia* transmission. The objectives for this study were to 1) determine the infection rate of *Bembidion* beetles, 2) characterize the found *Wolbachia* strains, and 3) predict the most likely modes of transmission. By understanding host-symbiont evolution, we can better predict how *Wolbachia* will affect host populations and also how the bacterium will evolve with its host over time.

pH-driven variability of *Posidonia oceanica* leaf microbiota

Lu Wang[1], Fiona Tomas[2, 3], Ryan S. Mueller[1] / [1]Department of Microbiology, Oregon State University, Corvallis, OR 97330, USA; [2]Department of Fisheries and Wildlife, Oregon State University, Corvallis, OR 97330, USA; [3]Instituto Mediterráno de Estudios Avanzados (CSIC-UIB), Balearic Islands, Spain.

The ocean acts as a sink for anthropogenic carbon emissions, and as a result, significant drops in ocean pH are projected to occur within the next century given the current rate of fossil fuel usage. These changes in ocean chemistry can yield a plethora of ecological consequences for marine macro and microorganisms. Seagrasses are projected to potentially benefit from ocean acidification, as they utilize both CO_2 and HCO_3^- as sources of carbon. Many seagrass species are carbon limited in their current environments, and previous studies on CO_2 enrichment of seagrasses have shown increased growth rate, biomass, and C:N ratio with increased CO_2. As seagrasses and their microbiota are metabolically linked, this increased carbon availability may yield changes in the seagrass microbiome as well. For this study, *Posidonia oceanica* leaves were sampled from acidified and ambient sites off the coast of Ischia, Italy, in which naturally occurring volcanic CO_2 vents acidify surrounding ocean waters. We used 16S rRNA amplicon sequencing and metagenome analysis to investigate potential differences between the acidified and ambient *P. oceanica* leaf microbiota. Preliminary results showed distinct differences in the leaf microbiota based on seawater pH. To gain better resolution of pH-driven community wide microbial differences, we generated representative metagenomes of acidified and ambient sites. We predict functional differences

within the microbiota, particularly in nitrogen metabolism and mineralization, as seagrasses in acidified areas are likely to be nitrogen limited. Additionally, these analyses may reveal adaptive functional differences within these microbes that live on seagrasses across this pH gradient.

POSTER PRESENTATIONS

A01 G The effect of elevated nitrogen on thermal properties of Antarctic mosses

Andrew F. Clements, Todd N. Rosenstiel, and Sarah M. Eppley / Biology Department, Portland State University, Portland, OR 97201

The rapid melting of glaciers along the coastal regions of Western Antarctica due to climate change has allowed pioneer species, such as mosses, to colonize newly exposed terrestrial substrate. The role of mosses in providing insulation and thus stabilizing ground temperature could be critical, as surface ice and snow are lost and the presence of subterranean permafrost containing ancient stored carbon is exposed. However, the effects of the insulation properties of mosses on this changing Antarctic ecosystem have been insufficiently studied. In addition, varying nitrogen levels can affect both moss morphology as well as the species diversity of their canopy ecosystem. A better understanding of the relationship between nitrogen levels and interspecies moss functional morphology could serve as a predictor of community ecology under continued warming conditions and, in turn, their potential for soil insulation. We measured the water holding capacity, drying rate, and thermal properties of three moss species under high and low soil nitrogen concentrations on King George Island (South Shetland Islands, Antarctica) to determine the effect of mosses on soil moisture and temperature and their potential role in permafrost preservation. Our high and low nitrogen sites were determined by distance from a large penguin colony that produces abundant guano and increased localized nitrogen. We found a significant difference in thermal conductivity and water content both between high and low nitrogen levels and among species, indicating moss morphology can significantly affect insulation ability in these Antarctic mosses.

A02 G Culturable fungal endophyte communities of primary successional plants on Mount St. Helens, WA, USA

Emily Wolfe, Robyn Dove, Cassandra Webster, Jacob Loveless, and Daniel J. Ballhorn / Biology Department, Portland State University, Portland, OR 97201.

While a considerable amount of research has explored plant community composition in primary successional systems, little is known about the microbial communities colonizing pioneer plant species. Fungal endophytes are ubiquitous within plants, and may play major roles in early successional ecosystems. Specifically, endophytes have been shown to affect successional processes, as well as alter host stress tolerance and litter decomposition dynamics—both of which are important components in harsh environments where soil organic matter is still scarce. In order to determine possible contributions of fungal endophytes to plant colonization patterns, we surveyed six of the most common woody species on the Pumice Plain of Mount St. Helens (WA, USA)—a model primary successional ecosystem—and found low frequencies of isolation (<15%), low species richness, and low diversity. However, while diversity did differ among woody species, we found no evidence of temporal shifts in community composition.

A03 U An "omics" approach to understanding the cost of volatile communication in moss

Danylyn Brennan[1], Leslie Kollar[2], Stuart McDaniel[2], Todd Rosenstiel[1] / [1]Department of Biology, Portland State University, Portland, OR 97201; [2]Department of Biology, University of Florida, Gainesville, FL 32611.

Across the tree of life, males and females differ in their reproductive strategies. Due to these differences, males and females have different trait optima where a trait that is beneficial in one sex is not always beneficial in the opposite sex. One experimentally extractable trait that highly influences reproductive success in mosses is volatile emissions and its interaction with micro-arthropods. Research has shown that females may emit a greater variety and abundance of volatile organic compounds (VOCs) than male plants. The female emissions are attractive to sperm-dispersing micro-arthropods and beneficial as the presence of micro-arthropods increases the number of fertilization events. We hypothesize that VOC emissions are costly in males while beneficial in females. There are many hypotheses suggesting resolutions for this genetic conflict. Current research suggests a strong selection for female VOC production. Here, we are taking a multi- “omics” approach to see if candidate genes associated with VOC production, and potentially under genetic conflict, are located on

sex chromosomes or under sex-biased gene expression, both of which could resolve genetic conflict. We are developing a new pipeline for pairing gas chromatography-mass spectrometry (GC-MS) with RNA sequencing. Here we present the first results from this effort, focused on cartridge-based sampling, and will describe ongoing efforts to develop this new multi-omic pipeline for metabolic analyses.

A04 U Reproductive biology of *Clerodendrum trichotomum*, a nonnative ornamental shrub in Portland, OR

Madison Thibado, Alex Temple, Katherine Klassen, Alice Goldin, Hime Worku, Diana Salgado Huicochea, David Taylor / Biology Department, University of Portland, Portland, OR 97203.

Plants requiring biotic pollination depend on pollen transfer between anthers and stigmas by floral visitors such as bees, moths, and birds, often occurring both during the day and at night. A study conducted by Sakamoto et al. in 2012 measured the effectiveness of diurnal and nocturnal pollinators on *Clerodendrum trichotomum*'s reproductive success in Japan, where *C. trichotomum* is a large native shrub. In our study, two individuals of *C. trichotomum* found at the University of Portland campus, where they are nonnative ornamental landscape plants, were used to replicate the Japanese research through experiments of diurnal, nocturnal, and complete pollinator exclusion as well as flower emasculation. Thus, we were able to analyze how both Portland-native pollinators as well as the introduced *Apis mellifera* interact with a nonnative ornamental species. From this, it was revealed the Portland population of *C. trichotomum* experienced successful fruit production, most often facilitated by *A. mellifera* during the day. However, pollinator-excluded inflorescences as well as emasculated flowers did not set fruit. We hypothesized that the fruit set results are due to chemical deterrents released by disturbed leaves in exclusion bags.

A05 U Cardenolide content in native Oregon milkweed under various environmental conditions

Maddie Wallace, Morgan Mealy, Sabrina She, Courtney Gima, and Laurie Dizney / Department of Biology, University of Portland, Portland, OR 97203.

The caterpillar stage of the imperiled Western Monarch (*Danaus plexippus plexippus*) feeds exclusively on milkweed (*Asclepias* spp.) in spite of the plants' ability to produce a defensive toxin called cardenolide. Monarchs not only tolerate this toxin, but ultimately sequester the cardenolides in their tissues, making the caterpillar and butterfly stages unpalatable to most predators. However, research suggests that monarchs prefer milkweed with lower concentrations of cardenolides, potentially due to the high cost of metabolizing high concentrations of toxins. Cardenolide content in milkweed can vary between plants and species, but little is known about which environmental factors affect cardenolide production and how cardenolide production affects plant growth. In this study, we explored the effects of four different environmental conditions on cardenolide content and growth in two species of milkweed native to Oregon, *A. speciosa* and *A. fascicularis*. We hypothesized there would be a tradeoff between cardenolide content and growth, with higher cardenolide content leading to decreased growth, and that this relationship would vary under the different environmental conditions.

A06 U Demographic filters on recruitment vary by species in western Oregon conifer forests

Carmen E. Hixson & Paige E. Copenhaver-Parry. Department of Biology, George Fox University, Newberg, OR, 97132.

Understanding the demographic filters – seed production, dispersal, germination, and establishment – that underlie spatiotemporal variation in forest recruitment is necessary to accurately anticipate the effects of environmental change on forest demography, population dynamics, and species range dynamics, as early life history stages are more sensitive to change than adult individuals. The transitions extending from seed production to germination are poorly understood and quantified components of recruitment owing to the difficulty of counting and tracking seeds in dense, closed-canopy forests, yet can have a substantial impact on seedling abundance. To better understand these transitions in two abundant western tree species – western hemlock and Douglas-fir – we quantified the correlation between seed abundance and adult neighborhood basal area or seedling abundance over one year of seed production in four forested stands extending across a large climatic gradient in western Oregon. In western hemlock, seed availability was more strongly correlated with large neighborhood basal area than with germinant counts, indicating that germination is likely a key limitation. In Douglas-fir, seed availability was more strongly correlated with germinant counts than with neighborhood basal area, indicating that seed production is likely a key filter. Differences in recruitment filters between species likely reflect a high sensitivity of western hemlock germination to microsite suitability – which may be strongly tied to light availability for this shade-tolerant species – and limited seed rain in Douglas-fir due to the tall stature and thick canopy of adult Douglas-fir in these mature stands, but a long-term seed data set is needed to confirm these trends.

B01 G Parasites of stranded pinnipeds from Northern Oregon and Southern Washington

Cecily D. Bronson, Dalin N. D'Alessandro, Deborah A. Duffield / Biology Department, Portland State University, Portland, OR 97201.

Dr. Duffield in the Department of Biology at Portland State University coordinates the Northern Oregon/Southern Washington Marine Mammal Stranding Program (NOSWSP). The objective of NOSWSP is to determine the cause of death of marine mammals that strand on the coast between Long Beach, Washington and Tillamook, Oregon and to document any suspected human interactions (i.e. boat strikes, bullet wounds, fisheries interactions, etc.). The aim of this work is to use the extensive necropsy database from NOSWSP to assess the prevalence of parasites found in four species of marine mammals in the suborder Pinnipedia—California sea lions (*Zalophus californianus*), Steller sea lions (*Eumetopias jubatus*), harbor seals (*Phoca vitulina*), Northern elephant seals, and (*Mirounga angustirostris*) —and how the diversity of parasite species and severity of parasite infections relate to host health. Discussed here is the process of collecting and identifying parasites from major host organ systems with a specific focus on the gastrointestinal tract. Early findings show that there is a wide variety of parasites that infect the Pinnipeds off the coast of Northern Oregon and Southern Washington including: liver flukes, stomach nematodes, heartworms, lungworms, and thorny-headed worms.

B02 G GABA daba doo, anoxia got nothing on you: GABA metabolism plays a critical role in survival of killifish embryos

Daniel E. Zajic, Jason E. Podrabsky / Biology Department, Portland State University, Portland, OR 97201.

In most vertebrates, brief lapses in oxygen availability can cause irreparable damages to vital organs, such as the brain and heart. However, there are some vertebrates that can survive periods of no oxygen (anoxia). Organisms survive anoxia by profoundly depressing their metabolism and relying on anaerobic metabolism. The annual killifish (*Austrofundulus limnaeus*) survives in ephemeral ponds in the coastal deserts of Venezuela and their embryos have the remarkable ability to tolerate anoxia for months. While most vertebrates rely on lactate as a main end-product during anaerobic metabolism, the unmatched anoxia tolerance of *A. limnaeus* embryos led us to determine if there are possibilities outside of lactate. When exposed to anoxia, embryos of *A. limnaeus* respond by producing significant amounts of γ-aminobutyric acid (GABA) and lactate. This study aims to understand the role of GABA and lactate in supporting the metabolic response to anoxia. To explore this, we investigated four developmentally distinct stages of *A. limnaeus* embryos that vary in their anoxia tolerance. We measured GABA and lactate concentrations across development in response to anoxia. We then inhibited enzymes responsible for the production and degradation of GABA and observed GABA and lactate concentrations, as well as embryo mortality. Here, we show for the first time that GABA metabolism affects anoxia tolerance in *A. limnaeus* embryos. Understanding the molecular mechanisms that allow organisms to survive without oxygen will allow us to understand why anoxia-sensitive organisms are unable to survive and perhaps lead to medical applications.

B03 U Species identification and gene comparison of twenty-nine unknown killifish species samples

Meranda M. Corona, Malcolm M. Peavy, Jason E. Podrabsky / Biology Department, Portland State University, Portland, OR 97201.

Abundant and diverse in Africa and South America, many species of killifish survive the environmental stress of their ephemeral ponds by entering embryonic diapause, an extreme state of dormancy. Diapause allows permanent populations to persist in anoxic water and through total dehydration. However, previous research has shown that many species share common ancestors that lack a diapause stage in their life cycles and have close relatives without the ability to enter diapause. To study how diapause has independently evolved in multiple killifish species, twenty-nine individual killifish samples with unconfirmed identities were collected in the field. To confirm the samples' identities so that the specimens may be used in a comparative study of genes potentially involved in diapause, universal fish primers and designed degenerate primers were used in conjunction and separately in the DNA barcoding of the cytochrome oxidase I (COI) gene for each sample. A comparison was done between the unknown sample COI sequences and species with entries in Genbank. A phylogenetic tree was created to discern the relationship between the sequenced genes and their closest matches. Nine species identities have thus far been confirmed. Future experiments can now use these samples confidently. Used in the context of the phylogenetic relationship between species, the presence of diapause genes or lack thereof in these samples can lead to insights on the convergent evolution of diapause and a better understanding of this novel developmental mechanism.

B04 U Life is hard: quantifying the correlations between biodiversity and geology on the Oregon Coast

Adam Ketchum, Crystal Toogood, Tara Prestholdt, Kristin Sweeney / Biology Department, University of Portland, Portland, OR 97203.

The shore platforms and rocky pools of the Oregon coast are critical foundations of coastal communities and intertidal habitats. These critical features have been well studied on their susceptibility to ongoing erosion from the incoming waves and abrasion from sediment; however, little is known on how biotic agents play a role. In Oregon, facilitative bioerosion is one of several processes mediating geomorphic alteration of rock surfaces, contributing to the production of landforms and/or reducing the resisting force of the rock (Naylor et al.). We aim to correlate rock roughness and microscale erosion through measuring the biodiversity and local topography of shore platforms along the Oregon coast. Preliminary results indicated no strong correlation between rock roughness and the local biota. However results indicates that the biodiversity of sites could be due to the shore platform's orientation to the ocean and incoming waves.

B05 U The effectiveness of using night cameras to capture biodiversity in the Serengeti

Adam Ketchum, Marissa DeVogelaere / Biology Department, University of Portland, Portland, OR, 97203.

Motion-activated cameras are becoming a popular and unobtrusive way to study wildlife populations. However, almost all of this research has focused on diurnal animals and little is known about how effective cameras can be at capturing the biodiversity of nocturnal animals. Over the course of 7 evenings our 2 cameras detected 8 of the 18 common nocturnal species in the Serengeti. These preliminary results suggest night cameras could be an effective way to document if and how nocturnal animals are being affected by ecotourism.

B06 U Effects of habitat quality on the health of small mammals

Shreya Kumar, Laurie Dizney / Biology Department, University of Portland, Portland, OR 97203.

Human activity has degraded most ecosystems to at least some degree. When degradation is severe enough, many wildlife species can no longer live in their native habitat. Even for those species that can persist in degraded environments, the lower quality habitat likely has adverse effects. Most of the limited research examining the effects of habitat quality on wildlife has examined ecological factors, such as an increase in non-native species, competition, and aggression. However, low-quality habitats may also negatively affect physiological factors, such as increasing chronic stress. In humans, increased long-term stress has been shown to adversely affect other physiological functions, including suppressing immune function. This study examined the effects of habitat quality on the physiology of small mammals, specifically deer mice (*Peromyscus maniculatus*), at Tualatin River National Wildlife Refuge (TRNWR). Historically, TRNWR lands were riparian forest but most were converted to non-native pasture grass. In 2008, TRNWR began restoring some of these lands. We used three levels of habitat quality to test our hypotheses that: 1) lower quality habitats would be associated with higher stress levels in deer mice compared to higher quality habitats, and 2) higher stress levels would decrease immune function. Chronic stress was evaluated through hair corticosterone analysis and immune function was assessed with total IgG assays. We found strong support for habitat quality affecting chronic stress, and marginal support for stress affecting immune function. Implications for restoration and human health are discussed.

B07 U Impact of *Pyrosoma atlanticum* on the microbial loop: results from flow cytometry and 16S rRNA gene sequencing

Carey Sweeney[1], Beatrice Pickett[1], Kelly Sutherland[2], Anne Thompson[1] / [1]Biology Department, Portland State University, Portland, OR 97201. [2]Department of Biology, University of Oregon, Eugene, OR 97403.

Phytoplankton plays a critical role in ocean carbon cycling, which means its role in the marine food web provides important information on global carbon cycling. Pyrosomes are colonial pelagic tunicates that can occur in large blooms. Recent work has shown that some pelagic tunicates selectively graze on microbes, but the feeding impact of pyrosomes is not well understood. Recent blooms of *Pyrosoma atlanticum* off the Oregon coast raise questions about the impact they have on the microbial community of this economically and ecologically important area. *P. atlanticum* colonies were sampled from a net tow. Background seawater was collected from Niskin bottles on a CTD rosette coinciding with the pyrosome sampling. Using flow cytometry we identified cyanobacteria and pigmented phytoplankton that had been consumed. Comparisons of

phytoplankton community structure between the background seawater and pyrosome guts may indicate preferential feeding on larger eukaryotic phytoplankton, suggesting selective grazing on the microbial community. Collaborators confirmed these results in a microscopy study of the same pyrosome colonies (Ward, et.al.). Individual pyrosome guts were sequenced using 16S rRNA gene universal primers. Sequencing did not add information on grazing preferences but did reveal a pyrosome-specific microbiome, distinct from surrounding seawater. Together, these results suggest that blooms of pyrosomes can impact the foundation of the food web off the Oregon coast.

B08 U Physiological effects of sucrose, glucose, and fructose consumption in female versus male mice

Tessa Nelson, Brianna Turner, Sarah Comstock / Department of Health Science, Corban University, Salem, OR 97317.

Obesity is a significant health concern associated with the development of conditions such as nonalcoholic fatty liver disease (NAFLD) and diabetes mellitus. Increased incidence of these conditions is often linked to sugar consumption associated with sugar-sweetened beverages. There are many common physiological changes affiliated with increased sugar consumption, but few studies have considered the differences between males and females. We hypothesized that chronic sugar consumption in male and female mice will lead to different physiological effects. Specifically, others have implicated fructose as being most detrimental, however these hypotheses have been made within mostly male models. However, initial pilot studies in our lab, demonstrated that females do not respond in the same way as males to fructose consumption. Due to this, we predicted that males would be more affected by fructose than females. This study investigates physiological differences between the sexes by measuring food and water consumption, overall weight gain, comparison of retroperitoneal white adipose tissue (RWAT), and glucose tolerance testing (GTTs). An obese mouse model using C57Bl/6 male and female mice was developed by providing mice with *ad libitum* access to a 30% sucrose (SUC), glucose (GLU), or fructose (FRT) solution in place of water for 18 weeks in addition to standard mouse chow. Results from this research indicate that there are sex-dependent metabolic differences between male and female mice that lead to different physiological outcomes.

B09 U Pressure and temperature tolerances of embryos and larvae from intertidal and continental shelf sea urchins

Kaylee Wilkinson[1], Matthew Mullins[2], Craig Young[3] / [1]Lane Community College, Eugene, OR 97405; [2]Department of Marine Biology, University of the Virgin Islands, St. Thomas, Virgin Islands 00802; [3]Department of Marine Biology, Oregon Institute of Marine Biology, University of Oregon, Charleston, OR 97420.

Pressure and temperature tolerances of larvae sometimes limit the ability of shallow-water species to invade and colonize deep-sea. The sister species of urchins *Strongylocentrotus purpuratus* (intertidal) and *Strongylocentrotus fragilis* (deep sea) have numerous differences in genotypic expressions that probably adapt them to their respective environments. Details of their adaptive responses have not been studied. Zygotes were fertilized and placed into prepared temperature/pressure vessels for comparisons of their developmental rates over a 72-hour period. *S. fragilis* zygotes were found to tolerate pressures up to 800 atm further than the adult specie's known ranges. As expected *S. fragilis* developed faster than *S. purpuratus* in their normal temperature to pressure combination ranges. Temperature ranges for *S. purpuratus* larvae experienced slower development at temperatures from 5-11.5 °C in the blastula stage and more normal development from 15-17°C reaching the gastrula stage. *S. fragilis* embryos did not blastulate and did not withstand the wide temperature range that *S. purpuratus* showed. At 15°C the majority of *S. fragilis* embryos died off. The physiological tolerances revealed in our experiments met the expectations for species that have adapted to their respective environments. As in *Echinus acutus* in the North Atlantic, an ancestor of *S. fragilis* probably invaded the deep sea from shallow water. The larval tolerances of *S. fragilis* are even greater than those in the adult range, suggesting that this species may continue to invade even greater depths in the future.

B10 U Observation of feeding patterns and parental care behaviors in Purple Martins (*Progne subis*)

Sarah Zalucha, Abby Knott, Katie O'Reilly / Biology Department, University of Portland, Portland, OR 97203.

Purple Martins are currently facing conservation threats related to climate change and migration timing, insecticide use, and habitat loss. In response to natural habitat loss, there has been an increase in man-made housing alternatives, such as gourds and apartment structures. These replace their natural nesting cavities and limit competition with their major dwelling

competitors, European Starlings (*Sturnus vulgaris*). The University of Portland is in the process of developing the Franz River Campus. As part of this process, wood pilings from an abandoned shipyard will be removed. Currently these pilings provide nests for a colony of Purple Martins. To measure the success of the colony, we observed feeding patterns and parental care behaviors between the different sexes and ages. Female Purple Martins feed their chicks in consistent time intervals, regardless of age. In comparison, older male Purple Martins feed their chicks more often than younger males. In addition, we determined the breeding phenology for the River Campus Purple Martins and compared them with regional colonies. To combat the eventual loss of housing for the current Purple Martin colony, artificial gourds have been installed as alternative habitat for the species. Future work will involve establishing a database of regional colonies and comparing reproductive success.

C01 G First molecular characterization and phylogenetic report for two parasitic nematodes: *Trichuris fossor* and *Heligmosomoides thomomyos*

Malorri Hughes, Deborah A. Duffield / Biology Department, Portland State University, Portland, OR 97201.

The parasitic nematodes *Trichuris fossor* and *Heligmosomoides thomomyos* have been described from *Thomomys* (Rodentia: *Geomyidae*) hosts using only morphological features. Due to the high degree of phenotypic plasticity observed in parasites, this study aimed to use molecular data to verify species delineations and also to generate hypotheses for their phylogenies. Studies such as this help properly quantify biodiversity and generate data that can be used to learn about gene flow among parasite populations and, when used in conjuncture with host DNA, shed light on host-parasite associations and processes such as cospeciation and coevolution.

C02 G Effect of SMAC mimetic Birinapant on cytokine production in T cell populations

Ashley Burton[1], Brittany Ligman[1], Susan E. Murray[1,2] / [1]Biology Department, University of Portland, Portland, OR 97203. [2]Department of Molecular Microbiology and Immunology, Oregon Health & Science University, Portland, OR 97239.

SMAC mimetics are emerging within cancer immunotherapy as a promising new field of interest. In some cancer cells, SMAC mimetics antagonize inhibitors of apoptosis proteins (cIAPs), which causes apoptosis. Within immune cells antagonization of cIAPs has been shown to activate the non-canonical NF-κB intracellular pathway which we hypothesize will increase human T cell proliferation and cytokine production. This is an important question, because increased T cell stimulation will overall reinforce the body's natural immune response against cancer. To test this hypothesis, human PBMCs were assessed via flow cytometry for TNFα and IFNγ production post αCD3 and αCD28 costimulation with varying amount of Birinapant. IL-2 production from isolated human T-cells were analyzed via ELISA after costimulation. Our data suggested that Birinapant does not cause significant upregulation of the T cell proliferative cytokine, IL-2, in whole human PBMCs but may upregulate IL-2 in isolated T cells. Birinapant may also cause the downregulation of pro-inflammatory cytokines TNFα and IFNγ in whole human PBMC. Further study will involve performing ELISAs on TNFα and IFNγ to obtain more quantitative data on specific cytokine production.

C03 U Proliferative responses of T cells to SMAC mimetic, Birinapant

Brittany Ligman[1], Ashley Burton[1], Susan E. Murray[1,2] / [1]Biology Department, University of Portland, Portland, OR 97203. [2]Department of Molecular Microbiology and Immunology, Oregon Health & Science University, Portland, OR 97239.

SMAC mimetics, chemotherapy drugs which imitate the natural SMAC molecules produced by the mitochondria, are of high interest to cancer research due to their ability to act as an antagonist to IAP's (inhibitors of apoptosis), thereby inducing apoptosis in cancer cells. We seek to determine whether the role of cIAP 1 and cIAP 2 in preventing the pro-inflammatory non-canonical NF-κB pathway in immune cells is also antagonized by SMAC mimetic drugs. If so, we would predict that SMAC mimetics increase T cell activation as measured by increased proliferation and CD25 expression. In these experiments whole PBMC samples and purified T cells were stimulated with αCD3 and αCD28 and treated with varying concentrations of the SMAC mimetic Birinapant. Proliferation and CD25 expression were analyzed using flow cytometry. While SMAC mimetics were previously demonstrated to increase proliferation in isolated T cells, our experiments have shown they have a negative effect on proliferation of whole PBMC samples. From this, we conclude that SMAC mimetics may have differing effects on the immune response depending on immune cell type. Further research is needed to determine the cause of this discrepancy to further understand the potential role of SMAC mimetics as a form of immunotherapy.

C04 U Genetic analysis of a cell cycle regulatory network in the *C. elegans* germline

Amy Moore, David Wynne / Department of Biology, University of Portland, Portland, OR 97203.

Haspin is a protein kinase required for proper chromosome segregation. We took two complementary approaches to understand the Haspin pathway using genetic analysis of *Caenorhabditis elegans*. This organism has two paralogs of Haspin, *hasp-1* and *hasp-2*, that have nearly identical kinase domains. Our first approach was to investigate the extent to which these two proteins have redundant functions. Previous work had shown that animals with *hasp-1* loss of function have a loss of embryonic viability and a high incidence of male progeny, both phenotypes consistent with defects in chromosome segregation. However, *hasp-2* null mutants produced no observable phenotype. To rule out the possibility that *hasp-2* plays a role in the absence of *hasp-1*, we generated a strain with loss of function mutations in both. Our data show that the double mutant phenotype resembles the phenotype of the *hasp-1* mutant alone, supporting the conclusion that *hasp-2* is not playing a role in the absence of *hasp-1*. Our second approach investigated the phenotype of strains that have point mutations within the kinase domain of *hasp-1*. Preliminary work showed that these strains had embryonic viability defects similar to those caused by *hasp-1* loss of function. The strains harboring these *hasp-1* point mutations were part of a high-throughput mutagenesis that resulted in many other mutated genes possibly responsible for the phenotype. We outcrossed the *hasp-1* gene from these strains and remeasured embryonic viability. Our results show that these *hasp-1* point mutations are not sufficient to cause chromosome segregation defects.

C05 U Comparison of fecal microbiota of *Ariolimax columbianus* during season changes and varying locations

Lisa H. Munk, Allison S. Bowden, and Sarah Boomer, PhD / Department of Biology, Western Oregon University, Monmouth, OR, 97361.

Ariolimax columbianus, commonly known as the pacific banana slug, is a native gastropod of the Pacific Northwest. Using a culture-based approach as well as 16S rRNA gene amplicon sequencing, we studied the fecal microbiota of local native *A. columbianus* from McDonald-Dunn Research Forest/Peavy Arboretum. DNA analysis showed a higher abundance of Gammaproteobacteria compared to other phyla found in the gut microbiome (ANOVA: single factor; $p \leq 0.05$). The Gammaproteobacteria were analyzed further by culture and DNA analysis to compare the changes of their concentration between 3 different locations in the spring with a location match slug for fall. There was a significant difference (t-test assuming equal variance; $p \leq 0.05$) in the diversity of the gut Gammaproteobacteria microbiota between seasons when utilizing a Shannon Diversity Index. Conversely, there was no significant difference (ANOVA single factor; $p \geq 0.05$) in diversity between the 3 different locations. In culture data, there was no significant difference in the total number of colony forming units nor the number of lac-positive and lac-negative Gammaproteobacteria between seasons (t test assuming equal variance; $p \geq 0.05$), as well as the locations (ANOVA single factor; $p \geq 0.05$). The DNA was consistent with our hypothesis that there would be a significant difference in Gammaproteobacteria microbiota between seasons; however, the data did not support our hypotheses that there would be a significant difference between the three different locations which was also seen in culture. Further analysis will be continued and will include more varying locations for both DNA and culture data.

C06 U Copper modulation and reactive oxygen production across yeast lifespan

Zachary Sherlock, Sofia Bauer, Megan Bestwick / Department of Biochemistry, Linfield University, McMinnville, OR

The mitochondrial electron transport chain (ETC) machinery is the primary site of superoxide formation, a reactive oxygen species (ROS) associated with premature cell aging. A primary defense against ROS in yeast (Saccharomyces cerevisiae) is the enzyme superoxide dismutase (Sod1p). This enzyme requires copper and zinc as metal cofactors in the conversion of superoxide to hydrogen peroxide, a less harmful ROS. How mitochondrial function contributes to yeast chronological lifespan (CLS) is particularly of interest, specifically how essential metals for mitochondrial function and their role in the production of radical oxygen species drive the aging process of yeast cells. Our aim is to determine the effect exogenous copper treatment on the CLS of yeast strains lacking Sod1p and its copper chaperone, Lys7p. Our results indicate that low levels of exogenous copper (0.25 mM copper sulfate or less in restricted nutrient media) extend yeast chronological lifespan, especially in cells lacking Lys7p. All cell types see a dramatic reduction in lifespan when exogenous copper levels are increased to 2.0 mM copper sulfate or higher. This indicates that a small increase in the amount of copper in the media is beneficial for yeast in these restricted media conditions. Our current studies are to assess protein levels and gene expression of the yeast ETC machinery, as well as ROS levels via fluorescent staining, to mechanistically understand how exogenous copper in a small dose is contributing to lifespan extension. By using biochemical dyes such as Dihydroethidium (DHE) and MitoSox, we are able to monitor ROS and show localization of these metabolic by-products with fluorescent microscopy at various points of the chronological lifespan of yeast.

C07 U *Saccharolobus solfataricus* surface layer isolation & interaction with *Sulfolobus* Spindle-shaped Virus 1

Susan Wallace, Kenneth Stedman / Biology Department and Center for Life in Extreme Environments, Portland State University, Portland, OR 97201.

Saccharolobus solfataricus is an extremophilic microorganism within the domain Archaea. Their natural environments are hot springs with temperatures reaching 90 °C and pH ranging from 2-4. These single-celled organisms are hosts to the unique *Sulfolobus* Spindle-Shaped Viruses (SSV's) of which there are over 20 variants. Little is known about the molecular mechanisms of infection and virus reproduction of SSV's. SSVs are characterized by a unique lemon shape with 6 short tail fibers at one end arranged as a hexamer. Strikingly, the external surface layer (S-layer) of *S. solfataricus* is characterized by self assembling hexameric pores comprised of two proteins, SlaA and SlaB. Given the six fold symmetry of both the virus tail and the S-layer, we hypothesize that the tail interacts with the S-layer directly. S-layer was isolated from *S. solfataricus* using methods adapted from Gambelli et al., 2019. Purified S-layer and SlaA will be imaged with transmission electron microscopy (TEM) in the presence and absence of SSV1. This observation will allow us to test our hypothesis for SSV-S-layer interactions and gain insight into the infection process.

D01 U Inducing a CRISPR gene edit in *Ovis aries* fibroblast cells to investigate a base substitution thought to be the disease-causing mutation in a sheep variant of GM1 gangliosidosis

Alex Chun, David Wynne, Amelia Ahern-Rindell / Department of Biology, University of Portland, Portland, OR, 97203.

GM1 gangliosidosis (GM1) is an autosomal recessively inherited neurodegenerative disorder that affects the central nervous system resulting in severe neurological pathology. GM1 occurs when there is a reduction in lysosomal β-galactosidase (β-gal) activity due to mutations in the GLB1 gene. The deficiency in β-gal activity leads to toxic accumulation of certain gangliosides that destroy neurons and cause fatal, neurological deficits in patients. In addition to humans, GM1 has been identified in several animal species including sheep. A variant of GM1 has been described in some sheep with a combined deficiency of β-gal and α-neuraminidase (α-neur), which are components of a lysosomal hydrolase complex. Research conducted on this ovine variant suggests that a single base substitution, a G to C transversion in exon 6 of the GLB1 gene, causes a missense mutation of cysteine to phenylalanine in ß-gal, which alters this lysosomal multienzyme complex. The purpose of this project is to use CRISPR editing to induce the G to C transversion in fibroblast cells from unaffected sheep to determine if this is the disease-causing mutation in sheep with this GM1 variant. The main objectives of this research project are: 1) induce the CRISPR transfection reagents (with suspected mutation) into normal sheep cell lines, 2) test for the presence of the mutation in the CRISPR treated cells (using PCR, RE digestion, gel electrophoresis, and DNA sequence analysis), and 3) assay for decreased ß-gal activity in the CRISPR treated cells. Hopefully, this research will one day lead to a therapeutic treatment for GM1.

D02 U Glycolysis and fructolysis in sugar-induced non-alcoholic fatty liver disease

Jack Farley, Levi Miles and James Donnell / Math and Science Department, Corban University, Salem, OR 97317.

Obesity is a significant risk factor in the development of nonalcoholic fatty liver disease (NAFLD). The increased liver adiposity is often linked to high sugar consumption. This study examined the correlation between the consumption of various sugars and the development of NAFLD. Female C57Bl/6 mice were given ad libitum access to 30% sucrose (SUC), glucose (GLC), or fructose (FRT) solutions in place of water (CTR) for 27 weeks. At the termination of the study, liver triglyceride levels were significantly elevated in all groups in comparison to (CTR) groups. Oil Red O staining confirmed these results, showing observable lipid droplet accumulation in the livers of all experimental groups. This lipid accumulation was most pronounced in SUC and GLC groups while the FRT mice had a more limited increase. Two-step RT-qPCR on liver tissue indicated changes in the regulation of genes in glycolysis, fructolysis, and fatty acid synthesis pathways. Genes involved in fatty acid synthesis were upregulated in all three sugar groups. GLC mice showed upregulation in both glycolysis and fructolysis. FRT mice showed upregulation in fructolysis. While the SUC mice did not show upregulation in either glycolysis or fructolysis, there was an upregulation in GAPDH, an enzyme that is utilized after glycolysis and fructolysis converge, which may indicate a possible utilization of both pathways for the dimer SUC. The results highlight glucose as the main contributor to upregulation in metabolic pathways, with a synergistic effect in sucrose on mouse physiology and gene expression.

D03 U Examining the gastrointestinal bacteria diversity in a high sugar diet in relation to obesity and inflammation using a mouse model

Austin Le Vey, Jenna Beilby, Emily Lockhart, Gracie Long, Graysen Rued, Christina Cooper / Department of Math and Science, Corban University, Salem, OR 97317.

Gastrointestinal bacteria hold a significant role in how humans digest and manage their fat and sugar intake along with other nutrients (Verdam et al., 2013). In the Western diet, the consumption of sugars and fats is increasing along with the rates of obesity. If the diversity of specific bacterial species associated with a high sugar diet is known, efforts can be made to treat the obesity epidemic through bacterial manipulation. The bacterial phylum firmicutes have been shown to cause a pro-inflammatory response in the gastrointestinal tract, while the species *Faecalibacterium prausnitzii* work as inflammation-inhibiting bacteria in the gastrointestinal tract (Verdam et al., 2013). Inflammatory bacteria play a key role in obesity-linked diseases like diabetes mellitus and cardiovascular disease (Pahwa et al., 2019). In 2000 alone, 125 million Americans had chronic inflammation conditions and 61 million had multiple conditions correlated with inflammation (Pahwa et al., 2019). This study's primary goal is to examine the diversity of gastrointestinal bacteria with a representative high sugar diet with a mouse model. Preliminary results indicate that *Bacteroides thetaiotamicron* and *Bacteroides ovatus* are present in greater amounts in obese mice, while *Bacteroides cellulosilyticus* is higher in lean mice. Additionally, bacteria from feces were successfully cultured both anaerobically and aerobically to determine bacterial diversity. Knowing the diversity of specific bacterial species between diet types can allow for the future exploration of inflammation-associated bacteria with obesity-linked inflammatory diseases.

D04 U Glucose-induced obesity increases susceptibility to cataracts via deamidation of lens crystallins

Emanuel Montanez, Kayla Sorrick, Damian Ball, Sarah Comstock / Department of Math and Science, Corban University, Salem, OR, 97317.

A mouse model of sugar-induced obesity (SIO) was used in this study to investigate the roles that obesity and sugar intake play in the development of age-related cataracts. Cataract formation is associated with several different pathways ultimately resulting in the aggregation of lens proteins called crystallins. Crystallins are extensively modified with aging and cataract development and research is still ongoing to determine how these modifications may result in cataracts. We have investigated the role that sugar-induced obesity (SIO) plays in aging of lens proteins by researching protein quality control mechanisms in an obese mouse model. Proteostasis is an inclusive classification that involves mechanisms that work concertedly to maintain the function of proteins within the cell. However, the capacity to recognize damaged proteins declines in aging cells which leads to accumulation of abnormal proteins, resulting in age-related pathologies like cataracts. Our findings indicate that sugar consumption leading to obesity results in an upregulation of lens chaperone proteins and the accumulation of PTMs, specifically deamidation of Asn and Gln residues of lens crystallins.

Influence of mitonuclear mismatch on outcrossing and male mating ability

Brent W. Bever[1], J.A. Sullins[1], U. Bergthorsson[2], V. Katju[2], and S. Estes[1]/ [1]Department of Biology, Portland State University, Portland, OR 97201; [2]Department of Veterinary Integrative Biosciences, Texas A&M University, College Station, TX 77845.

Despite considerable research effort, why sex evolved and why it is so widely maintained remains poorly understood. Mitochondria have recently been considered as a potential underlying cause. Mitochondrial function relies upon ~1000 nuclear DNA (nDNA) encoded products. For instance, the mitochondrial electron transport chain (ETC), which is key for eukaryotic energy metabolism, is composed of proteins encoded by both nDNA and mitochondrial DNA (mtDNA). Thus, mitonuclear cooperation is necessary for organelle function and organismal survival; however, the mtDNA genome is believed to experience continual mutational degradation. The "mitonuclear sex hypothesis" suggests that sex is maintained in order to increase the rate of occurrence of new nDNA alleles able to compensate for this ongoing mtDNA decay. It also specifically hypothesizes that mitonuclear mismatch will favor outcrossing over selfing in facultatively outcrossing populations. I tested this hypothesis using *Caenorhabditis elegans* nematodes, genetic manipulation of which allowed for evolution to be observed in populations experiencing three sexual systems: facultatively outcrossing (the primarily self-fertilizing wildtype state), obligately outcrossing, and obligately selfing. *C. elegans* strains containing well characterized mutations affecting mtDNA- or nDNA-encoded ETC subunits (i.e., different forms of mitonuclear mismatch) were allowed to

evolve in replicate populations experiencing the three sexual systems for sixty generations. In agreement with the mitonuclear sex hypothesis, preliminary data show the evolution of increased male frequency/outcrossing in a facultatively outcrossing strain (Fig. 1). I will also present data on the male traits underlying these increased rates of outcrossing.

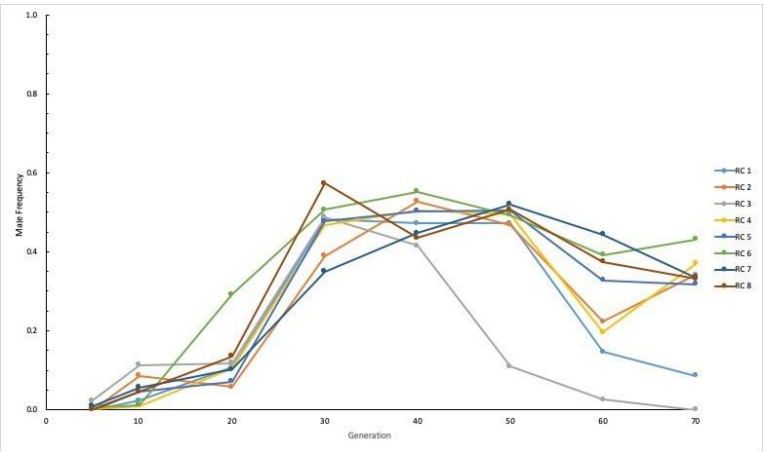


Figure 1. Male frequency within replicate *cox-1* mutant recovery (RC) lines at multiple generations of laboratory evolution.

Quantifying relationships between rock hardness and boring intertidal biota

Nick A. Crosby[1], Adam Ketchum[1], Crystal Toogood[2], Allison Nirmaier[2], Tara Prestholdt[1], Kristin Sweeney[2] / Biology Department and Environmental Department, University of Portland, Portland, OR 97203.

Despite the vital role of shore platforms in protecting coastal communities, the role of marine organisms in determining shore platform strength and topography is largely unquantified. Intertidal organisms have documented direct and indirect effects on rock integrity through boring and scraping behaviors. For example, sea urchins directly influence rock strength by boring multiple holes into rocks for shelter and indirectly through the release of sediment into the intertidal environment during boring activity, which can then increase the rates of erosion. Surface hardness also influences the presence or absence of boring biota as harder rocks are less suitable for carving out habitat. Therefore, we hypothesized that surface hardness is higher in areas with less boring biota due to their negative relationship with rock strength. Surface hardness was measured with N and L-type Schmidt Hammers by taking 30 hardness recordings at 5-11 points at each research site along the Oregon coast. To measure biodiversity, we laid a transect from high to low tide and recorded all biota along the transect and categorized each by their interactions with the rock, i.e. borer, grazer, etc. Additional quadrats were used to estimate the overall biodiversity in the area. Resulting data showed that sites with a lower average surface hardness had more boring intertidal biota, and vice versa. Preliminary results supported our hypothesis; however, additional research and statistical analysis is needed to further quantify the relationship.

Demographic filters on recruitment vary by species in western Oregon conifer forests

Carmen E. Hixson and Paige E. Copenhaver-Parry / Department of Biology, George Fox University, Newberg, OR, 97132.

Understanding the demographic filters – seed production, dispersal, germination, and establishment – that underlie spatiotemporal variation in forest recruitment is necessary to accurately anticipate the effects of environmental change on forest demography, population dynamics, and species range dynamics, as early life history stages are more sensitive to change than adult individuals. The transitions extending from seed production to germination are poorly understood and quantified components of recruitment owing to the difficulty of counting and tracking seeds in dense, closed-canopy forests, yet can have a substantial impact on seedling abundance. To better understand these transitions in two abundant western tree species – western hemlock and Douglas-fir – we quantified the correlation between seed abundance and adult neighborhood basal area or seedling abundance over one year of seed production in four forested stands extending across a large climatic gradient in western Oregon. In western hemlock, seed availability was more strongly correlated with large neighborhood basal area than with germinant counts, indicating that germination is likely a key limitation. In Douglas-fir, seed availability was more strongly correlated with germinant counts than with neighborhood basal area, indicating that

seed production is likely a key filter. Differences in recruitment filters between species likely reflect a high sensitivity of western hemlock germination to microsite suitability – which may be strongly tied to light availability for this shade-tolerant species – and limited seed rain in Douglas-fir due to the tall stature and thick canopy of adult Douglas-fir in these mature stands, but a long-term seed data set is needed to confirm these trends.

The effects of temperature, nutrients and non-native fish on harmful algal blooms in mountain lakes

Lara Jansen[1], Angela Strecker[2] / [1]Department of Environmental Science & Management, Portland State University, Portland, OR 97201; [2]Department of Environmental Sciences, Western Washington University, Bellingham, WA 98225.

Harmful algal blooms, most often caused by toxin-producing cyanobacteria, are seen as a growing environmental issue limited to lowland lakes impacted by human activities that increase the loading of limiting nutrients like phosphorus. Yet increases in cyanobacteria and even harmful blooms have been observed in mountain lakes, which are mostly isolated from development. The combination of rising temperatures due to a changing climate, increased atmospheric deposition of phosphorus by industry and the introduction of non-native fish may likely be making these seemingly pristine systems more vulnerable to cyanobacteria blooms and their potential toxins. Yet the combined effects of these stressors remains unknown. Therefore, I will examine if bloom-forming and toxic strains of cyanobacteria are additively influenced by these factors as each have been known to increase algal biomass with relatively high temperatures and phosphorus levels specifically favoring bloom forming and potentially toxic cyanobacteria. I will conduct a field survey of lakes in the Oregon Cascades, where blooms have been occurring in several lakes to capture the natural variation of cyanobacteria across gradients of temperature, phosphorus and fish stocking.

Role of the TonB systems in delivery and removal of antibiotics from *Vibrio vulnificus*

Ryan Kenton, Kristen Uskovich, Eva Richman, Brianne Zbylicki / Biology Department, University of Portland, Portland, OR 97203.

The TonB protein complex is vital and well studied in Gram-negative bacteria for the energy-dependent active transport of iron-bound substrates across the outer membrane. Recent reports have indicated that the TonB system may play a role in the influx of antibiotics in some bacterial species, while powering efflux pumps in others. For the first time, we have shown that TonB may be powering both systems in the human bacterial pathogen, *Vibrio vulnificus*. *V. vulnificus* contains three TonB system (TonB1, TonB2, and TonB3) and it has been shown that both the TonB1 and TonB2 system are utilized in iron-deplete conditions. Minimal inhibitory concentration assays were performed using wild-type and an array of TonB system deletion strains. Multiple classes of antibiotics were tested using the agar dilution method. Results indicate that both the TonB1 and TonB2 systems can power a drug efflux system specific for Fluoroquinolones. In addition, these same two systems may be powering an influx system capable of bringing Aztreonam into the cell.

Characterizing Thermotolerant Diatoms of Eastern Oregon Ladd Marsh Hot Springs

Erica Nadermann, Joe Corsini / Department of Biology, Eastern Oregon University, La Grande, OR, 97850.

Diatoms are single-celled photosynthetic organisms that have a silica (glass) cell wall. We are characterizing thermotolerant diatoms from the Ladd Marsh area located in Eastern Oregon near Hot Lake, in Union County. We have gathered samples from varying water temperatures and locations near the hot springs and begun to identify the commonly encountered diatoms. Over the past two years we have identified the following diatoms; *Rhopalodia gibba* (45 °C), *Nitzschia angustata* (20 °C), *Pinnuluria brebissonii* (45 °C), and *Pseudostraurosira americano* (20 °C). We have also discovered what seems to be a new species of *Mulleria* in the cooler regions of the main Hot Lake pond. In addition, we found that as the water temperature increased, the overall abundance and size of diatoms decreased. Interestingly, we observed more damaged diatoms at higher temperatures compared to the water cooler temperatures. This work will further our understanding of diatom diversity in Eastern Oregon.

Utilizing Zoom video conferencing to assess compatibility of potential macaque pairs

Samantha Persad, Cara Stull, Kristine Coleman / Oregon Health and Sciences University, Oregon National Primate Research Center, Beaverton, OR 97006.

The innate social behavior of rhesus macaques (*Macaca mulatta*) provides the main premise for social housing, including paired housing, in a laboratory setting. Previous studies evaluating paired housing have demonstrated increased immune function, enhanced ability to cope with variable environments, and reduced development of abnormal behaviors in paired *M. mulatta* individuals as opposed to singly housed conspecifics. While paired housing is inarguably beneficial, the process of identifying compatible partners occasionally proves difficult. Furthermore, pair attempts resulting in incompatibility may increase the potential for stressful events to occur, such as building transfers or aggressive encounters with conspecifics. This study tested Zoom video conferencing via iPad as a potential tool to assess partner compatibility prior to the physical pair attempt, with the goal of avoiding potential stressors and consequentially improving the pairing process. Behaviors analyzed for this study included: vigilance (attentiveness to the screen), positive affiliative behaviors (lip smacking, presenting), and anxiety (body shaking, scratching, yawning). Data were categorized by the sex of each partner. Data analysis yielded sex-dependent trends for vigilance and positive affiliative behaviors, with insignificant results for anxiety. This outcome implies a possibility of using Zoom video conferencing to improve pairing, therefore related studies should continue.

Bacterial contamination of conventional and organic spinach and ground turkey.

Tayler Tate /Department of Biology, Western Oregon University, Monmouth, OR 97361.

Foodborne pathogens affect millions of people in the United States every year. With the rise in popularity of organic foods, it is important to understand the differences that conventional and organic food production and handling can have on the bacterial contamination of the foods we consume. A previous study presented at OAS in 2018 on conventional and organic ground beef samples (n=4) showed conventional options had significantly higher bacterial contamination ($p=<0.0001$). To build on this study, both organic and conventional spinach (n=4) and ground turkey (n=4) were plated on MacConkey Agar, which selects for Gram Negative bacteria. Total colonies were counted and sorted into lactose positive (coliform enteric) and lactose negative (non-coliform enteric and soil pseudomonas) groups. Spinach samples showed that organic spinach had significantly more lactose positive bacteria ($p=<0.0001$), lactose negative bacteria ($p=0.032$), and total bacteria ($p=0.017$). Ground turkey samples showed that organic turkey had significantly more lactose positive bacteria ($p=0.023$), lactose negative bacteria ($p=0.039$), and total bacteria ($p=0.025$). A comparison of these results with the previous beef study shows that more testing needs to be done in order to identify the differences between conventional and organic food products so consumers can make educated decisions about the food choices they have.

CHEMISTRY

Section Chairs:

Angela Hoffman
University of Portland
Andrew Baggett
Linfield University

ORAL PRESENTATIONS

Synthesis of Small Molecule Inhibitors of the Arp 2/3 Complex.

Natalie Wade[1], Leah Thompson[1], Brad Nolen[2], Andrew Baggett[1] / [1]Department of Chemistry, Linfield University, McMinnville, OR, 97128. [2]Department of Chemistry, University of Oregon, Eugene, OR, 97403.

Actin is a key protein of the cytoskeleton that aids in cytokinesis, endocytosis, and cellular motility. Actin Related Protein (Arp2/3) complex is a seven subunit ATPase that is central to these activities by acting as a nucleation site for daughter filaments to branch from a preexisting filament strand. Branching is central to the activity of the actin network, therefore developing a highly potent inhibitor of Arp2/3 is highly desirable for research groups interested in the basic science of actin dynamics. Using small molecules to inhibit this activity is ideal because small molecules are fast acting and reversible inhibitors. The overexpression of Arp2/3 has been seen in relation to metastatic cancer, so synthesizing potential inhibitors may have clinical applications. This work describes the derivative synthesis, and *in vitro assays* that have been employed to create potentially more effective inhibitors compared to commercially available CK-666 and CK-869, while also discussing future routes of synthesis and biochemical data collection.

Isolation and Identification of Anti-Cancer Compounds from *Callisia fragrans*

Chung, Jessica; Ho, Siva; Bermudez, Alexys; Truong, Kevin; Brandon, Mackenzie; Hoffman, Angela, OSB
Department of Chemistry, University of Portland, 5000 N. Willamette Blvd. Portland, Oregon 97203.

For centuries, people have relied on locally available plants as a way to alleviate or cure ailments. Vietnamese medicine has incorporated the use of *Callisia fragrans,* also known as the basket plant, as a treatment for cardiovascular disease, burns, and cancer. To better understand its potential, this study focused on isolating and analyzing the efficacy of active compounds within the basket plant. To do so, a crude extract was derived from the roots and leaves using methanol. The sample was then tested for viability against the *Pythium ultimum* assay. The compounds were then fractionated using silica flash chromatography and analyzed for purity via thin layer chromatography (TLC). Currently, two active antifungal compounds have been identified: methyl p-hydroxybenzoate and p-aminobenzoic acid.

Electrochemical Sensors for Biological and Environmental Applications

Suji Park, Dipankar Koley; Department of Chemistry, Oregon State University

Electrochemical sensors have been developed for last few decades in many different types and ways. They can be applied in various fields of study such as biomedical or biomaterials, environment, energy, etc. Two projects will be introduced during the workshop to show how these sensors can solve such problems. One of the sensors we've developed is used to quantify pH and H2O2 simultaneously in real-time to study bacterial metabolism in local environment. One species of oral bacteria takes glucose and produces H2O2 which plays a key role in maintaining healthy oral condition. We assume that the H2O2 production will increase at higher pH. Since bacterial metabolism and interspecies interaction occur in few-micron surrounding from bacterial community, it is very challenging to approach there without destroying samples. Thus, we are using few techniques here; Scanning electrochemical microscopy enables us to control and fix the distance between a substrate and an extremely small microelectrode. Another sensor we are working on has unique composition of ion-selective electrode (ISE) membrane. ISE membrane is primarily made of insulating PVC that limits its use as an amperometric electrode. However, our sensor has a carbon-based dual function micro-ISE membrane. It is capable of switching between amperometric and potentiometric measurements without affecting the selectivity coefficients of ISEs. It showed an impressive uM and pM detection limit of Cu2+ and thus opening new avenues of exploiting the excellent selectivity of ISEs and low detection limit of ASWSV techniques. This sensor can be applied to trace heavy metal ions concentration in unknown liquid sample and to determine their solubility depending on pH. The design of sensors and experimental setup will be presented.

POSTER PRESENTATIONS

F01 G The impact of sour flavors on degradation during e-liquid vaping

Paul Kerber, Anna K. Duell, and David H. Peyton / Department of Chemistry, Portland State University, Portland, OR 97201

Electronic cigarettes are battery-operated devices that heat electronic cigarette liquids (e-liquids) into an aerosol that can be inhaled by the consumer. The degradation of e-liquids, which are primarily composed of propylene glycol (PG) and glycerol (GL), is capable of producing formaldehyde, acetaldehyde acetals, hemiacetals, and aldehydes which are possible irritants or carcinogens [1]. Many e-liquids are flavored with various sweeteners and additives that can promote degradation [2]. There are also sour e-liquids that contain acids and flavorants to create their sour flavor [3]. However, the specific effects and degradation pathways are unknown for sour e-liquid flavors. Sour flavors can be created by adding lactic, benzoic, levulinic, salicylic, or malic acid. We hypothesized that if sour e-liquids are flavored with one or more of the previously listed acids it could affect e-liquid degradation. The objective of this study was to measure the quantities of degradation produced during vaping with the addition of acids/sour flavorants and nicotine. We thus compared the degradation levels produced by vaping PG+GL with commercial e-liquid Sour Menace Sour Green Apple with 0 and 6 mg/mL of nicotine. E-liquids were vaped using a modified CORESTA puff method [4], using a KangerTechTM Subtank Mini e-cigarette, and analyzed using 1H NMR spectroscopy. An increase in degradation was observed when the Sour Menace with 0 mg/mL nicotine e-liquid was vaped compared to the vaped PG+GL mixture. The Sour Menace with 6 mg/mL nicotine showed an increase in degradation that was determined not to be statistically significant.

F02 G Diselenide-based probes for the detection of Thioredoxin reductase

T.J. Mafireyi[1], R.M. Strongin[1], and P.B. Cassidy[2] / [1]Department of Chemistry, Portland State University, Portland OR 97201, [2]Oregon Health and Science University, Portland, OR 97239

Skin cancer is highly prevalent and affects one in five Americans, with melanoma being the deadliest form. Current diagnostic biopsy methods are invasive and do not offer real time results. It is therefore imperative to design new, robust and non-invasive techniques that allow early detection. This work focuses on the design and application of a turn-on fluorescent probe, TM20, for the detection of Thioredoxin Reductase 1 (TrxR1), an enzyme overexpressed in melanoma cells. TM20 was synthesized by coupling a fluorescent dye to a diselenide moiety which quenches fluorescence. Current probes for TrxR1 have fluorophores conjugated to a disulfide quenching moiety. These probes however have slow reaction times (180 – 240 min) and high Km values (51.8 μM and 189 μM). TrxR1, in the presence of NADPH, reduced the diselenide bond and elicited a fluorescence turn-on response of TM20 with a Km of 15.89 μM and ≈20 times more intensity compared to other competing biological species. From computational docking simulations, probe TM20 had greater binding affinity to the TrxR1 active site (-11.6 Kcal/mol) compared to its disulfide analogue (-9.6 Kcal/mol). In vitro imaging studies also proved the diselenide probe superior in targeting TrxR1 in comparison to the disulfide probe. Treatment of cells with increasing levels of 2,4-dinitrochlorobenzene (DNCB), an irreversible inhibitor of TrxR1, led to proportional decreases in fluorescence upon addition of probe

F03 U Payload loading and release rates from mesoporous silica nanoparticles

Jessica Chung, Hayden Winter, and Andrea Goforth / Chemistry, University of Portland, Portland, OR, 97203

With current drug delivery systems, cancer patients must suffer through deleterious side effects due to the limited efficacy that conventional molecular therapies can provide. To treat tumor cells with higher accuracy and precision, many have looked towards nanoparticles as a possible drug transporter. In particular, mesoporous silica nanoparticles (MSNs) present a wealth of potential due to their high surface area, simplistic synthesis, affordability, biocompatibility, and degradability. To analyze the concentration of payload within MSNs, UV-vis experiments were employed to determine the rates of loading and unloading of the payload, Rose Bengal (RB), on both unmodified MSNs and those surface-treated with an aminosilane. This study analyzed the effects of pH conditions on unloading RB; while rates could not be determined for this study, a higher concentration of payload in the supernatant was seen in basic conditions versus acidic, and that in both cases, TEM results show no indication of degradation to the integrity of the MSNs.

F04 U Preparation of biomolecule functionalized gold core, silver shell nanoparticles: applications in targeted cancer therapy

Morgan Johnson, Brian Gilbert / Chemistry Department, Linfield University, McMinnville, OR 97128

Due to their nanoscale size and relative ease of ability to be coated with various substances, the use of nanoparticles in biomedical research is rapidly increasing in popularity. Biomolecule functionalized nanoparticle-based drug delivery vehicles may provide a safer alternative to traditional chemotherapy or radiation treatments. Traditional cancer treatments kill healthy cells as well as cancerous cells, but coated nanoparticles would specifically target the cancer cells, leaving the healthy cells unharmed. Surface-Enhanced Raman Scattering (SERS) can be used instead of fluorescent probes, which reduces the size of the nanoparticles and increases the sensitivity of detection. Presented is one quick and easy method of synthesizing SERS active, functionalized gold core, silver shell nanoparticles. Gold core, silver shell nanoparticles were layered in the order of bovine serum albumin, antibodies, luminol. Optimal visualization conditions were also found for SERS detection of nanoparticles in yeast. These functionalized nanoparticles offer promise as specific drug-delivery devices that will allow for easy monitoring of treatment by physicians with potentially fewer side-effects for the patient.

F05 U Antibody functionalized Au-core, Ag-shell nanoparticles: Application for a targeted drug-delivery system.

Madison Sisk, Brian Gilbert / Chemistry Department, Linfield University, McMinnville, OR 97128

The use of gold and silver nanoparticles (NPs) as a targeted drug-delivery system could replace current methods of treatment for diseases such as cancer. The addition of silver shell to a gold core makes the NPs more stable and gives favorable optical properties that are representative of pure silver NPs. The use of silver shell NPs has been particularly significant when they are coated with antibodies that can direct the particles to cells of interest. Our NPs were coated in bovine serum albumin (BSA) and various extracellular antibodies that attach to Saccharomyces cerevisiae cells, allowing us to determine the particles' potential toxicity in a biological system. Our results suggest that NPs coated with BSA and antibodies are not toxic enough to kill off healthy cells. A protocol for adding the tagging molecule 4',6-diamidino-2-phenylindole (DAPI) directly to the NPs to improve surface enhanced Ramen spectra (SERS) was also determined.

F06 U Synthesis of small molecule 7-azaindole derivatives of CK-666 as potential inhibitors of Arp 2/3 protein complex

Emily S. Tiedemann[1], Brad J. Nolen[2], and Andrew W. Baggett[1] / [1]Department of Chemistry, Linfield University, McMinnville, OR 97128, [2]Department of Chemistry and Biochemistry, University of Oregon, Eugene, OR 97403

Polymerization of actin filaments is necessary for cellular structure, shape, division, and motility. The actin related protein 2/3 complex (Arp 2/3) consists of seven protein subunits that allow for the polymerization of actin within a cell by providing a nucleation site. Inhibition of Arp 2/3 can lead to a slower rate of polymerization of branching actin filaments within a cell which leads to slower motility rates. Overexpression of the Arp 2/3 complex has been linked with metastatic cancerous cells. Based on these discoveries, the inhibition of Arp 2/3 is a potential anticancer treatment. The overall goal of this research is to synthesize small molecule inhibitors of Arp 2/3 that have IC50 values in the nanomolar range. The research described herein is to synthesize 7-azaindole derivatives of CK-666—a commercially-available Arp 2/3 inhibitor—and determine the effect of the additional nitrogen atom on the molecule's potency. The work on this compound thus far is focused on synthesizing the 2-methyl substituted azaindole starting material that is not commercially available.

Quantification of Chlorothalonil Degradation in Pollen

Rony Koluda[1], Louisa Hooven[2], Nina Rudin[3], Chloe Smallwood[4], Jeff Morre[1], Claudia Maier[1]; [1]Department of Chemistry, College of Science, Oregon State University, Corvallis OR; [2]Department of Horticulture, College of Agricultural Sciences, Oregon State University, Corvallis OR; [3]Department of Entomology and Plant Pathology, Oklahoma State University, Stillwater, OK; [4]Department of Animal Sciences, College of Agricultural Sciences, Oregon State University, Corvallis OR

Nanotechnology-based pesticide (NBPs) combine traditional active ingredients with various nano and micro-sized particles, which can provide more favorable physical and environmental properties such as stability, solubility, and ease of handling. The presence of pesiticides in pollen, beeswax, honey, and bees has been subject in many studies, since these contaminants are collected along with pollen and brought to the hive. Chlorothalonil is an agricultural fungicide active ingredient that can

degrade quickly in laboratory conditions, but may degrade gradually when formulated as an NBP and applied in agricultural environments. The present study aims to develop methods which will enable analysis of the degradation of the chlorothalonil chemical alone, compared with the formulated pesticide product, Bravo, in fermented pollen. The two groups, along with a control group, were added to pollen and fermented for a week. To verify fermentation, pH was measured. Untreated pollen in acetone was used as control. The samples were collected at different intervals along a course of a week and were analyzed via Synapt HDMS^{TM} Q-TOF Mass Spectrometer. The results confirmed the expected trend of degradation in both chlorothalonil and Bravo. Method development is a desired point of focus in the future

MS proteomics to advance your scientific pursuits

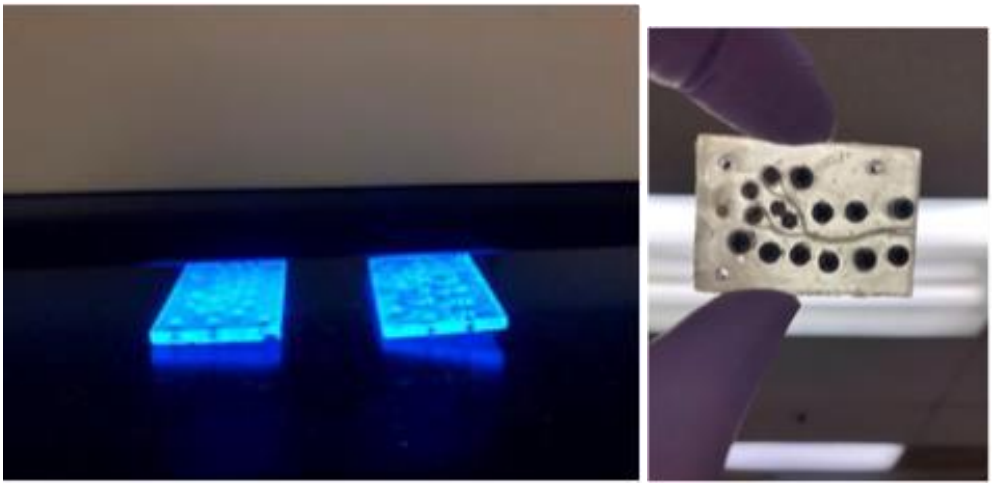
Liping Yang[1], Stanislau Stanisheuski[1], Zifeng Song[1],Jeffrey Morre[1], Fred Stevens[1,2], Claudia S. Maier[1,2]; [1]Oregon State University Mass Spectrometry Center, Corvallis, OR, 97331; [2] Linus Pauling Institute, Oregon State University, Corvallis, OR, 97331

Mass spectrometry (MS) based proteomics applications have grown rapidly and play a vital role in various research fields, such as environmental science, forest science, marine sciences, and biomedical sciences. The Thermo Scientific™ Orbitrap Fusion™ Lumos™ Tribrid™ MS in the OSU MSC, the most versatile and powerful mass spectrometry instrument currently available, can produce high quality proteomic data to advance scientific pursuits. Here, we present how MS proteomics helps to advance your projects by demonstrating its applications in research projects supported by OSU MSC. Bottom-up proteomics was applied to discover protein biomarkers and characterize the hypoxia-induced proteome profiles in different Osteosarcoma cell phenotypes. This research findings improved the biological understanding of osteosarcoma and suggested that the identified protein biomarkers could be potential targets for novel diagnostic and therapeutic strategies in osteosarcoma. Top-down proteomics was evaluated and applied to explore intact proteome profiles, characterize proteoforms including their post-translational modifications (PTM) in Osteosarcoma cells. The label free quantitative analysis showed the correlation of levels of distinct proteoforms and their degradation products in osteosarcoma cell lines of different metastatic phenotypes. Orbitrap Fusion Lumos MS is an exceptional tool for the detection and mapping of PTMs associated with oxidative stress and the bioactivation of xenobiotics because of its superior sensitivity, selectivity and versatility. We investigated the oxidative modifications of Cys-34 in Human Serum Albumin (HSA) which works as an internal dosimeter for various exposures like toxic materials and hazardous conditions.

Representing lung bronchiole patterns in lung-on-a-chip fashion

M. Hubbard, S. Rananavare, R. Lerud – Dept. of Chemistry, Portland State University. 1719 SW 10th Avenue Science Research & Teaching Center, Portland, OR 97207.

This project uses SLA 3D printing to design lung branching patterns in split die that can mold wax casts of bioinspired geometries. Casts encapsulated in PDMS can be melted out, and what's left are microfluidic channels. From there, we are investigating the removal of porcine gastric mucin plugs in the PDMS microfluidic channels, as it relates to diseases such as Cystic Fibrosis and Chronic Obstructive Pulmonary Disorder.



Small molecule analysis via High-Resolution Mass Spectrometry-Oregon State University Mass Spectrometry Center (OSU MSC)

Armando Alcazar Magana[1,2], Manuel Garcia-Jaramillo[1,2,3], Ashish Vaswani[1,2], Jeffrey Morre[1], Stanislau Stanisheuski[1], Liping Yang[1], Jan F. Stevens[2,4], Claudia S. Maier[1]. [1]Department of Chemistry, Oregon State University, Corvallis; [2]Linus Pauling Institute, Oregon State University, Corvallis, Oregon 97331; [3]Nutrition Program, School of Biological and Population Health Sciences, Oregon State University, Corvallis, Oregon 97331; [4]Department of Pharmaceutical Sciences, Oregon State University, Corvallis, Oregon 97331.

The OSU MSC uses state-of-the-art MS technology for the discovery, identification and quantification of small molecules in biological samples.

Untargeted metabolomics (discovery metabolomics)
The OSU MSC offers is fully equipment to perform MS metabolomics analyses for a wide range of applications for the discovery and quantification of metabolites in biological systems. An in-house compound library assists in the fast and reliable identification and quantification of ~600 primary metabolites and commonly found compounds in biological samples.

Untargeted fingerprinting analysis of plant extracts
For natural product research, the OSU MSC has LC-MS methods for chemical profiling of botanical extracts. Data is screened against our in-house ENZO library (a collection of over 502 compounds of known structure in plants) and compound annotations is facilitated using the Global Natural Product Social Molecular Network (GNPS). GNPS is a public spectral library used to construct molecular networks by aligning MS/MS spectra of the precursor ions and MS/MS fragments.

Untargeted lipidomic analysis
We have established lipidomics methods for profiling of thousands of lipid species using ultra-high-performance liquid chromatography (UPLC) coupled to high resolution quadrupole time-of-flight mass spectrometry systems. Raw data is processed by high throughput bioinformatics pipelines such as MS-DIAL V2.80 and Progenesis QI V2.4. A typical analysis provides annotations for over four hundred lipids.

LC-MS/MS bioanalysis for the accurate quantification of small molecules
OSU MSC uses targeted LC-MS/MS methods for the reproducible and sensitivity quantification of small molecules, metabolites and environmental contaminants in complex matrices. We have methods for plant hormones, plant phenolics and phytosterols.

GEOLOGY
Section Chairs:

Scott Burns
Portland State University

Jeffrey Myers
Western Oregon University

ORAL PRESENTATIONS

Anomalous crystalline cobbles on Olympic beaches, Washington.

Robert J. Carson and Sharon Ndayambaje / Department of Geology, Whitman College, Walla Walla, WA 99362

No granitic or high-grade metamorphic bedrock crops out on the Olympic Peninsula; local valley glaciers transported mostly basalt and sandstone toward the coast. However, the Cordilleran ice sheet carried crystalline clasts to the northern and eastern flanks of the Olympics. During the ancient "Salmon Springs" glaciation, the Juan de Fuca lobe of the Cordilleran ice sheet deposited limited granite and gneiss erratics as far south as La Push. How did crystalline cobbles reach Olympic beaches south of La Push? If icebergs transported these erratics, tectonic uplift and/or isostatic rebound is required because sea level was >100 m lower during glaciations. An alternative explanation is fluvial and marine transport in the last 6000 years (with sea level close to present height) of tree roots with crystalline rocks from the upper Columbia River system. Other possible factors include marine currents, longshore drift, waves, tsunami, kelp,and shipwreck ballast.

Understanding the impacts of historical land use change through sediment core analysis: Center Pond, Vermont

Turtle McCloskey[1], Tania Figueroa-Colón[2], Sarah Jonathan[3], Noah Snyder[3], and TimothyCook[4], [1]Department of Environmental Science and Policy, Southern Oregon University, Ashland, OR 97520. [2]Geology Department, University of Puerto Rico-Mayagüez, Mayagüez PR, 00682. [3]Earth and Environmental Sciences Department, Boston College, Boston MA,02467. [4]Geosciences Department, University of Massachusetts Amherst, Amherst MA, 01003.

The post glacial lakes of New England can provide records of how land use changes have influenced biogeochemical processes through the analysis of lacustrine sediment deposits. This project investigates the sensitivity of the Center Pond watershed in northern Vermont to disturbances associated with land use changes resulting from Euro-American settlement in the 18th and 19th centuries. This research provides insightful information regarding how New England watersheds respond to anthropogenic disturbances. Radiocarbon dates were used to create a geochronology for the cores spanning nearly 2500 years, and changes in the productivity and biogeochemistry of the Center Pond watershed were analyzed across this record to assess the impacts of land use change. Increases in carbon-nitrogen ratios (C:N)and iron-manganese ratios (Fe:Mn) in cores after approximately 1800 suggest environmental disturbances in the watershed, likely related to land clearing by Euro-American settlers. However, a clear increase in erosion as a result of these disturbances is not obvious; clastic sediment layers in cores occur during a period of decreasing human disturbance as revealed by Geographic Information Systems (GIS) analysis. Historical aerial photos indicate a decrease in cleared land from 18.25% in 1942 to 1.67% in 2016. Discrete clastic deposits during this period may correlate to historical floods**.** Despite a significant decrease in the intensity of anthropogenic disturbances and the widespread reforestation of the region, it appears that the lake has not returned to its pre-disturbance state.

Reevaluation of the Cenozoic Impression Record of *Pseudotsuga* Carr. in Western North America

Jeffrey A. Myers[1], Diane M. Erwin[2], and Howard E. Schorn[2] / Western Oregon University Department of Earth Science, Western Oregon University, Monmouth, OR 97361, myersj@wou.edu; [2]University of California, Berkeley, Museum of Paleontology, 1101 Valley Life Sciences Bldg., Berkeley, CA, 94720.

Fossil occurrences of *Pseudotsuga* (Pinaceae) have been reported from as early as the Cretaceous from dozens of localities in western North America and Eurasia. Reevaluation of the impression fossil record of *Pseudotsuga* in western North America finds that the majority of specimens identified as *Pseudotsuga* are either incorrectly identified or too poorly

preserved to be identified. Only eight occurrences have been confirmed at present, principally from winged seeds, although dispersed, but co-occurring, foliage, foliated and defoliated axes, and ovulate cones are consistent with *Pseudotsuga*, as well. The verified fossils form two groups and four morphotaxa. Ovulate cones and winged seeds of *Pseudotsuga laticarpa* Lakhanpal from the ~ 32 Ma Rujada Flora, Oregon, and *P. cassiana* (Axelrod) Schorn from the ~ 13 Ma Trapper Creek Flora, Idaho, resemble those of the extant *P. macrocarpa* (Vasey) Mayr. in cone and seed dimensions. Ovulate cones and winged seeds of *Pseudotsuga taxifolioides* Arnold from the 13 Ma Trout Creek Flora, SE Oregon, and *P. sonomensis* Dorf from the ~ 3 Ma Neer's Hill locality of the Sonoma Volcanics, resemble the extant *P. menziesii* (Mirb) Franco in cone and seed dimensions. These limited initial data suggest that the big-coned form of *Pseudotsuga* originated in the humid-mesic, microthermal coastal Northwest during the early Oligocene, and that the small-coned form first appeared in the middle Miocene of the interior west, under cooler, summer dry climatic conditions. Initially both forms represented sub-dominant components of broadleaved vegetation. Modern Douglas Fir-dominated coniferous forests of the coastal Pacific Northwest did not develop until the Pliocene, in response to the expansion of summer drought, as the North Pacific Gyre strengthened and cooled with the growth of north polar ice

POSTER PRESENTATIONS

G01 G The effects of temperature, nutrients and non-native fish on harmful algal blooms in mountain lakes

Lara Jansen[1] and Angela Strecker[2] / [1]Environmental Science & Management, Portland State University, Portland OR 97201, [2]Western Washington University, Bellingham, WA 98225

Harmful algal blooms, most often caused by toxin-producing cyanobacteria, are seen as a growing environmental issue limited to lowland lakes impacted by human activities that increase the loading of limiting nutrients like phosphorus. Yet increases in cyanobacteria and even harmful blooms have been observed in mountain lakes, which are mostly isolated from development. The combination of rising temperatures due to a changing climate, increased atmospheric deposition of phosphorus by industry and the introduction of non-native fish may likely be making these seemingly pristine systems more vulnerable to cyanobacteria blooms and their potential toxins. Yet the combined effects of these stressors remains unknown. Therefore, I will examine if bloom-forming and toxic strains of cyanobacteria are additively influenced by these factors as each have been known to increase algal biomass with relatively high temperatures and phosphorus levels specifically favoring bloom forming and potentially toxic cyanobacteria. I will conduct a field survey of lakes in the Oregon Cascades, where blooms have been occurring in several lakes to capture the natural variation of cyanobacteria across gradients of temperature, phosphorus and fish stocking.

G02 G Anomalous crystalline cobbles on Olympic beaches, Washington

Sharon Ndayambaje and Robert J. Carson / Department of Geology, Whitman College, Walla Walla, WA 99362

No granitic or high-grade metamorphic bedrock crops out on the Olympic Peninsula; local valley glaciers transported mostly basalt and sandstone toward the coast. However, the Cordilleran ice sheet carried crystalline clasts to the northern and eastern flanks of the Olympics. During the ancient "Salmon Springs" glaciation, the Juan de Fuca lobe of the Cordilleran ice sheet deposited limited granite and gneiss erratics as far south as La Push. How did crystalline cobbles reach Olympic beaches south of La Push? If icebergs transported these erratics, tectonic uplift and/or isostatic rebound is required because sea level was >100 m lower during glaciations. An alternative explanation is fluvial and marine transport in the last 6000 years (with sea level close to present height) of tree roots with crystalline rocks from the upper Columbia River system. Other possible factors include marine currents, longshore drift, waves, tsunami, kelp,and shipwreck ballast.

G03 G A study of urban-scale anthropogenic CO_2 emissions in Portland, OR using high resolution emissions inventories and meteorological modeling

James E. Powell, Christopher L Butenhoff, and Andrew L Rice / Department of Physics, Portland State University, Portland, OR 97201

About 70% of global energy-related fossil fuel CO_2 emissions occur in cities. In the absence of a national mitigation plan, cities in the United States are developing their own policies to mitigate emissions of CO_2. In the City of Portland, OR, a Climate Action Plan has been adopted aiming to cut local carbon emissions by 80% relative to 1990 levels by the year 2050. In 2019, the Oregon legislature is actively debating cap-and-trade legislation. This work depends on emissions inventories

(EI) to resolve CO_2 emissions spatially, temporally, and by sector. Despite numerous efforts to quantify the emissions of the city in EIs, high uncertainty remains and we don't have high spatial resolution inventories at all. Here we show a high resolution (1 km^2, hourly) EI of residential, commercial, industrial, and on-road CO_2 emissions for anthropogenic CO_2 in the three counties of Washington, Multnomah, and Clackamas in Oregon, for all of 2010. We use a data set of traffic counts from 2005-2017 to estimate onroad CO_2 emissions. We use EPA MOVES to estimate vehicle CO_2 emission factors (EF). For building sector emissions we use plat maps of the area's natural gas infrastructure and building energy modeling of diurnal heating patterns. The EI will be used to support MRV (measurement, reporting, and verification) efforts in the city, and by city planners seeking hotspots and creative angles on the problem of CO_2 emissions reduction.

G04 U Quantifying relationships between rock hardness and boring intertidal biota

Nick A. Crosby[1], Adam Ketchum[2], Crystal Toogood[1], Allison Nirmaier[1,] Tara Prestholdt[2], and Kristin Sweeney[1] / [1]Environmental Department, University of Portland, Portland OR 97203, [2]Biology Department, University of Portland, Portland, OR, 97203

Despite the vital role of shore platforms in protecting coastal communities, the role of marine organisms in determining shore platform strength and topography is largely unquantified. Intertidal organisms have documented direct and indirect effects on rock integrity through boring and scraping behaviors. For example, sea urchins directly influence rock strength by boring multiple holes into rocks for shelter and indirectly through the release of sediment into the intertidal environment during boring activity, which can then increase the rates of erosion. Surface hardness also influences the presence or absence of boring biota as harder rocks are less suitable for carving out habitat. Therefore, we hypothesized that surface hardness is higher in areas with less boring biota due to their negative relationship with rock strength. Surface hardness was measured with N and L-type Schmidt Hammers by taking 30 hardness recordings at 5-11 points at each research site along the Oregon coast. To measure biodiversity, we laid a transect from high to low tide and recorded all biota along the transect and categorized each by their interactions with the rock, i.e. borer, grazer, etc. Additional quadrats were used to estimate the overall biodiversity in the area. Resulting data showed that sites with a lower average surface hardness had more boring intertidal biota, and vice versa. Preliminary results supported our hypothesis; however, additional research and statistical analysis is needed to further quantify the relationship.

G05 U Demographic filters on recruitment vary by species in western Oregon conifer forests

Carmen E. Hixson and Paige E. Copenhaver-Parry / Department of Biology, George Fox University, Newberg, OR, 97132.

Understanding the demographic filters – seed production, dispersal, germination, and establishment – that underlie spatiotemporal variation in forest recruitment is necessary to accurately anticipate the effects of environmental change on forest demography, population dynamics, and species range dynamics, as early life history stages are more sensitive to change than adult individuals. The transitions extending from seed production to germination are poorly understood and quantified components of recruitment owing to the difficulty of counting and tracking seeds in dense, closed-canopy forests, yet can have a substantial impact on seedling abundance. To better understand these transitions in two abundant western tree species – western hemlock and Douglas-fir – we quantified the correlation between seed abundance and adult neighborhood basal area or seedling abundance over one year of seed production in four forested stands extending across a large climatic gradient in western Oregon. In western hemlock, seed availability was more strongly correlated with large neighborhood basal area than with germinant counts, indicating that germination is likely a key limitation. In Douglas-fir, seed availability was more strongly correlated with germinant counts than with neighborhood basal area, indicating that seed production is likely a key filter. Differences in recruitment filters between species likely reflect a high sensitivity of western hemlock germination to microsite suitability – which may be strongly tied to light availability for this shade-tolerant species – and limited seed rain in Douglas-fir due to the tall stature and thick canopy of adult Douglas-fir in these mature stands, but a long-term seed data set is needed to confirm these trends.

G06 U Testing the correlation of trace element characteristics with the petrology and temperature of eruption of mid-Miocene rhyolites in Eastern Oregon

Brianna Young, Martin Streck / Department of Geology, Portland State University, Portland, OR.97201

The Lake Owyhee Volcanic field (LOVF) in eastern Oregon experienced several major eruptive events during the mid-Miocene (16.8 to 15.5 Ma), resulting in the emplacement of 3,900 km 3 of rhyolitic lava flows and ash flow tuffs. Eighteen samples from eleven different silicic centers of LOVF were selected for this study. While all samples of this study are

classified as rhyolite, their compositions vary greatly with regard to trace and major elements. Using trace element concentrations, these rhyolite samples were classified as “A-type”, described as resulting from “hot and dry” magmas and associated with hot-spot activity, or as “I-type” or “calc-alkaline”, described as rhyolites from “cool and wet” magmas and associated with subduction zones. Five samples from three units (Buchanan, Circle Bar, and Dam rhyolites) were classified as I-type, eight samples from five units (Dinner Creek tuff, Littlefield, Jump Creek, Mahogany Mountain, and Three Fingers rhyolites) were classified as A-type, and five samples from three units (Unity, Cottonwood, and Dooley Mountain rhyolites) were classified as “borderline”, plotting between A- and I-type. Mineral assemblages were recorded for each sample. Similarities in these assemblages can be seen between different samples that are classified as the same “type” (A- or I-). I-type samples contain plagioclase feldspar with high An, sanidine with high Or, orthopyroxene, apatite, biotite, and/or amphibole. A-type rhyolites, on the other hand, typically contain lower-An plagioclase, lower-Or sanidine, low-En clinopyroxene, and/or zircon. Temperatures were estimated using geothermometers specific to the mineral assemblages that were recorded for each sample. The temperature range for samples that are classified as A-type is 783 C to 984 C whereas the I-type rhyolites give a much larger range of 737 C to 1043 C when including every geothermometer used. When excluding geothermometers that yield estimates that are greatly influenced by composititon (i.e. high An feldspar will yield anomalously high temperatures), the estimate range for I-type rhyolites is 737 C to 900 C. The temperatures estimated for the A-type rhyolites in this study are consistent with published A-type rhyolite temperatures, such as those found in the Snake River Plain. The I-type rhyolites are slightly more complicated; when excluding the geothermometers that appear greatly influenced by composition, the I-type rhyolites align with published values, such as calc-alkaline rhyolites found at South Sister in Oregon and Okareka center in New Zealand. The effect of hydrous minerals can be seen on several of these I-type rhyolites as the samples that contained biotite and/or amphibole tend to yield much lower average temperatures than samples that do not contain these phases. Similarly, the I-type samples that contained pyroxene tend to yield much higher average temperatures than other I-type rhyolites.

HEALTH SCIENCES & KINESIOLOGY

Section Chairs:

Bradley Cardinal
Oregon State University

Mary Imboden
George Fox University

ORAL PRESENTATIONS

The role of recess in the health of elementary school children

Janelle Thalken[1], Alexandra Szarabajko[1], Laura Neilson[1], William V. Massey[1] / [1]Kinesiology Program, School of Biological and Population Health Sciences, College of Public Health and Human Sciences, Oregon State University, Corvallis, OR 97331.

Despite increasing attention on the benefits of school recess, Oregon elementary schools do not have any state level recess requirements. This is concerning given that recess provides one of few opportunities for physical activity during the school day, and obesity rates remain high in child populations. The purpose of the current study was to examine the relationship between recess quality, recess time and body mass index (BMI). Data were collected at 26 elementary schools across four distinct regions of the United States. Schools ranged from 31.6% to 98.2% economically disadvantaged (M=78.53; SD=17.95). Recess quality was measured using the Great Recess Framework-Observational Tool (Massey et al., 2018) by trained observers with at least two observation days per recess at each school. Recess time was classified into three different time categories, less than 20 minutes per day, 21-30 minutes per day and more than 30 minutes per day. BMI was measured by height and weight assessments completed on children who were randomly selected from each of the third and fifth grade classrooms (n=468; M=19.83; SD=4.48). BMI was calculated using the measured height and weight scores, and then translated to z-scores, percentiles, and age-adjusted BMI category. Two-level regression models were conducted in Mplus v.8.2. Recess time significantly predicted student BMI scores (b= -.704, p= .027) when controlling for key covariates. There was no relationship found between the quality of the recess environment and BMI scores. The study findings suggest that time spent at recess is important for elementary-age children and their physical health.

Recess reset: Common problems and proposed solutions to increase the quality of recess in elementary schools

Deanna Perez[1], Janelle Thalken[1], Alexandra Szarabajko[1], Laura Neilson[1], Alycia Korn[1], William V. Massey[1] / [1]Kinesiology Program, School of Biological and Population Health Sciences, College of Public Health and Human Sciences, Oregon State University, Corvallis, OR 97331.

Considerable attention has been paid to the implications of recess on childhood development. Emerging data suggests decision makers must consider the quality and accessibility of recess (Massey et al., 2020). In order to develop solutions to increasing the quality of children's recess experiences, the purpose of the current study was to document common problems observed during elementary school recess and the conditions in which these problems emerged. Data were collected from 112 recess sessions in 25 schools located throughout the United States. The Great Recess Framework-Observational Tool (GRF-OT; Massey et al., 2018) measures the following factors: (1) safety and structure of the recess environment, (2) student behaviors, (3) adult supervision and engagement, (4) transitions, and (5) physical activity patterns. The GRF-OT guided observations and field notes. Following data collection an inductive content analysis was conducted (Tashakkori & Tashakkori, 2010). Analyses revealed poorly designed and maintained playground spaces contribute to common safety problems observed during recess. Moreover, a combination of insufficient space planning and maintenance, lack of play equipment and game availability, and limited adult involvement reinforced social hierarchies leading to exclusionary practices. While recess is often deemed a child-led portion of the school day, results highlighted the important, and often forgotten, role adults play in recess. For example, adults have the resources to design play spaces, ensure the availability of adequate equipment, reinforce norms of behavior, and maintain spaces and equipment. Findings will be presented within the context of practical solutions schools can adopt to mitigate problems observed during recess.

Assessment of university employees' life-satisfaction based on well-being, body mass index, and sleep

Md. Dilsad Ahmed[1], Kashef N. Zayed[2] / [1]Kinesiology Program, School of Biological and Population Health Sciences, College of Public Health and Human Sciences, Oregon State University, Corvallis, USA / [2]Physical Education Department, Sultan Qaboos University, Oman

This study examined the role of well-being, body mass index (BMI), and sleep as predictors of university employees' life-satisfaction. Using simple random sampling procedures, a cross-sectional sample of 315 (Male *n*=173, Female *n*=142) permanent employees of Sultan Qaboos University (SQU) in Oman were recruited into the study. The mean age of participants was 36.41 yr. (± 9.10). Participants were categorized according to one of four BMI levels: underweight (9.2%), overweight (34.9%), obese (19.7%), and normal (36.2%). Further, participants physical activity levels were categorized into one of four levels: vigorous exercisers (19.4%), moderate exercisers (27.3%), mild exercisers (30.5%), or no exercisers (22.9%). Descriptive statistics (*M*, *SD*), bivariate correlations, and hierarchical regression, were performed to determine the best predictors of life-satisfaction. Further, path-analysis was used to observe the strength of the item's correlations diagrammatically. The result showed a positive relationship between life satisfaction and wellbeing. Regression analysis identified two potential dependent variables – well-being and BMI – as significant predictors of permanent university employees' life satisfaction (*R*= .518), which together accounted for 26.8% of the variance. Lastly, path-analysis between life satisfaction, wellbeing, and BMI resulted in a sound model fit (i.e., CMIN/DF-4.102, CFI-.969, TLI-.906 and RMSEA-.099). In conclusion, well-being and BMI impact permanent university employees' life-satisfaction. While an important variable associated with good health, sleep was not found to be an important variable in the present model.

The relationship between concussions and mental health

Rachel Fox[1], Mary T. Imboden[1] / [1]George Fox University, 414 N. Meridian Street, Newberg, OR 97132

Mental health disorders and concussions frequently share similar symptoms including low mood, irritability, and anxiety. However, traditional concussion treatment protocols have not considered a patient's mental health status. This study aimed to assess the relationship between concussions and mental health in college-aged athletes. Participants included 176 men and women recruited from George Fox University athletic teams between October 2018 and September 2019. All participants completed a mental health survey including questions from the GAD-7, PHQ-9, and PCL-s. Independent sample T-tests were performed to determine if there were significant differences between athletes with a previous history of concussions versus athletes with no concussion history. Approximately 10% (n=17) participants of the total population had a history of a brain injury in the form of a concussion. Additionally, 10% (n=17) of participants self-reported a history of mental health illness. However, 27% of the athletes (n=48) scored high enough on the mental health survey to be considered as having a mental health illness. Further, athletes that had experienced a concussion showed significantly higher depression, anxiety, and PTSD scores ($P < 0.01$). In conclusion, the findings suggest a relationship between concussion history and mental health symptoms, highlighting the need for mental health screenings to be implemented in pre-participation screenings of athletes and especially as part of the concussion treatment plan.

Leading change through knowledge translation in health science and kinesiology

Jafrā D. Thomas[1], Bradley J. Cardinal[2] / [1]Department of Kinesiology and Public Health, College of Science and Mathematics, California Polytechnic State University, San Luis Obispo, CA 93407. [2]Kinesiology Program, School of Biological and Population Health Sciences, College of Public Health and Human Sciences, Oregon State University, Corvallis, OR 97331.

A widely accepted social mandate for science is to generate knowledge that promotes the public good. One overlooked topic when experts attempt to translate scientific knowledge into practical ends is suitability. Suitability is the systematic measure of a lay resource to determine the extent that end-users would find value in and could apply its content. Readability is one well-documented suitability issue that limits the effectiveness of science communication to lay audiences, irrespective of discipline. Suitability entails other indicators of end-user utility, indicators that are rarely studied with respect to physical activity promotion resources (Thomas et al., 2018). To advance knowledge on the prevalence of suitability issues within educational resources meant to promote physical activity among the public, we studied 139 free web articles published between 2008 and 2018 (*M*=2015.97, *SD*=2.42), produced by diverse sources, written in English, communicated primarily through text, and located using validated lay adult search strategies. The Suitability Assessment of Materials method was adapted (subdomains=20). Most web articles were at least satisfactory across 12 subdomains and unsatisfactory for the remaining 8. The results substantiate the hypothesis that suitability issues are not well understood by resource producers/selectors. Regardless of organizational type, most web articles did not pass critical criteria, suggesting that they were not ready for dissemination. The implication of these findings will be discussed. Given the social mandate

for science to promote the public good, we will provide recommendations for a publicly engaged scholarship that supports the dissemination of suitable lay resources (Thomas et al., in press).

Thomas, J. D., Flay, B. R., & Cardinal, B. J. (2018). Are physical activity resources understandable as disseminated? A meta-analysis of readability studies. *Quest, 70*, 492-518. https://doi.org/10.1080/00336297.2018.1463269
Thomas, J. D., & Cardinal, B. J. (in press). How credible is online physical activity advice? The accuracy of free adult educational materials. *Translational Journal of the American College of Sports Medicine*.

POSTER PRESENTATIONS

H01 G Promoting healthcare access and physical activity engagement for persons with disabilities

Winston Kennedy, Abigail Lue, and Robert Fruin / Kinesiology Department, Oregon State University, Corvallis, OR 97331

Healthcare professionals (HP) appear to be gatekeepers of general health needs, including opportunities for physical activity (PA). This may cause disparities in healthcare and PA access for persons with disabilities (PWD) when compared to persons without disabilities. A 2010 CDC Healthy People report cited that 36% of adults do not engage in any leisure-time PA; this increases to 56% for adults with disabilities. Further research highlights that PWD receive fewer preventative and treatment services than persons without disabilities. Preventative treatment involves promotion, recommendation, or prescription of PA from HP. To understand these disparities, this review will explore the empirical experience of PWD within healthcare and PA, and provide future direction as informed by the Social Ecological Model (SEM). Generally, PWD have comparatively larger health concerns, stemming from their specific disability or a secondary condition. Additionally, they may experience barriers to PA in physical and psychosocial dimensions. HP have expert knowledge of their patients' disabilities and are a trusted source of information for families. This puts them in a unique position to create and educate PWD about PA opportunities at various levels, as well as provide access to quality healthcare. The SEM may be foreign to many HP; most provide care at the individual level. Avenues for HP to extend their expertise and knowledge are present but not always salient. Educating various HP on the SEM, and including tangible ways to integrate the SEM model into provided care, may lead to increased access to healthcare and opportunities for PA.

H02 G Human skeletal muscle fatigue causes phosphorylation of key structural and regulatory proteins

Scott Mongold[1], Larry L. David[2], and Damien M. Callahan[1] / [1]Department of Human Physiology, Oregon Health and Science University, Portland, OR 97239; [2]University of Oregon, Eugene, OR 97403

Muscle fatigue, an acute reduction in force generating capacity during repeated or prolonged activation, is associated with altered intracellular metabolism and diminished excitation contraction coupling. However, prolonged, high-intensity activation of skeletal muscle likely causes myriad post-translational modifications in the sarcomeric proteins that regulate and make possible, muscle contraction. Exploration of the sarcomeric phosphoproteome have been limited to pre-clinical models of muscle fatigue. In the present study we sought to broadly characterize the phosphoproteome of skeletal muscle 1) at rest and 2) following acute fatigue to test the hypothesis that regulatory and contractile proteins are phosphorylated during fatiguing exercise. Four young volunteers (ages 20 – 24 years, 2 males, 2 females) participated. With their dominant leg, volunteers performed repeated, maximum voluntary contractions under moderate resistance until task failure. Immediately following fatigue, bilateral, percutaneous biopsy of the vastus lateralis muscle was performed on the fatigued and non-fatigued (non-exercise control) limbs. Tissue (~50 mg) was blotted, removed of any adipose tissue, snap frozen and stored at -80°C until analysis by the Proteomics Shared Resource at OHSU using liquid chromatography followed by high resolution mass spectrometry. The analysis revealed differential phosphorylation patterns in over 4,000 peptides. The sarcomeric proteins showing the greatest response to fatigue included: tropomyosin beta chain (β-Tm), myosin regulatory light chain (RLC), titin, and myosin II. Our findings confirm our hypothesis that fatigue is associated with a range of phosphoproteomic alterations in the human sarcomere and reveal novel targets for future investigations into the specific role of phosphorylation in contractile performance.

H03 G Evaluating the impact of an exercise program for youth living in out-of-home care

Emmanuel Ughelu, Deanna Perez, Janelle Thalken, Alycia Korn, and William Massey / Kinesiology, Oregon State University, Corvallis, OR 97331

Youth homelessness remains a public health issue in the United States (U.S.). In Oregon, the U.S. Department of Housing and Urban Development (HUD) estimates that approximately 1,300 youth experience homelessness on any given day. Although interventions and programs continue to mitigate youth homelessness and its associated risks, community collaborations are needed to facilitate holistic development among this population. Research suggests that sport and exercise programs can be effective to increase the health and well-being in homeless and traumatized youth populations (Massey & Williams, 2020). Given this, the purpose of the current study was to conduct an evaluation of an exercise program for transient youth in the Corvallis and Albany areas of Oregon. Social Fitness Club (SFC) is a sport and exercise program that features a university-community collaboration between a local organization working alongside youth who are homeless and/or in out-of-home care. SFC meets once a week for 90 minutes at Oregon State University with each session focused on creating a positive association for health and physical activity through exercise (e.g., weight room, yoga, dance, active games), mentoring relationships, autonomy, and a variety of on-campus experiences. The content of the presentation will focus primarily on the results of our formative and process evaluation. Within this, we will outline the SFC theory of change, challenges to program implementation, and youth experiences within the program. A focus on practical strategies and lessons learned through our program evaluation will be highlighted with recommendations for scholars planning to engage with this population in future pursuits.

H04 U Analysis of common healthcare conditions of rural medical mission clinics in Haiti

Lauren Baddeley, Jonathan Howe, and Joseph Elkins / Math and Science Department, Corban University, Salem, OR 97317.

Since 2012, Corban University students travel with a team of medical professionals to Haiti to gain a deeper understanding of healthcare practices in developing countries. Physicians, physicians' assistants, nurses, pharmacists and dentists work with the patients in Haiti to address their healthcare needs and students shadow the providers. In May 2019 this team went to a new location in Haiti and hosted four medical clinics in rural locations that have limited access to regular medical care. A major consideration when planning this trip is that the medication prescribed to patients must be purchased in advance and brought to the clinic each day. Therefore, there is a limited supply available which can quickly run out depending on the medical needs of the patients seen. Without data on the chief complaints of the patients seen at these rural locations, the medication that was purchased was often not appropriate for the most commonly presenting complaints. In order to guide medication purchases and medical training for future trip participants, data from the 2019 trip was analyzed for chief complaints, common diagnoses and prescriptions. A total of 469 patients were seen at 4 rural clinics. The three most common diagnoses were hypertension, gastro-esophageal disease (GERD) and urinary tract infections (UTIs) and the most prescribed medications were acetaminophen, Diflucan, and Lisinopril. The results from this study will be used to inform future medication purchases. Additionally, medical professionals participating on the trip will be informed of the common diagnoses and typical prescriptions available for those diagnoses.

H05 U The influence of cardiorespiratory fitness, muscular fitness, and flexibility on memory.

Brittany Bravo, Emily A. Spencer, Alyssa R. Del Castillo, and Mary T. Imboden / Health and Human Performance, George Fox University, Newberg, OR 97132

Cardiorespiratory fitness (CRF) has been shown to be associated with cognitive function, including attention and memory. However, less is known regarding how the other health-related components of fitness may influence cognitive function. The primary aim of this study was to determine whether a relationship exists between memory and three different components of fitness: CRF, muscular fitness, and flexibility in apparently healthy adults. All participants (n=54) completed physical fitness assessments, including a maximal exercise test using the Bruce protocol to determine CRF, push-up test to assess muscular fitness (MF), and sit-and-reach test to assess flexibility. Further, participants completed the everyday memory questionnaire (EMQ) to subjectively assess memory. Participants were divided into low and high memory groups, based on their score on the EMQ (low score< 26, high score≥ 26). Independent samples T-tests were employed to determine differences between the low and high memory groups in CRF, MF, and flexibility. The high memory group had significantly higher CRF ($P=0.03$), and a trend towards higher flexibility ($P=0.06$). However, there were no differences between the low and high memory groups in MF ($P=0.88$). The findings are consistent with past research suggesting a positive relationship between CRF and cognitive function. However, this study also shows potential memory benefits with higher levels of flexibility. Future research should assess these relationships in a larger population, as well as examine how improvements in physical fitness (CRF, MF, and flexibility) may lead to changes in memory over time.

H06 U The relationship between cardiorespiratory and muscular fitness on workplace performance.

Ashlyn Fast, Joseph Ballard, Lacey Dean, and Mary Imboden / Health and Human Performance, George Fox University, Newberg, OR 97132

Cardiorespiratory fitness (CRF) and muscular fitness have been shown to be associated with exercise performance levels. However, less is known about the relationship of CRF and muscular fitness with workplace performance. Therefore, the objectives of this study were to assess the influence of CRF and muscular fitness on energy, productivity, and engagement in the workplace, as well as on employee job confidence. Participants included 54 employees from George Fox University (mean age: 46.5 ± 12.7 years). All subjects completed a health and fitness assessment, including a maximal exercise test utilizing the Bruce treadmill protocol (CRF) and a maximal push-up test (muscular fitness). Participants also completed a survey, self-reporting their work performance levels. A univariate analysis of variance was performed to assess differences in CRF and muscular fitness for those self-reporting low, moderate, or high on workplace performance measures (energy, productivity, and engagement) and job confidence. Results showed a significant positive relationship between CRF and all four measures of workplace performance ($P<0.05$). Muscular endurance also had a positive relationship with all workplace performance measures ($P<0.05$) with the exception of productivity. Based on the current results, employers should encourage employees to participate in an exercise program to improve their CRF and muscular fitness, as both measures were positively related to workplace performance measures and job confidence.

H07 U The effects of intermittent fasting on attention and energy levels

Riley Moresco, Corina Stillwell, and Mary Imboden / Health and Human Performance, George Fox University, Newberg, OR 97132

Intermittent fasting has become a popular eating pattern in recent years. Current research on the topic shows the improvements in cardiovascular health, weight status, insulin sensitivity, etc. associated with intermittent fasting. However, there is limited information on whether intermittent fasting affects cognitive function. The objective of this study was to examine the impact that intermittent fasting has on energy levels and attention span. Eighteen participants (average age 24, 70% female) completed two weeks of normal eating, followed by 2 weeks of intermittent fasting. Each week participants performed a 1.5-mile run followed by an objective attention test (Letier 3) and a subjective survey that assessed attention and energy levels in the classroom. A t-test was performed to measure differences in attention levels and the 1.5 mile run time between the normal eating and intermittent fasting weeks. Results showed significantly higher levels of attention based on results from the Leiter 3 objective assessment ($p<0.05$) during the second week of the intermittent fasting period compared to the second week of normal eating. Further, intermittent fasting led to significant improvements in the 1.5-mile run suggesting improvements in energy and performance. Intermittent fasting has been associated with numerous physical health benefits. The current findings add to the literature by highlighting the importance intermittent fasting may have on cognitive function, where results showed intermittent fasting increases attention span and energy levels.

H08 U The Supercrip: Model of inspiration or model that reinforces able-bodied hegemony?

Danielle Sterba and Winston Kennedy / Kinesiology Department, Oregon State University, Corvallis, OR 97331

The rise of participation options for athletes with physical and intellectual disabilities has risen within the last half-century, and with it, the supercrip representation of athletes with disabilities. Supercrip can be defined as a stereotypical representation of individuals with disabilities that highlights their accomplishments as inspirational stories of defying or overcoming their disability to succeed. Sport, as a microcosm of society, is reflective of the processes of society and has a key role in furthering hegemonic ideals, the ideals of socially dominant groups. The purpose of this review is to examine the legitimacy of the supercrip model as a positive mode of representation for athletes with disabilities, explore its connection to able-bodied hegemony, and propose next steps in facilitating research and discourse around representation for athletes with disabilities. It was found that the supercrip model perpetuates able-bodied hegemony by describing athletes with disabilities as "overcoming" or "defying" their disability to accomplish what able-bodied athletes achieve. This reinforces that able bodies are the norm and that individuals with disabilities need to be overly exceptional to participate in sport. Sports and sports representation are vehicles that further hegemonic norms, and reshaping the methods of representing disability in sports has the power to challenge hegemonic ableism and further social justice through sports. With little consensus on how to represent disability in sport, next steps should include involving athletes with disabilities in the conversation of how to best represent their accomplishments in sport.

H09 U Comparative benefits of protein and creatine supplementation over 3 weeks among resistance- trained college-aged students

Alexander R Swartz, Madelynn Krotzer, and Mary T. Imboden / George Fox University, Newberg, OR 97132

Supplement use has increased over the past years, as a means for improving performance, especially among commercial gym-goers. While many studies have shown the benefits of supplementation, comparative studies on the effect of protein versus creatine supplementation on muscular strength performance are lacking. The purpose of this study is to examine differences in muscular strength improvements following a resistance-training program supplemented with creatine monohydrate versus whey protein isolate. Fourteen college-aged males not currently consuming supplements were recruited and assigned into either the protein or creatine group. Subjects performed the 3-repetition maximum (RM) bench-press test at baseline and following 3 weeks of resistance training + supplementation. A repeated measures T-test was conducted to assess differences between pre and post-assessments. An independent samples T-test was conducted to assess differences in strength changes over the study period in the protein and creatine groups. The protein group significantly increased their 3-RM bench-press by an average of 17.14 lbs. (+25.42%; p = 0.0009) between pre- and post-assessment. The creatine group also significantly increased their 3-RM bench-press by an average of 14.29 lbs. (+21.54%; p = 0.0137) between pre- and post-assessment. However, there was no statistically significant difference in muscular strength change between the protein and creatine groups (p = 0.5821, respectively). Athletes looking to increase their upper body strength over a short period of time may want to consider supplementing with protein or creatine following their resistance training. However, neither supplement is comparatively more beneficial for increasing strength following resistance training.

H10 U Comparing college students stress levels in response to a change of living conditions: From the city life of Portland to the bush of Tanzania

Aaron J. Yamasaki, Kaylyn S Fukuji, and Tara Prestholdt, / Biology Department, University of Portland, Portland, OR, 97203

The stress levels of college students were analyzed while being in two contrasting environments: the busy life of academia compared to the full immersion into the great Serengeti of Africa. Heart rate and blood pressure are correlated to elevated cortisol in the individual. Thus, this study aimed to analyze the patterns in how environmental factors may affect an individual's stress levels. General trends were identified and is the basis for understanding how the environment plays a role in the overall health of the human body.

Instructional language used by strength and conditioning coaches: Analysis of mic'd up videos.

Alexandra Szarabajko[1], Bradley J. Cardinal[1], Nzubechukwu Emmanuel Ughelu[1], Dakota Dailey[1], and Jake D. Wambaugh[1] / [1]Kinesiology Program, School of Biological and Population Health Sciences, College of Public Health and Human Sciences, Oregon State University, Corvallis, OR 97331.

Strength and conditioning (S&C) coaches work with athletes to improve strength and decrease injuries. Designing and facilitating practices effectively are fundamental skills highly emphasized in S&C certification programs. One area S&C coaches feel least trained is in their ability to use psychological skills to effectively communicate with their athletes. This study sought to understand the instructional language used by S&C coaches. On the basis of a critical discourse analysis, ten mic'd up videos were analyzed using the "Self-Assessment Feedback Instrument" (Mancini & Wuest, 1989). Half of the videos showed male coaches coaching male athletes and the other half coaching female athletes. Coaches' statements were transcribed verbatim and then classified into eight categories (i.e., instruction during performance, praise, hustle behavior, questions, names, giving directions, global psychological skills, and other). A total of 367 statements were recorded. No differences were observed in the use of instructional dimensions between sports or context (p>0.05). Four categories of the instructional languages accounted for 254 (69.3%) of the total observations (instructions [n = 91, 24.8%], praise [n = 59, 16.1%], hustle behavior [n = 52, 14.2%], and questions [n = 52, 14.2%]). These observations were overrepresented (standard residuals ranging from +0.9 to +6.66). The other four dimensions were underrepresented (standard residuals ranging from -1.75 to -3.23). Based on this analysis, instructions were predominately used, and psychological skills underused. What coaches' say greatly impacts athletes' motivation and performance. There is a need for the development of practical communication tools for S&C coaches.

Universal design for learning: An overview of principles for equitable education and exploration on their application to physical activity promotion in healthcare settings.

Jafrā D. Thomas[1], Winston Kennedy[2], Bradley J. Cardinal[2] / [1]Department of Kinesiology and Public Health, College of Science and Mathematics, California Polytechnic State University, San Luis Obispo, CA 93407. [2]Kinesiology Program, School of Biological and Population Health Sciences, College of Public Health and Human Sciences, Oregon State University, Corvallis, OR 97331.

Academic preparation in kinesiology has multiple applications, including the preparation and ongoing professional development of physical and health (P&H) educators (Thomas et al., 2019). P&H educators seek to inspire and teach future generations of people to lead healthy-active-lifestyles across their lives (Cardinal et al., 2016). Central to achieving this aim is that nobody is left behind (U.S., *National Physical Activity Plan*). The focus and educational methods must be inclusive. Universal Design for Learning (UDL) is a curriculum-design-tool for creating inclusive educational practices, which has seen nascent application in physical education settings as one means of assuring inclusivity when teaching children and youth with disabilities (Kennedy et al., 2019). Individuals entering the adult years become especially reliant on healthcare systems for guidance and support. Unfortunately, healthcare providers, though, are not universally prepared for this (Cardinal et al., 2015). Strategies to build healthcare provider capacity to effectively counsel patients with regard to physical activity exist (e.g., Project PACE [Physician-Based Assessment and Counseling for Exercise]). However, unique socio-structural barriers remain for individuals with disabilities, including some that may be manifested by healthcare providers due to implicit biases. Research on counseling curricula for active lifestyle promotion that are designed and implemented with UDL methods should provide insights that will help close the knowledge gap between healthcare provider training and people's lived experiences. Kinesiologists are well-positioned to facilitate such work. We will discuss a-UDL-approach to curriculum development and provide future research recommendations aimed at supporting equity in patient counseling practices focused on physical activity promotion.

Cardinal, B. J., Park, E. A., Kim, M., & Cardinal, M. K. (2015). If exercise is medicine, where is exercise in medicine? Review of US medical education curricula for physical activity-related content. *Journal of Physical Activity and Health, 12*, 1336-1343. https://doi.org/10.1123/jpah.2014-0316
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Kennedy, W., & Yun, J. (2019). Universal design for learning as a curriculum development tool in physical education. *Journal of Physical Education, Recreation & Dance, 90*, 25-31. https://doi.org/10.1080/07303084.2019.1614119
Thomas, J. D. & Ness, J. M. R. (2019). An academic career in kinesiology? Our realization it is a thing and personal journey towards one. *Proceedings of the Oregon Academy of Science, 78*, 25. http://oregonacademyscience.org/OASRevised2019Proceedings.pdfn

Does exercise counteract caffeine's impact on anxiety levels?

Briana Van Tassle[1], Kate Haugen[1], Mary T. Imboden[1] / [1]George Fox University, Newberg, OR 97132.

Caffeine has been named the World's most widely consumed psychoactive drug, with many consuming this product to increase energy and alertness. However, high amounts of caffeine have also been shown to lead to higher levels of anxiety. Contrarily, exercise has been shown to improve symptoms of anxiety. However, limited studies have assessed if regular exercise minimizes caffeine's impact on anxiety levels. This study aimed to assess the impact of caffeine on anxiety levels in college-aged exercisers compared to non-exercisers. This study enrolled 215 participants who all completed an online survey of 26 questions inquiring about daily caffeine consumption, exercise, and anxiety levels including questions from the Hamilton Anxiety Scale Test and the GAD-7 anxiety rating scale. The exercisers and non-exercisers were divided into high (≥24 oz. daily) and low (<24 oz. daily) caffeine users, and an independent samples T-test was performed to assess differences between high caffeine exercisers and high caffeine non-exercisers in anxiety levels. Further, an independent samples T-test was performed to assess overall differences in anxiety between the high and low caffeine users. Overall, the high caffeine users had higher self-reported anxiety levels than the low consumers. However, when assessed by exercise status the high caffeine non-exercisers reported a higher amount of anxious feelings than high caffeine exercisers($p<0.05$). Further, in the exercise group caffeine consumption was not related to anxiety levels. These findings suggest a positive relationship between caffeine consumption and anxiety levels; however, exercise may help prevent anxiety even in those that consume high amounts of caffeine.

MATHEMATICS & COMPUTER SCIENCE

Section Chair:

Corban Harwood
George Fox University

ORAL PRESENTATIONS

LIBRE-ary, a distributed digital archiving system

Ben Glick, Jamie Quishenberry, Jens Mache / Department of Mathematical Sciences, Lewis & Clark College, Portland, OR 97219

As the world becomes more and more data-dependent, new problems of digital object storage continue to arise. People increasingly depend on having ready and easy access to the data they need to carry out their everyday lives. With this increased focus on data in everyday life comes a drastic increase in the amount of data people are responsible for. A corollary to this increasing dependence and scale is a problem we would define as digital clutter. Much like physical clutter, digital clutter can lead to confusion, complex data-management strategies, and often, unfortunate loss of important data and documents. One of these new data-related problems is what we call the "digital archive problem." People and organizations have a need to keep track of a huge amount of data and in very specific ways. They are often required by data management plans to keep specific versions of specific objects or certain objects may simply be very important. It is easier now than it ever has been to lose track of the data we depend on every day. There has been a significant amount of work on the problem of computer backup systems, and there has been some work on special, single-purpose digital archives, but surprisingly little work has been done on a truly general-purpose digital archive system. This project is able to utilize some of the advancements of other digital backup systems which have been created and operated for some time now, through the digital object storage adapter In this presentation, we introduce LIBRE-ary, our solution to the digital archiving problem.

Sensitivity of method stability to numerical oscillations

Corban Harwood / Department of Mathematics and Applied Science, George Fox University, Newberg, OR 97132

In numerically solving partial differential equations, it is essential to predict and identify irregular behavior including error amplification and numerical oscillations. Noise in initial conditions from measurement errors can create unwanted oscillations which propagate in numerical solutions. To demonstrate the sensitivity of stable methods to numerical oscillations, we apply the unconditionally stable Crank-Nicolson method to various linear and nonlinear PDE. Further, we present a technique of prohibiting errors from such oscillations in time when solving initial-boundary-value problems of semilinear diffusion equations. The unconditional stability and oscillation-free properties of our method are proven through local analysis about an attracting steady-state solution. The proven accuracy of our method and the usefulness of oscillation-free stability is further verified through solving a Fisher-type equation where oscillation-free solutions are successfully produced despite random errors in the initial conditions.

Combinatorics of integer partitions

Ethan Jensen / Department of Mathematics and Applied Science, George Fox University, Newberg, OR 97132

In this presentation, we explore the connection between combinatorics and particular values of the Riemann zeta function. The goal is to develop a new algorithm to calculate the exact form of positive even zeta values in terms of pi without using identities involving the Bernoulli numbers.
By comparing coefficients in the Euler product and Maclaurin series expansions of hyperbolic sine, we can compute the exact form of several series related to the zeta function in terms of pi. By systematically constructing partitions of n-dimensional positive integer lattices, we can express positive even values of the zeta function as linear combinations of these series. Solving the system of linear equations gives us a recursive procedure to compute them. The coefficients of the linear equations are analogous to computing the number of ways to distribute a specified set of blocks of various sizes into a specified set of holes, making this a combinatorics problem. This resulting combinatorics problem is solved using a greedy algorithm.
Establishing the connection between combinatorics and the zeta function suggests that the Riemann hypothesis may have deeper, far reaching consequences for all fields of mathematics and computer science.

PHYSICS

Section Chair:

Todd Duncan
Pacific University

ORAL PRESENTATIONS

Measuring the rate and extent of polymerization of photopolymers housed in capillary waveguides

Amber Smith and James Butler/ Department of Physics, Pacific University, 2043 College Way, Forest Grove, OR 97116.

Self-healing systems are ones that regenerate during or after a process of degradation has occurred. These systems have many applications such as structural integrity, physical protection, and general durability. In particular, it is important to protect individuals in situations where high-speed damage to protective clothing can have serious health-related consequences. Fibers that can heal on millisecond timescales have potential to create innovative fabrics for this purpose. We hypothesize that photopolymer filled capillary waveguides can change their physical properties at these timescales. Through an injection of high intensity light into the capillary waveguides, we aim to measure both the speed and depth of polymerization which will cause rigidity in the capillary itself. We have developed an interferometer-based system to measure the rate and extent of polymerization in these waveguides, using interference and indices of refraction.

Plasma modeling of an IEC fusion reactor via 1D Vlasov Equation.

Mitikorn Wood-Thanan, Jeff Black, Aaron Maroni, Erik J. Sánchez / Department of Physics, Portland State University, Portland, OR 97201.

Nuclear fusion represents a fundamentally different approach to harnessing nuclear energy than conventional methods based on nuclear fission. It promises relatively clean energy generation using universally abundant fuel with no risk of a meltdown scenario associated with conventional fission reactors. Due to the numerous challenges in constructing and maintaining a practical fusion reactor, many reactor designs have been proposed. The most recognized of these designs are the tokamaks, which is the design being used at the International Thermonuclear Experimental Reactor (ITER) in France. While ITER remains the forefront of fusion reactor research, it is not designed to produce electricity and will not be fully operational for at least a couple of decades. To expedite research in energy generation, it is important to consider different economical reactor designs. One alternative design is the Inertial Electrostatic Confinement (IEC) fusion reactors. While they have yet to match the efficiency and power output of tokamaks, IEC fusion reactors are not prohibitively expensive nor time-intensive to fabricate to the degree where it is possible for a private individual to fabricate their own reactor. To achieve greater theoretical understanding of IEC devices, we have created a plasma simulation that is designed to be run on a GPU cluster in order to investigate physical phenomena that can be exploited to improve the device's capabilities. The simulation tracks the position and momenta of ions and electrons within the reactor as well as accounting for processes such as ionization, excitation, secondary electron emission, and calculating nuclear fusion reactions.

Metallophthalocyanines as electrocatalysts for membraneless H2O2 fuel cells

Bao Nguyen, Neal Kuperman, Gary Goncher, Raj Solanki / Department of Physics, Portland State University, Portland, OR, 97207.

One-compartment hydrogen peroxide fuel cells with Co, Cu, and Fe phthalocyanine (PC) and iron nitride (Fe_xN) as cathodes and Ni anode have been investigated as sustainable energy sources. The cells were operated under acidic conditions and at room temperature. The potentials for onset of the catalytic currents in these cells were determined via cyclic voltammograms. Potential-current linear sweep voltammetry was utilized to determine the open circuit potentials (OCP) and the power densities the fuel cells. The maximum output power densities of FePC and CoPC, CuPC, and Fe_xN were 740 $\mu W\ cm^{-2}$, 48 $\mu W\ cm^{-2}$, 50 $\mu W\ cm^{-2}$ and 430 $\mu W\ cm^{-2}$, respectively. These power densities are suitable for powering micro-devices.

Multiple working hypotheses and information-theory as a more intuitive basis for model selection

Choomno Moos, Peter Moeck / Nano-Crystallography Group, Department of Physics, Portland State University, P.O. Box 751, Portland, OR 97207-0751, USA.

The misrepresentation of physical quantities and misuse of statistical techniques are widespread throughout scientific publication [1]. Malpractices such as incorrectly reporting uncertainties on measured and derived quantities, and the misuse of null-hypothesis procedures, such as data-dredging and p-hacking, are prevalent in many scientific publications. Moreover, inferences are often uninformative, made without sufficient consideration of all plausible models, and often there is no quantitative, non-binary comparison of the considered models. Two sources of problematic practices with null-hypothesis testing are its unintuitive, arbitrary nature, and its technical limitations. Another is a false belief that it is a fundamental part of the scientific method. While the Bayesian approach offers an alternative to significance testing, the computational difficulty involved and the need to use subjective priors leave much to be desired. An information-theoretic approach, based on Akaike's Information Criterion (AIC), remedies many of these issues, providing an easy to use and intuitive alternative to null-hypothesis testing that is superior in virtually all aspects. This approach is presented herein. The accompanying presentation "Metadata analysis of the linear thermal expansion of urea using information theory" by Grayson Kolar provides a demonstration of this approach.

[1] Anderson D., Burnam K., Thompson W. (2008). Null Hypothesis Testing: Problems, Prevalence, and an Alternative. Journal of Wildlife Management, vol. 64 no. 4, pp. 912-923.

Metadata analysis of the linear thermal expansion of urea using information theory

Grayson Kolar, Choomno Moos, Regan Garner, Peter Moeck / Nano-Crystallography Group, Department of Physics, Portland State University, P.O. Box 751, Portland, OR 97207-0751, USA.

Several experiments on the linear thermal expansion of urea as a function of temperature have been conducted. Existing literature that reports the temperature ranges used do not contain values between 123 K and 188 K. Using the Akaike Information Criterion (AIC), data existing in lower temperature ranges appear to have a quadratic fit, which, along with reported peak broadening [2], agrees with the accepted modern physics description. This relationship does not appear to be maintained in larger temperature ranges [1]. Linearity was assumed for the larger temperature range data set, which does not appear to align with the Akaike weights that were obtained. Herein, AIC is used to obtain Akaike weights of different data sets which suggest a possible, previously unreported phase transition between currently reported temperature ranges. Application of techniques mentioned in the previous talk "Multiple working hypotheses and information-theory as a more intuitive basis for model selection" by Choomno Moos are explained, and the importance of not assuming linearity in the thermal expansion of crystals is discussed.

[1] Julian, M. M. (2015). Foundations of crystallography with computer applications . Boca Raton: CRC Press, Taylor & Francis Group

[2] Birkedal, H. et al . (2004). The charge density of urea from synchrotron diffraction data. Acta Crystallographica Section A Foundations of Crystallography , 60 (5), 371–381. doi: 10.1107/s0108767304015120

Recursive identification of best-fit plane symmetry groups for more-or-less 2D periodic images

Connor Shu[1, 2] and Peter Moeck[2] / [1]Sunset High School, Portland, OR, [2]Nano-Crystallography Group, Department of Physics, Portland State University, Portland, OR 97207-0751.

CRISP, a popular electron crystallography software package, [1] cannot objectively identify the plane symmetry group of images that contain pseudosymmetries. Because of these pseudosymmetries, symmetry groups of lower order may be mistaken for their higher-order supergroups. By using a novel information theory-based approach for geometric model selection, supergroups and subgroups may be compared without estimating the noise level [2]. This elimination of a researcher-dependent, subjective judgement allows for objective classification of symmetry. Another issue with CRISP's algorithm is that its residuals do not account for geometric bias. In this work, we correct for this bias with the geometric Akaike Information Criterion (g-AIC). Once these corrected residuals are calculated, they are used in inequalities between supergroups and subgroups to determine if the higher-order supergroup is better fitting then the lower order subgroup. Previously, to identify the best-fit plane symmetry groups, these comparison calculations were done by hand. By modeling the symmetry hierarchy with a graph-like data structure, recursion can be used to automate the best-fitting plane symmetry group identification. Finally, because it is fundamentally unsound to assign a definitive classification of symmetry to noisy experimental data, ad hoc-defined confidence levels are instead calculated for the best-fit plane symmetry groups.

[1] www.calidris-em.com/crisp.php.

[2] P. Moeck, Symmetry 10 (2018) paper 133 (46 pages).

POSTER PRESENTATIONS

K01 G Designing a grating coupler to demonstrate the time evolution of interference patterns in a nanophotonic waveguide for pump-and-probe measurements

Nabila Islam and Rolf Könenkamp / Department of Physics, Portland State University, Portland, OR 97201

The advancement in the photonics technology has been facilitated significantly by the availability of high resolution near-field microscopy. Photoemission electron microscopes (PEEM) are powerful tools capable of synchronously imaging wave nature of light manifested by interference patterns as well as its particle nature through the energy exchange between the incident photons and the photoemitted imaging electrons. The electric field intensity variation of the interference pattern produced by the interaction between the incident light and the modes coupled into a transparent nanophotonic waveguide produces varying photoemission yields creating contrast in PEEM image. In this work the time evolution of such interference pattern is obtained by varying time delay between the pump and probe pulse in numerical simulations using COMSOL Multiphysics software - a finite-element-method (FEM) solver. A grating coupler is also designed to selectively couple 400nm light for transverse magnetic polarization into a 260-nanometer thick ITO nanophotonic waveguide placed between a glass substrate and an air superstrate by the means of matching effective indices. Imaging time evolution of the interference patterns by PEEM provides great potential for studying the dynamical properties of nanophotonic devices.

K02 G Metallophthalocyanines as electrocatalysts for membraneless H_2O_2 fuel cells

Bao Nguyen, Neal Kuperman, Gary Goncher, and Raj Solanki / Physics Department, Portland State University, Portland, OR 97201

One-compartment hydrogen peroxide fuel cells with Co, Cu, and Fe phthalocyanine (PC) and iron nitride (FexN) as cathodes and Ni anode have been investigated as sustainable energy sources. The cells were operated under acidic conditions and at room temperature. The potentials for onset of the catalytic currents in these cells were determined via cyclic voltammograms. Potential-current linear sweep voltammetry was utilized to determine the open circuit potentials (OCP) and the power densities the fuel cells. The maximum output power densities of FePC and CoPC, CuPC, and FexN were 740 $\mu W\ cm^{-2}$, 48 $\mu W\ cm^{-2}$, 50 $\mu W\ cm^{-2}$ and 430 $\mu W\ cm^{-2}$, respectively. These power densities are suitable for powering micro-devices.

K03 G Optical coupling studied in aberration-corrected electron microscopy

Theodore Stenmark and Rolf Koenenkamp / Department of Physics, Portland State University, Portland, OR 97201

Metallic nanoparticles have attracted considerable attention over the last decade due to their plasmonic properties. They exhibit localized surface plasmon resonances (LSPR) at particular excitation frequencies depending on the size, shape and material. The synthesis and properties of these particles have been extensively studied and there are a wide variety of applications in medical tagging, sensing, and optical coupling. As we move toward nanoscale devices it becomes critically important to be able to understand and measure not only bulk properties but also the resonances of individual and small groups of nanoparticles. The LSPR of a particular particle can be modified based on its substrate and proximity to neighboring particles and there is a need for characterization tools to analyze these dependencies for small systems. Photoemission electron microscopy (PEEM) is a surface microscopy technique where a sample is illuminated with a high intensity photon source and the resulting photoemitted electrons are collected to form an image. This allows for imaging of the spatial distribution of photon intensity in a sample. Our home-built aberration-corrected PEEM has proved to be a powerful tool for characterizing plasmonic responses and has been used to observe propagating surface plasmon polaritons as well as resonances of patch and bowtie antennas. In materials such as silver and gold we use a multi-photon process to produce a photo emitted electron. This non-linear excitation process produces strong contrast between areas of differing photon density. We report on the current resolution in our PEEM and present first results for on plasmonic resonances in single metallic nanoparticles and particle dimers. The results indicate that optical interparticle coupling can quantitatively be studied on the nanometer scale.

K04 HS Quantum machine learning frameworks for improved SiD calorimetry and Higgs boson analysis

Lucas Braun and Melissa Shell / School of Science and Technology, Beaverton, OR 97006

Quantum neural networks (QNNs) provide efficient data analysis through large feature Hilbert spaces and could solve classically-intractable particle physics problems. However, current research on QNN applications at future Higgs factories is limited. The performance of several essential QNN frameworks at particle physics tasks has also not been evaluated. This research examined the usability of deep and convolutional quantum neural networks in calorimetry and event tagging at the SiD detector planned for the International Linear Collider (ILC).

QNNs with different input sizes, circuit depths, and connectivity patterns were trained to correct electron energy measurements and identify H-->tau,tau events to determine optimal QNN designs for current and future quantum computers. Quantum and statistical noise were applied to assess robustness and current implementability. Optimal QNNs were compared with similarly-trained classical neural networks.

Both energy correction and event identification tasks were readily solved by QNNs. Eight-qubit QNNs with ~150 trainable variables and moderate circuit depth (~3 hidden layers) performed optimally regardless of connectivity, allowing for versatile implementation. Deep QNNs performed better overall than deep convolutional QNNs for few qubits but were less scalable. Low-connectivity, short-depth QNNs helped mitigate low-level quantum noise, improving performance under realistic conditions. All QNNs trained quickly, and data compression minimally impacted performance.

The results indicate that low-connectivity (quasi-local) deep QNNs provide flexible, noise-mitigating frameworks for solving diverse particle physics problems at the ILC on current and future quantum computers. These results can guide future QNN research as quantum technologies and ILC data analysis continue to grow.

PSYCHOLOGY

Section Chair:

Björn Bergström
Pacific University School of Graduate Psychology

ORAL PRESENTATIONS

Evidence based diversity training: a community exposure & response paradigm

Nicole Trammel; Jonathan Ramirez; Bjorn Bergstrom, School of Graduate Psychology, Pacific University

This presentation outlines a framework for improving and constructing diversity training models. Current research that examined the change in individuals' attitudes towards undocumented immigrants during a canvassing project suggests that applying evidenced based tools, like motivational interviewing, may improve the effectiveness of educational materials that challenge existing beliefs (Kalla & Broockman 2020; LaCour & Green, 2014). Nonetheless, there is a general gap within the diversity training literature, namely: a lack in identified mechanisms that explain patterns of resistance to change within diversity training contexts, as well as data that explains why various studied approaches have been effective. This presentation draws on theory and methods from anthropology, social psychology, and clinical psychology to create a theory informed meta-framework that details the mechanisms that help explain the human change process, and how to implement those principles for diversity trainings within organizations. Additionally, to better understand common obstacles (Kraft, Lodge, & Taber, 2015) that occur during diversity trainings, this meta-framework examines how culture becomes a system of meaning through which individuals' reflexively co-construct and manage their lived realities and how culture concepts become naturalized as a result. This presentation will conclude with an exploration of existing clinical interventions and skills and how those tools might be utilized to improve the effectiveness of diversity trainings within organizations.

Impaired distractor suppression as a marker of self-reported concussion

Daniel McCarthy Psychology, WOU

Concussions and their neurobehavioral consequences are currently a hot topic of discourse. Recent work suggests that individuals with a self-reported history of concussions experience heterogeneous deficits in several domains, including motor control, attention, and working memory (e.g., Howell et al., 2018; Hudac et al., 2018). Here, we investigated the interplay of attentional and motor inhibition by combining a singleton paradigm with 3D reach tracking. Participants reached to an odd-shaped target (e.g., circle among diamonds); on half of trials, a salient, task-irrelevant, colored distractor was present. Results indicate that individuals with a self-reported history of concussion showed impairments in both the planning and execution of goal-directed reaches. Additionally, distractor presence led to increased attentional conflict during target selection relative to those with no self-reported history of concussion. These results support the heterogeneous nature of concussion-related injury and suggest that goal-directed reaching may be a sensitive and robust measure to determine the cognitive consequences of concussion.

Factors Effecting Mental Health Practitioners Intervention Use: A Proposed Research Method

Ethan Waranch; Bjorn Bergstrom, School of Graduate Psychology, Pacific University

Selection of interventions that are efficacious and backed by evidence is an important skill to have as a mental health clinician, since evidence-based interventions result in improved outcomes for patients. Understanding why a clinician would choose to use an intervention that is not evidence-based is therefore also important so that training and screening of future clinicians can be adjusted. More research is needed to help educators and trainers identify the student traits and socialized attitudinal barriers to adopting evidence-based thinking and approaches to psychology. The presentation will discuss the extant current research on the topic, and will identify directions for future research.

The ABCs of creativity: Using language patterns to identify creative behaviors

Gianna Young; Morgan Montoya; Grant Hess; Madison Hoffman; Jessica Murfin; David Foster, Psychology, WOU

Teams are regularly utilized to generate creative solutions to complicated problems. Little research, however, has addressed the process of team creativity; in part, because of the difficulty in measuring creative processes within teams. The purpose of our research is to demonstrate that patterns of language usage occurring during team interactions can be used as indicators of creative behavior; eliminating the need for unreliable self-reports or expensive, time-consuming coding. Previous studies indicate that variation in creativity can be explained by linguistic features. For example, Foster and Murfin (2016) found unique language usage patterns associated with different creative behaviors (e.g., fluency, flexibility, integration, and evaluation) in college students completing a team-based survival task. This current study is attempting to replicate our original findings using an expanded definition of creative behavior to include the categories of: problem finding/formulation; information gathering; ideation; and idea evaluation. Participants in 43, three-person groups completed two intellective, problem-solving scenarios where they rank ordered various objects in terms of their importance for the group's survival in the wilderness. Language style will be examined by analyzing the verbal content of the groups' interactions. Verbal content was collected by video recording and transcribing group interactions during the problem solving scenarios. The transcripts will be analyzed using Linguistic Inquiry and Word Count (LIWC) software (Pennebaker, Booth, & Frances, 2007). Independent coders will assess creativity by counting the number of times group members engaged in problem finding/formulation; information gathering; ideation; and idea evaluation. Current progress and future directions will be discussed.

Attachment style predicts drinking motives and network characteristics in an adult sample of military spouses

Thomas Rounds; Cynthia Mohr; Annie O'Neill; Leslie Hammer, Psychology, Portland State University

Interpersonal processes can have significant effects on individual's health behaviors and long-term health outcomes. One way of conceptualizing how one deals with these interpersonal processes is through attachment theory (e.g., Hazan & Shaver, 1987), which describes how one reacts to emotional intimacy with others. This study looks at attachment styles (i.e. secure, avoidant, anxious) as predicting drinking motives and social network characteristics among military spouses. It was hypothesized that insecure attachment styles (i.e., avoidant and anxious) would be associated with coping-related drinking motives and poorer network characteristics. As part of a larger couples study with the Oregon National Guard, 365 service member spouses completed a baseline survey of relationship and health behavior characteristics. Spouses were mostly white (84%), female (86%), and 36 years old on average (SD=8). All participants completed the Adult Attachment Survey, the Important People Instrument, and the Drinking Motives Questionnaire. Those with an anxious or avoidant attachment style were significantly more likely to endorse drinking-to-cope motives than those with secure attachment styles and rated those in their social network as less important and supportive. Additionally, those with an avoidant attachment style had more heavy drinkers in their network, which can in turn lead to heavy drinking among spouses. Implications and further research directions are discussed.

Intelligence mindset, goal endorsement, and perceptions of feedback among college students

Nell Scherfling; Jennifer Henderlong Corpus, Psychology, Reed College

Students' beliefs about the malleability of intelligence ("intelligence mindsets") are powerful predictors of their motivation and achievement. Endorsing the belief that intelligence is malleable ("growth mindset") leads to adaptive learning goals and persistence when facing setbacks, whereas endorsing the belief that intelligence is fixed ("fixed mindset") leads to less adaptive goals and learned helplessness. No research to date, however, has examined how intelligence mindsets guide students' processing of feedback, particularly when narrative feedback is provided in the absence of letter grades. The goal of the present study was to examine the relationships among college students' intelligence mindset, goal endorsement, and perceptions of feedback. Drawing from the mindset and feedback recipience literatures, it was predicted that students with a growth mindset would report feedback on academic assignments to be more useful than would students with a fixed mindset. Additionally, students with a growth mindset were hypothesized to endorse learning goals, and students with a fixed mindset were hypothesized to endorse ability goals. Two hundred and forty-seven college undergraduates completed

survey measures of mindset, goals, and feedback utility. As expected, there was a negative correlation between fixed mindset and the perceived utility of feedback. Students with fixed mindsets tended to endorse ability goals, but the hypothesized correlation between growth mindset and learning goals did not emerge. Learning goals did, however, predict the perceived utility of feedback. These findings suggest that the motivational constructs of mindset and goal endorsement should be considered within the literature on feedback recipience.

Intergenerational conflict surrounding dating and marriage among White and Latinx emerging adults

Adrian Manriquez; Alicia Ibaraki, Psychology, WOU

Cohabitation, dating, and premarital sex are considered developmentally normative experiences for all emerging adults in the U.S. (Arnett, 2020). However, these practices may not receive the same support from parents of Latinx emerging adults and may instead serve as a point of conflict (Basáñez et al., 2014; Raffaelli & Ontai, 2001). Moreover, parental approval regarding whom their child has romantic relationships can also be a source of conflict rooted in racial and cultural preferences (Morales, 2012; Muro & Martinez, 2018; Shenhav et al., 2017). Other research suggests conflict surrounding dating and marriage may be more contingent on gender factors more so than racial factors (Hovell et al., 1994; Raffaelli, 2005; Shenhav et al., 2017). This study had two primary aims: (1) to examine the gender differences in intergenerational conflict surrounding dating and marriage experienced by Latinx emerging adults; and (2) to investigate ethnic differences in intergenerational conflict surrounding dating and marriage. Inferential statistics revealed that Latinas experienced more intergenerational conflict than male Latinos do regarding whom to date $t(50.86) = -2.10$, $p = .04$ and when to marry $t(70.67) = -3.47$, $p = .001$. Latinas also experienced more intergenerational conflict than white females regarding when to marry $t(197.89) = -2.49$, $p = .01$. These findings suggest that patterns of intergenerational conflict surrounding dating and marriage may be related to both gender and ethnicity.

Mindset as a predictor of academic achievement and academic buoyancy

Hannah Moran; Jennifer Henderlong Corpus, Psychology, Reed College

While academic stressors are unavoidable and perhaps ubiquitous features of the collegiate environment, vast individual differences exist in students' perceptions of and responses to these experiences of challenge; while some students are stifled by academic difficulty and incapacitated by failure, others are invigorated by challenge and see setbacks as an opportunity for learning and growth. Previous studies indicate that students' implicit theories of intelligence (i.e. growth versus fixed mindset) may influence their academic successes and task-specific patterns of persistence, but research has not yet considered how mindset might predict "academic buoyancy," or students' resilience to everyday academic setbacks, which has been shown to predict positive school outcomes. The present study used longitudinal survey data to examine whether individual differences in students' mindset at their entrance to college would predict differences in first-year academic achievement (GPA), first-to-second year college retention, and subsequent academic buoyancy. 474 first-year students completed a measure of mindset during college orientation; 247 of these students again reported on their mindset as well as academic buoyancy during junior or senior year. Academic records were obtained from the college registrar. Analyses are currently underway; it is expected that first-year growth mindset will significantly predict GPA at the end of freshman year, first-to-second year retention, and subsequent academic buoyancy.

Does level of identification with the military protect against the harmful impact of combat exposure on mental health?

Philip Bouleh; Cynthia Mohr; Cameron McCabe; Leslie Hammer, Psychology, Portland State University; Naval Health Research Center; Oregon Health & Science University

Significant evidence links combat exposure to psychiatric disorders like PTSD in military personnel, creating the need to elucidate how resilience can be maximized as a means of attenuating the impact of exposure to intense stress. Social identity theory postulates that an individual's identification with a group, such as the military, can be instrumental in the provision of a sense of belongingness that is crucial for social integration, meaning and support during times of difficulty (Tajfel & Turner, 1986; Jetten et al., 2017). Therefore, this study examined how different levels of military identification interact with the effects of combat exposure on poor mental health outcomes, in light of the protective capacity of belongingness to support psychological resilience. We conducted

a secondary analysis on a sample of 497 separated service members (representing all branches of the military) and active duty reservists; the average age is 39.91 years old, 83.7% male and 86.0% White. We hypothesized that military identification would provide a buffer against the deleterious effect of combat exposure on mental health, such that those with stronger levels of military identification will show a weaker relationship between combat exposure and poor mental health outcomes – assessed in terms of perceived stress, PTSD, and emotional distress, and satisfaction with life. Our results indicated that collective self-esteem and combat exposure both significantly predicted PTSD symptoms, and collective self-esteem did not buffer the effect. The implications of these findings will be discussed.

Characteristics of Gritty People

Whitney Mendenhall; Cameron Stumpf; Brenley Knakkergaard; Christopher Koch, Psychology, George Fox University

Grit, a term used to describe perseverance and passion for long term goals, has been the focus of many recent studies (Credé et al., 2017; Duckworth et al., 2007). The purpose of this study was to expand our understanding of what grit looks like in college students. We collected data from 74 undergraduate students attending a private university in the Pacific Northwest. Participants completed measures for: need for cognition, need for cognitive closure, subjective perseverance, and mindfulness, and grit. Subjective perseverance, need for cognition, and three factors of mindfulness (i.e., describing, acting with awareness, and non-reactivity to inner experiences) were significantly correlated with grit. A regression analysis revealed that subjective perseverance and one of the mindfulness subscales (acting with awareness) significantly predicted 61% of the variance, $F(2, 71) = 55.49$, $p < .001$. Our findings suggest that while grit and subjective perseverance are related to one another, they remain distinct. Gritty individuals appear to possess perseverance, but they also have a higher degree of mindfulness.

Language usage patterns as indicators of creative behavior: A replication

Brook Kline; Salvador Pantoja Ramirez; Sierra Preston-Thompson; David Foster, Psychology, WOU

Teams are regularly utilized to generate creative solutions to complicated problems. Little research, however, has addressed the process of team creativity; in part, because of the difficulty in measuring creative processes within teams. The purpose of our research is to demonstrate that patterns of language usage occurring during team interactions can be used as indicators of creative behavior; eliminating the need for unreliable self-reports or expensive, time-consuming coding. Previous studies indicate that variation in creativity can be explained by linguistic features. For example, Kim, Lee, and Lee (2012) found associations between creativity and various forms language usage expressed in a writing sample in a study of Korean college students. Similarly, Skalicky, Corssley, McNamara, and Muldner (2017) found linguistic features such as use of the present tense and a wide-ranging vocabulary were associated with creativity in a study of college students solving open-ended problems through computer mediated communication. Foster and Murfin (2016) found unique language usage patterns associated with different indicators of creativity (e.g., fluency, flexibility, integration, and evaluation) in college students completing a team-based survival task. Our new study will attempt to replicate and expand these original findings. This expansion includes using a definition of creative behavior to include the categories of problem finding/formulation and information gathering in addition to ideation and idea evaluation. This expanded definition of creative behavior necessitates the need for a new task designed to elicit adequate samples of each behavior. The development and testing of open-ended tasks will be discussed.

Predictors of leader effectiveness for college undergraduates

Jesse Johnson; David Foster, Psychology, WOU

The Bloomberg Job Skills report (Levy & Rodkin, 2019) found that both leadership and working effectively with others were both very important and yet difficult to find competencies when organizations were hiring employees. Similarly, Kozlowski and Ilgen (2006) found that formal educational experiences designed to help students develop these competencies were lacking in both quantity and quality at the undergraduate level. The Psychology of Leadership class at Western Oregon University addresses this major gap in undergraduate education. The class explores the nature of leadership from a variety of theoretical perspectives and provides students with the opportunity to practice and develop their leadership skills in the context of a team-based community service project. Students complete self-assessment questionnaires, evaluating themselves relative to the different

theoretical orientations towards leadership. These self-assessments include areas such as leadership traits, strengths, needs, values, philosophy, style, and behavior. Some self-assessments were made both at the beginning and the end of the course to allow students to reflect on changes in their leadership in their final paper. Peer assessments, based on student performance on the community service project, include ratings of professionalism, leadership behavior, contribution to team outcomes, and overall ratings of leader effectiveness. Data were available from fourteen different self-assessment questionnaires and multiple peer ratings per person. Data were collected across eight different sections of the course taught over the last three years by the same instructor. The goal of the project is to identify correlates of leader effectiveness in college settings. Potential research questions will be discussed.

Evidence-Based Teaching (EBT) via Gamification: Improving the efficiency and effectiveness of teaching interventions via scaffolded multimodal immersive learning.

Keegan King; Pete Alexander Steele; Bjorn Bergstrom, School of Graduate Psychology, Pacific University

Learning theory broadly supports the medical school mantra of "*see one, do one, teach one*" in its scaffolded approach to training psychological researchers and clinicians alike. Research suggests that multimodal learning enhances both the rate, retention and scope of comprehension within learners, as well as appealing to a broader range of neurological/learning styles; with particular success being found in the sciences (Freeman et al. 2014; Kantrowitz, 2014). Thus, pedagogical approaches are tasked with improving the effectiveness of teaching interventions which target the learner's scope of knowledge (e.g., content and subject matter domains), cognitive style (e.g., process of engaging in critical, creative and analytical thinking), as well as the subjects attitudinal disposition (e.g., confidence, motivation, morale, distress tolerance, etc.) in the application of learning targets, succinctly identified by organizational researchers as KSAO's (knowledge, Skill, Ability, and Other) and recent research suggests the power of face-to-face learning increases the crystallization of these skills (Schulze, 2017). Gamification offers a unique vehicle for delivering complex pedagogical interventions, which simultaneously target multiple domains of learning (e.g., content, process, and motivation). Furthermore, excessive levels of distress associated with the learning process inhibit and impair effective cognitive learning states (Lacoe, 2012; Wright, 2014). Role-playing, vignettes, fish-bowls, and feedback are typical and established teaching tools for training future clinicians and gamification enables a tailored ecosystem, in which pedagogical interventions can be stacked/combined, paced and dosed to specific training targets and levels of development (Annetta, 2008; Villalta et al., 2011; Weisberg et al., 2013) promoting the holistic growth (e.g., knowledge, skills, ability, emotional valence and identity) of the student, in contrast to more traditional truncated teaching interventions. Thus, this presentation argues that gamification is (1) consistent with the science and principles of Learning Theory and ERP principles; (2) is an underutilized pedagogical tool that offers a more efficient and ecologically valid approach to clinical training; (3) provides descriptive metrics of training/learning outcomes, moving towards a model of Evidence-Based Teaching (EBT) and clinical training.

Social Ostracism Modulation of Physical Pain Perception and Tolerance

Mitchell Koontz; Zachary Simmons, Psychology, University of Portland

Previous research has demonstrated strong correlations of anterior cingulate cortex activation in response to both social exclusion and physical pain, suggesting the two may operate via a common neural circuit. If there is indeed overlap, then it is possible that chronic activation of the circuit via one type of stimuli might influence responses in the other. The present study sought to test both of these predictions. Participants were exposed to both a physical stressor that induced pain (cold water submersion) as well as one that induced feelings of social exclusion (Cyberball). Additionally, data was collected about chronic experiences of social exclusion – ostracism from peers – to test whether such experiences may have blunted experiences of acute social exclusion and also perceptions of physical pain. Though these primary hypotheses were not supported, results did suggest chronically ostracized participants perceived pain more intensely when experiencing acute inclusion compared to those who experienced acute exclusion, despite equivalent baseline pain tolerance.

Trends in college students' alcohol, nicotine, prescription opioid and other drug use after recreational marijuana legalization: 2008–2018

Zoe Alley; David C. R. Kerr; Harold Bae, School of Psychological Science, OSU; School of Biological and Population Health Science, Oregon State University

Young adult college students may be particularly sensitive to recreational marijuana legalization (RML). Although evidence indicates the prevalence of marijuana use among college students increased after states instituted RML, there have been few national studies investigating changes in college students' other substance use post-RML. The cross-sectional National College Health Assessment-II survey was administered twice yearly from 2008 to 2018 at four-year colleges and universities. Participants were 18–26 year old undergraduates attending college in states that did (n = 243,160) or did not (n = 624,342) implement RML by 2018. Outcome variables were self-reported nicotine use, binge drinking, illicit drug use, and misuse of prescription stimulants, sedatives, and opioids. Other variables included individual and contextual covariates, and institution-reported institutional and community covariates. Publicly available information was used to code state RML status at each survey administration. Accounting for state differences and time trends, RML was associated with decreased binge drinking prevalence among college students age 21 and older [OR (95% CI) = 0.91 (0.87 − 0.95), p < .0001] and increased sedative misuse among minors [OR (95% CI) = 1.20 (1.09 − 1.32), p = .0003]. RML did not disrupt secular trends in other substance use. In the context of related research showing national increases in college students' marijuana use prevalence and relative increases following state RML, we observed decreases in binge drinking and increases in sedative use that both depended on age. Findings support some specificity in RML-related changes in substance use trends and the importance of individual factors.

Students' Satisfaction and Perception of Interprofessional Learning in a Mindfulness-based Intervention Group for Overactive Bladder

Lyndsay Wehrle; Jocelyn Taylor; Rachel Herron; Ruth Zuniga; Rebecca Reisch, School of Graduate Psychology & School of Physical Therapy, Pacific University

Interprofessional education and experiences are becoming more prevalent and more important in health professional education (Fox, et al., 2017). However, most of these interprofessional experiences occur through clinical work or the classroom and there is little emphasis on how interprofessional learning can occur through research(Evans, 2019). Clinical psychology and physical therapy graduate students were engaged in an interprofessional research pilot study utilizing mindfulness and self-management skills to help women cope with overactive bladder. A six-session group incorporated specific mindfulness and behavioral skills with student research assistants performing several activities in the study. Students' responsibilities included weekly check-ins with participants, supporting mindfulness activities, anatomy and physiology of overactive bladder and discussing and supporting behaviors and goals that may improve bladder health. Whereas the main goal of the project was to study the effects of the program on participants' bladder health, students involved in the project also gained valuable lessons. These included increased knowledge and understanding about bladder health, mindfulness, and research methodologies. Additionally, students learned about how to collaborate with other professions and learned specific knowledge of each profession. This presentation aims at discussing the pilot study, addressing student experiences in regards to interprofessional learning and illustrating how research can be a meaningful and viable way to support students' interprofessional learning and future collaboration.

Neuronal loss in the Prelimbic Cortex, not the Infralimbic Cortex in a mouse model of HD

Julia Norton; Mark Pitzer; Pallavi Saharia; Brandi Pang, Psychology, University of Portland; Oregon Health and Sciences University

Huntington's disease is a fatal, neurodegenerative disease that consists of a triad of cognitive, psychological and motor deficits. While the neurobiological implications of motor dysfunction have been thoroughly researched, there is little understanding in what underlies maladaptive-risk taking behaviors that take place early on in HD. Studies suggest that dysfunction in dopaminergic signaling in the basal ganglion circuits contributes to preservation of risk taking behaviors. Further, the shell of the nucleus accumbens that typically suppresses unproductive reward-seeking behaviors has been shown to receive reduced mesolimbic dopamine signals in transgenic HD mice. Alterations in medial prefrontal-cortical inputs to the nucleus accumbens have yet to be assessed in the context of HD. Here, we utilized immunofluorescent techniques to investigate neuronal and glial changes in the infralimbic and prelimbic subregions of the mPFC, two regions that innervate the nucleus accumbens shell and core respectively. Results indicated significant neuronal loss in the prelimbic cortex of HD mice compared to controls at 15 weeks. Our findings of fewer PL neurons over time in HD affected mice support the concept a diminished ability for the PL to direct appropriate goal-related behaviors when it comes to reward,

resulting in maladaptive decision making. Further investigation in how the cortico-accumbens reward circuit is compromised in HD may indicate potential biomarkers in early symptomatic stages of the disease.

Microaggressions and Muslims in America

Anam Khan; Jane Tram; Jhoevhana Sabado; Nandita Kumar, School of Graduate Psychology & School of Physical Therapy, Pacific University

Muslims in America (MIA) are people who currently reside in the United States of America and follow an Islamic faith. MIA are often targeted for hate crimes, discrimination, and violence. Limited empirical research on the experience of MIA exists. Existing research does not consider acculturation and important demographic variables in relation to microaggressions. The purposes of the present study were to obtain better insight into the experiences of this marginalized population. We are still in the process of collecting data, but 53 people have participated thus far. So far, we have three preliminary findings. First, we found a significant positive relation between higher levels of acculturation and higher perceived safety when they are in public with individuals who do not identify as Muslim. In other words, more acculturated MIA perceive a higher level of safety than their less acculturated MIA counterparts when they are in public with non-MIA people. Second, we found a significant positive relation between frequency of microaggressions experienced and levels of stress experienced. In other words, MIA that experienced more microaggressions also reported higher levels of stress. Third, a new finding from this study shows that female MIAs reported higher frequencies of microaggressions compared to those that did not identify as female. In other words, microaggressions appear to be experienced at a higher frequency by female Muslims in America. The implications of our findings will be discussed.

The Relationship Between the Mother-Daughter Bond and a New Mother's Psychological and Physiological response to her baby

Allison Keil; Sarina Saturn; Rachel Mehlman, Sabrina Legaspi; Zachary Simmons, Psychology, University of Portland

The present research examines the relationship between physiological and psychological profiles in mother-baby-grandmother triads (N=78). Specifically, this transgenerational study explores how new mothers respond to their infants in both stressful (heel prick) and bonding (breast feeding) contexts, and whether these responses are informed by the relationship reported between the mothers and their *own* mothers (i.e., grandmothers). Results show that new mothers (N=30) who reported more positive relationships with their own mothers (via the Parent-Child Interaction Questionnaire-Revised, PACHIQ) have significantly lower respiratory sinus arrhythmia (RSA) scores during key bonding events with their babies. RSA was used as an index of vagal regulation. Mothers who reported higher scores on the acceptance subscale of PACHIQ had significantly lower RSA scores during their baby's heel prick ($p=0.02$). These results suggest that women who report stronger relationships with their mothers experience less vagal regulation during (a characteristic of lower RSA). This study provides very preliminary evidence that mother-daughter dynamics may play a role in regulating maternal behavior in the next generation, potentially via calibration of physiological responses to stressful or nurturing stimuli.

Risk and Protective Factors for Latinx Adjudicated Youth

Tanya Gonzalez; Ruth Zuniga; Jennifer Clark, School of Graduate Psychology, Pacific University

Minority youth ages 10 to 17 are three times more likely to be incarcerated than their White counterparts. In 2015 Juvenile facilities held 48,043 youth and 22% of these youth were Latinx; the expectation is that the number will increase as the Latinx population increases. Research is necessary to determine the risk and protective factors for Latinx youth so resources can be allocated to address the needs of those most at risk to engage in criminal behaviors before they do so or before they recidivate. Research has identified protective factors for all youth, including family support, peer support, and school engagement as well as risk factors for all youth, including substance use, lack of family support, and history of mental illness. However, this research has focused mainly on White youth and have not considered the difference in factors based on culture for Latinx youth. The purpose of this presentation is to discuss a study focused on identifying protective and risk factors that are specific to Latinx adjudicated youth. This study is being conducted in collaboration with the Washington County Juvenile Department in Oregon. Results are yet to be determined but it is expected that they align with these

hypotheses: Latinx individuals experiencing risk factors such as a history of family neglect and abuse and family conflict will have higher rates of recidivism. Latinx individuals experiencing protective factors such as having positive family relationships, higher school engagement, and greater family supervision will have lower rates of recidivism. This study will highlight helpful factors for professionals intervening with Latinx youth prior to the youth interacting with the criminal justice system.

Resiliency, chronic illness, and depression in Latino migrant farmworkers

Marisol Beaulac; Ashley Poolman; Ruth Zuniga, School of Graduate Psychology, Pacific University

The agricultural industry in the United States is reliant on the manual labor provided by migrant and seasonal farmworkers. There are an estimated 2.5 million farmworkers in the United States and 76% identify as Latinos. Many of these farmworkers are low income, have little formal education, and were born outside of the United States. Farmworkers often spend time away from their families and may experience significant physical and mental health challenges. Research has shown that migrant farmworkers face discrimination, social isolation, poverty, dangerous working conditions, limited access to healthcare, and a life expectancy of only 49 years. Because of these challenges, farmworkers are susceptible to both physical and psychological health problems including chronic conditions such as diabetes and depression. Many stressors and barriers make managing chronic illness difficult for migrant farmworkers. Language barriers, poor pay, discrimination, and lack of transportation can prevent farmworkers from receiving healthcare services. Despite these challenges, many migrant farmworkers are able to manage these mental and physical health difficulties and overcome barriers, demonstrating resiliency and coping factors. Social support, community involvement, hope, religion, and spirituality are associated with stress reduction and improved mental and physical health. This presentation will discuss the literature in regards to resiliency factors among farmworkers dealing with chronic illness and mental health conditions. It will discuss a proposed study to examine how these factors may influence the physical and mental health of migrant farmworkers. This presentation could be helpful to researchers and practitioners working with the immigrant, migrant and seasonal farmworkers community.

Attitudes Towards Seeking Mental Health Services: Muslims in the America

Jhoevhana Sabado; Jane Tram; Anam Kahn; Alexandra Lawall, School of Graduate Psychology, Pacific University

Since the 9/11 terrorist attacks, Muslims in America (MIA) have increasingly experienced discrimination, hate crimes, and violence, which may place them at higher risk for mental health symptoms. Research has examined factors related to mental health seeking attitudes among MIA such as stigma related to mental health, cultural mistrust, and lack of cultural competence among professionals in our field. However, little of the existing research examines acculturation and stress caused by microaggressions and microassaults its relation to mental health seeking attitudes. The purpose of our study was to examine the relations between acculturation to American values, acculturation to Islamic values, and likelihood of seeking mental health services. Additionally, this study examined the relation of stress due microaggressions and microassaults experienced by MIA and mental health seeking behavior. To date, 48 MIA participants have completed our study. Participants completed an online survey that consisted of up to 53-items that assessed demographics, acculturation, and mental healthcare seeking behaviors. We found three preliminary findings. First, we found a significant positive relation between acculturation to American values and the likelihood of seeking mental health services. Second, we found a significant negative relation between Islamic values and likelihood of seeking mental health services. Lastly, we did not find a significant relation between stress caused by microassaults and likelihood to seek mental health services. Similarly, we did not find a relation between microaggressions and likelihood to seek mental health services. The implications of our findings will be discussed.

The Implications of Acculturation and Colonial Mentality for the Mental Health Treatment of Filipinos

Jacquelene Lopez; Jane Tram; Alex Pardico, School of Graduate Psychology, Pacific University

As the third largest Asian subgroup in the U.S., continued growth of Filipinos is anticipated with Census projections suggesting an 80% increase of the Asian population by 2050. Filipinos comprise four million of the U.S. population, but are the least likely of any Asian American subgroups to utilize mental health services. They

remain underserved and underrepresented in clinical mental health practice although studies show alarmingly high rates of depression and suicidal ideation and attempts among Filipinos. Inaccessible care sensitive to culture-specific issues, values, and beliefs may help explain this disparity. For example, research on colonial mentality as a form of internalized oppression through covert manifestations of cultural shame, embarrassment, and perceptions of cultural or ethnic inferiority has been shown to affect Filipinos. In addition, spiritual beliefs and practices specific to native Filipino culture are rooted in the foundation of Filipino psychology. Survey data collected from 227 participants revealed two main findings in the present study. First, a negative relation between cultural shame and embarrassment and value placed on native Filipino spirituality suggests higher levels of cultural shame and embarrassment were associated with lower value placed on native Filipino spirituality. Second, a positive relation between acculturation level and likeliness of seeking mental health care suggests high acculturation to American culture is associated with increased likeliness to seek mental health care. The implications of our findings are discussed.

Body image, anxiety about body exposure, and sexual satisfaction in individuals with chronic physical illness or disability

Shannon Hughes; Anne Willis, School of Graduate Psychology, Pacific University

Positive, desired, and consensual sexual experiences contribute to overall physical and psychological well-being. While it is well documented that individuals with chronic illness and disability experience individual and systematic barriers to sexual satisfaction, little is known about the role of anxiety around body exposure during sex. Thus, the objective of this study was to understand the experiences of individuals with chronic physical illness or disability in the domains of body image, anxiety about body exposure during sex, and sexual satisfaction. A total of 375 individuals with chronic physical illness or disability completed an online survey distributed to chronic illness and disability groups via social media. Participants responded to a series of demographic questions as well as the Appearance Evaluation subscale of the Multidimensional Body-Self Relations Questionnaire (MBSRQ), Body Exposure during Sexual Activities Questionnaire (BESAQ), and Sexual Quality of Life Questionnaire (SQOL-F). Data collection was completed January 2020 and this presentation will present the findings and implications for future research.

Experiences of binary and non-binary transgender people

Nikolai Guimaoutdinov; Jane Tram, School of Graduate Psychology, Pacific University

The existing literature focuses primarily on the experiences of binary (male or female) transgender people and only occasionally includes non-binary individuals as an after-thought. Due to a shared transgender status, they are often conflated and the differences between their experiences are not examined or acknowledged. This study investigated the differences between binary and non-binary transgender individuals' experiences of transgender identity via the Transgender Identity Survey (TIS). Binary and non-binary participants (n=34 and n=38, respectively) completed an online questionnaire containing demographic questions as well as the TIS. Four independent T-tests were conducted along the TIS subscales of passing, pride, alienation, and shame. After controlling for multiple comparisons, we found three main findings when comparing binary and non-binary participants. First, non-binary individuals possessed significantly more pride (M=34.97, SD=7.09) in their transgender status than binary individuals (M=21.82, SD=10.01). Second, non-binary individuals possessed significantly less shame (M=25.03, SD=10.15) than their binary counterparts (M=39.59, SD=11.12). Third, non-binary individuals possessed significantly less concern about passing (or being perceived) as their affirmed gender (M=20.37, SD=7.21) than binary individuals (M=36.71, SD=9.58). We found no significant differences found between binary and non-binary participants with regard to their feelings of alienation from other transgender individuals. The standard of care for transgender individuals is focused on transitioning, or bringing transgender individuals closer to passing. These findings suggest that this standard of care may not be accounting for the needs of the non-binary community. Implications of these findings will be discussed.

Perceived Social Support and Compensatory Consumption Using High-Status Products

Lindsay Phillips; Zachary Simmons, Psychology, University of Portland

Though there is disagreement among researchers about how self-concept is formed, most agree that a wide array of factors are relevant. Two determinants that are particularly common to many of these self-concept models are social support and status. Their inclusion is unsurprising, as both index dimensions important in human social life. Previous research has established that dimensions of self-concept may be activated in a compensatory

manner, such that when one is compromised others are upregulated to buffer the loss. The present study examines how manipulating perceived social support influences purchasing behavior (as a proxy for status-seeking). After priming various levels of social support, participants were presented with a series of both high- and low-status items and asked how much they desired each. Though the results do not suggest a relationship between social support and desire for high-status, this may be a function of our unsuccessful status manipulation. The results do, however, provide evidence against one model of self-concept (self gifting theory), because participants in the low social support group did not rate items at a significantly higher rate than those in the control or high support groups.

Effect of Task Related Self-Efficacy on Performance and Self-Evaluation

Jasmine Langley; Zachary Simmons, Psychology, University of Portland

Bandura's self-efficacy framework asserts that mastery experiences are more effective in promoting self-efficacy than are vicarious successes. The present study utilized an experimental design to test whether experiential or vicarious self-efficacy experiences had different influences on a subsequent task (unscrambling anagrams). Following the manipulation, task self-efficacy was measured, along with task performance, self-evaluation of performance, and depressive symptoms. Though no differences emerged from the experimental manipulation of modes of self-efficacy, positive correlations were observed between self-efficacy, task performance, and self-evaluation while depression was found to have negative relationships with these variables.

The Transmission of Parenting Styles to Sons

Alexandra Lawall; Jane Tram; Nandita Kumar, School of Graduate Psychology, Pacific University

Continuity in maladaptive and constructive parenting techniques from one generation to the next has been supported in the current research. More specifically, it has been found that children whose mothers were controlling are then more likely to use negative parenting techniques with their children. It has also been found that children whose mothers provided them with warmth and affection, are likely to then use constructive parenting techniques with their children. However, a dearth of research has been completed pertaining to specific types of parenting styles transmitted from one generation to the next. The purpose of this study was to examine the types of parenting styles that are passed down from parents to their sons. Through a 60-item questionnaire, (n = 28) males indicated how they were parented and how they raise (or would raise) their children. Two main findings were obtained. First, we found a positive correlation between sons whose parents used authoritarian parenting and subsequent authoritarian parenting. Second, we found a positive correlation between sons whose parents used permissive parenting and subsequent permissive parenting. The findings from our study will help supplement the current literature that exists pertaining to parenting that is predominantly focused on mothers. The results of this study will help mental health providers better understand why parents use particular parenting styles. Mental health providers will then be able to provide parents, who currently use maladaptive parenting techniques, with more constructive parenting tools.

Stress, Burnout, and Support among 911 Dispatchers and Call-Takers

Emily Kearns; Jane Tram; Kristi O'Shea, School of Graduate Psychology, Pacific University

911 dispatchers and call-takers have a fundamental role in ensuring the safety of callers and officers on the street. Despite the intense environment in which calls take place, research on 911 dispatchers and call-takers is currently limited, and therefore the goal of the current study was to outline work related post-traumatic stress symptoms and work-related resources for 911 dispatchers/call takers. Specifically, questions pertaining to Post-Traumatic Stress were determined by a self-reported symptom distress scale and work-related resources were determined from prompts implemented from the researcher. This study was conducted in communication centers within Alberta, Canada. Participants (n=200) completed a 56-item online questionnaire. Results indicated 37% of participants were diagnosable for a Post-Traumatic Stress Disorder (PTSD). In terms of resources available for 911 dispatchers/call-takers, less than 40% were aware of five proposed external resources (outside of the agency) for mental health support services. Several agency specific stress reduction resources available were determined. Implications of this research highlights and targets the need for education for both management and staff on the importance of mental health within this line of work. Furthermore, we found that it is critical and helpful to apply

stress reduction strategies within the workplace and educate management and staff on external resources available. Finally, stigma reduction in regard to mental health is imperative and discussed within this context.

Parenting styles and subsequent relationship quality

Nandita Kumar; Jane Tram; Alexandra Lawall, School of Graduate Psychology, Pacific University

Parents transmit life lessons and foster growth in their children. Research shows that parents may also transmit their style of parenting from one generation to the next. This idea, called the intergenerational transmission of parenting, has spurred research in other areas of parenting such as relationship quality. This study focuses on authoritarian, authoritative, and permissive parenting styles, and the relation each style has to subsequent relationship quality with romantic partners. Participants over the age of 18 who have current or prior romantic relationship experience completed an online survey about their parents' parenting style and the quality of their current relationship or most recent relationship. The goal of this research was to examine whether parenting style extends beyond parent-child relationships to impact other relationships. The data indicated that parenting style does not extend beyond these parent-child relationships and does not impact a child's subsequent relationship quality with a partner. The implications of these findings are discussed.

Who's exposure is it anyway? Using improvisational theater as Exposure Therapy (ET) for social anxiety

Sarah Glidden; Bjorn Bergstrom, School of Graduate Psychology, Pacific University

Social Anxiety Disorder (SAD) consists of several areas of challenge for a client, including an intense fear of judgement or humiliation in social settings, being excessively self-conscious, and being avoidant of naturalistic social settings. Due to the complications inherent in this disorder, Social Anxiety is often untreated, inappropriately treated, or treated to a sub-optimal standard (Social Anxiety Disorder: Recognition, Assessment and Treatment [British Psychological Society], 2013; Hindo, & González-Prendes, 2011). Social Anxiety remains one of the most common and persistent anxiety disorders according to Mavranezouli et al., 2015) with a substantial economic burden through healthcare costs and/or productivity losses for our clients. In vivo exposure is a cost-effective and potent intervention to treat social anxiety and related disorders, in as little as one session (Wright, et al., 2018). Recent research has utilized interventions based on Improvisational theater exercises (Krueger et al., 2017) to improve the outcomes for those suffering from Anxiety disorders, including SAD (Examining the Effects of an Improvisation Group [ClinicalTrials.gov], 2018; Felsman et al., 2019), by combining therapeutic elements of exposure, group cohesion, humor, and play (Sheesley et al., 2016). Due to the complimentary structure of Exposure therapy and interventions based on Improvisational theater exercises, more research is needed to determine the effects of Improv on Social Anxiety and patient cognitive processes when utilized through the lens of In Vivo Exposure therapy.

Evaluating diversity socialization within accredited graduate psychology programs: An adapted-replication study

Emily Reed; Bjorn Bergstrom; Lisa Christiansen, School of Graduate Psychology, Pacific University

Graduate students learn about the norms and importance of equality, diversity and inclusion (EDI) topics through four distinct stages of socialization1. In each of the four stages, graduate students are exposed to the expectations of their field and norms regarding EDI in various venues and levels of implicit and explicit communication2. The proposed research examines the formal diversity socialization that occurs in two required diversity courses in a Pacific Northwest graduate psychology program, using a self-report pretest posttest design to evaluate the effectiveness of the courses at impacting student's multicultural identity and awareness of EDI topics. The study examines how group membership in various domains may influence the diversity socialization experience of students throughout participation in required diversity courses. Based on literature, it is hypothesized that students will exhibit increased knowledge and awareness of working with diverse clients as a result of enrollment in a required diversity class. In addition, it is hypothesized that student personality factors will impact diversity outcomes. For instance, students that score higher on Openness to Experience and Agreeableness may exhibit different outcomes when compared to other personality profiles. Lastly, it is hypothesized that group membership, specifically demographic groups, may experience differential gains. For instance, students with

more exposure to EDI formal socialization may experience differential experiences when compared to students will relative lack of this exposure.

Improving performance through fear: Utilizing Exposure and Response Prevention (ERP) for performance optimization with athletes

Ethan Wallace; Bjorn Bergstrom; Tamara Tasker, School of Graduate Psychology, Pacific University

Performance anxiety in sports is ubiquitous; following the Yerkes-Dodson performance curve, anxiety can both increase performance and, in excessive amounts, decreases functionality in various domains. Exposure and Response Prevention (ERP) is among the most evidenced and validated approaches (i.e., two independent randomized control studies) for ameliorating anxiety within clinical populations. However, there is preliminary evidence that ERP-based interventions can increase performance even within sub-clinical populations. This presentation will discuss the active ingredients and underlying mechanisms of change within ERP, and provide a translational framework for generalizing these principles within sub-clinical populations, such as athletes, in order to optimize performance. Methods, applications and directions for future research will be discussed.

Waist-to-hip ratios and the pop-out effect: Examining attentional biases toward attractive bodies

Arianna Stone; Emily Beck; Niki Costello; Victoria E. Greer; J. Daniel McCarthy; Jaime M. Cloud, Psychology, WOU

Previous research demonstrates that evolutionarily-relevant stimuli (e.g., snakes, angry faces) "pop-out" of visual arrays, leading to faster and more accurate identification compared to stimuli that do not impact fitness as strongly. The present study investigated the identification of low (vs. high) waist-to-hip ratios (WHR) using a visual search paradigm: participants searched for a discrepant female torso in matrices of otherwise identical female torsos. 85 participants (10 male, 74 female, 1 non-binary) viewed 3x3 and 5x5 matrices of female torsos with 0.70 or 0.90 WHRs and indicated whether a discrepant stimulus was present via a button press. As predicted, participants were faster and more accurate in detecting a 0.70 WHR amongst 0.90 WHRs than the reverse; however, reaction time differences were larger for small matrices than large matrices. These results suggest that low WHRs readily capture attention, but still require serial processing.

POSTER PRESENTATIONS

L01 U Consent capacity: Appreciation impairments in patients with Traumatic Brain Injury

Valentine C. Soto[1], Katrina Okerstrom-Jezewski[2], Daniel Tranel[2], and Melissa Birkett[1] / [1]Psychology Department, Southern Oregon University, Ashland OR 97520,; [2]Department of Neurology, University of Iowa, Iowa City, IA 52242

Patients with traumatic brain injury (TBI) across severity levels show impairments in consent capacity when making medical decisions. Similarly, determining whether to participate in medical research requires these capacities. How does TBI affect the research consent process, more specifically, appreciation? Though patients show deficits in medical decision making, what ability do participants with TBI possess in the form of research consent ability? In comparing two patients with traumatic brain injury to 10 healthy adults, separated into two groups (1:5 TBI to healthy patients) by age and level of education, researchers rated (0-2) responses to the Iowa Consent Appreciation Tool (ICT). Patients showed impairments in appreciation; when reflecting the impact of research on themselves, TBI patients demonstrated beliefs that researchers planned to place them in groups or give them treatments with the most potential benefit to their condition. However, this patently false belief suggests impairments in these patients' ability to consent. These findings indicate the necessity for further research. Due to the small sampling in this study, future projects should focus on larger groups of TBI patients and project findings across multiple comparison groups to assess the degree of impairment.

L02 U Fake news: It is not the headline, it is the source

Audrey Wrede, Cody Jacot, and Christopher Koch / Psychology Department, George Fox University, Newberg, OR 97132

Recently, fake news has been a topic of interest. Need for cognition, conformity, independence, and intellectual openness can all interact with the acceptance of new ideas (Lee, 2014; Bryson & Grimshaw, 2009). In an effort to help understand

the fake news phenomenon, we examined the possible link between acceptance of fake news and these personality traits. Thirty news headlines, consisting of an equal number of authentic and false headlines from liberal, moderate, conservative sources, were presented to participants (n=24) who were asked to indicate whether or not they believed the story and rate how confident they were in their decision. Participants also were asked to complete the four personality measures. No personality trait had a significant effect on accuracy or confidence. Sources and authenticity of headlines did affect how accurately participants determined headlines ($F(2,42) = 16.10$, $p < .001$). Participants were most accurate when the headlines were authentic and from a moderate source ($M = 4.18$, $SD = 0.80$) when compared to moderate fake headlines ($M = 2.27$, $SD = 1.35$). Sources and authenticity of headlines also affected how confidently participants determined headlines ($F(2,42) = 30.65$, $p < .001$). Participants were least confident when rating fake headlines from moderate sources ($M = 47.27$, $SD = 14.78$) compared to authentic headlines from moderate sources ($M = 65.06$, $SD = 11.63$).

OTHER POSTERS

Developing a community of support for women in marine science: SWMS Oregon

Anna Lake[1], Kayla Nease[2], Carey Sweeney[2], and Anna Ward[1] / [1]Biology Department, UO, [2]Department of Biology, Portland State University, Portland, OR 97201

In 2019 the Unesco Institute of Statistics reports that less than 30% of the world's researchers are women. Pervasive stereotypes and gender bias result in barriers that women must overcome to attain careers in STEM fields. The Society for Women in Marine Science, Oregon chapter (SWMS Oregon) was founded in 2019 to develop a support network for the growth, advancement, and awareness of women in marine science.

Members span all career levels and bring together professionals from industry and academia throughout Oregon. Through SWMS Oregon, we aim to highlight the diverse experiences, celebrate research, and promote the visibility of women in the marine science community. By cultivating discussion, presentation, and mentorship, SWMS aims to foster an inclusive, diverse community of members passionate about marine science. SWMS Oregon is securing funding for mentoring and outreach programs, curriculum development, and networking and professional development. SWMS strives to address marginalized communities and bring awareness to the strengths and challenges of women in the STEM field. The newly founded Oregon chapter, is looking to reach out to other students and professionals, to gain visibility in the community, and to develop a strong membership base.

Fissile O.U.T. (Optimal Uranium Technology): A conceptual analysis

Rexx Thomas / Physics Department, Portland State University, Portland, OR 97201

Nuclear energy, while exceedingly dense, has two primary issues that prevent it from being widely accepted and utilized: 1) the waste from nuclear energy can persist for generations; and 2) errors can be catastrophic. A conceptual analysis is presented that addresses both of these issues. Fissile O.U.T. is designed to run on Uranium-238 (U-238). The significance of this is that U-238 is abundant, can be sourced from nuclear waste, and it does not sustain a chain reaction which limits the probability of severe core failure. Additionally, the core design combines atomic physics with the quantum wave/particle duality of nature in order to direct the neutrons to specific locations in the core that house small pockets of more energy dense fuel. Furthermore, rather than the standard model of utilizing steam to convert thermal energy to mechanical energy, Fissile O.U.T. utilizes pressurization of gas into a solid for energy storage rather than batteries. Development and implementation could offer safer nuclear energy production while reducing current levels of nuclear waste.

NOTES

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