



Undergraduate Research Symposium May 17, 2019 Mary Gates Hall

Online Proceedings

SESSION 1G

PSYCHOSOCIAL AND PHYSIOLOGICAL DYNAMICS OF RESILIENCE AND WELL-BEING

Session Moderator: Judith A Howard, Sociology
MGH 238

12:30 PM to 2:15 PM

* Note: Titles in order of presentation.

Retrogenerational Impact: The Victory of African American Grandmothers

Bradford (Brad) Howe, Senior, Psychology
Mentor: Peter Vitaliano, Department of Psychiatry and Behavioral Sciences

High psychological resilience has been significantly linked to better medical recoveries, psychological recoveries, and resistance to psychological deterioration. Currently, many African American grandmothers are engaged in emergent childcare due to serious family trauma. I have identified key aspects of the lives of these women which are relevant to their resilience through a literature review, personal cultural experience, and focused interviews. This preliminary research informed my creation of a theoretical model relating resilience to faith, music, and justice. Utilizing thoroughly tested psychological measures which correspond to each aspect of my theoretical model, I am performing a pilot study to determine the strength of the relationships between all four of these constructs. More frequent, and deeply shared, music experience within a family is anticipated to covary with higher scores of resilience. This is due to shared emotional experiences fostering positive attachment amongst the family members. Also, stronger perceptions of injustice as well as doubt in one's faith are both expected to negatively correlate to one's resilience. If a person expects the world to unjustly not return their efforts or expects their personal coping techniques to fail, they will be less likely to utilize these avenues. Immediately, I am returning my findings to support groups for grandmothers and, under the guidance of a psychiatric professor, also sharing general information about resilience. Findings from this pilot study will guide future experiments to determine how best to support grandmothers, concerning resilience. Information yielded by larger scale research of this type will inform the

development of fast, inexpensive, culturally appropriate, and non-invasive techniques for detecting individuals with low resilience.

POSTER SESSION 2

Commons East, Easel 46

1:00 PM to 2:30 PM

Child-Nature Interaction in a Hong Kong Nature Preschool Program: An Interaction Pattern Approach

Ling Wai Lam, Senior, Psychology
Mary Gates Scholar, UW Honors Program
Mentor: Peter Kahn, Psychology

Over the last few decades, there has been increasing interest worldwide in nature preschool programs, which provide young children the freedom to explore, discover, and construct knowledge from their direct experience with the natural environment. This research project investigates how the presence of nature provides affordances that lead to important developmental outcomes. Using a naturalistic observational methodology, I collected over 700 short videos of preschool children (18 months – 6 years old) interacting with nature in a leading nature preschool program in Hong Kong. Analyses draw on interaction pattern theory, wherein an interaction pattern is understood to characterize essential forms of human-nature interaction, specified abstractly enough such that many different instances of the same pattern can be enacted. Results are revealing 38 keystone interaction patterns, such as *Cohabiting with Wild Animals*, *Immersing One's Body in Water*, *Splashing in Mud Puddle*, *Climbing High in Small tree*, *Gathering Nature Items*, etc. Based on this interaction pattern analysis, I am then testing a core hypothesis: that children enact more relational behavior in more wild parts of the outside nature, and more domination behavior over nature in more domestic parts of outside nature. If this hypothesis is supported, it will provide data that speaks to how interaction with more wild forms of nature can help move our world away from its largely domination-oriented sensibilities (human domination over nature and over other people) to those that are more relational.

POSTER SESSION 2

Balcony, Easel 116

1:00 PM to 2:30 PM

Possible Role of Exosomes in Colon Cancer

Sharda Raina, Senior, Psychology, Biochemistry

Mentor: Peter Wu, Department of Surgery

Mentor: Daniel Wu

Exosomes are 40-50nm extracellular vesicles released by all cell types, and are involved in a variety of cellular mechanisms including modulation of immune response and cancer microenvironment. Exosomes embed proteins, lipids, and nucleic acids from the parent cells and circulate in abundance in human serum. Recently, exosomes have been shown to have potential application as cancer biomarkers with potentially increased sensitivity and specificity compared to traditional protein or nucleic acid markers. In cancer patients, exosomes are also shed in real time, allowing potential applications in directing therapy, monitoring treatment response, and surveying recurrent disease. Using a known tumor marker, carcinoembryonic antigen (CEA), we examined the role of CEA-specific exosomes as a colorectal cancer biomarker. To establish the methodology, we used CEA-secreting colorectal cancer cell lines LOVO and HT29. We compared exosome isolation methodologies and established an ultracentrifugation-based technique to maximize both purity and yield. Through this methodology, we isolated exosomes from cell-free media and demonstrated that CEA co-localizes with coxsackie-adenovirus receptor (CAR), a senescence-related marker of interest in our laboratory. This finding suggests that tumor-derived exosomes could be used to quantitatively define certain cellular events. We then used archival and fresh patient samples to examine whether the CEA-exosomes could be applied in disease monitoring in patients with metastatic colorectal cancers receiving chemotherapy. Efforts are ongoing to define whether CEA-specific exosomes are tumor specific, and whether exosome conjugate protein and nucleic acid can be further used as novel biomarkers in selective clinical situations.

SESSION 2B

MACHINE LEARNING

Session Moderator: Kurtis Heimerl, Computer Science and Engineering

MGH 228

3:30 PM to 5:15 PM

* Note: Titles in order of presentation.

Using Artificial Intelligence to Predict Possibilities of Human-Nature Interaction in Natural Landscapes: A Proof of Concept

Audryana Nay, Senior, Environmental Science & Resource Management (Landscape Ecology & Conservation)

Mentor: Peter Kahn, Psychology

Think about a meaningful interaction in nature that you have

had. Now characterize it in such a way that you could imagine many such examples of it happening, and even though each example would be at least a little different from the others, you would not have a problem recognizing each one as essentially the same form of interaction. An example includes *Walking along the Edges of Water and Land* (e.g., around Green Lake or at the beach in Golden Gardens). We call these characterizations *interaction patterns*. By assembling a verb, preposition, and nature noun, the profound internal experiences we feel in nature are given vernacular expression. Over the last five years, my research lab has empirically generated over 150 interaction patterns in diverse landscapes. Currently, interaction patterns have to be identified by an expert. This is where my novel research project comes in. I am using an Application Programming Interface (API) called Clarifai to develop an Artificial Intelligence (AI) program that can predict possible interaction patterns in a landscape from photo data. I anticipate having worked with approximately 10,000 photos to train the system on around two dozen interaction patterns by the end of spring quarter 2019. My goal is to develop a proof-of-concept for our novel approach, which could then be scaled upward with potentially large implications for conservation and urban design. For example, a future AI system like this one could predict the range and depth of interaction patterns experienced in a landscape that is under threat of development, to argue that that landscape is worth preserving. Our future AI system could also be integrated into the industry-standard urban design software AutoCAD, to optimize the integration of interaction patterns into urban design. In short, a proof-of-concept now: global reach later as a hopeful endpoint.

POSTER SESSION 3

Commons East, Easel 70

2:30 PM to 4:00 PM

Magnetic Properties of Palouse Loess

Eric De Sart, Senior, Environmental Science, UW Tacoma

Mentor: Peter Selkin, School of Interdisciplinary Arts & Sciences

Deposits of windblown silt, or loess, provide information about the wind direction as well as wind speed in the geological past. In general, stronger winds can transport both larger and heavier particles. Loess is also subject to soil formation processes, making it an archive of other paleoclimate variables. In this study, we have collected samples of the Palouse loess along the Columbia River, in southeastern Washington State, to examine the effects of wind transport on heavy (magnetic) minerals. We examine the particle size and composition of magnetic separates using a Scanning Electron Microscope (SEM) and energy dispersive x-ray spectroscopy (EDS) as well as bulk particle size. We expect a relationship between these characteristics and sample distances downwind

from the source area, giving us a better understanding of the environmental conditions in which the loess was deposited. We plan to compare our results to physical models to determine wind speed and direction during glacial-interglacial cycles.

POSTER SESSION 3

Commons East, Easel 71

2:30 PM to 4:00 PM

Magnetic Properties in Puget Lowland Lahars

Thomas Kenji Melot, Senior, Environmental Sci: Geosciences (Tacoma)

Mentor: Peter Selkin, School of Interdisciplinary Arts & Sciences

The Osceola Mudflow is one of the largest historic lahars, or volcanic mudflows, from Mount Rainier discovered to date. It flowed from Mount Rainier to the Puget Sound through the White River valley about 5,600 years ago. For this study, samples of the Osceola Mudflow deposit were taken from a vertical profile on an outcrop along the White River and were analyzed using anisotropy of magnetic susceptibility, or AMS. An AMS analysis measures the orientations of magnetic particles too small to see through a microscope in relation to the bulk of the sample. The orientations of submicroscopic magnetic particles have been used in prior studies to determine variations in flow directions and related characteristics in lava flows and sediments; however, little is known about the behavior of clay-rich lahars such as the Osceola Mudflow. In this study, we compare vertical variations in the AMS characteristics of the Osceola Mudflow to expectations based on fluid dynamics. It's expected that these AMS measurements will indicate lower flow rates at the bottom of a flow compared to the surface of the flow. Measurements of the vertical variations in magnetic properties of clay-rich lahar deposits is expected to allow for better predictions about the flow characteristics of future clay-rich lahars which has implications for hazard mitigation.

POSTER SESSION 3

Balcony, Easel 114

2:30 PM to 4:00 PM

Prevention of Cellular Senescence through Late-Age Mitochondrial Dysfunction Intervention

Tara Asal Saleh, Freshman, Pre-Sciences

UW Honors Program

Mentor: Mariya Sweetwyne, Laboratory Medicine and Pathology

Mentor: Bicong Wu

Mentor: Peter Rabinovitch, Pathology

Mitochondrial dysfunction, characterized by decreased effi-

ciency of the Electron Transport Chain (ETC) and loss of structural integrity, is linked to cellular senescence, an irreversible end to the cell-division cycle that contributes to aging. Minimizing senescence through late age intervention may prevent aging tissue dysfunction. Systematic treatment of old mice with a tetrapeptide, SS-31 reduced mitochondrial dysfunction and senescence in kidneys. We hypothesized that a similar effect would occur in other organs, and with other mitochondrial targeting interventions. These interventions included the SS-31 tetrapeptide which interacts with mitochondrial cardiolipin to improve structure and function, and NMN (Nicotinamide Mononucleotide), which fuels the organelle for more efficient adenosine triphosphate generation through the ETC. We treated old mice at 24 months-of-age for 8 weeks with either SS-31, NMN, or both interventions combined. Control groups included young-untreated mice at 4 months-of-age and old-untreated mice sacrificed with the treatment groups at 26 months-of-age. By comparing tissues, including heart, kidney, liver, skeletal muscle, skin and brain, within individual mice, we were able to account for differing rates of aging between mice. To determine the relative levels of senescence and treatment response in each tissue, we used Immunohistochemistry to quantify known senescence markers p16 and HMGB1, and quantitative-PCR to measure p16 mRNA transcript levels. As expected, preliminary results from p16 staining showed higher overall senescence burden in old as compared to young mice. The staining patterns also revealed senescence susceptible cells, with majority of p16 positivity in liver satellite cells, glomeruli and tubules of kidney, fibrocytes of heart and myocytes of skeletal muscle. Overall, the kidney and liver had more p16 positive senescent cells than did heart and muscle. These tissues are currently under analysis to determine whether intervention treatments can reduce cellular senescence.

POSTER SESSION 3

Commons West, Easel 28

2:30 PM to 4:00 PM

Black and White Spouse Caregivers of Persons with Alzheimer's Disease: Differences and Similarities

Eliana Vaughn Claps, Senior, Psychology

Keenan Blaine Solomon, Junior, Pre-Social Sciences

Mentor: Peter Vitaliano, Department of Psychiatry and Behavioral Sciences

Alzheimer's disease has been labeled the disease of the 21st Century. Societies around the world have not properly prepared for the expected massive increase in cases projected for the next 30 years. It is unclear who will care for the increase in numbers of people who will not be able to care for themselves. At present, the vast majority of care is provided in the home by family members. Spouses represent a sizable percent of these family members. Research on spouse care-

givers (CGs) has focused mostly on Whites, with relatively little research on minorities. Research that has examined minorities has mostly examined self-rated measures, with little work on biological indices. The current study compares four groups of spouses: Black CGs (n = 7), Black Non-Caregivers (NCGs) (n = 8), White CGs (n = 115) and White NCGs (n = 108). We observe differences in perceived stress, coping, burden/distress and physiological measures. The outcome of our research recommends interventions that could be used to mitigate health problems in caregivers that may allow them and their care-recipients to remain in their homes and live independently.

POSTER SESSION 3

Commons East, Easel 85

2:30 PM to 4:00 PM

Accessible Design on Mobile Apps for Elders

Han (Hannah) Jiang, Junior, Information Technology & Administrative Management, Central Washington University
Mentor: Naomi Petersen, Curriculum, Supervision & Educational Leadership, Central Washington University
Mentor: Josh Welsh, English, Central Washington University
Mentor: Ellen Bjorge

In the era of new technologies, the functions of mobile apps cover all aspects of our lives. Social networking apps expand our social and business groups, as well as increase job and entertainment opportunities dramatically. Other types of apps, such as travel and buying & selling apps, enable people to get both tangible and intangible products without leaving home. The fast development of mobile apps, however, made it difficult for elders over 65 to understand and learn, and the physical condition of elders presents barriers to operating new technologies. Overall, the lack of accessible design on mobile apps has caused elders to not have the equal opportunity to obtain information and enjoy the same conveniences as other age groups; and new technologies have gradually made the older generation feel abandoned. In the past six months, I conducted a competitive analysis of the current situation of using mobile apps by the elderly to gain a broad view on the user experience of mobile apps for elders. I designed and distributed a questionnaire survey among members of the Yakima Serious Table Tennis Club to understand the barriers they encountered when using various types of mobile apps. I interviewed two retirees from different fields of employment and cultural backgrounds about their views on the usability of different kinds of mobile apps. Ultimately, referring to my collected data and the Web Content Accessibility Guidelines version 2.1, I analyzed possible changes that could be made by some popular apps to improve the accessibility for elders. I created interface templates of an accessible mobile social media for elders using Adobe Experience Design; then I edited it to a final version while doing usability tests on the templates.

The conclusions from this research could be used to help design applications that are suitable for more age groups, and to ultimately make society more inclusive by letting elders have equal opportunity to enjoy new technologies.

POSTER SESSION 3

Commons West, Easel 26

2:30 PM to 4:00 PM

The Need for Social Supports in Caregivers with Cancer Histories

Yi Le (Ino) Zhang, Senior, Psychology

Echo (Qianying) Peng, Senior, Psychology

Ruitao Zhang, Senior, Psychology, English (Creative Writing)

Nuan Crystal (wen) Wen, Senior, Accounting, Psychology

Mentor: Peter Vitaliano, Department of Psychiatry and Behavioral Sciences

Mentor: Jin You, Department of psychiatry and behavioral science, Washington University

Many of the world's most important countries are experiencing large increases in their populations of older adults (e.g. Japan, China, Italy, Germany). Such longevity is requiring a greater need for long term care. However, societies can not afford to pay for formal care, so informal (unpaid family) caregivers (CGs) are becoming increasingly important. Unfortunately, many CGs are at high-risk for psychosocial/health problems. Moreover, caregivers with pre-existing health problems are particular risk. Our goal is to examine factors that may make cancer caregivers vulnerable. We used a vulnerability (have a cancer history or not) by exposure (being a caregiver or not) model, and stratified our participants into four groups: Cancer Caregivers, Non-Cancer Caregivers, Cancer Non-Caregivers, and Non-Cancer Non-Caregivers. At baseline and 15-18 months later, we measured indicators of life quality and caregiver demands: satisfaction with support, well-being, perceived support, loneliness, and hours spent caregiving. Cancer Caregivers reported poorer social supports and more time caregiving. This is important because previous work has shown that Cancer Caregivers have more negative and fewer positive life experiences and that these are related to the ability to fight tumor growth. Despite innovations, this study only included white Americans. Also, to increase participation among persons with cancer, we only included those who were not treated for at least one year and who had not suffered from serious forms of cancer. Our results would probably have been stronger had we included persons with more serious cancers, but such individuals might not have participated or been able to be caregivers. Given the rapid rise of cancer in China, we suggest that research examine cancer and caregiving in China and that cross-cultural research be done in the U.S. and China. To understand the dynamics of caregiving, health and well-being, one needs to

study these processes cross-culturally.

POSTER SESSION 3

Commons West, Easel 27

2:30 PM to 4:00 PM

Disaster Perceptions and Preparedness Behaviors among U.S. Older Adults

Melissa Krook, Recent Graduate,

Mary Gates Scholar, Innovations in Pain Research Scholar, Undergraduate Research Conference Travel Awardee

Mentor: Peter Vitaliano, Department of Psychiatry and Behavioral Sciences

The recent large number of world-wide disasters has catapulted disaster research to a highly important endeavor. 2017 was the most expensive on record with 16 U.S. climate events' losses totaling \$306 billion. Research suggests the costliest effects may result from emotional and psychosocial health. Those who are: seniors, distressed, and/or experience early-life vulnerabilities are at increased risk for negative health responses. This study addresses the need to reduce vulnerability and increase preparedness by evaluating how older adults perceive/prepare for disasters, including psychological factors that may influence their motivation to prepare. Literature review results from 26 references indicate older adults are: (1) among our most vulnerable populations for natural disasters, (2) underprepared, though resources are available, and (3) preparing close friends/family before themselves. The Socioemotional Selectivity Theory (SST) posits that as we age, our time perceptions become constrained, motivations shift, and we prefer positive over negative information. Therefore, I asked: (1) if older adults are intuitively resistant to negative information, such as impending disasters, how might we reframe it to be congruent with their desire for positive information? (2) If we approach older adults through more positive experiences, will they be receptive and motivated to prepare? I employed a model, namely: disaster preparedness behavior (PB) is a function of vulnerability (V) and resilience (R). To test this, a survey was developed to assess how factors of V and R would interact and influence PB. I will pilot test this survey through the evaluation of community-living older adults. PB is expected to be negatively related to V, positively related to R. This study extends disaster research by using psychological variables to predict preparedness and evaluating motivation to prepare using SST as a guiding framework. Results should increase knowledge about older adults' perceptions of disaster preparedness and factors to mitigate increased preparedness.

POSTER SESSION 3

Balcony, Easel 117

2:30 PM to 4:00 PM

Recognizing Base J from Single Molecule Real Time (SMRT) Sequencing

Ivan S (Ivan) Montero, Junior, Computer Science, Applied & Computational Mathematical Sciences (Discrete Mathematics & Algorithms)

Mentor: Peter Myler, Global Health; Biomedical Informatics and Medical Education

Mentor: Aakash Sur, Biomedical and Health Informatics

Base J is a glycosylated nucleobase found in Trypanosomatids, a family of single celled parasites causing Sleeping Sickness, Chagas Disease, and Leishmaniasis. This modified base is thought to play an important role in transcriptional termination for these organisms. Current methods of analyzing Base J rely solely on chromatin immunoprecipitation experiments, which provide low resolution information pertaining to Base J positions. While previous studies have shown that SMRT-seq interpulse duration (IPD) is associated with the position of Base J, we still lack methods to use this information to produce a genome wide, nucleotide-level map of Base J. Here we explore analytical approaches such as dimensionality reduction, machine learning, and signal processing to determine patterns of IPD and DNA enrichment which correspond to Base J across the entire *Leishmania tarentolae* genome. We show that many simplified approaches such as peak calling, and dimensionality reduction do not contain enough information to accurately classify Base J. We also utilize signal decomposition with Fourier transforms, machine learning clustering and regression methods to provide a more complex treatment of the data. Our findings are an important step in producing an algorithmic approach to identifying precise locations of Base J and can yield insight into transcriptional regulation in Trypanosomatids.

POSTER SESSION 3

Commons West, Easel 22

2:30 PM to 4:00 PM

Narrow Band Filters for LSST

Steven Marshall Bet, Senior, Astronomy, Physics: Comprehensive Physics

Mentor: Peter Joachim, Astronomy

Mentor: Jessica Werk, Astronomy, University of Washington, Seattle

The Large Synoptic Survey Telescope (LSST) will be capable of observing objects of 25+ magnitude across the u, g, r, i, z, y broad-band filters. At these extremely dim magnitudes the survey will turn up a large number of unresolvable red point-

like sources. With some variation depending on the filter, beyond roughly 25 magnitude these filters will lose the ability to provide data accurate enough for an observer to reconstruct the parameters of the objects being detected. In other words, past that point it will become difficult to tell whether an object is a nearby low mass main sequence star, a far away giant, or a high-redshift galaxy. The simplest possible solution to this problem is to add some more filters, specifically ones with narrower band width. If these narrow band filters allow for accurate data to be collected at higher magnitudes than their broad band counterparts can, it would not only solve the problem, but do so without necessitating a longer survey or requiring any great feat of engineering to implement. A simulated LSST field consisting of roughly 127,000 stars was used to explore this possibility. The (simulated) observed magnitudes and colors of each star were compared to a catalog of each star's true magnitudes, with a nearest-neighbor algorithm applied in an attempt to recover that star's true effective temperature, surface gravity, and metallicity. This process resulted in accurately-recovered stellar effective temperatures out to far greater magnitudes than allowed by the broad band filters. Unfortunately, improved parameter recovery seems for now to be unique to effective temperature, as this initial test has not shown any great improvement in the recovery of gravity or metallicity over the broad band filters.