



## Undergraduate Research Symposium May 17, 2019 Mary Gates Hall

## Online Proceedings

**POSTER SESSION 1**

Commons West, Easel 18

11:00 AM to 1:00 PM

**Examining Structure of Self-Esteem and Associations with Outcomes***Andrea Mei Little, Senior, Philosophy, Psychology, Mathematics**Mentor: Brian Flaherty, Psychology*

Measurement in Psychology usually assumes continuous dimensions. Correspondingly, theoretical constructs are typically conceptualized as dimensions, meaning that observations differ in degree. However, theoretical constructs may also be categorical, i.e., rather than differing by degree, differing qualitatively. Different construct operationalization's may lead to different scientific conclusions. Self esteem has long been of interest in Psychology. It has been conceptualized in various different ways, but always dimensional. Some self-esteem measures (for example, the The Rosenberg Self Esteem scale) seek to measure globally how much one values themselves as a person, without focusing on specific domains. On the other hand, other self-esteem measures (for example, the State self esteem scale) focus on perceived capabilities in specific domains, such as performance, social, and appearance. In the National Survey of Youth, participants rated themselves in specific areas, and then again as they would like to be. Using these data, we examined how different operationalization's of self-esteem are associated with a few psychologically interesting outcomes such as drug use and crime. Specifically, we compared continuous and categorical representations of self-esteem. By examining the assumption of continuous latent variables, we shed light on how scientific conclusions differ based on construct operationalization.

**POSTER SESSION 2**

MGH 206, Easel 166

1:00 PM to 2:30 PM

**Dynamics of Environmentally Independent Decision-Making in Invertebrate Movement Patterns***Daniel Tibbles, Sophomore, Philosophy, Microbiology, North Seattle College**Mentor: Ann Murkowski, Biology, North Seattle College**Mentor: Kalyn Owens, Chemistry, North Seattle College*

The sensory mechanisms by which organisms orient towards potential food prior to initiating movement are well-researched. However, behavioral mechanisms in stimulus-poor environments which determine foraging through seemingly stochastic movement variability or random-walk models remain poorly understood. Existing literature describe analyses of a variety of single-organism emergent movement patterns but do not appear to offer comparative analysis between single- and multi-individual environments nor within degrees of resource availability. We introduce a new analysis of observed fluctuations in spontaneous movement by *Caenorhabditis elegans* exposed to diverse conditions of competition and resource abundance. We describe a sequence of experiments which quantify the movement patterns of *C. elegans* through video imaging pattern recognition codified by run-length-time and turn-angle-time in comparison to recursively updating algorithmic position estimation. We expect to observe movement patterned on optimized explore-exploit strategies—such as simple random walk or Lévy flight—with frequency of implementation influenced by both population and resource density.

**SESSION 2N****MCNAIR SESSION - THE IMPORTANCE OF PERCEPTIONS (HUMANITIES AND SOCIAL SCIENCE)***Session Moderator: Phillip Thurtle, Comparative History of Ideas*

MGH 295

3:30 PM to 5:15 PM

\* Note: Titles in order of presentation.

**On the A Prioricity of Beauty in Kant's 3rd Critique***Jesse Loi, Junior, Philosophy, Mathematics**McNair Scholar, UW Honors Program**Mentor: Colin Marshall, Philosophy*

Immanuel Kant, in the Critique of the Power of Judgement, describes how we come to find objects beautiful through an aesthetic judgement. In particular, he claims that an object is beautiful in virtue of its property that we cannot find a concept to match it with. This explains our contemplation when

looking at art whereas an object such as a hammer does not motivate us to contemplate it. He also notes that beauty does not rely on the idea of perfection, which is to have the most of certain qualities. In contrast to beauty, Kant puts forth the idea of purposiveness, which is a consideration towards an object's existence being a part of the causation of some end. This means for an object to have a purposiveness would be for it to fit as a means to an end goal. Kant then puts forth the idea of there being two types of beauty, being adherent and pure. Pure beauty follows Kant's general agreement that beauty should be free from concepts. However, Kant experiences certain tensions in terms of adherent beauty, in which an object is beautiful because of its utility. This appears contradictory to Kant's previous commitments to a lack of concepts. I explore these tensions and consider possible Kantian explanations for this. I've begun study on Robert Clewis' "The Origins of Adherent Beauty" to inform this topic as well. Clewis elaborates on the different approaches during that time to reconcile utility and beauty, noting several positions Kant takes before assuming his current ideas. If we are able to resolve answers relating to adherent beauty, we will be able to design possible criteria for secondary adherent beauty. Doing so will also allow us to possibly add a purpose to different types of art depending on what concept they are the perfection of.

### POSTER SESSION 3

MGH 241, Easel 127

2:30 PM to 4:00 PM

#### **Reducing Tag Identification Time in a Molecular Tagging System**

*Aishwarya Mandyam, Senior, Computer Science, Philosophy*  
*Mentor: Katie Doroschak, Computer Science & Engineering*  
*Mentor: Luis Ceze, CSE*  
*Mentor: Jeff Nivala, CSE*

Labeling objects with DNA-based tags can provide a secure, difficult to fake identifier that is particularly useful for objects of high value or those that cannot be physically tagged. In this problem setup, a tag is a bit string, where each bit represents the presence or absence of a DNA strand containing a particular barcode. Our goal is to consistently and accurately identify the tag. These DNA barcodes were designed for use on a MinION nanopore sequencer, which outputs a time series signal corresponding to the DNA sequence. Ideally, each barcode should generate a dissimilar signal, which makes it easier to distinguish from other barcodes. We designed 96 barcodes that are signal orthogonal (i.e the signal output from the MinION was as dissimilar as possible), and detected them using signal processing algorithms. Using this system, I created an error analysis pipeline to ensure that we can identify tags both quickly and accurately. In order to optimize the time it takes to identify a tag, it was important to

minimize the number of sequencing reads we needed to observe on the MinION, without sacrificing accuracy. I found that using a subset of the reads produced approximately the same error rate as a full run. Therefore, we can run the MinION for a shorter amount of time, and still identify tags at a similar error rate compared to a longer runtime.

### POSTER SESSION 3

Balcony, Easel 112

2:30 PM to 4:00 PM

#### **Loss of Vacuolar Acidity and Iron-Sulfur Cluster Production Affect Yeast during Aging**

*Dexter Euwen Chen, Senior, Biochemistry, Philosophy*  
*Rachael Kate Tran, Senior, Spanish*  
*Justin Drake (Justin) Dillard Telm, Sophomore, Engineering Undeclared*

*Mentor: Kenneth Chen, Genome Sciences*

*Mentor: Matt Kaerberlein, Pathology*

The lysosome is a critical organelle affected by the aging process. Changes to lysosomal physiology during aging and their effects on cellular function are poorly understood. Here, we study the lysosome-like vacuole of the budding yeast during replicative aging. Using a microfluidic device, we trap hundreds of mother cells and visualize them over the course of their replicative lifespans. Using strains with fluorescent protein tags we investigate protein abundance, intracellular physiological conditions, and organelle morphology. We find that during aging, the vacuole becomes progressively less acidic. Using a *vma* mutant as genetic model of vacuolar pH dysfunction, we find that loss of vacuolar acidity triggers a loss of respiratory capacity, loss of iron-sulfur cluster protein activity, and iron starvation response. We find that iron supplementation rescues both the loss of respiratory capacity and shortened replicative lifespan of *vma* mutant cells. We see that during aging, a similar iron starvation response occurs, correlated on a single-cell level with the loss of vacuolar acidity. We propose that the loss of iron-sulfur cluster synthesis capacity due to loss of vacuolar acidity is a conserved process underlying multiple aging phenotypes.

### POSTER SESSION 4

Balcony, Easel 117

4:00 PM to 6:00 PM

#### **Characterization of the Link between Dravet Syndrome and Non-Neuronal Brain Cells**

*Timothy Mark (Tim) Lantin, Senior, Biology (General), Philosophy*

*Mentor: Ruth Westenbroek, Pharmacology*

*Mentor: Rachael Stein, Neuroscience*

Dravet syndrome (DS) is a form of intractable epilepsy that manifests itself in infancy. It is comorbid with behaviors resembling autism, motor deficits, and premature death. Human infants with DS also experience both febrile and non-febrile seizures. Therefore, research into the mechanistic pathway of DS in mice may shed light on the alleviation of DS symptoms detrimental to the human quality of life, as well as help to identify avenues for gene therapy and further research. Symptoms of DS have been shown to recruit certain immunologic entities such as microglia, a type of glial cell. Glial cells, or non-neuronal brain cells, have traditionally been thought to merely play the supportive role of providing nutrients to neurons. However, recent studies have shown that glia play a more active role in stabilizing information processing, brain function, and maintaining brain homeostasis. Following microglial recruitment, another type of glia, astroglia, are activated. Astroglia form the blood-brain barrier and collaborate with microglia to produce neuroinflammation through gliosis. Gliosis has been shown to interfere with normal neural function, which is postulated to contribute to Dravet phenotypes. Thus, DS symptoms may produce either hypertrophic astroglia or increased distribution of astroglia, both of which interfere with the ability of inhibitory interneurons to adequately regulate neural excitation as a result of induced neuroinflammation. Investigation into the link between glia and Dravet syndrome is the core of this research and has revealed sex differences in the distribution and size of astroglia. In particular, immunohistochemical staining of brain tissue on Dravet females have shown greater astroglial concentrations in the DG relative to their male counterparts, when coupled with behavioral analysis and EEG readings. This difference has implications in Dravet syndrome research and treatment.