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UNIVERSITY of WASHINGTON | BOTHELL



**MAY 13  
2016**

10 a.m. – 5 p.m.  
ARC

UNDERGRADUATE

# RESEARCH

AND *Creative Practice*  
SYMPOSIUM



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**FEATURING**  
RESEARCH  
SCHOLARSHIP AND  
CREATIVE WORK!

# **Undergraduate Research and Creative Practice Symposium**

## **Event Schedule**

<b>10 am</b>	<b>Opening Remarks</b> <i>ARC Top Floor, Dominik Juarez ASUWB President</i>
<b>10 am – 1 pm</b>	<b>Poster Session 1</b> <i>ARC Top Floor</i>
<b>10 – 11:45 am</b>	<b>Social Sciences Oral Presentations</b> <i>ARC 121</i>
<b>11:30 am – 12:30 pm</b>	<b>Clamor Presentations</b> <i>ARC 210</i>
<b>12:30 – 2 pm</b>	<b>Engineering Sciences Oral Presentations</b> <i>ARC 121</i>
<b>1 – 4 pm</b>	<b>Poster Session 2</b> <i>ARC Top Floor</i>
<b>2 – 3 pm</b>	<b>Clamor Presentations</b> <i>ARC 210</i>
<b>2:30 – 4 pm</b>	<b>Biological, Chemical and Environmental Sciences Oral Presentations</b> <i>ARC 121</i>
<b>4 – 5 pm</b>	<b>Presentation of Faculty Mentor Award</b> <i>ACR Top Floor</i> <i>Chancellor Wolf Yeigh and City of Bothell</i> <i>Deputy Mayor Davina Duerr</i>

# **Oral Presentations**

**Social Sciences and Humanities**

**Oral Presentations:**

**10 – 11:45 am**

**ARC 121**

**Engineering Sciences Oral Presentations:**

**12:30 pm - 2:00pm**

**ARC 121**

**Biological, Chemical and  
Environmental Sciences**

**Oral Presentations:**

**2:30 pm - 4:00pm**

**ARC 121**

## **Social Sciences Oral Presentations | 10 – 11:45 am | ARC 121**

10 – 10:15 am

### **Representation of Race and Gender in People Magazine**

*Author(s): Kelsey Bolinger*

*Mentor: Julie Shayne*

*Abstract:* Using a cultural studies framework, I am examining the ways in which race and gender are portrayed in People magazine and how these representations contribute to internalized identities, specifically focusing on women’s lived experience, and how these internalized identities manifest into real socio-economic life outcomes. Preliminary data has been collected using critical visual analysis. This method is used to contextualize images through their rooted historical placement as well as image production and consumption. This process has involved collecting over 800 images per magazine edition and reorganizing the images based on perceived gender and race. This magazine is central to my research due to its capacity to reach over 12.3 million users, according to their published statistics, and its inherent message “People Magazine” to cover all people, including diverse populations. The majority of people in this magazine, over 6 months, has been White women. It is imperative to understand how diverse audiences actually read media texts and to what extent these texts impact or influence the audience to examine the ways in which power operates within societies, and specifically how power is embedded within the images of People magazine.. Therefore, focus groups comprised of, 13-15 year old females and 18-21 year old females are being asked questions about their lived experiences with popular media in general and specifically with People magazine. Even though this research is focused on People magazine, I claim that (mis)representation of race and gender happens throughout all forms of popular media.

10:15 – 10:30 am

### **Genetics Predisposing People to Generalized Anxiety Disorders**

*Author(s): Molly Miller*

*Mentor: Charles Collins*

*Abstract:* Within the field of psychology, under the umbrella of generalized anxiety disorder (GAD) research, there are people who seek to find what causes or predisposes someone to GAD. Both environmental and biological factors are often researched and examined. Researchers have looked into family structures, peer stimulus, age as well as environments that people live in to determine risk factors for GAD. Researchers have also examined people’s goals and what constitutes success in people’s minds. However, when taking into account all of the differing data claiming to know the cause and biggest risk factors for GAD, the most compelling data backed with minimally debated research is a genetic predisposition to the disorder. Data compiled from a wide variety of researchers worldwide was examined using meta-analysis. While the conclusion states GAD is heavily influenced by a genetic predisposition, alternative conclusions are also presented in an attempt to show the breadth of information about GAD

even if it is not commonly accepted knowledge. This research is important to know because when a genetic predisposition can be identified, additional risk factors can be determined and prevention plans can be set in place. Furthermore, side effects of medications used to treat GAD can be predicted if the genetic predisposition of one person matches that of another. However, the research is relatively young and is still very much developing.

10:30 – 10:45 am

**Making News and Making Freedom: Race, News and What ‘Freedom’ Means Today**

*Author(s): Amani Carithers, Lexi Jones*

*Mentor: Susan Harewood*

*Abstract:* This research explores media coverage of a spate of racially charged incidents that occurred on university campuses across the United States between 2015 and 2016 as a way to investigate contemporary meanings of freedom. At the University of Missouri, locally known as Mizzou, Black Lives Matter demonstrations began after African American students were targeted on campus. This incident and the African American students’ political response was just one example of similar incidents at other colleges across the US. The incidents, the protest actions, and the media coverage bring to the fore important questions about race, freedom, freedom of the press, and academic freedom. For example, during the days of protest at the University of Missouri there was a great deal of discussion about the university administration’s efforts to control the media’s free access to protestors. Similarly at Yale University, a memo suggesting that students should think carefully about their Halloween costumes so as not to cause offense was discussed in terms of students’ freedom to make mistakes. All of this is occurring as media activists are focused on what ‘freedom of the press’ means within a corporate media environment and academics are concerned with academic freedom within corporatized university, but, most importantly, within an atmosphere in which mass incarceration, police shootings and invectives against Muslims haunt the lives of African Americans, Latina/os and Muslim Americans. The research argues that events at universities are especially instructive because the college campus holds a special place in the American imagination. Using narrative analysis this research investigates news discourses about the campus incidents as ways in which journalists, news makers, and members of the public who comment on the news seek in different ways to police the racialized borders of US citizenship.

10:45 – 11 am

**Neuroscience, Trauma, and Moral Development**

*Author(s): Meghan Hawkins*

*Mentor: Pierre Mourad, Jean Eisele*

*Abstract:* A child’s moral development is influenced by their physical environment as well as by their emotional state. Many children suffer physical or emotional trauma that can affect their neurological development for the rest of their life. For example, children who experience physical neurological trauma may develop impaired basic moral skills. In addition, those who

experience emotionally traumatic events may develop mental illness. When I began this research, I hypothesized that children who suffered trauma at a young age would show lower levels of moral development. Contrary to my hypothesis, my literature survey of several case studies shows that there are positive and negative results that arise after trauma. For example, children who are involved in trauma show, on average, higher levels of moral development, but are still prone to develop mental health issues. Understanding the effects of trauma on brain development and social skills can help us to be sensitive and responsive to children who have experienced any range of trauma in their early lives. It is important for educators to be aware of these facts and their implications so they can create an environment in which the students can thrive.

11– 11:15 am

**Decolonization through Student Activism: Documenting the Diversity Center Initiative at UW Bothell**

*Author(s): **Alejandra Perez***

*Mentor: Janelle Silva*

*Abstract:* This research focuses on the ongoing student activism at the University of Washington Bothell advocating for a Diversity Center. Since 2011, students have expressed their need for a Diversity Center on campus. This projects highlights the voices and experiences of the students through analyzing social structures, institutions, and their connection to collective identity, collective activism. We argue that this form of activism is used as a tactic of decolonization and resistance, as it challenges the historic capitalistic colonization of the university. The focus of this research is to recognize that social institutions are shaped, transformed, and influenced by a social structure. This work is important in understanding the institutions epistemic framework is rooted and continues to operate through white supremacy and capitalism. Through this resistance and activism, students have redefined collective efficacy, developed intentional communities, and work to both heal and dismantle systems of oppression.

11:15 – 11:30 am

**School Gardens: Progressive or Reactionary?**

*Author(s): **Carly Baker***

*Mentor: Jessica Ketcham, Jesus Perez*

*Cascadia College Participant*

*Abstract:* In this analysis of different discourse communities, I determine how people are viewing school gardens in academic, media, and organizational settings. In order to investigate how school gardens are framed in these three settings, I perform a discursive review of nine separate sources. Gardens are said to promote development in social skills, education, nutrition, and civic duty for students and to increase community interaction. However, even with the public agreement of the articulated benefits, a majority of schools still do not have or have failed to maintain a garden for a variety of reasons. Discussions centered around integration and promotion of school gardens have increased, but harsh criticism remains. Primarily, organizations are talking about the benefits and implementation of school gardens

but common critical themes have been focused on political and emotional issues. Several academics are connecting gardens to neoliberalism and the associated deficiencies, but realizing the benefits of gardens likely outweigh the risks. Media sources are discussing politics, but putting an emphasis on emotion to create a more opinionated conversation. Diversity and socioeconomic status are a main topic of discussion as well. Many of the benefits discussed have short and long term effects for students because of the emotion and lifestyle it provokes. While many of the drawbacks are based on political beliefs, they can have an emotional effect on some students as well. When used in ways suited to the community, school gardens can have significant benefit for student learning, public involvement, and environmental awareness. This discursive research attempts to connect the way that school gardens are framed with the way they are resourced in particular communities

11:30 – 11:45 am

**UWB Social Justice and Diversity Archive: Ingersoll Gender Center**

*Author(s): Colin Davis, Michaella Rosner, Hillary Sanders, Erik Larson, Reiko Usami*

*Mentor: Julie Shayne*

*Abstract:* Ingersoll Gender Center is a support organization for transgender and gender-liminal people and their loved ones in the Seattle area and beyond. One of the first organizations of its kind in the world, Ingersoll has provided advocacy, education, support, and resources to the transgender community for nearly 40 years, but its history has remained largely undocumented, and its importance to LGBTQIA+ history has gone largely unnoticed. Our group conducted interviews with Ingersoll founder Marsha Botzer to capture her first-person perspective on the history of the organization, and of the transgender community in the United States. We also collected photographs of artifacts and scans of primary documents significant to the history of Ingersoll and the Seattle transgender community. We submitted the data for inclusion in UWB's Social Justice and Diversity Archive. This digital archive is an invaluable window into the past for researchers interested in the history of grassroots social justice movements. The collected materials chronicle Ingersoll's challenges and triumphs through the years, and records changes in attitudes about transgender issues over time. Ingersoll has significantly more material cached, but it remains unseen in storage. Preserving historical materials like these is key to preserving the history of transgender people, which in turn contributes to preserving the lives and rights of trans people. Any progress the transgender community has made can be lost all too easily. Similarly, without a concerted effort to preserve these histories, they are lost forever, through negligence or overt silencing, and the community itself is endangered. Preserving these narratives enriches our understanding of LGBTQIA+ history, and contributes to the ongoing struggle for the safety and security of the transgender community.

## **Engineering Sciences Oral Presentations | 12:30 – 2 pm | ARC 121**

12:30 – 12:45 pm

### **Optimized Classification of Binary, Multi-class, and Regression Data Sets using a Generalized Flow**

*Author(s):* **Matthew Bihis**

*Mentor:* **Sohini Roychowdhury**

*Abstract:* Databases are growing too large for a single computer to handle; cloud-based platforms are capable of handling limitless amounts of information while big data is quickly becoming one of the most sought after fields for its many applications. My research focuses on adapting machine learning methods within the cloud-based computing platform: Microsoft Azure Machine Learning Studio (MAMLS), and comparing the results to the current state-of-the-art processes. Our goal is to create and automate a generalized flow that utilizes cloud-based resources for classification and regression tasks. In this work, classification tasks refer to data sets where each sample has a discrete label, i.e., class A, B, or C, while regression tasks refer to data sets where each sample has a continuous label, i.e., anywhere within the range from 1-10. In both cases, the goal is to correctly predict the label for each sample through the implementation of machine learning algorithms. The preliminary results imply that the MAMLS platform is a viable option for an automatic classification application because the overall process did not need to be tailored specifically for each data set. The automated decision-making process, including the choice of an optimal machine learning algorithm and parameter fine-tuning, has been realized through the inclusion of modules written in the 'R' programming language. My current work focus on an in-depth analysis of prior work regarding the data sets in study. Currently, the automated flow is capable of accepting a generalized input and synthesizing optimal, parameterized classification results with minimal manual supervision, this cloud-based flow can be applied to a wide range of vendor-based applications.

12: 45 – 1:00 pm

### **Securing Data of IoT Devices**

*Author(s):* **Pavel Krivopustov**

*Mentor:* **Geetha Thamilarasu**

*Abstract:* The Internet of Things is gaining popularity with the availability of inexpensive and small-sized hardware to be purchased on the market. IoT enables physical devices such as sensors and microcontrollers to directly connect to the internet for transmission of collected data. This research focuses on securing transmission of data between an internet connected sensor and a server. A sensor will be developed to simulate transmission of data over the network in real time. Our expected results include discovering vulnerabilities that may enable unauthorized interception of data from the sensor. Identifying ways to secure data that is sent from any IoT device will help experts in this domain to develop a sensor which securely collects data for various useful real life applications.

1:00 – 1:15 pm

**Optimizing Hole Transporting Layer Thickness for Organic Solar Cells**

*Author(s): Malia Steward*

*Mentor: Seungkeun Choi*

*Abstract:* Enhancing the performance of polymer solar cells (PSC) has been a driving force in research into PSC applications and fabrication processes in the field of solar energy. Although the power conversion efficiency (PCE) for this type of organic solar cell has increased to about 6% due to recent fabrication modifications, there is still a need for improvement in device architecture. Creating a solar cells involves a strategic fabrication process that consists of several layers, each serving a crucial role, that must be built in sequence. By optimizing the parameters of transport layers that facilitate charge carriers from the active layer, the device PCE performance can be improved. Fabricating solar cells starts with a premade indium-tin oxide (ITO) coated electrode glass slide, followed by ZnO, an electron transport layer (ETL) created with specific measurements. The active layer, P3HT:PCBM, is then created with appropriate concentration levels. MoO<sub>3</sub>, a hole transport layer (HTL), is deposited on top of the active layer, applying different thicknesses. The last layer, silver (Ag), is deposited, where this layer acts as our second electrode. Completing the solar cell with the second electrode completes the circuit. Electron charge carriers transport through ZnO to ITO, while the hole charge carriers transport through MoO<sub>3</sub> to Ag. My research aims to address what is the optimized thickness of the hole transport layer (HTL), MoO<sub>3</sub>, in order to further improve the PCE. In focusing on MoO<sub>3</sub>, results determined that as the layer thickness of MoO<sub>3</sub> reduces, the PCE increases. In opposition, as the layer thickness of MoO<sub>3</sub> increases, the PCE decreases. By controlling the thickness of the hole transport layer, this allowed me to find an optimized thickness to produce high PCEs. This research, therefore, opens new possibilities for future processes when optimizing a particular layer and improving PCE in PSCs.

11:45 am – 12 pm

**Indianapolis Homelessness Prevention and Rapid Re-housing Program (HPRP) Long-term Outcomes Report**

*Author(s): Lundy By, Molly Brown, Danielle Vaclavik, Johnathan Bryla, Maurine Aclipen*

*Mentor: Molly Brown*

*Abstract:* Analysis of data from the Homeless Management Information System (HMIS) in Indianapolis on all 2,477 adults and children served in the Homelessness Prevention and Rapid Re-housing Program (HPRP) implemented from 2009 to 2012 will be presented. The HMIS was a useful tool for exploring preliminary long-term outcomes of HPRP, identifying future directions for evaluation, and recommendations for implementing homelessness prevention and rapid re-housing interventions. We use data from the report for three subsets of HPRP participants: single adults, two-adult households, and families with children to examine Homelessness Prevention and Rapid Rehousing assistance. It was assumed that these three types of households differed in important ways that may influence housing outcomes, including risk factors for homelessness, and household income potential,. Participants who re-entered homeless services were compared to those who did not re-enter services on demographic and

program-related factors. The rate of re-entry over time was also examined to identify critical timeframes for housing loss after housing placement. The first year following HPRP exit appeared to be critical window in which a large proportion of participants re-entered. As such, outcomes of prevention and re-housing assistance programs may be enhanced with regular follow-ups with discharged program participants for at least one year.. Most HPRP participants had very low incomes both at entry and exit from the program, despite financial services being offered to program participants. The majority of participants entered permanent housing with incomes lower than 50% of the area median income, an identified risk factor for homelessness. In order to ensure housing stability, particularly among those residing in mainstream affordable housing, economic stability must also be a programmatic emphasis in prevention and re-housing interventions and should examine the causes of the discrepancies in outcomes between rapid re-housing assistance and homeless prevention assistance. In turn, the difference in risk factors for both groups may shed light on appropriate remedial steps. Possibilities may include the retaking of specific assistance programs to target and prioritize specific groups for optimal outcomes or may alter the less efficient programs.

1:30 – 1:45 pm

**SAFF: Sustainable Aquaponics at Farmer Frog**

*Author(s): Justin Kneip, Richard Yip, Joshua Hurley*

*Mentor: Pierre Mourad*

*Abstract:* Farmer Frog, a local farm in Woodinville, strives to support environmental friendly sustainable practices and is installing an aquaponics system to exemplify sustainable agriculture practices. The farm has reached out to our team at UWB to design a sustainable energy solution to reflect their sustainable ethics. Aquaponics is a combination of hydroponics and aquaculture, this is essentially a fish farm in a mutualistic relationship with a plant garden. By replacing the nutrients in the soil with fertilizer from the fish, and replenishing the chemicals to clean the fish tank using water filtered through the plants, a sustainable relationship mirroring a natural cycle is formed that benefits both plants and fish. This system requires a pump in constant operation, for filtration purposes, and multiple grow lights for the plants. Our team initially investigated powering these components using wind power at the client’s request. After using data from National Renewable Energy Laboratories and local weather stations, we determined that wind power will be inadequate. Our limited budget therefore forced us to focus our design towards solar power. After significant research into real world electrical systems our team has developed an initial design for the electrical components. This system will begin as a grid tied solar system of only a few panels due to budget restrictions, but we have designed the system to easily accommodate additional units as more funds become available. Our team is currently exploring permitting and other requirements, making final design reviews, and selecting physical mounting systems. Our final design will accommodate electrical and structural permitting and utility requirements with an eye towards Farmer Frog’s vision, all while striving to achieve the greatest usable lifespan possible within budget restrictions.

1:45 – 2 pm

### **Portable Solar Powered Cooler**

*Author(s): Luis Alvarado, Robby Shaffer, Jake Schriener, Elliott Vega*

*Mentor: Pierre Mourad*

*Abstract:* This project consists of designing and constructing a Portable Solar Powered Cooler that was commissioned by two organizations: SAgE Farms and 21 Acres. A total of \$23,050 was allotted for the design, construct, and delivery of a Portable Solar Powered Produce Cooler. The ability to cold store their produce will enable SAgE Farms to become USDA certified which will allow them to sell their produce to public institutions rather than being relegated to farmer's markets. These farms need to cold store their produce, but may not have an appropriate device or access to grid power. The design is to super-insulate a portion of a 20' shipping container and mount a solar array on top of the container to power a mini split air conditioner and other electronics. A device called CoolBot will be used to trick the air conditioner into cooling below its restricted lowest setting. The Solar Powered Cooler is currently being built at the University of Washington Bothell and will be transported to SAgE farms after construction is finished. This project will not only help SAgE Farms run better as a business, but it has the potential to impact all of King County by providing a template for new and existing farms to follow.

## **Biological, Chemical and Environmental Sciences Oral Presentations**

**2:30 – 4 pm | ARC 121**

2:30 – 2:45 pm

### **Expression, Purification, and Activity of the LAGLIDADG Homing Endonuclease I-LtrWI.**

*Author(s): David Adil, George Stoyanov, Vaughn Shepherd*

*Mentor: Lori Robins*

*Abstract:* Targeted gene modification and correction is a transformative technology that is currently progressing from basic research and development to applications in medicine, industry and agriculture. Gene targeting systems include four types of targeted nucleases: LAGLIDADG homing endonucleases (LHEs), zinc-finger nucleases, TAL effector nucleases, and clustered regularly interspaced short palindromic repeats, and CRISPR-associated endonucleases (CRISPR/Cas). Each of these systems has the ability to make double strand breaks in DNA. LHEs are promising tools for gene targeting due to their small size (~35 kDa) and high specificity (14-20 bp). One specific LAGLIDADG homing endonuclease is I-LtrWI. To fully understand the LHE family, wildtype, and six variants of I-LtrW1 were overexpressed and purified by nickel affinity chromatography. Using site-directed mutagenesis, variants of I-LtrW1 were generated with an amino acid residue change in the catalytic sites. The purified enzymes were assayed for activity using supercoiled DNA containing a target DNA sequence specific to I-LtrW1. The activity was monitored by agarose gel electrophoresis in an effort to understand catalytically important residues. The results will be used to develop a general method for converting LHEs into LHE nickases, enzymes that make single-strand breaks in target DNA

sequences. LHE nickases can lead to advancements in targeted gene modification for genetic diseases such as cystic fibrosis.

2:45 – 3 pm

**Assessing how physiological plant traits and water availability alter plant community composition at two primary succession sites on Mount Saint Helens**

*Author(s): Laurel Baum*

*Mentor: Cynthia Chang*

*Abstract:* The eruption on Mount Saint Helens offers the opportunity to use 35 years of contiguous data collection and research on primary ecological succession. The long term study of plant community composition patterns have been used to understand mechanisms that drive the succession of species on a changing landscape. We have added plant physiology traits to further our understanding of this topic. Our research question addresses: ‘How do physiological plant traits such as drought tolerance or competitive ability related to specific site conditions such as water holding capacity in the soil?’ Plant traits such as Specific Leaf Area (SLA) can help determine competitive ability or drought tolerance. Plant community composition data was collected from twenty-one permanent research plots on Mount Saint Helens and 84 sub-plots. Data collected during the summer of 2015 includes 2,000 chlorophyll measurements, 1,753 leaf samples which were weighed and measured for SLA, and 336 soil samples were taken for water holding capacity analysis. We compare species-specific plant traits to site specific soil water holding capacity. This research examines the relationship between plant physiology and site environmental characteristics, which allows us to understand how environmental drivers impact ecological succession on Mount Saint Helens.

3 – 3:15 pm

**Vertical Distribution of Understory Avian Populations in Cocha Cashu**

*Author(s): Benjamin Haagen, Kiley J. Sullivan, Wenyi Zhou*

*Mentor: Ursula Valdez, Timothy Billo*

*Abstract:* Tropical rainforests are havens of biodiversity, hosting some of the most species rich areas in the world. Cocha Cashu Biological Station in Manu National Park, Peru, hosts a myriad of plants and animals, with one study reporting the amount of avian species at 270 (Socolar et al., 2013). Many of these birds have developed highly specialized hunting techniques over thousands of years of evolution which necessitate that they hunt in particular areas or heights of the forest. To meet these hunting needs and aid in their predation or foraging, these birds have developed specialized physical traits. We designed a study to test these physical differences against the height at which the individuals can be found. Over a four day period, twenty individuals were captured and used for data collection. From these data, the ratio of wing length to weight was explored to seek a correlation between this ratio and the height at which different avian species tended to propagate. We hypothesized that birds with smaller wing length to weight ratios would be found at lower heights than birds with larger wing length to weight ratios. From the limited data set, the existence of such a correlation appeared to be confirmed and our hypothesis supported. We drew the conclusion that understory birds that

have a higher ratio between tarsus length and body weight will fly at a higher level.

3:15 – 3:30 pm

**From Filing Cabinet to Desktop: Moving the UWB/CC Wetlands Archive to the 21st Century**

*Author(s): Dawn Hatfield, Jake McDermott, Maura Shelton, Eleanor Smith, Sarah Verlinde, Janice Jap, Tahira Nurjaman, Kowshal Choodi*

*Mentor: Santiago Lopez, Charlotte Rasmussen, Caren Crandell*

*Abstract:* In 1997, the University Washington Bothell (UWB) and Cascadia College (CC) began restoring 58 acres of pasture land to a functioning floodplain ecosystem, known as the UWB/CC North Creek Wetlands (Wetlands). In 2013 a group of students, staff and faculty started the UWB Geo-Database project, which focuses on mapping the vegetation, hydrology, and biological organisms in the wetlands using Geographic Information Systems. Digital files are being created from CAD files, PDF's, written reports and other non-digital media that were collected during the restoration and early monitoring phases of the UWB/CC wetlands as outlined in the original master plan. Once these documents are digitized they will be used to create map layers of the area, including the original planting and morphological features as well as the original monitoring data that includes vegetation points, photo points, transects, wells, and piezometers. These layers, along with a hydrology and a qualitative vegetation layer will be available for use by the UWB research community. Features including a trail layer that will allow researchers to navigate to individual polygons of interest without disrupting other research project are being created. Access to the baseline data will aid in understanding the ecological processes and long-term effects of planned wetlands restorations. This project will create a multitude of new research opportunities by providing easier access to the data for analysis. Having the ability to analyze this data will provide a better understanding of the important functions of wetlands in urban areas and may increase conservation efforts.

3:30 – 3:45 pm

**Mycoremediation of *E. coli* and Other Fecal Coliform Bacteria in Three Time Treatments.**

*Author(s): Kellen Maloney*

*Mentor: Robert Turner*

*Abstract:* Mycoremediation is a discipline of bioremediation that uses fungi to filter pollutants from ecosystems. This discipline has been successful in filtering Fecal Coliform Bacteria (FCB), including *E. coli*, from water sources, but has usually been tested over time periods less than 1 hour. To better understand the interactions between the fungi *Stropharia rugosoannulata* (K.S.) and FCB through time, this research project measures changes in FCB concentrations after three residence time thresholds; Run-through, 1 Hour, and 24 Hours. Experimentation utilized the already contaminated water of North Creek, which usually hosts FCB levels of several hundred to thousands of colony forming units/100 mL of sample. To test the hypothesis that water samples with longer residence time in K.S. fungi would yield lower output FCB and *E. coli* concentrations, a simple vertical flow filtration method was used. The filters were constructed from 1/2in diameter, clear PVC pipe, each filled with 175g of K.S. fungi medium or a control

medium (non-inoculated woodchips). Three replicate and one control filter were created for each treatment, and then three pseudo-replicate water samples from each tube were averaged to measure and compare *E. coli* and other FCB concentrations. Data was run through a statistical t-test to confirm its significance. Results show that total fecal coliform concentrations were reduced in the Run-through treatment by 46% (t-test,  $p = 0.0324$ ,  $n=9$ ), 67% in the 1HR treatment (t-test,  $p = 0.0053$ ,  $n=9$ ), and 99.65% in the 24HR residence time treatment (t-test,  $p = 0.0019$ ,  $n=9$ ). These results suggest that FCB-contaminated water from North Creek can be filtered more effectively when exposed to *Stropharia rugosoannulata* for longer periods of time. This knowledge can be used to better design Mycoremediation/filtration projects, where the construction of fungi-inoculated bioswales may be more effective than quick filtrations.

3:45 – 4 pm

### **Enzyme Kinetics and Inhibition of *Helicobacter pylori* Aldo-Keto Reductase (HpAKR)**

**Author(s): Tate Higgins, Stephanie Napier, Carolina Seek, Taryn Meacham**

**Mentor: Lori Robins**

**Abstract:** *Helicobacter pylori* (*H. pylori*) is one of the most common human pathogenic bacteria, and it is present in more than fifty percent of the world's population. *H. pylori* have been linked to gastritis, peptic ulcers, and gastric cancer in humans. Current treatments for infection include antibiotics and proton pump inhibitors. However, recently, antibiotic resistant strains of *H. pylori* have been identified which has prompted efforts to identify alternative treatments for *H. pylori* infections. *H. pylori* aldo-keto reductase (HpAKR) is an enzyme required for *H. pylori* survival in acidic conditions. As a result, HpAKR presents itself as an attractive target for alternative treatment. In this project HpAKR activity was assayed with small molecule inhibitors to determine which are most effective. To have large enough concentrations of HpAKR for activity assays HpAKR was over expressed and purified by nickel affinity chromatography. The Michaelis-Menten kinetics of HpAKR was determined by conducting activity assays at increasing substrate concentrations and measuring the decrease in absorbance of NADPH at 340 nm. Inhibition assays were conducted with the inhibitor sodium valproate. It was observed that at concentrations of 2 mM and 4 mM sodium valproate inhibits the activity of HpAKR. Currently, additional small molecule inhibitors are being assayed and a library of inhibition data is being compiled.

# **Clamor Presentations**

**Clamor Presentations:**

**11:30 am – 12:30 pm**

**ARC 210**

**Clamor Presentations:**

**2 - 3 pm**

**ARC 210**

## **Clamor Presentations | 11:30 am – 12:30 pm | ARC 210**

11:30 – 11:45 am

### **Quantum Physics and Melancholy Crow**

*Artist: Dana Doran*

Abstract: Dana graduated (magna cum laude) from UW Bothell in 2014 with a bachelor's degree in Interdisciplinary Art. While her artistic endeavors vary between mediums and substrates her focus is primarily in two dimensional pieces of oil on canvas. Impressed by her studies in preserving habitat and climate change, Dana often incorporates these issues into her work by using a blackbird either representing himself, nature as a whole, or an anthropomorphic rendition in substitution for man's dilemma and his place in nature. Her work asks the viewer, through the use of visual clues, to consider its message, if only for just a moment, as art is not only documentation of the culture in which we live; it identifies and defines who we are as a society.

*Melancholy Crow*, 2015, places the blackbird in a pose that would not be found in nature and was intentioned to draw reference to such classics as Manet's Olympia. While the message, man's encroachment on habitat is strictly subliminal, the classic pose is meant to direct the viewer's attention to nature and man's interaction with it.

*Quantum Physics*, 2015 is the artist's vision of a headline that read, "Scientists show future events decide what happens in the past." Based on the act of observation, the article explained that Australian scientists had used protons in a double slot experiment that proved the statement. This piece represents the artist's interpretation of the observation.

11:45 am – 12:00 pm

### **Tussles toward a poetics**

*Artist: Beth Secor*

Abstract:

12:00 – 12:15 pm

### **When The Leaves Fall**

*Artist: Tommy Tang*

*Abstract:* I made this film specifically for the Audience Awards' Kodak Super 8 Filmmaking Challenge, in which contestants were tasked with creating a short that was at least half shot on Super 8 film. I chose the subject of small children learning about death because that genre generally plays well to short film festival audiences. The story is a loose adaptation of a film from 1912, Falling Leaves. The 1912 film opens with a doctor demonstrating that he's just found the cure for tuberculosis. We then see the main character, a little girl whose older sister is dying of TB. The little girl hears that her sister will die when the leaves fall, and mistakenly

thinks that the leaves are the cause of her disease. She gets a bunch of string, goes out to the front yard, and starts hanging up leaves on trees. The doctor from the beginning just happens to be walking by. He asks what she's doing, then comes in and cures her sister's TB. I saw the climactic scene in The Story of Film documentary series, and thought that it was very poignant. However, when I saw the whole film I felt that it robbed the story of any emotion and suspense because it showed the solution to the problem at the very beginning, and the climax was based entirely on chance. I thought the story could be retold much more effectively and realistically by trimming down the plot and focusing on emotion. I decided to retell it not by focusing on curing a disease, but how people find ways to deal with the inevitable.

12:15 – 12:30

### **Afterthoughts**

*Artist: Vivian Chuang*

Table: 37

In crafting the pieces for my Afterthoughts series, I focused on the relationship between my medium, my interaction with said medium and the implications of creating such works. I believe that individual visual literacy is a manifestation of one's life and cultural experiences, as context can only be built with a sense of understanding. My medium being vintage magazines, the I take existing images, deconstruct them and reassemble them into compositions. In doing so I am actively taking pieces of context, whether it be historical or personal and composing a new image that wipes away the contextual weight of the materials. In the creation of these pieces, I let the context build themselves, it could be said that these works are a commentary on pseudo-intellectualism, as their surrealist format is a cue for viewers to think about the meaning or message behind these works when really there is none. I was heavily inspired by Dadaism, the avant-garde art movement in the early 20th century, also known as "anti-art", to fight the the constraints of traditional aesthetics and express disgust at the status-quo. What interested me the most about this self-destructive and actively hypocritical movement were the philosophical implications of viewing and creating pieces that actively defy convention and live in the realm of abstraction, is to create meaning by rejecting all coherent thought revolutionary or is the idea of rejecting thought a coherent thought in its own? It can be argued that creating anti-art is an act of art itself, creating an endless cycle of deliberation that is in the end, pointless. As the creator of this piece I concur as well as accept the nihilist implications of it, as any context given to these pieces are nothing but an Afterthought, something that never existed in the first place.

## **Clamor Presentations | 2 – 3 pm | ARC 210**

2 – 2:15 pm

### **The Strongest of Men**

*Artist: Jeremy Mounts*

*Abstract:* What I love about the story of Carlos is that his story has many different layers of humanity to it, and in the end it is a story that we can all identify with in one way or another. The stories that interest me the most are the ones that have some kind of personal change or

life changing moment. When I first talked to Carlos I immediately knew that I wanted to be a part of telling his story. His inspirational story of his dramatic weight loss was inspiring in its own right, and the story of his competitive climbing even though he battled muscular dystrophy stands on its own, but the part of the story that captures me the most is his dedication to be encouraging and inspiring to others, especially to those with FSH. His story has the thing that hard to explain but easy to recognize, his story has the  $1+1=3$ . It seems impossible that  $1+1=3$  but this story is a good example of it. It's hard to describe and put to words, but it's easy to recognize when you see it, it's the stories that have that extra something special. What I believe to be the formula to  $1+1=3$  is this; I believe that it is one's personal life experiences + a life changing moment + our shared connections to the story as an audience = 3. It is this shared connection that is hard to define, we don't see it on the screen, it's not in the audio, or any other explicit form of overt communication, but we know it's there, we feel it, and we recognize it right away. We are the unseen third component to the story. Our connection to the stories that we see or hear is what completes the story.

2:15 – 2:30 pm

**Susan Deserved It**

*Artist: Acacia Thorng*

*Abstract:* Susan Deserved It is a digital photograph taken using a wide angle fisheye lens. The flowers pictured are commonly called Black Eye'd Susans. With this piece, I aim to encourage critical analysis of the names we give items and how they are evocative of misogyny that is deeply seeded into American society. This misogyny is so deeply ingrained that we find it acceptable to name a tank top 'wife beater' or a give a gender-less flower a name that implicates violence against women.

2:30 – 2:45 pm

**Violence**

*Artist: Brent Cox*

*Violence* is composed of text transcribed from field recordings I took during protest marches in the spring of 2015 in Baltimore, Maryland following the death of Freddie Gray. For days the streets of Baltimore were flooded by peaceful protestors demonstrating their anger and outrage with institutional systems that obscure justice, promote inequality, and perpetuate racist ideology in a city that, like so many in the United States, particularly marginalizes and oppresses the African American community making the experience of violence a daily burden. When the protestors approached walls of armed officers clad in riot gear, they raised their hands to indicate that they were not armed, and that their protest would be conducted in peace, despite it being a response to extreme violence. While the content of the language in the work is about violence, that same language composes an image the raised, unarmed hand that suggests solidarity, peace, and protest. It evokes the movement of the protestors, the swarm of voices, and the urgency of active responses to dangerous, and violent, institutional structures.

## **Poster Session 1 | 10 am – 1 pm | ARC Top Floor**

### **3D Chocolate Printer**

*Author(s): Jake Blurton, Luke Johnson*

*Mentor: Pierre Mourad*

Easel: 1

*Abstract:* Traditional 3D printers melt down an initially solid plastic filament, reshape the plastic in its near-liquid state, and then allow the plastic to harden again. However, these common printers only allow for the printing of a solid material that can be heated to a liquid state without any chemical degradation of the material, and do not address the printing of materials that are viscous liquids or pastes at room temperature and atmospheric pressure. Here we report our initial contributions to this active field of inquiry, focused initially on 3D printing high quality, customizable chocolate, as a preamble to printing bio-materials. While chocolate is a solid at standard temperature and pressure, it will liquefy at 31 degrees C. We are designing a paste extruder with a novel means of deploying the chocolate. Specifically, our method of extrusion uses an evenly heated, FDA-compliant, polyethylene syringe to liquefy chocolate and push it onto the print bed. A motor will control movement of the plunger and thus chocolate flow. After the chocolate printer is completed and functioning up to our standards, our experience with paste extrusion can be used by others for bio-printing applications.

### **Structural design for efficient and scalable video game software**

*Author(s): Nenad Bulicic*

*Mentor: Aina Braxton, Jason Pace*

Easel: 2

*Abstract:* Video game design plays a major role in the productivity, efficiency, scalability, and general understanding of the entire project's software. Hug the Line (HTL) is the latest, incubatory stage, project at the Digital Future Lab (DFL). In the past, projects at the DFL have faced problems of inefficiency and lack of understanding of how the software is set and how changes can be made. Team members lacked clarity on what is possible and how to reach production goals. By researching the best design practices in the video game industry and comparing current DFL project's practices for projects including HTL and Corrupted. Our team should be able to design efficient and scalable software for HTL. The design will help efficiently scale HTL from a one to a 200 level game. Specifically, I will be reviewing the current layout and design of Corrupted which is written in C# and runs on Unity. I will also be creating a layout for HTL as it currently exists in Java. The knowledge gained from these two software environments will allow me to make informed design choices in how best to layout the structure for HTL as it is ported to Unity and rewritten in C#. Detailed documentation will be kept for the software layout, its inner workings, and the results of the research. Implementation of the knowledge and practices, gained from the research in the design of HTL, will increase team-wide

knowledge of the project and be used as a template for subsequent DFL design projects to improve efficiency, scalability, and increase productivity.

### **Developing Games in a Professional Environment**

*Author(s): Michael Voght*

*Mentor: Aina Braxton, Jason Pace*

Easel: 3

*Abstract:* The Digital Future Lab (DFL) is a Software Development Studio where interdisciplinary teams create commercial products while teaching students programming concepts. The DFL has a scaffolded approach to prepare students for professional roles in the software industry. A case study of myself, (Michael Voght), a student participant interested in developing mobile applications is illustrated here. Initially assigned the title Junior Developer, I worked with a large code base and a team that consisted of 2 Seniors, a Junior, and a previous UWB graduate. I worked mainly on animations and user interface based on beta testing results to prepare the release to the iOS App Store. The insights I gained from that led me to becoming a Lead Developer for the next phase of the project which was porting the mobile version of DFL's commercial game, Ghostlight Manor, to a PC build. As a lead developer, I mentored new junior developer(s) that were on my team. Over the past year as a lead developer, I have learned how to manage a large code base with multiple developers working on the same code using source code control including GitHub. Working on the user interface for both the PC and mobile versions forced me to critically think, not only about how Users interact with mobile devices, but the Users interaction between the touch screens of mobile devices and the point and click of a PC user. Taking the position of lead developer taught me leadership skills and gave me the confidence that I wouldn't have gained as a junior developer. It allowed the team to trust in my abilities more and gave me the opportunity to expand on what I have learned. I have continued working with the Digital Future Lab and will be transitioning to a different project once my current project is complete and launched. The work I have done with DFL projects, have provided me with invaluable experience and knowledge experience beyond what I ever expected that I could learn and have prepared me for a professional career in Game Development or Software Development.

### **Project Management in Software Development**

*Author(s): Christina Jugovic*

*Mentor: Jason Pace, Aina Braxton*

Easel: 4

*Abstract:* Software development studios bring together experts from many disciplines that work together to create a cohesive project. Since there are so many people working together, the production process can become complex and unorganized very quickly. By using project management methods and task tracking software like Jira, studios can stay organized and on track during the production cycle and can assess the success of a project. Jira allows the use of agile development which breaks a production cycle into small sprints, usually of two weeks, and scrum, an agile framework, to finish a project. By determining the critical path, which finds the

tasks that need to be finished before others based on task interdependencies for the Digital Future Lab (DFL)'s projects, Ghostlight Manor and Corrupted, two week sprints of tasks can be effectively planned. Once all sprints are planned, each sprint can be tracked to make sure tasks are being completed on time. All tasks have time estimates, due dates, and team members assigned to complete each task within their sprints. Checking in with all team members regularly to make sure their tasks are being completed and updating Jira with the appropriate information, using project management practices, and agile development practices is expected to make our software development process much more organized and successful. For example, using "created vs. resolved issues report" within Jira to see a map of the issues create and resolved over time should improve team efficiency and productivity. With this tool, I can determine if our team has finished more tasks over time than created at the beginning of a project. If we resolve more tasks than created, then we can adapt this type of production process in all future DFL projects.

### **Game and API Development for Teaching Programming Concepts**

*Author(s): **Branden Drake, Rachel Horton***

*Mentor: Aina Braxton, Jason Pace*

Easel: 5

*Abstract:* A team of two programmers, myself included, set out to create a game with a small team. As junior developers, we were faced with a choice between several different high-level development methodologies. Broadly speaking, there are two different schools of programming development processes: Waterfall and Agile. Waterfall prioritizes detailed planning and documentation before programming, while Agile prioritizes iterative development and reactive design. Extreme Programming is one specific style of Agile principles which encourages pair-programming (two people coding cooperatively). During the development of the game, we experimented with a variety of methods from Waterfall and Extreme Programming. When creating challenging new code, we tried to create high-level designs to guide the actual programming (Waterfall). However, this seemed to be an inefficient use of time, and ultimately we found that starting programming with minimal forethought (Extreme Programming) was more effective, as fleshing out the code for a feature allowed us to simultaneously learn about additional code we would need to write soon. We also found that the quality of the code that we wrote as a team (Extreme Programming) was significantly more readable and usable, not only by programmers, but also for other members of the development team. Our theory is that Extreme Programming's reactive design works well for the unpredictable cycle of pre-production game development. We also theorize that pair-programming works well for a team of junior programmers because each of them can compensate for the other's knowledge gaps, while capitalizing on individual programming strengths.

## **Cross-Platform Game Development Through Porting**

*Author(s): Chad Dugie*

*Mentor: Kelvin Sung*

Easel: 6

*Abstract:* To expand the audience and implement new game features for a previously released video title, Ghostlight Manor, a development team was tasked with porting the game to PC platforms. . The shift in platforms allowed us to use different audio/visual hardware and new user input controls. Most of the work that needed to be done did not involve writing new code but in modifying the existing code. Communication was the key to project success. By maintaining contact with current and previous developers to receive suggestions for possible solutions and to refer to their knowledge and experience much of the frustration, project delays, and mistakes often associated with projects of this type were avoided. Agile software development life cycle models such as Scrum, evolutionary prototyping, and extreme programming rely on team communication. To make use of Scrum, our team created a backlog, organized sprints, and scheduled regular meetings. We used the extreme programming method to make agreed upon changes to the game. Porting the game to another set of platforms revealed the opportunity for evolutionary prototyping to implement new ideas and features by releasing test builds of the game to show the end result of these ideas. This project has shown that conforming to agile methods is imperative to porting a game with minimal issues and within reasonable time. By combining new designs and functionality, the resulting product is a clean and stable ported release.

## **Paleolimnologic Study of Gravelly Lake, Tacoma, Washington**

*Author(s): Nicholas Chen*

*Mentor: Avery Shinneman*

Easel: 7

*Abstract:* Paleolimnology is the study of past environmental conditions by collecting sediment cores from inland waters such as lakes. This study is focused on sediment cores taken from Gravelly Lake in Tacoma, Washington. Gravelly Lake has demonstrated changes in carbon and nitrogen over time, however it is not known if and how these changes have affected the ecology of the lake. We identified and counted the relative abundance of different diatoms (algae) types to learn more about the ecological changes and how they relate to chemical changes in the lake. Comparisons can also be made with climate or human changes in the watershed. These results will provide data about possible environmental problems in the lake (ex. food web and ecosystem balance, contamination, water quality) and suggest further areas of study.

## **Satellites Affecting the Earth's Rotation Rate**

*Author(s): Joshua Christensen, Stinson Li*

*Mentor: Warren Buck*

Easel: 8

*Abstract:* This previous quarter we set out to examine the question of whether launching satellites from the earth's surface into space could alter the earth's rotation rate. This would imply that there may be a downside to launching satellites from earth that would need to be taken into account when considering humanity's exploration of the universe. Examining concepts learned in the first quarter of physics, we posited that launching satellites into space from earth's surface would indeed affect the earth's rotation rate. In order to examine this hypothesis, we first conducted calculations utilizing rotational motion equations, as well as multiple possible arrangements of the orbiting satellites. Next, we developed a computer program in order to calculate and graph multiple point values for our calculated equations. The graphs that our program developed show that according to our equations, launching satellites into space does have an effect on the earth's orbit. However, while this effect is very small today, as the net amount of satellites increases, this effect will become greater.

## **Spring Oscillator Pendulum: Revision on the Analysis and Plotting of a Real and Projected Path of the System**

*Author(s): Emanuel Gomez*

*Mentor: Rachel Wade*

*Edmonds Community College Participant*

Easel: 9

*Abstract:* Spring oscillators are impressive in that they provide a vertical simple harmonic motion that may easily be represented as a mathematical function. Pendulums also follow the same paths as they too project the motion horizontally. We sought to mathematically replicate the motion of spring oscillators as a perfect system onto a 2D plane (graph) and produce a comparative plot of real and theoretic data to eventually lead to a conical pendulum spring oscillator. The plan for this project was to revise and build upon the first attempt which followed the conservation of energy to a degree, but failed to resemble the actual data – focusing on what failed, a bigger spring and heavier mass was used to make a new comparison between theoretical to real data. Once the algorithmically calculated data points were compared with the mathematical and experimental data, a transition of the followed 2D algorithm onto a 3D setting was performed. The programming language Java was used to follow a vector based algorithm, and lines of codes were put in place to print out instantaneous data points at every set time incrementations. The end result concluded with the alignment of the y-direction indicating that the algorithm had captured much of the complex vertical pendulum motion, however the poor results in the x-direction indicate aspects of the motion have yet to be properly accounted for in the Java program.

## **Face Recognition and Facial Expression Detection using PCA Algorithms**

*Author(s): Mengting Liu, Yiting Xu*

*Mentor: Lawrence Lam*

Easel: 10

*Abstract:* Face recognition was first used in the 1960s in security systems, remote conferences and identification verification. Since then, face recognition has been developed and expanded for use in preventing terrorist attacks and clinical image storage. Face expression technology has also emerged in the human computer interface and emotional robots. Behind these technologies, different algorithms were used such as Linear Discriminant Analysis, Independent Component Analysis and Principle Component Analysis (PCA). Among those, PCA is the simplest one to use with small sample size, high recognition rate and effective compression. Initially, we used the PCA algorithm to implement a face recognition program and we tested the program using the AT&T face database. The face recognition success rate of our own randomly picked pictures was 40%. However, after we made code improvements and performed quality control on the pictures in the database, accuracy increased to above 90%. Since the PCA is designed for 2-D face recognition without 3-D face detection features, it is recommended to use as-similar-as-possible angle of the faces in the testing pictures. To further improve accuracy, background noises such as clothes, hands, upper body etc. should be reduced in the pictures. Our next goal is to detect one of the facial expressions, sadness, based on mouth shape in a picture using the Viola-Jones algorithm. The expected results will show a correct detection of sadness based on the universally accepted six principal emotions. Then we plan to further expand the detection to other emotions. One of the applications is in game development to gauge the excitement of game players.

## **Flywheel Tourniquet**

*Author(s): Colin Hufman, Katy Kuznetsova, Bryan McDermott*

*Mentor: Pierre Mourad*

Easel: 11

*Abstract:* An emergency medical field technician's kit is supplied with simple and effective provisions that are essential to preserving the lives of servicemen and women. Many of the supplies in the kit have reached maturity in terms of innovation and room for advancement. However, we believe it's time to give one of the oldest medical devices in the kit an upgrade. The tourniquet may simultaneously be the most life sustaining and under-engineered tool used in emergency medical situations. Tourniquets are used to stem traumatic blood flow in patients who are at risk of death from blood loss. The current mechanism is hundreds of years old and is effective but can be enhanced to increase efficiency resulting in more lives saved. We're building a prototype based on our project sponsor's "Flywheel Tourniquet" design, a rip cord driven tourniquet for which they've recently submitted a provisional patent. We're utilizing on-the-shelf parts for the prototype and will physically test it in order to provide a proof of concept for their design. We are also working on a business plan which will include manufacturing analysis and possible alternative solutions and designs. Thus far we've primarily conducted

internet research and interviewed emergency medical staff. Through this process, we've developed a better understanding of the user environments and scenarios as well as determined key areas of the device to focus our design efforts on. We're beginning to purchase existing assemblies to strip for parts for the prototype and have started developing 3D models using SolidWorks. We believe we can provide a viable option in terms of functionality but it is still unclear whether or not the device will be economically feasible.

### **Introducing Praat as Web-Services for Endangered Language Analysis**

*Author(s): Kevin Wu*

*Mentor: Min Chen*

Easel: 12

*Abstract:* Currently, about 90% of the world languages are endangered and many are quickly vanishing. Language Endangerment is considered one of the most urgent problems in humanities. We aim to design and develop web services on a cloud platform to process endangered language recordings and extract audio features to facilitate effective language documentation and analysis. To achieve this goal, we deployed Praat audio analysis components into a cloud-based web application. Praat is a linguistics tool that has been widely used by researchers to analyze sound samples. However, Praat is a standalone application, and does not expose any libraries or services to be used in third-party applications. We deployed Praat audio analysis components as web services in the Azure cloud platform that can be integrated into any application that supports HTTP communication. We have also designed a web UI for general users to access Praat component via web browsers. With these Praat components, users can not only view the spectrogram of a specific soundtrack but also its pitch, intensity, formant, pulse and waveform within a same screen. Users can also zoom in, zoom out or select a specific time range of a soundtrack based on individual needs. In addition, all such information can be saved or printed for future access or sharing among users. In our future work, we plan to deploy more Praat functions and other linguistics tools to our web application and further improve the efficiency and availability of our web services.

### **Detection of Baleen Whale Calls Using Hydrophone Array**

*Author(s): Stefan Zelenovic*

*Mentor: Shima Abadi*

Easel: 13

*Abstract:* Increased anthropogenic influences on the sound environment of the ocean could be having an effect on marine mammal behavior. Hydrophone arrays deployed in the ocean have been used to detect a variety of sounds including Baleen whale calls. Initially, background research on the acoustic characteristics of whale calls patterns was conducted to understand what actual whale call signals look like. By analyzing various data sets from multiple research cruises that reported frequent whale sighting, the goal is to determine if the firing of air guns has an effect on Baleen whale behavior. In this project, spectral analysis is used to examine different noise phenomena such as background noise, full air gun blasts, mitigated air gun

blasts, electrical interference, and other noise characteristics recorded by an expedition in the Northeast Pacific Ocean in summer 2011. No whale calls were recorded in this data set. However, having experience in detecting various acoustical phenomena is one of the skills learned from this research.

### **Numerical Methods for Transient Conjugate Heat Transfer**

*Author(s): Cameron Whalen*

*Mentor: Eric Salathe*

Easel: 14

*Abstract:* Community Based Learning (CBL) interactions with two local sustainable education groups: SAgE Farms and 21 Acres both located in Woodinville, WA identified the need for walk-in, off-grid, refrigerated space to store produce for market. In a continuing effort to characterize the heat transfer, this study aims to improve the design, construction, maintenance and overall operation of similar structures. The approach utilizes various modes of computational modelling coupled with empirical data. The first step of the project includes the development of models in Matlab, which synthesize fundamental fluid mechanics and heat transfer theory with local climate data. These models are primarily concerned with (1) the conjugate heat transfer of the wall structure and (2) the natural convection during interaction of the interior air volume and humid ambient air. The Matlab model is being improved through inclusion of the additional factors: added thermal mass, condensation of humid air on the interior wall surface, thermal radiation and variation of door opening behavior. In order to strengthen the overall model, the Computational Fluid Dynamics (CFD) software, ANSYS FLUENT is being used to better understand the transient behavior of the natural convection at the door interface. The basic modelling has suggested that natural convection is the driving mode of heat transfer. Therefore, door opening and food storage behavior could have the greatest impact on the optimization of future systems. Although, the initial models have substantiated the basic assumption that more insulation is better, future experimental data taken from the actual structure will help to improve the understanding of the impact of the natural convection phenomenon and ways to decrease the cooling load and power requirements of the cooler. Ultimately, the implications of this study will lead to highly efficient refrigerated spaces that best suit local historical climate data.

### **MASS Parallel I/O**

*Author(s): Michael O'Keefe*

*Mentor: Munehiro Fukuda*

Easel: 15

*Abstract:* The University of Washington Climate Analysis (UWCA) is an application that uses the Multi-Agent Spatial Simulation (MASS) Library to analyze climate change by reading large amounts climate data from Netcdf files - files created specifically for storing scientific data. UWCA reads from a massive set of climate data that requires a lot of memory space for faster

analysis. More memory space requires using multiple computers to run the application. Slow read performance caused by sending the data from the master computer to the slave computers, creates a bottleneck increasing computation time. A solution to this problem is to read the climate data directly to the slave computers. Implementing parallel input and output (I/O) within the MASS Library will increase the Netcdf file read performance within UWCA, while simultaneously enhancing the I/O capabilities of the MASS Library. MASS implements a distributed space, called "Places", where multiple autonomous analyzing programs, called "Agents", can move from "Place" to "Place". The approach to parallel I/O is to allow each "Place" to open, read, write, and close the same file in parallel. To open or close a file, just one "Place" must perform either the open or close operation. To read a file, the first "Place" to read must read the entire file into main memory (a buffer) and the following "Places" must read from the buffer. To write to a file, all "Places" must write to main memory (a buffer) and the last "Place" to write must write the entire buffer to the file. Currently, each parallel I/O operation has been fully designed; while open, close, and most of read has been implemented and tested for Netcdf and Text files. Implementation and performance results will be presented.

### **Posture Self Correction Device**

*Author(s): Harpreet Pandher*

*Mentor: Lawrence Lam*

Easel: 16

*Abstract:* Chronic pain affects over 100 million people in the United States. More than 28% of adults reporting pain cited back pain as the cause. Incorrect or poor posture may lead to this condition and efforts to maintain correct posture may make a contribution toward prevention or relief of pain. Posture corrective devices such as Posture Braces are available but the effectiveness of these devices is limited. Over time, even those people who wear braces may get busy and begin to slouch rather than maintaining their posture. Here we propose a new device based on flex sensor technology and vibrating discs to notify the wearer of bad posture. Flex sensors have been used in different areas for their useful property to change their resistance when bent. The use of a wearable device with posture detecting sensors could help users maintain better posture over longer periods of time as it would remind them to correct their posture regardless of distractions. Here we aimed to investigate the flex sensor's response to a change in the curvature radius of the spine and measure the posture while seated. A simple apparatus was made with the flex sensor mounted on a garment. The flex sensor resistance was converted into voltage signal and recorded. The measured data indicated a linear response of the resistance to the curvature of the bending of the garment. The prototype successfully demonstrated the flex sensor posture correction concept. In the next design phase, we will use more flex sensors to build a full back-support garment by combining the flex sensors with another sensor, such as an accelerometer, providing both curvature and positional information in physical rehab applications.

## **Securing Machine Learning Against Poison and Evasion Attacks**

*Author(s): **Julio Perez***

*Mentor: Brent Lagesse*

Easel: 17

*Abstract:* Machine learning is used in many applications in order to correlate user data and create connections that humans cannot determine alone. Currently machine learning requires large amounts of training data to work correctly. In order to maintain the integrity of the data set to react correctly to changes (an example of a change would be if users interacted with the environment differently). To solve this problem machine learning systems need to be able to accept feedback constantly from users and add that new data to the training set the machine learning algorithm uses. Unfortunately, if a machine learning system is allowed to take in data constantly from normal users, the system becomes vulnerable to training set corruption, via poison and evasion attacks. My research revolves around solving the training set vulnerability on machine learning systems that train on input data. The methodology for solving this problem is to detect the attack as it is occurring and remove the attack data from the training set when it is discovered. In order to create the detection and removal features I have proposed creating a defense layer that fits in a machine learning system that can be used with any machine learning algorithm. To accomplish this goal a simulation system was created that initializes users and data that is sent to a machine learning system. The simulation is completely self contained. In this setup I am able to introduce different defense layers that use unique algorithms to determine if a particular user is an attacker and react accordingly. Current defense layers include anomaly detection, feature randomization and feature fencing. The next phase of the experiment is to use real-world data sets to see how the system responds compared to other system defenses.

## **ThreadOS C++ Edition**

*Author(s): **Benjamin Phan, Brett Holman, Zakk Roberts***

*Mentor: Erika Parsons*

Easel: 18

*Abstract:* ThreadOS is an operating systems simulation frequently used by universities to demonstrate operating systems concepts, and it is currently used in our CSS430 curriculum. While ThreadOS was written in Java for simpler development and cross-platform capabilities, this programming language adds an extra layer of thread mapping and interpretation between Java byte-code and computation on the physical system, making ThreadOS as slow as any other Java program. More importantly from a learning perspective, this layer adds unnecessary complexity, distracting students focusing and learning actual course concepts. To remove this layer, we needed to translate ThreadOS to a different programming language, namely C++ and using the Boost library to retain platform independence. One of the biggest challenges in this translation was related with the synchronization aspect of the operating system. It is difficult to synchronize threads properly for the ThreadOS scheduler to schedule them to run. To resolve this issue, we focused on researching synchronization strategies to translate Java

synchronization into C++ and Boost synchronization primitives. As a result, ThreadOS modules involving synchronization were successfully translated, having its scheduler work largely as intended. We have been able to verify the functionality of the new ThreadOS-C++ version by using existing ThreadOS programs and test-cases. While we are still working on a few issues, this new version should provide a faster and more in-depth experience for future operating system courses.

### **Frequency Dependence in the Evolution of a Syntrophic Mutualism**

*Author(s): **Aryanne Macarulay, Samantha Rhothisen, Andrew Tagle***

*Mentor: Kristina Hillesland*

Easel: 19

*Abstract:* There are many mutualistic interactions that occur naturally in the world. Some of these mutualistic relationships evolve to be obligate, where the presence of one species is dependent on the other for its survival. We study the evolution of an obligate relationship with two model organisms, a sulfate reducer, *Desulfovibrio vulgaris*, and a methanogen, *Methanococcus maripaludis*. These organisms have evolved in an environment that forced their cooperation for 1000 generations, which has shown that 13 out of 22 *D. vulgaris* populations have lost their ability to reduce sulfate. To confirm if these mutations are beneficial or not, we measured the fitness of mutants with knockouts in the sulfate-reducing gene pathway relative to the wild-type strain with either an ancestral or evolved *M. maripaludis* partner. The final population size of each *D. vulgaris* mutant will be measured using *FREQ-Seq*; a technique that quantifies frequencies of various mutations in an amplicon. In previous iterations of this experiment, results presented a discrepancy between replicates (I and II) due to a failed cell lysis technique. We found out that only a small fraction of the cells were lysed. With a better cell lysis protocol, we expect to see an increase in *D. vulgaris* mutant frequencies when paired with either an ancestor or evolved *M. maripaludis* compared to the wild-type. The data collected from these experiments will help us have a better understanding whether losing the ability to reduce sulfate is a beneficial mutation for *D. vulgaris* or not.

### **There's a Map for That: The UWB/CC Wetlands Geodatabase**

*Author(s): **Dawn Hatfield, Eleanor Smith, Kowshal Choodi, Johnathan Rutledge***

*Mentor: Charlotte Rasmussen, Santiago Lopez*

Easel: 20

*Abstract:* Located on the University of Washington Bothell (UWB) campus, the North Creek Wetlands are a successfully restored and functioning floodplain ecosystem. The Wetlands are a living learning laboratory offering hands-on research experiences for students, faculty, and community members while providing invaluable ecosystem services vital to the Sammamish River and Lake Washington region. The UWB Geodatabase (GDB) is a student-led research project created to centralize storage of spatial and temporal data collected by students, staff, faculty and other community members. This data can then be analyzed to understand ecosystem function in urbanizing environments. Utilization of Geographical Information System

(GIS) software for data management provides researchers access to the qualitative and quantitative data for the creation of interactive multi-layered digital maps that can be analyzed, shared and studied. Research data will be collected at the end of each quarter and uploaded to the GDB to maintain an updated list of research conducted in the wetlands. Collection of this data in the GDB allows for tracking of seasonal variations in ecological, hydrological, and geomorphological changes of the wetlands. Currently, adjustments are being made to the quantitative vegetation, hydrology, water quality data, and the trail layers. An animal species layer is being created to identify areas of habitation and species density. The GDB facilitates further research by providing opportunities to compare various environmental data and parameters utilizing GIS to understand the ecological and environmental changes in the North Creek wetlands.

### **Understanding A Lake's Life Through Diatom Analysis**

*Author(s): Humzah Shaikh*

*Mentor: Avery Shinneman*

Easel: 21

*Abstract:* Paleolimnology uses lake sediment to investigate the history of a lake and its surrounding watershed. Our team took a closer look at two lakes in the urban Tacoma area, Gravelly Lake and Waughop Lake. Using chemical analysis of the sediment provided from students at University of Puget Sound we wanted to understand how the chemical shifts they reported in the sediment affected lake ecology by studying changes in the diatoms. Diatoms are photosynthetic, unicellular organisms which are primary producers in the lake food web. Different diatoms prefer different ecological niches making it possible to analyze the habitat changes in the lake when the chemical shifts occurred. With the use of microscopy we are able to analyze the different diatoms at specific intervals in the sediment. The relative abundance of various species with certain habitat preferences will help us describe the ecological history of the lake and develop hypotheses about how climate change and human impacts can affect lakes and their surrounding watersheds.

### **The Great Divide: A Children's Book of Cell Biology**

*Author(s): Devoni Rose Whitehead*

*Mentor: Alaron Lewis*

Easel: 22

*Abstract:* The illustrative work of Devoni Rose Whitehead was created in collaboration with Professor Alaron Lewis. These series of art pages, created with pencil and ink, are a portion of pages for an upcoming children's book on cell biology. With twenty four pages of simplified illustrations and simple dialogue, young children will be able to get a very first look at the process of protein synthesis, and a brief introduction to the various proteins of the cell. In this book, different proteins within the cell are modeled as robots. Each robot represents a different type of protein or a set of proteins. The story follows Katie, a young eight year old who falls into a human cell and is greeted by a robot, one that gives her a tour inside and outside of a cell.

This greeter bot shows young Katie that proteins are very much like robots working in a factory. Each long ribbon of robot blueprint represents DNA, the essence of all life, and each portion of DNA codes for a protein, or a robot in this case. This analogy shows the young readers that each different protein robot has a specific job, and that each job is vital for the process of life. We are working to make sure that the jobs of each robot roughly mirror the jobs of the proteins they are modeled after. Thus, Katie's experiences can help to teach young children the basics of cell biology in a fun context. Having an immense passion of both the arts and science, I have managed to combine the two very different worlds in order to illustrate a fun yet informative piece that all people will enjoy.

### **Finding Protein-Protein Interaction Inhibitors to Cure Malaria Infection**

*Author(s): Becka Warfield*

*Mentor: Peter Anderson*

Easel: 23

*Abstract:* Malaria infection, which is caused by parasites of the genus Plasmodium, can lead to severe illness or even death. Worldwide, most malaria-related deaths are caused by *Plasmodium falciparum*, which contains a protein called 4V3D. The 4V3D protein consists of a CIDR $\alpha$  domain of HB3var03 PfEMP1 which binds to the endothelial protein C receptor (EPCR) found in humans. HB3var03 PfEMP1 is part of the PfEMP1 surface protein family, found in *P. falciparum*. It is necessary for the *P. falciparum* 4V3D surface proteins to bind to EPCR in order to infect the host. If the interaction between the CIDR $\alpha$  domain and EPCR can be inhibited, severe malaria infection could be prevented. Therefore, a new molecule with the ability to bind to one of the domains with greater binding affinity must be found. Research methods used in this project include determining the peptide segment that makes the greatest contribution to the binding energy of the two domains, pharmacophore searching, molecular modeling, and docking simulations. These methods were performed to yield sixty lead compounds total. Of the sixty total molecules, the three top compounds were selected, which have binding energies around -8.6 to -8.7 kcal/mol. Further research will be conducted involving optimization of the top three lead compounds. Optimization of the lead compounds will result in modified versions with more favorable (more negative) binding energies. These final optimized compounds are then expected to properly block the binding of the CIDR $\alpha$  domain and EPCR, causing the inhibition of malaria infection.

### **Impact of Genetic Diversity and Phenotypic Plasticity on Ecosystem Productivity Under Manipulated Drought**

*Author(s): Erica Qiao, Rebecca Kim, Elizabeth Nightingale, Meerit Said, Stephany Sideris, Nicholas Vrandenburg*

*Mentor: Cynthia Chang*

Easel: 24

*Abstract:* Biological diversity is known to be a key contributor in benefiting ecosystem productivity and functioning. While phenotypic plasticity (the ability of a single genotype to

reflect more than one phenotype under various environments) has been the focus of numerous recent ecological literature, it is still undetermined what explicit roles genetic diversity versus phenotypic plasticity have on diversity-productivity relationships in ecosystems. In our experiment, we manipulated genetic diversity as well as variation in propensity for phenotypic plasticity of *Arabidopsis Thaliana* individuals under drought and non-drought conditions to address the following topics: (1) the relationship between genetic diversity and phenotypic plasticity, (2) the relationship between genetic diversity and productivity, and (3) the impact of genetic diversity for phenotypic plasticity on productivity. Results from Results from this study are critical to understand ecological relationships integral for productivity and ecosystem functioning, as well as agricultural practices, in the face of projected climate change scenarios.

### **Measuring and Cultivating Community Resilience: Case Studies and Participatory Methods**

*Author(s): Marc Macarulay, Sana Farooqi, Shiku Wainaina, Brenda Solis, Portney Shibale, Jessica Jacobson*

*Mentor: Jody Early, Victoria Breckwich Vasquez*

Easel: 25

*Abstract:* Much has been written about the term "resilience" and its relationship to health and well-being over the last several decades. Less discussed, however, is the concept of "community resilience" and its relationship to population health. Within the public health literature, the concept has been narrowly focused on emergency preparedness and disasters. The purpose of this literature review was to explore the peer-reviewed health -related literature to examine how this term has been defined in various settings and communities and to arrive at a more holistic definition of "community resilience" for the public health field. To do this, we performed a critical review of literature to compare definitions, context and case studies, and factors often associated with concepts of community resilience such as "community capacity," "social capital," "community adaptability," and "collective efficacy." Several themes emerged from the literature that were used to draw a core ideas map to help conceptualize the connections that arose. Our results are a first step at developing a more comprehensive understanding of local, global, and intercultural perspectives of "community resilience" and factors that are associated with it. This research can also be used to develop a theoretical framework for measuring and expanding community resilience.

### **UW Bothell Wetlands Amphibian Inventory**

*Author(s): Christie Caldwell*

*Mentor: Caren Crandell*

Easel: 26

*Abstract:* Amphibians are among the most important members of an ecosystem, given their large biomass and sensitivity to toxins. The UW Bothell wetlands possess several different types of communities that provide a diversity of habitats for amphibians. Given the lack of any previous amphibian inventories in these wetlands, this research is important in beginning a research program that utilizes field methods appropriate for a protected restoration site,

collecting preliminary data, and adding information to the site geospatial database. Four different methods are currently in use for the inventory, all of which are routinely used by the National Park Service and are considered passive approaches. Any and all findings are recorded through Global Positioning System (GPS) points for inclusion in the database. Ten PVC pipes filled with a small amount of water for moisture are paired with ten plywood coverboards, the former of which has been successfully used to find Pacific treefrogs (*Pseudacris regilla*) that crawl into the pipes, and the latter for salamander species that prefer residing beneath damp, woody debris. Each point is checked opportunistically, and placed throughout the site (excluding the campus crow roost). Random walks and searching along a specific transect are also a large part of finding amphibians. The random walks are done in no set location on the site, and consist of walking through the wetlands with careful observation. Using transects is a similar method, but is always in the same place. Despite the study's recent beginning, already several amphibian species have been identified either by sight or sound, including juvenile American bullfrogs (*Rana catesbeiana*), Pacific treefrog (*Pseudacris regilla*) eggs, hatchlings, and adults, and Western long-toed salamander (*Ambystoma macrodactylum*) eggs and adults. More species are expected in the coming summer months, when most of the amphibians' larvae are active and therefore simpler to locate and identify.

### **A Novel Clustering Algorithm for Wind Power Forecasting Based on a New Initialization Approach**

*Author(s): James Bassett*

*Mentor: Mahmoud Ghofrani*

Easel: 27

*Abstract:* This research proposes a hybrid wind power forecasting method, which utilizes the K-means clustering technique with a new initialization approach that aims to increase the accuracy of the final forecast. By clustering historical data, selecting proper clusters' centroids and optimal groups of data to be used as input to the neural networks, the precision of the output can be greatly increased. The performance of the proposed initialization method is evaluated and compared to other initialization techniques. Wind power datasets with diverse characteristics, from different wind farms located in the United States, are used to determine the accuracy of the hybrid forecasting method through various performance measures.

### **Looking For Evolution in Wasterwater Treatment Plants**

*Author(s): Stephen Wallen, Charlie England, Kathleen Luu*

*Mentor: Kristina Hillesland*

Easel: 28

Do species evolve in diverse communities, in a manner similar to the simple two species microbial community system? We are comparing the evolution that we've seen in a species of sulfate reducers found in our simple two-species laboratory environment and comparing this evolution to that of a large, more complex anerobic digester of the wastewater treatment plants. In our 'simple community' a methanogen, *Methanococcus maripaludis* and a sulfate reducer, *Desulfovibrio vulgaris* were paired. When two species are forced to live together over

generations we expect to see evolution take place to some extent. It was found that after 1000 generation *D. vulgaris* loses its ability to reduce sulfate in this paired relationship. Using this laboratory paring as a model, we are looking at the evolution of sulfate reducers in these two different anaerobic digesters, one from the University of Washington and the other located at Brightwater Municipal Waste Water Treatment Center. Both digesters are anaerobic and have low levels of sulfate present. To test our hypothesis we are currently extracting DNA from samples taken weekly from both digesters. The *dsrAB* gene is first amplified, as it is a conserved region within sulfate reducers and their relatives. We will then perform Illumina sequencing to better determine the diversity of sulfate reducers present. Using this information, we will be able to design primers for the *sat*, *apsA* and *apsB* genes. This will show us if any mutations are present among the population of sulfate reducers in both digesters. This will be means for the comparison between real world and experimental conditions. Future work will look for mutations in the *sat*, *apsA* and *apsB* genes. By identifying these loss of function mutations in both the digesters, we will be able to see the impact of evolution on sulfate reducers in complex communities.

## **ART EXHIBITION**

### **Research and Reflections of Artists Through Fused Glass**

*Artist: Wendy Wilson*

*Mentor: Deborah Caplow*

Table: 30

*Abstract:* I was inspired by Winslow Homer's love of color, and his ability to capture the beauty of the wilderness, water, weather, and wind on paper. I identify with Homer's portrayal of the struggle to survive, "man and animal against nature." I was inspired to re-create this feeling of the Sloop, Nassau, 1899, on fused, translucent glass: Sloop, Minnow, 2013. The sparkling aqua waters of the tropics against the dark, billowy winds, threatening sky, and the injured sailboat spoke to me. I divided my picture in half, like Homer. For the bottom half of the image, I cut out and shaped bright, tropical colors of blue, green, and teal translucent glass. I pieced them together in a mosaic pattern, and put clear "frit" (powdered glass) in-between to fill the cracks. I divided the picture in half, with thin strips of brown translucent glass at the horizon. The clouds in the background are painted with teal, grey, blue, moss green, dark green, and champagne frit carefully applied, firing the whole piece at 1400 degrees. The sailboat and sails were cut out of semi-opaque white glass separately, shaded, and applied in a second firing. The third firing was a cooler slump firing; shaped over a form, for the desired shape. This sailboat's hull is the shape of The Minnow, my 88-year-old father's boat; I made it in honor of him as he raced and sailed it until recently. Winslow Homer (1836-1910) created paintings that demonstrated his illustrative ability, and his skill in depicting light and shadow, portraying large open spaces with sky and water, and his mastery of color and transparency. The struggle with the elements was Winslow Homer's love affair with nature and the artist's brush. I was inspired

by his knowledge of color, and love of nature in his life's work.

### **Jessica Cole's Art Portfolio**

*Artist: Jessica Cole*

*Mentor: Amy Lambert*

Table: 31

*Abstract:* Jessica Cole was born into a working class family in the small town of Central Valley, California. She is a mother to three children and a wife of over 10 years to her husband Ryan. In 2016 Cole earned her BA from the University of Washington Bothell specializing in Society, Ethics, and Human Behavior. In an era that struggles with gender equality and the acceptance of climate change, Cole's art combines social justice in both feminism and environmental justice, calling into question American cultural practices. She uses multiple mediums including household materials and photography. Process is an important component to Cole's work because it allows for critical analysis of the topic at hand as well as to turn inward for self-reflection. An example of this is seen when Cole spends time with a cast of her abdomen, driving with it in the passenger seat, sitting next to it in the hall way, sketching it, and then finally making an enlarged clay sculpture of it. In "Cleaning Water" she drinks dirty dishwater and cleans her dishes in a polluted stream. In "Knowledge Holders: Insufficient Dummy" she sinks deep into family tradition and knits with her dying relative and then molds the knitted piece around her mother. In "Home", Cole struggles with her perception of her physical form and challenges herself to mold her own abdomen. Through her work Cole seeks to understand the epidemiology of cultural practice and knowledge. Her intent is to make people question their own behaviors while also searching for a deeper understanding of her own personal truths.

### **Exploring Limitations**

*Artist: Salvador Barriga*

*Mentor: Amy Lambert*

Table: 32

*Abstract:* This is a progressive collection of my works in my interdisciplinary path consisting of digital paintings and portraits, paper-maché masks, pen and pencil drawings, photographs, and a few sculpture pieces of varying media, all of which ask the question of "what are the limitations of each medium in which they were produced?" My digital rendition of one of Claude Monet's paintings aimed to explore how accurate a painting can be recreated in a digital format within the limitations of software, hardware, and personal art style. My digital portrait pieces were part of a series which aimed to give meaning to sex in our own society in which the concept is overexposed to the public rendering us desensitized. My paper-maché mask pieces were each geared to a different question; how few features can be on a mask yet give expression; how can realistic textures be made; how can paint influence how a piece is "read." My pen and pencil drawings explored the limitations of the human mind and its willingness to give truth to thoughts in the form of a personal journal. My photographs explored one of the many myths we lived by to address many issues through a composite piece consisting of paper-maché masks, as well as a studio in which the photographs were taken. My sculpture in clay

explored expressing emotions of longing and loneliness. My sewn sculpture explores telling a story with only two components and how strong of a message few items can create.

### **Quantum Physics and Melancholy Crow**

*Artist: Dana Doran*

Table: 33

Abstract: Dana graduated (magna cum laude) from UW Bothell in 2014 with a bachelor's degree in Interdisciplinary Art. While her artistic endeavors vary between mediums and substrates her focus is primarily in two dimensional pieces of oil on canvas. Impressed by her studies in preserving habitat and climate change, Dana often incorporates these issues into her work by using a blackbird either representing himself, nature as a whole, or an anthropomorphic rendition in substitution for man's dilemma and his place in nature. Her work asks the viewer, through the use of visual clues, to consider its message, if only for just a moment, as art is not only documentation of the culture in which we live; it identifies and defines who we are as a society.

*Melancholy Crow*, 2015, places the blackbird in a pose that would not be found in nature and was intentioned to draw reference to such classics as Manet's Olympia. While the message, man's encroachment on habitat is strictly subliminal, the classic pose is meant to direct the viewer's attention to nature and man's interaction with it.

*Quantum Physics*, 2015 is the artist's vision of a headline that read, "Scientists show future events decide what happens in the past." Based on the act of observation, the article explained that Australian scientists had used protons in a double slot experiment that proved the statement. This piece represents the artist's interpretation of the observation.

### **Susan Deserved It**

*Artist: Acacia Thorng*

*Mentor: Marc Studer*

Table: 36

Susan Deserved It is a digital photograph taken using a wide angle fisheye lens. The flowers pictured are commonly called Black Eye'd Susans. With this piece, I aim to encourage critical analysis of the names we give items and how they are evocative of misogyny that is deeply seeded into American society. This misogyny is so deeply ingrained that we find it acceptable to name a tank top 'wife beater' or a give a gender-less flower a name that implicates violence against women.

### **Afterthoughts**

*Artist: Vivian Chuang*

Table: 37

Artist Statement: In crafting the pieces for my Afterthoughts series, I focused on the relationship between my medium, my interaction with said medium and the implications of

creating such works. I believe that individual visual literacy is a manifestation of one's life and cultural experiences, as context can only be built with a sense of understanding. My medium being vintage magazines, the I take existing images, deconstruct them and reassemble them into compositions. In doing so I am actively taking pieces of context, whether it be historical or personal and composing a new image that wipes away the contextual weight of the materials. In the creation of these pieces, I let the context build themselves, it could be said that these works are a commentary on pseudo-intellectualism, as their surrealist format is a cue for viewers to think about the meaning or message behind these works when really there is none. I was heavily inspired by Dadaism, the avant-garde art movement in the early 20th century, also known as "anti-art", to fight the the constraints of traditional aesthetics and express disgust at the status-quo. What interested me the most about this self-destructive and actively hypocritical movement were the philosophical implications of viewing and creating pieces that actively defy convention and live in the realm of abstraction, is to create meaning by rejecting all coherent thought revolutionary or is the idea of rejecting thought a coherent thought in its own? It can be argued that creating anti-art is an act of art itself, creating an endless cycle of deliberation that is in the end, pointless. As the creator of this piece I concur as well as accept the nihilist implications of it, as any context given to these pieces are nothing but an Afterthought, something that never existed in the first place.

## **Poster Session 2 | 1 pm – 4 pm | ARC Top Floor**

### **The Effect(s) of Fungal Endophytes on Lettuce (*Lactuca sativa*) Growth in an Enclosed Aeroponic System**

*Author(s): Nicholas Begley*

*Mentor: Charlotte Rasmussen*

Easel: 1

*Abstract:* The current industrial agriculture model relies heavily on water and fossil fuels to create fertilizers, herbicides, and pesticides needed to grow food, as well as harvest, process, transport and distribute food to urban areas. Growing crops indoors relies on energy to operate water, lightning and temperature controls systems to maintain a consistent environment for optimal, healthy plant growth. Decreasing the carbon footprint associated with these agriculture models while increasing access to healthy food in urban areas is a step towards improving nutritional and environmental health. Studies have shown that fungal symbionts can confer a plant's tolerance for increased temperatures, drought, high CO<sub>2</sub> levels, and protect plants from disease. This study will investigate plant growth and water consumption in aeroponic systems by measuring potential effect(s) of the fungal endophytes (i.e. *Trichoderma* sp., *Curvularia* sp. and *Colletotrichum* sp.) has on Lettuce (*Lactuca sativa*) grown under reduced water conditions. Quantifying differences in biomass, rate of growth, water consumption and relative water content between the infected plants and uninfected plants, will determine if the relationship between the endophyte increased the plant's growth while decreasing the energy

consumption and water dependency. Urban indoor agriculture systems may provide alternatives to meet the nutritional demands of growing populations in urban areas by using hydroponic and aeroponic methods. New technologies applied to large scale, indoor agriculture operations could decrease water and energy requirements needed to grow food sustainably. Creating energy and water efficient systems could have substantial economic, environmental and societal benefits.

### **Are Individual Differences in Heat Production During Nitrous Oxide-Induced Hypothermia Correlated with Heat Production During a Cold Challenge?**

*Author(s): Andreas Cimpan, Dragana Markanovic-Gaston, Chris Prall, Salwa Al-Noori, Karl Kaiyala, Douglas Ramsey*

*Mentor: Salwa Al-Noori; Douglas Ramsay*

Easel: 2

*Abstract:* Nitrous oxide (N<sub>2</sub>O) is a pharmacologically active gas used clinically in dentistry and medicine. It is also an abused inhalant. Our lab has an established rat model of N<sub>2</sub>O-induced hypothermia that can assess changes in core temperature (T<sub>c</sub>) as well as the determinants of T<sub>c</sub>, i.e., heat production (HP) and heat loss (HL). Drug-induced hypothermia elicits hypothermia-opposing autonomic HP responses that account for individual differences in the degree of hypothermia observed during an initial N<sub>2</sub>O administration. Furthermore, these individual differences in HP also predict the rate of tolerance development at the level of T<sub>c</sub>, predict an individual's subsequent self-administration of N<sub>2</sub>O, and predict the degree of allostatic over-correction of T<sub>c</sub> that develops over repeated N<sub>2</sub>O administrations. This study was designed to determine whether a rat's HP response to a non-drug, cold challenge is correlated to its HP response during an initial N<sub>2</sub>O administration. Individual rats (N=20) were tested in two different sessions in counterbalanced order; one session involved a 60% N<sub>2</sub>O challenge while the rat was at 22°C ambient temperature and the other session involved a cold (10°C) ambient temperature challenge while the rat was exposed to control air. The N<sub>2</sub>O challenge was achieved as a rapid exponential rise to a steady-state 60% concentration whereas the cold challenge was a ramp change starting from 22°C. The two challenges were given 7 days apart. During each 2-h challenge, 1200 HP measurements were collected using indirect calorimetry and median values were evaluated. Results found a correlation (r=0.57; p=0.009) between HP responses during a N<sub>2</sub>O challenge and HP responses during a cold challenge. These findings have translational importance because they suggest that individual differences related to a young individual's addictive vulnerability may be predicted using a non-drug challenge which facilitates human research pertinent to understanding the pathogenesis and treatment of drug addiction.

## **Comparing the Hydrolysis Mechanisms of Thioesters and Oxoesters Using Kinetic Isotope Effects**

*Author(s): Xin Gao*

*Mentor: Lori Robins*

Easel: 3

*Abstract:* Thioester hydrolysis is an important reaction that is catalyzed by a variety of enzymes in biochemistry. Previous studies have investigated the hydrolysis mechanism of the thioester formylthiocholine (FTC) using kinetic isotope effects (KIEs) in enzyme-catalyzed and nonenzyme-catalyzed conditions. The data suggested that both concerted and stepwise mechanisms are plausible. To further explore and understand the transition state structure for the hydrolysis of FTC, we are investigating the hydrolysis of the oxoester analog, formylcholine (FCh). We are currently determining the formyl-H KIEs for the hydrolysis of FCh in acidic, neutral, and alkaline conditions using nuclear magnetic resonance spectroscopy. Here, we report current progress and preliminary results on the formyl-H KIEs for the hydrolysis of FCh. This study will provide a comparison for the KIE data collected with FTC, and will aid in the future design of inhibitors for enzymes that utilize thioesters as substrates.

## **Vocalizations of Non-Breeding American Crows (*Corvus brachyrhynchos*) in Three Daily Aggregations**

*Author(s): Arianna Greer*

*Mentor: Douglas Wacker*

Easel: 4

*Abstract:* American Crows (*Corvus brachyrhynchos*) form four different daily aggregations: after roosting at sunrise (post-roost aggregations), while gathering or foraging during the day (diurnal activity centers), before roosting at sunset (pre-roost aggregations), and at night while sleeping (roosts). Crows vocalize in all these aggregation types, but the type of calls they make may differ between each context. We hypothesize that pre- and post-roost aggregations act as information centers where crows use calls to share information about potential foraging areas. We predict that this function would lead to differences in vocalizations between pre- and post-roost aggregations and diurnal activity centers. To address this prediction, we recorded vocalizations from crows in pre- and post-roost aggregations and diurnal activity centers within the greater Seattle area. We analyzed spectrograms of these recordings and compared vocal patterns between aggregation types. The total number of crows varied by context, with more crows observed in post-roost aggregations than in diurnal activity centers. The average number of syllables per caw call, duration of caw call syllables, number of calls per crow, and call duration did not differ across these contexts. The average duration of gaps between syllables in caw calls did differ across contexts, with pre-roost aggregations having significantly longer average gap durations than diurnal activity centers. This variation in vocalizations may indicate that crows share different information across the three different contexts. In order to determine whether crows might be sharing information about foraging locations on pre- and post-roost aggregations, future work will incorporate playback studies to determine if calls

given primarily in pre- and post-roost aggregations cause crows to change their behavior on diurnal activity centers.

### **The Influence of Fungal Endophytes on Growth of Root Crops in Stressful Environments**

*Author(s): Allison Kane, Paul Morgan*

*Mentor: Charlotte Rasmussen*

Easel: 5

*Abstract:* A potential mechanism to promote agricultural crop productivity and water conservation during periods of stressful growing conditions involves the use of fungal endophytes. Many fungal endophytes exhibit a symbiotic relationship with plant species helping to modulate phenotypic changes that enhance nutrient acquisition and endow host plants with an increased tolerance to environmental stressors. The influence of different genera of fungal endophytes (*Trichoderma* species, *Curvularia* species, and *Colletotrichum* species), in promoting taproot growth and drought tolerance, was tested in carrots (*Daucus carota*), beets (*Beta vulgaris*), and radishes (*Raphanus sativus*) grown under greenhouse and field conditions. Treatment groups were inoculated with fungal endophytes and, along with controls, subjected to different environmental conditions and stressors including field versus greenhouse conditions and different degrees of drought using varying watering regimes. Endophytic fungal effect on crops experiencing drought stress was measured through comparative analysis of taproot and shoot mass and necrosis rate between control and treatment groups. Additional chlorophyll and soil moisture measurements were obtained for carrot and radish crops. Carrot crops inoculated with *T. harzianum* showed a cultivar-specific increase in taproot and shoot growth, as well as survival rate, under high degrees of drought stress, while *C. protuberata* appeared to confer no benefit. Results for endophytic effect on *B. vulgaris* and *R. sativus* are still under study. Our initial findings suggest that mutualism may be highly specific requiring both appropriate combinations of genera of fungal endophyte and cultivar of host in order to occur. Further research is necessary to confirm these findings and to test the effects of other genera of fungal endophytes in other crops and under different environmental stressors.

### **Assessing the Composition of the Winter and Spring Bird Communities at the UWB Wetlands**

*Author(s): Fatih Ketenci*

*Mentor: Ursula Valdez*

Easel: 6

*Abstract:* Understanding the composition of avifauna of different ecosystems has been the focus of a wide number of scientists in North America. The knowledge of the structure of a bird community provides information about the species found in an area as well as their ecological roles. More importantly, a long-term monitoring of the species composition in an ecosystem provides an important tool for assessing the status of their populations as well as the responses to the habitat changes. The University of Washington Bothell (UWB) North Creek wetlands, present one of the most successful restoration efforts of the past 20 years. Faculty and students have been evaluating the changes in vegetation composition, in the stream organisms,

invertebrates and in other ecological aspects associated with the establishment of the wetland. In the summer of 2015, an effort to establish a long-term monitoring of the bird community was started and we joined these efforts with the goal to determine the composition of the bird community in the winter and spring of 2016. In addition to the ecological research goals, we are also working on producing education materials that help students and the general public to become more familiar with the avifauna of the area. We are conducting auditory and visual point count and transect surveys to determine species composition, and we are using distance methods to determine bird abundance along the different vegetation types found in the area. We are also collecting information on the natural history of the species, and documenting the observations with photographic materials that will be also used in the elaboration of a photographic guide to the birds of the UWB Wetlands. To date we have registered a total of 51 species within 26 families that are distributed within 8 guilds (Insectivores, filter-feeders, nectarivores, frugivores, carnivores among others). Our work will provide important contributions to the long-term documentation of bird communities of the UWB wetlands.

### **Determining Potential inhibitor(s) of Thioredoxin Glutathione Reductase, Key Enzyme of *Schistosoma Mansoni* Parasite**

*Author(s): Mengkhy Lay*

*Mentor: Peter Anderson*

Easel: 7

*Abstract:* Schistosomiasis is a parasitic worm disease that affects more than 200 million people and the drug praziquantel remains the only treatment. Recently there have been reports of patients showing signs of resistance to praziquantel. Consequently, there is an urgent need to develop a new drug to serve as an alternative to praziquantel. In this experiment, we will determine potential inhibitor(s) of Thioredoxin glutathione reductase (TGR), an essential enzyme that is responsible for the parasite's survival. We will use three phases of computational modeling techniques including virtual screening, lead optimization, and down-selection to determine potential drug candidates. Using virtual screening, we determined the top hit molecule with a predicted binding affinity of -10.0 kcal/mol. Furthermore, we improved the binding affinity of the hit molecule to -13.7 kcal/mol using lead optimization. We are currently working on optimizing the next top hit molecules and will eventually proceed to the down-selection phase. As a result, we will generate a list of drug candidates with the highest predicted binding affinity and lowest predicted toxicity levels. Ultimately, these drug candidates could potentially progress into preclinical and clinical development and eventually serve as a marketable drug.

**Measuring Dehydroepiandrosterone (DHEA) in Song Sparrow (*Melospiza melodia morphna*) Plasma Using a Salivary Enzyme Linked ImmunoSorbent Assay (ELISA)**

*Author(s): Amanda Morgan, Aaron Ayenew, Quinn Brandt*

*Mentor: Douglas Wacker*

Easel: 8

*Abstract:* Dehydroepiandrosterone (DHEA) is a steroid hormone that is produced in the adrenals, gonads, and the brain. DHEA modulates social behavior in humans and many other vertebrates, including the song sparrow (*Melospiza melodia morphna*). Here, we attempted to modify an enzyme-linked immunosorbent assay (ELISA) designed to detect DHEA in saliva samples to quantify DHEA concentrations in avian plasma. We used dextran-coated charcoal to prepare stripped plasma samples in which all steroids present were removed, and then added known concentrations of DHEA to these stripped samples to form a standard curve. In order to determine whether constituents of blood would interfere with the salivary ELISA's ability to accurately measure DHEA levels, we compared values obtained from this plasma standard curve with those from a standard curve prepared in assay buffer. If such interference were to occur, we predicted that there would be less DHEA detected in the plasma curve due to the presence of binding globulins and other factors. Contrary to our prediction, more DHEA was observed in the plasma standard curve relative to the standard curve prepared in assay buffer. We originally attributed the observed difference to inadequacies in the stripping process of the plasma samples. Further testing proved that we had successfully stripped DHEA from the plasma samples. The hypothesis we are currently investigating is whether or not the use of two different DHEA stock solutions in the assay caused the observed curve differences. We will address this hypothesis by using only one DHEA stock solution in the preparation of future assays. In future studies, we plan to assess the effects of DHEA on female song sparrow social behavior. We can use the data gathered in this study to better predict the behavior that both birds and humans might exhibit with low/high levels of DHEA.

**Linking Non-vocal and Vocal Behaviors in the American Crow (*Corvus brachyrhynchos*)**

*Author(s): Gregory Niblack, Bonnie Johnson, Edelman Navaluna, Austin VanderWel*

*Mentor: Douglas Wacker*

Easel: 9

*Abstract:* Crows are intelligent social animals, and many studies have focused on understanding their complex vocalizations. Here we examine the ways in which non-breeding crows use both vocal and non-vocal behaviors across contexts. Both vocal and non-vocal data were collected in the field using video camera recordings at three different behavioral contexts: post-roost aggregations, diurnal activity centers, and pre-roost aggregations. An ethogram of behaviors and vocalizations was developed from the video data and each behavior was illustrated. Each illustration diagrammed the movements involved with each behavior, to provide a visual key to support future research. We are currently analyzing the data collected to assess whether certain behaviors are more prevalent in particular contexts, and how this aids context-

dependent communication. This study will provide insight into a more complex mode of communication in crows and how such communication differs across behavioral contexts.

### **Is Specialization a Typical Outcome of 1000 Generations of Evolution in Mutualism?**

*Author(s): Irina Stroynyy, Yemesrach Demissie, Colin Feng, Douglas Henderson*

*Mentor: Kristina Hillesland*

Easel: 10

*Abstract:* When isolated subpopulations adapt to the particular features of local predators, prey, or cooperative partners in their environment, populations may become specialized to their local partner and less able to interact with other populations. Understanding to what extent this hypothesis explains the diversification of microbial species, which cooperate or compete with each other in complex communities is our goal. For example, when an interaction is based on the cooperative exchange of hydrogen, specialization occurs. We tested whether specialization was a common outcome of evolution between the bacterium *Desulfovibrio vulgaris* and the archaeon *Methanococcus maripaludis* after they evolved together for 1000 generations. To test if *D. vulgaris* populations tended to become specialized for the *M. maripaludis* populations they evolved with (and vice versa), we revived 6 independently-evolved communities, separated the *D. vulgaris* and *M. maripaludis* populations from one another, and then paired each population back up with their sympatric partner (same community) or with 5 allopatrically-evolved partners (isolated community). We used microscopy to quantify the density of *D. vulgaris* and *M. maripaludis* to test whether the absolute fitness of either species was higher in sympatric versus allopatric pairings. We also competed allopatrically-evolved and sympatrically-evolved *D. vulgaris* against one another. Our results show that some sympatric pairings were more efficient than allopatric pairings; however no distinct trend was identified. We conclude that variation across cocultures in population yield of *D. vulgaris* or *M. maripaludis* is not necessarily correlated with whether they evolved in sympatry or allopatry, suggesting that the first 1000 generations of adaptation to a new mutualism may not be characterized by specialization.

### **Examining the Effects of Different Diets and Salinities on Copepod Population Growth**

*Author(s): Martha Raymore*

*Mentor: Megan Dethier*

Easel: 11

*Abstract:* The coastal oceans are subject to climate impacts leading to sea level rise, increases in the frequency and intensity of storms, and increased precipitation. These events can lead to a rise in the amount of fresh water entering coastal ecosystems from runoff or rainfall, which cause decreases in ocean salinity. Understanding marine food web dynamics requires an understanding of how species interactions will respond to environmental changes of this kind. Sea urchins are key members of nearshore food webs and may help to link food availability between shallow and deep zones along coastal areas. Urchins' inefficient digestion, means that their feces may possess large amounts of available nutrients, which other organisms can use as a viable food source. This research aimed to test the population growth of *T. californicus*

copepods in both low salinity and normal seawater environments, and with diets of either fresh *Ulva* or urchin fecal *Ulva* was studied. The caloric content of these different diets was also determined. Results showed that both diet and salinity significantly affected population growth, low salinity is the better environment, and fresh *Ulva* is the better diet.

### **African and Afro-Caribbean Women's Health Study (AACWHS)**

*Author(s): Heather Hewitt*

*Mentor: Shauna Carlisle*

Easel: 12

*Abstract:* The African and Afro-Caribbean Women's Health Study (AACWHS) focuses on perceived discrimination and stress among African and Afro-Caribbean U.S. immigrants. The overall aim of the study is to gain a better understanding of the negative health effects of perceived discrimination, in the short term and over the life-course. We are interested in collecting biometrics to assess allostatic load, in combination with quantitative data from surveys utilizing scales including the Everyday Discrimination Scale and Phinney's Multigroup Ethnic Identity Measure (1992). Combined with other measures, the survey will assess perceived discrimination in the form of attribution of everyday hassles, and connection to one's own ethnic group here in the U.S. The original hypothesis of this study was that the longer Afro-Caribbean and African women participants have lived in the United States, the more likely they are to ascribe daily hassles to discrimination, and the greater the negative health effects may be. This study has multiple goals. We would like to determine why health profiles differ between foreign-born and native-born peoples, and identify how immigrants' appraisals of daily experiences may serve as a protective factor that mediates the impacts of discrimination on health, at least within the first few years of living in the U.S. The study seeks to gain a better understanding of the role that perceived discrimination plays in stress level, while examining the biological pathways that link perceived discrimination and chronic stress, i.e., how perceived discrimination triggers a physiological response that leads to negative health effects.

### **A Comprehensive Review of Bicycle Safety and Compliance in King County**

*Author(s): Stephanie Lim*

*Mentor: Hoa Appel*

Easel: 13

*Abstract:* Recent incidents have shown a significant lack of compliance with traffic laws among cyclists. Previous research focusing on motor vehicle behavior in bicycle-related accidents is extensive, but there is limited research focusing on cyclists' behavior and compliance. In this study, we will observe cyclist behavior and compliance at five major intersections in King County where bicycle-related accidents are most prevalent. In addition, motorists' behavior will be observed at these intersections in order to fully understand the relationship and interaction between both modes of transportation. A survey will be conducted that evaluates both cyclists'

and motorists' perceptions of bicycle safety. This survey will be given to 200 motorists and 200 cyclists. In addition, this study aims to evaluate the infrastructure in place regarding the two modes of transportation, which will be crucial for potentially establishing new policies and requirements for cyclists. The expected outcome of this research is reduced bicycle-related accidents with increased cooperation of cyclists and motorists, as well as cooperation from King County administration and law enforcement. The potential impacts include better infrastructure for bicycles on the road resulting in improvements in individual health, public health and environment health as more people feel safe bicycling.

### **Geography of Opportunity: Place and Space as Determinates of Postsecondary Outcomes in the Lives of Disabled Youth and Those Labeled with Disability**

*Author(s): Whitney Corthell*

*Mentor: Jason Naranjo, Heather Evans*

Easel: 14

*Abstract:* Researchers in human geography have long observed the role location plays in determining individual opportunity and subsequent outcomes. Community, neighborhood, and school contexts shape youth's developing identities, as well as influence future careers, educational paths, and socio-political involvement. Consequently, the places and spaces we engage with everyday play a significant role in how our lives unfold. Not all geographical settings host the same opportunities and resources, however, and some disadvantaged communities are less equipped to nurture growth and self-efficacy. This phenomenon is especially problematic when considering already marginalized populations, such as youth with disabilities. While geography of disability is gaining interest and relevance within the academic community as an interdisciplinary area of study, there is a lack of research concerning the way place and space affect the long-term adjustment of youth with disabilities. The purpose of this project is to address this gap in knowledge by asking how structural, geographical influences shape the transition from high school to community for youth with disabilities. We use a review of the theoretical and empirical research literature to draw insight into how geography shapes long-term outcomes experienced by youth with disabilities. To frame our analyses we subscribe to some of the tenets of the Social Model of Disability, which locates disability within societal barriers, attitudes, and structures rather than within the individual. In completing a thorough review of the available literature, we will attempt to identify specific geographical indicators of opportunity for the population of interest. Our hope is that this research will not only build a foundation for future projects, but will also influence educators and policy makers to take into consideration their role in improving opportunity for youth with disabilities as they move from high school and into their general communities.

## **UWB Social Justice and Diversity Archive: Ingersoll Gender Center**

*Author(s): Colin Davis, Michaella Rosner, Hillary Sanders, Erik Larson, Reiko Usami*

*Mentor: Julie Shayne*

Easel: 15

*Abstract:* Ingersoll Gender Center is a support organization for transgender and gender-liminal people and their loved ones in the Seattle area and beyond. One of the first organizations of its kind in the world, Ingersoll has provided advocacy, education, support, and resources to the transgender community for nearly 40 years, but its history has remained largely undocumented, and its importance to LGBTQIA+ history has gone largely unnoticed. Our group conducted interviews with Ingersoll founder Marsha Botzer to capture her first-person perspective on the history of the organization, and of the transgender community in the United States. We also collected photographs of artifacts and scans of primary documents significant to the history of Ingersoll and the Seattle transgender community. We submitted the data for inclusion in UWB's Social Justice and Diversity Archive. This digital archive is an invaluable window into the past for researchers interested in the history of grassroots social justice movements. The collected materials chronicle Ingersoll's challenges and triumphs through the years, and records changes in attitudes about transgender issues over time. Ingersoll has significantly more material cached, but it remains unseen in storage. Preserving historical materials like these is key to preserving the history of transgender people, which in turn contributes to preserving the lives and rights of trans people. Any progress the transgender community has made can be lost all too easily. Similarly, without a concerted effort to preserve these histories, they are lost forever, through negligence or overt silencing, and the community itself is endangered. Preserving these narratives enriches our understanding of LGBTQIA+ history, and contributes to the ongoing struggle for the safety and security of the transgender community.

## **Portable Solar Powered Cooler**

*Author(s): Luis Alvarado, Robby Shaffer, Jake Schriener, Elliott Vega*

*Mentor: Pierre Mourad*

Easel: 16

*Abstract:* This project consists of designing and constructing a Portable Solar Powered Cooler that was commissioned by two organizations: SAgE Farms and 21 Acres. A total of \$23,050 was allotted for the design, construct, and delivery of a Portable Solar Powered Produce Cooler. The ability to cold store their produce will enable SAgE Farms to become USDA certified which will allow them to sell their produce to public institutions rather than being relegated to farmer's markets. These farms need to cold store their produce, but may not have an appropriate device or access to grid power. The design is to super-insulate a portion of a 20' shipping container and mount a solar array on top of the container to power a mini split air conditioner and other electronics. A device called CoolBot will be used to trick the air conditioner into cooling below its restricted lowest setting. The Solar Powered Cooler is currently being built at the University of Washington Bothell and will be transported to SAgE farms after construction is finished. This

project will not only help SAgE Farms run better as a business, but it has the potential to impact all of King County by providing a template for new and existing farms to follow.

### **Heesch Numbers of Hexagons with Matching Rules**

*Author(s): Morgan Ascanio*

*Mentor: Casey Mann*

Easel: 17

*Abstract:* The Heesch number of a shape (or tile) is the maximum number of complete "layers" said shape can form around itself in a tiling. Regular hexagons can tile the two-dimensional plane in exactly one way, so tiling theorists impose "matching rules" on them to make things interesting. A matching rule on a regular hexagon dictates which of the six sides, when indexed, may touch which other sides and with what orientation. There are four possibilities: two sides cannot match, they can match with only the same orientation, they can match with only opposite orientations, or they can match in either manner. This yields approximately 4.4 trillion rule sets. The ultimate goal of this project is to use the computing cluster to find which of these rule sets give rise to finite Heesch numbers, but the existing code that exhaustively checks each rule set takes an exorbitant amount of time if the Heesch number is large or the rule set tiles the plane (has an infinite Heesch number). We are building filters that identify which rule sets tile the plane in a k-tile-transitive manner, currently as far as k=4. We hope that this will allow us to run the exhaustive Heesch number checking code on a much smaller data set, which would allow us to see results in a reasonable amount of time.

### **The Harsh Reality of Insider Threats**

*Author(s): Samreen Khadeer*

*Mentor: Marc Dupuis*

Easel: 18

*Abstract:* Insider threats are a harsh reality within organizations as technology use continues to grow. As internet related crimes increase exponentially, providing adequate security measures maintains is a top managerial concern. The reasons behind why insider threats occur stem from the idea of motivation. We strive to step inside the mind of an insider and discover exactly what it is that compels an insider to commit a crime in the first place by analyzing his or her personality, emotion, financial background, and demographical background. Increasing awareness of alarming personality traits and being consciously aware of common emotional indicators can lead to early detection and prevention of insider crimes. As corporations grow larger and larger, they begin contracting out many of their projects to third party companies that have the same access to secure systems as an employee within the company. Contract employees have fewer loyalty ties to the corporation. Thus, when faced with access to confidential information, they are more likely to use it to their own unethical advantage. On the other hand, there are various contributing factors such as financial stability and cultural differences that can increase the likelihood of an insider committing a crime. When an insider is under financial strain and is faced with confidential information that could potentially benefit

his or her finances, they are more likely to use that confidential information to their own advantage. Developing a concrete solution is difficult but security infrastructure all over the world remains extremely underdeveloped. Thus, adopting managerial training on detecting threats from emotional indicators is the first step in adopting security infrastructure that can lend a hand in detecting insider threats before they truly become a threat.

### **Wireless High Speed Underwater Communication**

*Author(s): Eric Miller, Zaid Alshatwi, Stephen Ton*

*Mentor: Pierre Mourad*

Easel: 19

*Abstract:* Current methods for underwater wireless communication rely on sonar, which uses a much lower frequency, and therefore is incapable of achieving high rates of data transfer. Sonar also affects marine mammals and fish in a way that is not fully understood at this time. Our main objective is to create a prototype device using commercial off the shelf (COTS) hardware that can achieve a wireless high speed (1 TB/hr) communications link that is usable over a short range while submerged in seawater. Electromagnetic waves such as WiFi suffer greatly underwater due to attenuation, which results in a very short range of signal strength. In order to achieve our goals of increased signal strength and greater range our group decided to develop a high gain antenna, commonly called a cantenna, which will work underwater. Our solution; will allow for WiFi (5.8 GHz) to have a greater range underwater; and therefore solve the issue. The cantenna is theoretically able to transfer up to 1 TB of data per hour. This work, performed in partnership with the Applied Physics Lab of the University of Washington, and our main client OceanGate Inc., will enable submersibles to communicate with each other underwater and exchange data. To date we have finished all of the preliminary calculations for both 2.4 and 5.8 GHz, ordered materials, and have started to build the prototype.

### **Metallization Techniques for Thin-Film Organic Photovoltaic Cells**

*Author(s): Wyatt Moore*

*Mentor: Seungkeun Choi*

Easel: 20

*Abstract:* Organic photovoltaics (OPV) have emerged as a focus in photovoltaic research due to the potential for low-cost, simple, and high throughput manufacturing capabilities for products that can convert solar energy into electrical energy. One layer of interest is an electrical conductor (electrode) on the top of the cell that is used to make contact with the semiconducting materials beneath it. High vacuum deposited metals such as silver (Ag) are commonly used for this top electrode of the cell limiting size due to the high cost of silver and throughput issues. This will significantly limit the performance of OPVs as larger sizes are necessary for many practical applications. My research addresses these important engineering issues by developing an alternative deposition method with less expensive materials. Replacing vacuum deposited Ag electrodes with electroplated copper (Cu) will significantly lower-material costs and provide comparable conductivity characteristics that will not harm OPV performance.

Recently it has been shown that high vacuum deposition can be replaced with low-cost metallization techniques such as electroplating. Electroplating is a well-established industry process that is relatively low-cost, and simple making it a suitable choice for rapid processing. While electroplating technology has been adopted for silicon-based photovoltaics, its advantages and implications have yet to be explored in OPVs. My method of investigation tests OPV performance once the device are fabricated and the initial Ag electrode deposited, then I will electroplate a thick Cu electrode on top of the Ag electrode, and once again test for OPV performance. Characterizing the effects of the electroplated Cu on the power conversion efficiency (PCE) will determine if replacing a sophisticated manufacturing process and expensive material with simple methods and cheap materials such as electroplated Cu will create opportunities for further low-cost high throughput technologies for OPV.

### **IVER II UUV Restoration Project**

*Author(s): Kara Nuno, Conner Gracia, Nhan Ly, Spenser Petherick*

*Mentor: Pierre Mourad, Ivan Owen*

Easel: 21

*Abstract:* Many marine mammals, including baleen whales, are heavily affected by the sonar and acoustics signals produced by oil surveying ships when these ships are trying to detect offshore locations of potential oil deposits. This use of sonar and acoustic signals often results in the whales beaching themselves with many individuals being injured or killed. Our research project will modify an IVER II Unmanned Underwater Vehicle (UUV) to provide the capability of towing an array of hydrophones that can be used to triangulate the whale locations to reduce or prevent usage of these acoustic signals in the presence of whales. This way, oil companies and other researchers can ensure that there are no whales nearby and can minimize the effect on whale populations. We are working with the Applied Physics Laboratory (APL) of the University of Washington to choose and test the best hydrophone option for this application. We must ensure that the hydrophones are able to capture sounds in the very low frequency range of baleen whales calls. We expect to have a fully functional UUV that can be both remotely controlled and function autonomously. It will be capable of a functioning at a depth of 20 meters and operational for up to 30 minutes per trip. In addition, we will include the design and prototype of an attachment system that will be capable of towing up to five hydrophones and not interfere with the pressurization of the vehicle.

### **Super Neutral Ned**

*Author(s): Evin Owen*

*Mentor: Rachel Wade*

*Edmonds Community College Participant*

Easel: 22

*Abstract:* Through the application of mathematical operations designed to simulate real world electromagnetic interactions, Super Neutral Ned creates a fun and engaging environment for teaching the basic concepts of these forces. The player is drawn into a two-dimensional world

of circular charges where they must guide Ned through complex obstacles of an electric, magnetic, or gravitational nature. To guide Ned to the goal, and therefore complete the level, they must carefully learn how these forces affect Ned and the other objects in the level. Super Neutral Ned successfully brings an engaging experience that is both challenging and educational, bringing electromagnetic concepts into an interactive visual format.

### **Wireless ECG and Blood Pressure Monitoring System**

*Author(s): Manuja Sharma, Devon Griggs, Arian Naghibi, Colton Wallin, Victor Ho*

*Mentor: Hung Cao*

Easel: 23

*Abstract:* High blood pressure (BP) or hypertension (HTN) is a common condition which can lead to serious cardiovascular complications if left uncontrolled. HTN is marked by increased pressure in the arteries that can lead to stress on the heart, also known as hypertensive heart disease. 67 Million American adults (31%) are affected by hypertension, 47% of whom maintain normal blood pressure control. The condition requires continuous monitoring of blood pressure (BP) and electrical activity of heart (Electrocardiography- ECG) which the existing bulky instruments fail to provide without hindering the patient's daily activities. The recent advances in micro-/nano-technology has enabled development of wearable devices targeting accurate measurement of ECG, BP, skin impedance, and other physiological parameters. In this work, we have taken advantage of this technology and proposed a home monitoring cuff-less and hassle-free blood pressure device that measures both BP and ECG, and provides wireless real-time communication. A user can wear this device on his arm where the BP/ECG data are collected and transmitted to a computer or a mobile device. The work is broadly divided into two phases: micro/nano sensor development and wireless data transmission. We are in the first phase of the project and have successfully obtained heart rate from a piezo-electric pressure sensor strapped to the wrist. We are now working to develop a non-cross electrode ECG. Using the time difference (PTT) between the peak values from heart sensor and R-peaks of ECG we will mathematically estimate BP. An algorithm to isolate the peaks and calculate the PTT efficiently is being developed. In phase 2, we will wirelessly send data to a mobile device to maintain records. Finally, we aim to minimize the circuitry and build it on a flexible material. This research will aid the development of mobile-health by making home monitoring easier for patient and practitioner.

### **Degradation of Polymeric Granular Composites**

*Author(s): Kaleb Dempsey*

*Mentor: John Bridge*

Easel: 24

*Abstract:* Understanding the thermal-mechanical characterization and strengthening mechanisms of polymeric granular composites that are used by many Thoroughbred horse racetracks and other equine sports surfaces will aid in wear prevention and correction. Current emphasis is understanding the degradation mechanisms of the material components

as they age over time. Testing of the extracted polymeric binder shows that chemical oxidation is occurring. Degradation of the polymers due to Ultraviolet (UV) radiation, primarily UV-A and UV-B, are hypothesized to change the mechanical properties of the track material. These changes of the sport track properties and characteristics can adversely affect the racing performance and safety of the horse and jockey. Such examples include slower track times and increased track related injuries. Future work currently entails the creation of a UV chamber to monitor UV radiation and promote accelerated weathering to confirm the hypothesis.

### **SAFF: Sustainable Aquaponics at Farmer Frog**

*Author(s): Justin Kneip, Richard Yip, Joshua Hurley*

*Mentor: Pierre M*

Easel: 25

*Abstract:* Farmer Frog, a local farm in Woodinville, strives to support environmental friendly sustainable practices and is installing an aquaponics system to exemplify sustainable agriculture practices. The farm has reached out to our team at UWB to design a sustainable energy solution to reflect their sustainable ethics. Aquaponics is a combination of hydroponics and aquaculture, this is essentially a fish farm in a mutualistic relationship with a plant garden. By replacing the nutrients in the soil with fertilizer from the fish, and replenishing the chemicals to clean the fish tank using water filtered through the plants, a sustainable relationship mirroring a natural cycle is formed that benefits both plants and fish. This system requires a pump in constant operation, for filtration purposes, and multiple grow lights for the plants. Our team initially investigated powering these components using wind power at the client's request. After using data from National Renewable Energy Laboratories and local weather stations, we determined that wind power will be inadequate. Our limited budget therefore forced us to focus our design towards solar power. After significant research into real world electrical systems our team has developed an initial design for the electrical components. This system will begin as a grid tied solar system of only a few panels due to budget restrictions, but we have designed the system to easily accommodate additional units as more funds become available. Our team is currently exploring permitting and other requirements, making final design reviews, and selecting physical mounting systems. Our final design will accommodate electrical and structural permitting and utility requirements with an eye towards Farmer Frog's vision, all while striving to achieve the greatest usable lifespan possible within budget restrictions.

### **Marine Hexcopter**

*Author(s): John Lynch*

*Mentor: Pierre Mourad*

Easel: 26

*Abstract:* The Marine Hexcopter examines the unique issues facing long term deployment of an autonomous flying system in a marine environment. As it stands, autonomous systems commonly referred to as "drones" are limited in their effective range and endurance in a given mission. We aim to create a drone that can survive in a marine environment for months at a

time, while still being capable of fulfilling mission objectives. We have been working in conjunction with the University of Washington Applied Physics Lab on to manufacture the specialized components. The challenges that we face include flotation, recharging, and corrosion issues associated with the marine environment. Conceptually, we have laid the groundwork for the creation of a sea base recharging platform that accompanies the Marine Hexcopter, allowing for indefinite time on mission. At this time we have established a land based version of the Marine Hexcopter to create a baseline for flight performance. With our land based prototype we have been able to troubleshoot hardware and navigation issues. We are currently working on the second prototype of the Marine Hexcopter which will be capable of both stable flotation and flight. To facilitate this we are using CAD modeling software and creating physical mockups to simulate the structure of the prototype. The Marine Hexcopter represents a milestone in drone technology, establishing the beachhead in an environment hostile to electronics.

### **Optimizing Hole Transporting Layer Thickness for Organic Solar Cells**

*Author(s): Malia Steward*

*Mentor: Seungkeun Choi*

Easel: 27

*Abstract:* Enhancing the performance of polymer solar cells (PSC) has been a driving force in research into PSC applications and fabrication processes in the field of solar energy. Although the power conversion efficiency (PCE) for this type of organic solar cell has increased to about 6% due to recent fabrication modifications, there is still a need for improvement in device architecture. Creating a solar cells involves a strategic fabrication process that consists of several layers, each serving a crucial role, that must be built in sequence. By optimizing the parameters of transport layers that facilitate charge carriers from the active layer, the device PCE performance can be improved. Fabricating solar cells starts with a premade indium-tin oxide (ITO) coated electrode glass slide, followed by ZnO, an electron transport layer (ETL) created with specific measurements. The active layer, P3HT:PCBM, is then created with appropriate concentration levels. MoO<sub>3</sub>, a hole transport layer (HTL), is deposited on top of the active layer, applying different thicknesses. The last layer, silver (Ag), is deposited, where this layer acts as our second electrode. Completing the solar cell with the second electrode completes the circuit. Electron charge carriers transport through ZnO to ITO, while the hole charge carriers transport through MoO<sub>3</sub> to Ag. My research aims to address what is the optimized thickness of the hole transport layer (HTL), MoO<sub>3</sub>, in order to further improve the PCE. In focusing on MoO<sub>3</sub>, results determined that as the layer thickness of MoO<sub>3</sub> reduces, the PCE increases. In opposition, as the layer thickness of MoO<sub>3</sub> increases, the PCE decreases. By controlling the thickness of the hole transport layer, this allowed me to find an optimized thickness to produce high PCEs. This research, therefore, opens new possibilities for future processes when optimizing a particular layer and improving PCE in PSCs.

## **Incorporating 3D Printing Technology into Prosthetics Socket**

*Author(s): Han Dang, Bruno Uttara, Kirillos Boules*

*Mentor: Pierre Mourad*

Easel: 28

Prosthetics Sockets, the shell that encases the residual limb in an amputee, are important for the comfort, fit and usability of prosthetic devices” Amputees typically spend \$3000-\$5000 to obtain just a socket which can take approximately 2 weeks or more depending on how busy the prosthetics center is. In this project, we incorporate 3D printing into conventional lamination socket production in order to reduce the costs and production time. Conventional socket processing and fabrication include limb measuring, mold creating, and sockets lamination while our method requires limb scanning, frame printing, and socket lamination. In order to test our method, we will produce dog bone specimen sections that replicate the socket components to perform various tests such as tension, compression, and bending. The dog bone will have different 3D printing material (Carbon fiber PLA) to laminating material (Epoxy resin) volume ratio. We are going to make 5 specimens of each model, in which 3 will be tested and the two are back up in case we fail to obtain accurate and precise data. MATLAB will be used to manipulate and analyze the data. Recording time and test results is critical because it will determine which ratio will be optimal for patients to use while also reducing time and cost. Realistically sockets for the hand do not require to handle as strong forces as lower limb sockets. If the optimum combination of this composite can be applied to leg sockets, this could be a revolution in prosthetics socket industry because it eliminates all of the expensive components in making sockets. This would allow us to increase our stakeholders and markets to the low-income areas, charity organizations, and third world countries where they experience disease war, and other hazards that cause people to lose their limbs.

## **Art Exhibition**

### **Exploring Limitations**

*Artist: Salvador Barriga*

*Mentor: Amy Lambert*

Table: 32

*Abstract:* This is a progressive collection of my works in my interdisciplinary path consisting of digital paintings and portraits, paper-maché masks, pen and pencil drawings, photographs, and a few sculpture pieces of varying media, all of which ask the question of “what are the limitations of each medium in which they were produced?” My digital rendition of one of Claude Monet’s paintings aimed to explore how accurate a painting can be recreated in a digital format within the limitations of software, hardware, and personal art style. My digital portrait pieces were part of a series which aimed to give meaning to sex in our own society in which the concept is overexposed to the public rendering us desensitized. My paper-maché mask pieces were each geared to a different question; how few features can be on a mask yet give

expression; how can realistic textures be made; how can paint influence how a piece is “read.” My pen and pencil drawings explored the limitations of the human mind and its willingness to give truth to thoughts in the form of a personal journal. My photographs explored one of the many myths we lived by to address many issues through a composite piece consisting of paper-maché masks, as well as a studio in which the photographs were taken. My sculpture in clay explored expressing emotions of longing and loneliness. My sewn sculpture explores telling a story with only two components and how strong of a message few items can create.

## **Violence**

*Artist: Brent Cox*

Table: 33

*Abstract: Violence* is composed of text transcribed from field recordings I took during protest marches in the spring of 2015 in Baltimore, Maryland following the death of Freddie Gray. For days the streets of Baltimore were flooded by peaceful protestors demonstrating their anger and outrage with institutional systems that obscure justice, promote inequality, and perpetuate racist ideology in a city that, like so many in the United States, particularly marginalizes and oppresses the African American community making the experience of violence a daily burden. When the protestors approached walls of armed officers clad in riot gear, they raised their hands to indicate that they were not armed, and that their protest would be conducted in peace, despite it being a response to extreme violence. While the content of the language in the work is about violence, that same language composes an image the raised, unarmed hand that suggests solidarity, peace, and protest. It evokes the movement of the protestors, the swarm of voices, and the urgency of active responses to dangerous, and violent, institutional structures.

## **Susan Deserved It**

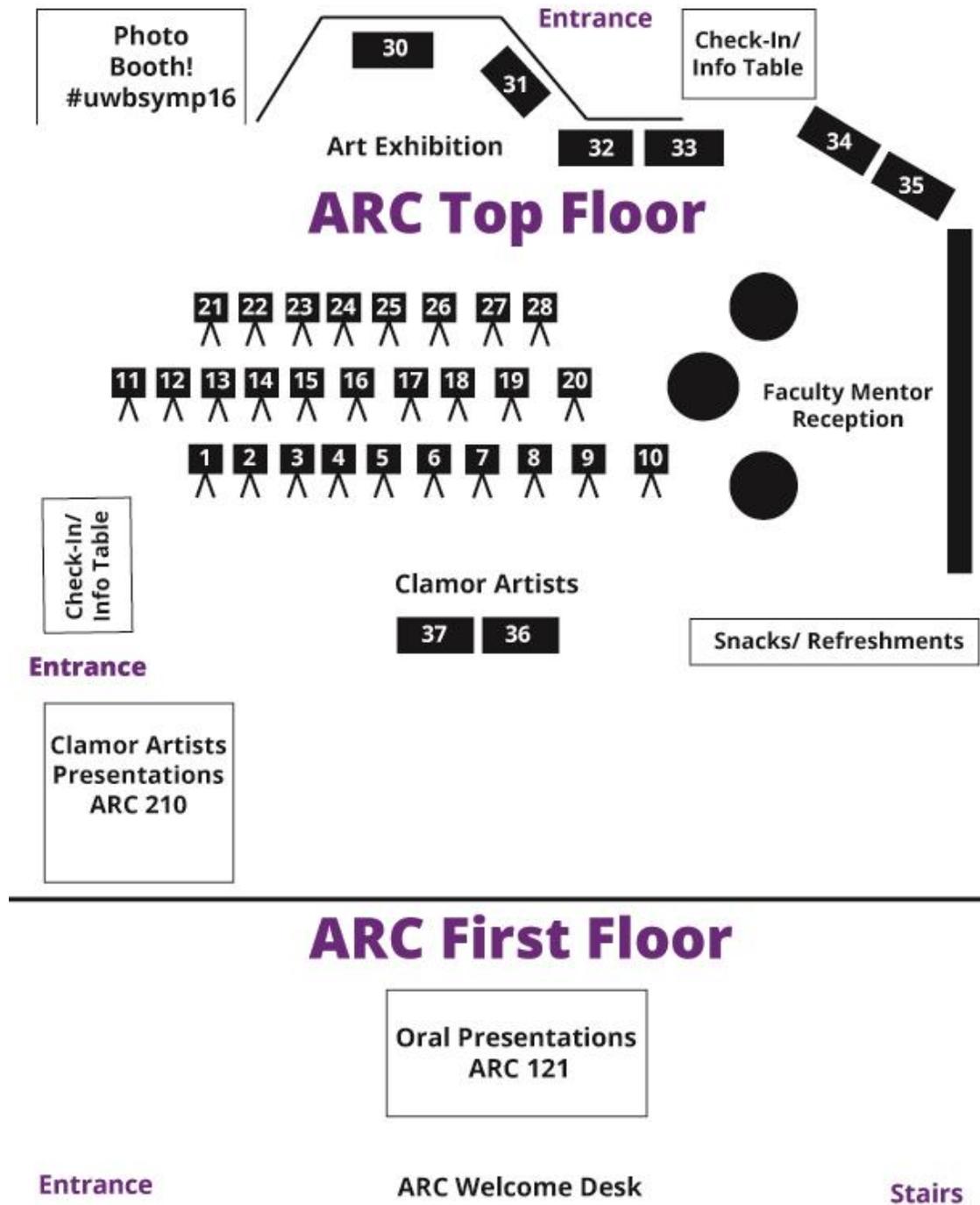
*Artist: Acacia Thorng*

*Mentor: Marc Studer*

Table: 36

Susan Deserved It is a digital photograph taken using a wide angle fisheye lens. The flowers pictured are commonly called Black Eye'd Susans. With this piece, I aim to encourage critical analysis of the names we give items and how they are evocative of misogyny that is deeply seeded into American society. This misogyny is so deeply ingrained that we find it acceptable to name a tank top 'wife beater' or a give a gender-less flower a name that implicates violence against women.

# Event Map



## Important Dates for 2016-2017

- ⚙ Undergraduate Research Fair: **Oct 12, 2016**
- ⚙ UWB Founder's Fellow Application Deadline: **December 4, 2016**
- ⚙ Undergraduate Research Week: **January 23 - 27, 2017**
- ⚙ Undergraduate Research and Creative Practice Symposium: **May 12, 2017**