2015 Summer Research Symposium I: Poster Sessions
Wednesday, September 30, 2015 - 12:45-2:00 p.m.
Carver Atrium
Simpson students who conducted summer research will present their findings

Creating an Interface for Surveillance Monitoring: Combining Behavioral Research and Technology
Sara Beadle

Gun crime is a growing concern in society and law enforcement works to confront this by surveillance monitoring. Research by Sweet and Meissner (2015) showed that law enforcement officers and laypersons are no better than chance at spotting suspicious behaviors or weapons. In this study, researchers applied behavioral cues from Sweet and Meissner and integrated them into a video interface. Because of time constraints, this summer we only collected data from naïve controls. Each viewed videos and made judgments whether someone was concealing a weapon. Results of this study support previous findings, with both groups performing poorly and lacking confidence in their decisions. The most behaviors were reported when the participant correctly identified a concealed weapon, and significantly less behaviors were reported when there was a correct rejection (no weapon and user responded with not present) and miss (there was a weapon but the user responded otherwise). Data on the interface usability was collected, and showed favorable responses from users as well. Findings contribute to concerns about the accuracy of surveillance and behavior monitoring and provide insight on what can be done to improve training for officers. The next steps are to continue the study using law enforcement officers and see how they perform and complete eye tracking experiments of the same videos to identify what behaviors are being observed and missed.

Influences of industrial & transportation-based air pollution on lichen & lichen inhabitants
Dana Bohan

Lichen have long been utilized as air quality bioindicators. These efforts utilize a parameter termed lichen diversity value (LDV). This value has an inverse correlation with air pollutant levels such as sulfur dioxide and nitrogen oxides. In order to determine the utility of this method I tested it locally in the parks and small stands of forest in Polk, Marion, and Warren counties in Iowa. One component overlooked when lichen sampling is performed as a means to the end of air quality determination are the large populations of microscopic invertebrates that inhabit lichen tissues. My hypothesis

was that air pollution would have an effect on lichen as well as the aforementioned microorganisms, and I set out to survey both lichen populations and the diversity and abundances of the invertebrates within. Lichen diversities were not observed to have a relationship to pollution metrics, nor was lichen diversity shown to have any impact on overall invertebrate diversity. Two significant relationships were observed, the first indicating a direct relationship between lichen diversity and tardigrade abundance ($p = 0.029$) and the second showing a direct relationship between annual average daily traffic (AADT) and nematode abundances in trees of the genus Quercus ($p = 0.029$). These findings have a number of impacts upon the bioindicator-based assessment of air quality in Iowa, mainly that lichen diversity values are likely not an exceptionally effective tool in this pursuit ($p = 0.750$), and perhaps the high availability and simple extraction of nematodes provides an accurate alternative indicator. A finding not restricted to the oak genus was that tardigrade abundance and lichen diversity are two directly related factors, giving some insight into the preferences of this particular group of invertebrates and their sensitivity to alterations in the diversity in lichen populations. This gives us a hint at the complex ecological role of lichen.

Water Quality of First Order Streams in Central Iowa: Do Watershed Conservation Projects Really Work?
Abigail Golder

The water quality of river systems has been compromised over the years due to agricultural and urban runoff getting into first order streams. Iowa has responded by implementing conservation land management practices throughout the state. This study focused on 6 first order streams in central Iowa, which were split into three categories of "conservation streams", "conventional streams", and "reference streams". I hypothesized that there would be better water quality in streams within watersheds that use conservation land management practices. My results showed that when compared with the other stream categories, conservation streams had the highest overall Water Quality Index ($p=0.037$*). When analyzing the variables in depth, I noticed that some of the data did not follow this trend. However, due to the way the Water Quality Index is set up with weighted factors, the numbers still averaged out to support my hypothesis. The bioassessment portion of this study was inconclusive due to confounding variables and low sample sizes. However, when focusing on just the water quality index data, the hypothesis can be supported; the conservation streams tested have better water quality than the other streams, showing that the efforts of the conservation watershed projects are helping to improve water quality.

The Effects of Precipitation on Tree-Ring Growth Widths in Eight Species of Broadleaf Trees
Neil Johnson

Scientists learn about past climate variation by studying historical records and clues that remain in ice, corals, fossils, trees, etc. These clues are called proxy indicators. Proxy indicators can tell us how the climate has changed and why these changes happened. Tree-ring widths are natural archives that provide proxy data for reconstructions of various climate elements on longer time scales (Azizi et al., 2013; Heinrich et al., 2013). Tree-ring records can be precisely dated to the calendar year, which allows them to be compared directly with instrumental records. When using tree rings as a proxy to reconstruct past climate, the potential of the proxy is measured through the strength of the linear correlation between measured tree-ring widths and climate conditions like precipitation and temperature. The tree species in this study were: *Carya ovate, Quercus alba, Quercus rubra/velutina, Gleditsia triacanthos, Quercus macrocarpa, Celtis occidentalis*, and *Populus deltoides*. I sampled from two properties in south-Central Iowa, Riley (Marion Co.) and Lake Ahquabi (Warren Co.) to collect the increment cores. I collected the increment cores by inserting an increment borer into a tree at breast height (1.4 meters). Once back in the lab, I measured the cores with a dissecting microscope and a ruler. My alternative hypothesis is tree-ring widths will correlate with precipitation levels and temperature. If my alternative hypothesis is supported, then conducting climate reconstructions in the future should expand our knowledge of climate variability for this area. My data showed that tree-ring growth widths correlate with annual precipitation levels and growing season precipitation levels, but the correlations are not significant. Future studies should increased replication and increased measurement precision.

Developing a Computational RNA Sequencing Pipeline for the Analysis of Glucocorticoid-induced Gene Regulation in BCP-ALL Cells
Alec McIntosh

RNA sequencing is a modern analytical technique that allows precise quantification of all RNAs simultaneously and how their levels change in response to stimuli at any moment in time. Although many tools are available, principles for interpreting the data are still evolving, and there are no gold standard protocols for computational analysis once data is generated. Every year new versions of these tools are being developed that employ better trimming, counting, mapping, and normalizing techniques. Using these modern advancements and improvements of RNA sequencing, I was able to synthesize a computational pipeline that enabled us to analyze our data in a manner that would help

us best answer our research questions. We set out to determine how Dexamethasone and Prednisone gene regulation differ in B-cell Precursor Acute Lymphoblastic Leukemia cells. Glucocorticoid treatment has long been the standard treatment for patients with such conditions and it has been shown that Dexamethasone works better in a clinical setting than Prednisone in treating BCP-ALL. Using the RNA sequencing pipeline I have developed, we have been able to use to gene regulation to provide some insight on Dexamethasone's clinical advantage.

Mayo Clinic: Free Testosterone
Anna Pierce

I was a lab technician in the Endocrinology lab at Mayo Clinic in Rochester, Minnesota. My 'bench' was free testosterone in which I measured the percentage of free testosterone in a serum sample using a very manual method. I compared my percentage calculated to the amount of total testosterone in that patient sample (in another bench) and was able to process my results and give them to the patient and their physician to help diagnose and treat illnesses.

Life in a Vacuum: Surface Analysis of Thin Films
Tony Saucedo

We create Boron Phosphide thin films via vapor deposition. These films are used to detect radiative particles by trapping neutrons in the crystal lattice. Using an ultrahigh vacuum chamber we are able to perform various surface analyses to determine the purity of our film. Our results from Auger Spectroscopy show peaks around 120 and 179 eV which relate to phosphorous and boron, however there is also a large peak indicative of carbon at 272 eV as well as oxygen at 540 eV. This suggests that our film has been contaminated by air while transferring into the vacuum chamber.

Characterization of peptidoglycan synthesis during growth and sporulation of *Myxococcus xanthus* using a fluorescent D-amino acid
Trey Scott

Myxococcus xanthus is a soil dwelling bacterium with a developmental cycle engendered by amino acid starvation. Using the fluorescent D-amino acid carboxytetramethylrhodamine-amino-D-alanine (TADA), we discovered a peptidoglycan-labeling pattern analogous to peptidoglycan synthesis in *E. coli*. TADA labeled cells showed higher fluorescence at a pole in shorter cells, at septa in pre-divisional cells, and random in cells of various lengths. *M. xanthus* appears to lack the peptidoglycan recycling pathway of *E. coli*. Fluorescence in the media increases over

time with TADA labeled cells undergoing a pulse chase suggesting that the label is being secreted. *M. xanthus* produces spores during starvation conditions or upon glycerol exposure. In 2008, it was shown that glycerol exposure leads to spores that lack peptidoglycan. During submerged culture development, starvation-induced spores incorporate TADA. Unexpectedly, we showed that TADA labels glycerol-induced spores. These results suggest that peptidoglycan may be present in starvation-induced spores and glycerol-induced spores.

Assessment of Stream Quality in Central Iowa
Mathew Thompson

The purpose of this study is to evaluate water quality in central Iowa. This area seemed ideal for the project because it offers a variety of agricultural drainage ditches, urban creeks, and relatively good quality reference sites. This allowed us to compare the amount of herbicide pollution caused by farmers and homeowners and lawn care services. It also allowed us to determine differences in water quality between these areas. Water chemistry was assessed to determine the quality of Iowa streams. The results of an Anova test (p= .088) indicated that there was no a significant difference in the water quality of agricultural drainage ditches, urban streams, and reference streams. Herbicides were not detected in the streams.

2015 Summer Research Symposium II: Oral Presentations
Wednesday, October 28, 2015 - 12:45-2:00 p.m.
Carver Atrium and Jordan Lecture Hall
Simpson students who conducted summer research will present their findings

12:40-12:45 p.m.

Opening remarks

12:45-1:00 p.m.

The Second Spanish Republic, Reacting to the Past
Ethan Fredrick and Tyler Stokesbary
Location: Carver 215

The form of a history is as important as its content in conveying meaning. Reacting to the Past offers educators a unique pedagogical approach to history that meaningfully engages students with historical moments. Games assign students to historical figures; over a number of class periods they will use primary source documents and game mechanics to achieve the objectives of their role. The Second Spanish Republic tells a history of interwar Europe which captures the ideas of the age some of which continue into 21st century like nation building and the value of democratic deliberation. There are Reacting to the Past games set in interwar Europe, but they suffer in excess from flaws of the Reacting to the Past method: character notoriety, a sense of inescapability and preconceived narratives. This game benefits from the fact that most students know little about the Second Spanish Republic. Students play as historical figures who were a part of the Congress of Deputies of the Republic. Across game sessions which span 1931 to 1936 students will push their agendas, compete with their opposition and react to new events like the rise of the National Socialists in Germany. In its first play test, the game's election, parliamentary and ideological components proved robust. Drafters are now working to improve the components of the game that do not fit easily into a parliamentary setting such as the large Anarcho-Syndicalist movement.

1:00-1:15 p.m.: Concurrent Sessions

Palmer Amaranth Project
Teig Loge, Maggie Long, Park Mikels, Molly Monk
Location: Carver 215

No abstract

Removing ocular artifact from electroencephalogram data utilizing eye-tracking technology
Christopher Hanson, Matthew Hayden, Rachel Kaale
Location: Carver 231

Electroencephalogram (EEG) data is often riddled with unwanted artifact including, but not limited to eye blinks and eye movements, interference from AC electrical devices, changes in skin potentials, and muscle activity. These artifacts can make it very difficult to accurately interpret EEG data. Therefore, this research has been dedicated to creating a novel approach for ocular artifact removal in EEG data that utilizes eye-tracking technology, is simpler than other widely-used methods, and requires only a small number of EEG channels. These goals were accomplished with the Simpson College Eye-Track Algorithm (SCETA) which was developed in MATLAB. This algorithm utilized matrix mathematics and statistical analysis to accurately remove artifacts created by eye blinks. During the fall of 2015, an IRB approved study was conducted to test the technique and it was found that while SCETA was not as effective as some other artifact correction techniques such as Independent Component Analysis, its speed, versatility, and applicability to data sets with small numbers of channels make it a strong option as an ocular artifact correction technique.

A Mathematical Model of a Rod Photoreceptor Population
Louis Joslyn
Location: Carver 215

Phototransduction is a complex biological process in which photons are detected in the retina giving rise to a meaningful representation of the incident light. In low-light conditions, this occurs primarily in the rods with the light signal being encoded in their membrane potentials. The ionic current model of Kamiyama et al. (1996 and 2009) describes changes in the membrane potential due to a photocurrent and other ionic currents. In the retina, rods function together in a large coupled population. In this work, we simulate a population of rods coupled with gap junctions and study the consequences of the network properties of the coupling, about which little is known experimentally. In particular, we consider rods uniformly distributed on a Cartesian grid or hexagonally tilted with varying connection strengths. This presentation will introduce necessary background knowledge on rod physiology, examine the biochemistry described by the Kamiyama rod model, present results on our population model, and provide insight into the functional purpose of gap junctions.

Tempe's Valley Metro Light Rail and its Effect on Neighborhood Crime
Steph Lash
Location: Carver 231

The link between public transportation and crime is often assumed to be more than it truly is. This study looks at crime rates and calls for service numbers before, after and in relation to the Valley Metro Light Rail in Tempe, Arizona. Analysis of crime data in conjunction with Census data in the neighborhoods surrounding the Light Rail help depict a picture of its surrounding environment. A mix of qualitative and quantitative data was collected about each Light Rail station and the surrounding neighborhoods. Frequency, types of calls and crime by type were analyzed before and after the Light Rail went in. In addition to looking at calls and crime, land use of the surrounding neighborhoods was analyzed as well as the demographics of the people living in those neighborhoods. The intent was to gain a better understanding of who the Light Rail affected, and to give context not only to the crime but also to the environment that allows the crime to occur. The qualitative nature of this information helps to understand the areas in a way that number and data simply can't do. To further help understand the crime that occurs on the Light Rail itself, ridership numbers and demographics were collected and analyzed. These rider demographics showed who the typical rider is and

helped link periods of high crime with periods of high ridership. Overall no connection between the Light Rail and higher crime rates was found to be present in Tempe, Arizona.

1:30-1:45 p.m., Concurrent Sessions

Inhibiting Cell Growth Signaling in Prostate Tumor Cells
Kelly Brass
Location: Carver 215

Managing the addition of new cells in human tissues must be precisely controlled - damaged cells must be replaced quickly, but if cells are created too fast, a tumor can form. If bound, EphA receptors are known to slow the creation of new cells, diminishing tumor growth. Therefore, EphA and EphrinA signaling could play a key role in the development of new treatment strategies for cancer. Importantly, prostate cancer cells contain a large amount of EphA receptors, making these cells a good model for this study. Since EphrinA protein can slow cell growth, we tried adding EphrinA into prostate cancer cells, expecting to see an inhibitory affect on cell growth. We performed various assays, introducing various members of the EphrinA family of proteins into prostate cancer cells, testing for inhibition of cell survival. We were able to observe a decrease in prostate cancer cell growth with multiple members of the EphrinA family. In the future, we will work to determine how the EphrinA proteins and EphA receptors are working together to inhibit cell growth.

Coulomb Explosion Imaging and Ionization of Diiodomethane in Strong Laser Pulses
Kyle Jensen
Location: Carver 231

Halomethanes, including the diiodomethane (CH_2I_2) molecule, are responsible for the production of reactive halides leading to ozone destruction.[1] Through exploitation of an ultrafast, 25 fs. pulse pump-probe setup and high-resolution reaction microscope, time-resolved Coulomb explosion (CE) imaging was established. As a result, ion fragments and dissociation channels subsequent to CH_2I_2 ionization and Coulomb explosion were classified. Furthermore, vibrations within the molecule's structure after excitation were observed.