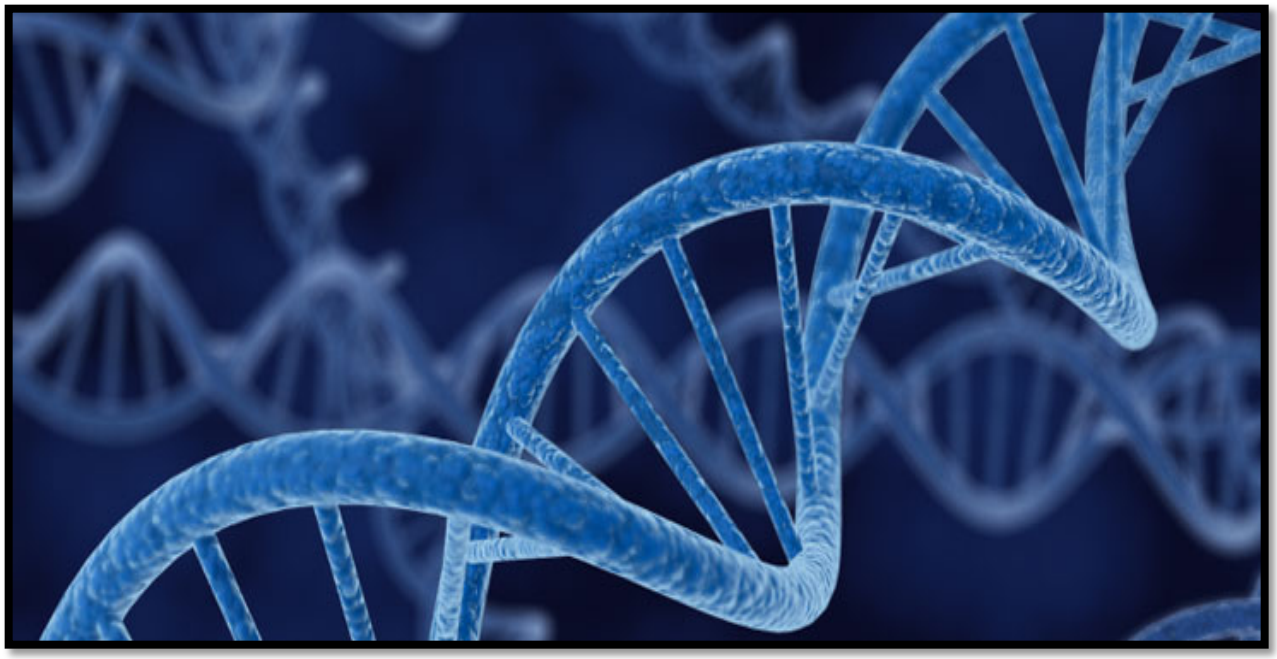
Department of Biology
College of Science
Biology Undergraduate Research Symposium

Spring 2021 Virtual Undergraduate Research Symposium



April 12th -13th 2021
Virtual Research symposium
Utah State University

UtahStateUniversity
DEPARTMENT OF BIOLOGY

Table of Contents

Undergraduate Research

UGR 17	9	**"Exploring canid monogamy: Characterization of the distribution of oxytocin receptors in the brain of the coyote (Canis latrans)"** *Trevor Anderson*
UGR 18	**9**	**"Comparing L-389,899 and ALS-II-69 as human-selective oxytocin receptor antagonists"** *Blake Nielson, Matthew Webb*
UGR 19	9	**"Secondary effects of stair striping distractions on stair negotiation"** *Travis Boman*
UGR 20	10	**"Analyzing Fatal Bird-Window Collisions Occurring on USU's C&SS Building, Brigham City, Utah"** *Jacob Larkin, Taylor Kenyon, Hunter Martin, Madeline Jensen, Cristian Soto, Maria Scott, Braxton Martin*
UGR 21	10	**"Effect of Bird Age on the Likelihood of Fatal Window Collisions at Utah State University's C&SS Building"** *Taylor Kenyon, Jacob Larkin, Hunter Martin, Brooklyn Kotter, Cristian Soto, Karissa Sears, and Dr. Jessica Habashi*
UGR 21	11	**"Weather Patterns and Seasonal Effects on Bird-Window Collisions at USU's C&SS Building, Brigham City, Utah"** *Braxton Martin, Jacob Larkin, Taylor Kenyon, Hunter Martin, Brooklyn Kotter, Cristian Soto, Karissa Sears, and Dr. Jessica Habashi*
UGR 21	11	**"Bird-Window Collision Mitigation at USU's C&SS Building, Brigham City, Utah"** *Hunter Martin, Jacob Larkin, Taylor Kenyon, Brooklyn Kotter, Karissa Sears, Cristian Soto, and Dr. Jessica Habashi*

Internships/Co-ops

Poster	Page	
ITRN 1	11	**Utah Department of Health Newborn Screening** *Taylor Brynn Anderson*
ITRN 2	11	**Utah Digestive Health Institute at Tanner Clinic: Internship** *Kelley Dean*
ITRN 3	12	**Lab Technician - National Aquatic Monitoring Center** *Aletia James*
ITRN 4	12	**Internship with Smithfield Fire and EMS** *Breanne Bodrero*
ITRN 5	12	**Hagworm silk synthesis and strength** *Joshua Corry*

Undergraduate Research

Distribution of vasopressin 1a receptor binding in the brain of coyotes (Canis latrans)
Sophia Adamis, Madeline Measom

Arginine vasopressin (AVP) is a neuropeptide hormone that has been shown to be a factor in the biological basis of social attachment in monogamous species. It functions in the brain to modulate social memory, territoriality, and social attachment between pair-bonded adult mates of the same species. Research has mostly focused on the vasopressin 1a receptors (AVPR1a) in the brains of socially monogamous rodents and non-human primates. These studies demonstrate a critical role of AVP and AVPR1a in the neurobiology of social attachment, especially influencing species-specific, pairbond-related behaviors. Coyotes are a unique species in the context of social research because they are socially monogamous and have also exhibited sexual and genetic monogamy, which is rare among mammals. The goal of this study is to establish the distribution of AVPR1a throughout the coyote forebrain in order to compare their receptor map to other known monogamous species. This comparative work will lay the

neuroanatomical foundation for future studies of the AVP system of coyotes. In order to map coyote AVPR1a, we used six brains that were opportunistically collected from captive-housed coyotes at the USDA Millville Predator Research Center. Of the six brains three were male and three were female. The samples were fresh frozen on dry ice within hours of death and sectioned at 20 microns using a cryostat. We processed them using AVPR1a autoradiography according to procedures that are well established in literature. Our areas of interest include regions previously shown to be important in social behavior in other monogamous mammals: the lateral septum, cingulate cortex, rhinal cortex, claustrum, and the diagonal band. We also looked at sex differences in AVPR1a binding and found no significant difference but did see a trend of males having higher levels of binding than females. To our knowledge, this study is the first to examine measures of the AVP system in coyotes and will serve as the basis for future research on the biological basis of social behavior in coyotes

Substrate Purity and its Effect on PRMT1 Activity
Tate Shepherd

Protein arginine methyltransferase 1 (PRMT1) catalyzes the transfer of a methyl group from S-adenosyl-L-methionine (AdoMet) to specific arginine residues of a target protein. Arginine methylation can impact the activity of the target protein and is an important regulatory process in human cells. Dysregulation of PRMT1 has been associated with severe disease in humans, including cancer. Accurate data concerning PRMT1 activity is important to the characterization of the enzyme. The activity of PRMT1 is studied by combining the enzyme with AdoMet and a target protein for methylation and measuring the amount of methylation that occurs over time. AdoMet that can be purchased commercially is understood to be impure, which may lead to bias in data collected using the reagent. AdoMet can also racemize to an inactive stereoisomer, further decreasing the purity of the reagent. To test if the impurities found in commercially available AdoMet affect measured PRMT1 activity, AdoMet was enzymatically synthesized and purified via fast protein liquid chromatography (FPLC) and high-pressure liquid chromatography (HPLC). To estimate the usable lifespan of synthesized and purified AdoMet in the lab, a sample of the reagent was subjected to freeze/thaw cycles and analyzed via HPLC. The synthesized reagent was found to be stable through at least 20 freeze/thaw cycles. The activity of PRMT1 using purified AdoMet was compared to the activity of the enzyme using the commercial reagent. The collected data indicate that the impurities found in the commercially available reagent do not significantly affect PRMT1 activity when measured under steady state conditions.

Seed morphology variation in a hyperdiverse tropical plant genus
McKenna Peel

The genus Psychotria includes over 1500 species worldwide, and often many species occur together at the same site. I analyzed seeds from 21 species of Psychotria collected from a tropical forest site in Panama to determine the variation in seed ridge size, which may help explain differences in other fruit traits and seed dispersal dynamics that allow these species to coexist. There was much variation in the seed depth and a significant difference in several of the species. This variation could be important in determining seed dispersal dynamics. Additionally, these results give us more reasons to explore the secondary metabolites in the pulp and observe how it influences the digestion dynamics.

Comparing Secondary Metabolite Content of Fruits and Leaves in a Tropical Forest
Lyndey Higham

In this project, we evaluated the similarity of secondary metabolite composition in the leaves vs reproductive tissues of sympatric species in the genus Psychotria. The process for this involved collecting samples of plant tissue from Barro Colorado Island, Panama and analyzing the chemical composition of those samples. Secondary metabolites were extracted using solvents and the dry weight was measured to find their mass. Statistical tests were used to determine the significance of the relationship of masses amongst species as well as tissue types. The most interesting finding was that amongst all species studied the ratio of secondary metabolites between mature pulp tissue and leaf tissue is NOT significant.

Study of in vitro Remdesivir Resistance for Severe Acute Respiratory Syndrome 2 (COVID-19)
Zoe Meyer

Severe Acute Respiratory Syndrome Coronavirus 2, colloquially know as COVID-19, has brought the world to its knees. Researchers around the globe are racing to gain more insight into the virus responsible for this deadly pandemic. Remdesivir is a drug that has been considered as a potential treatment for SARS2. The FDA has even approved Remdesivir for treatment of SARS2 in certain situations. Development of antiviral resistance is always a concern with drug treatments. Therefore, it is important to assess the ability of SARS2 to develop antiviral resistance to remdesivir, and how development of antiviral resistance might affect the virus's fitness. This study aims to create a strain of SARS2 with antiviral resistance to remdesivir. The process of developing a remdesivir resistant strain of SARS2 can give us insight into the ability of SARS2 to develop remdesivir resistance, and further studies can be done on a remdesivir resistant strain to assess changed fitness. To achieve a remdesivir resistant strain we passaged SARS2 on Vero 76 cells with a range of concentrations of remdesivir. Media from wells containing partial CPE was collected and used as the new virus stock for the next passage. Development of remdesivir resistance was assessed by increasing values of the EC50. The EC50 of remdesivir against SARS2 increased slightly until passage 3, and then dropped at passage 4. Five more viral passages were performed, with the EC50 increasing slightly. Overall, the EC50 increased from 4.7uM up to 17uM. For development of a resistant strain, the EC50 should be many times higher than the original value. Therefore, we have not yet been able to develop a remdesivir resistant strain of SARS2. We may attempt additional passaging of the virus, and after that try alternative methods to develop a remdesivir resistant strain.

Patch Clamps, Electrophysiology, and the Optimistic Future of Neuroscience at USU
Riley Elmer

The Neuroscience department is a small, yet nonetheless rapidly growing field at Utah State University. While many students are encouraged to take classes from related fields such as psychology and biology, an official Bachelor's degree has not yet been published for the university. As one of those students, digging deeper into the world of neuroscience has yielded many discoveries on biology/behavior relations that go largely unnoticed by the general student population. However, in preparation for a coming Neuroscience Major, I was given the opportunity to assist Dr. Sara Freeman in preparing for a Neurophysiology Lab course in the Spring of 2022. Utah State has acquired equipment to further both research and classroom learning with patch clamp electrophysiology equipment. This project will outline both our work in constructing the patch clamp equipment and in developing experiments for future undergraduate neuroscience, biology, and other interested students as they foster their curiosity of how the brain interacts with its environment. By bringing further attention to the university student body, this program will gain traction as it attracts those who discover the side of science they hadn't known they could discover.

Immune Response in Solitary / Social Bees
Gabriella Cale

In most insects, there is a natural spike in metabolic rate when faced with an immunity challenge. (Ardia et al., 2012) Whereas, in honeybees, there is no metabolic alteration or difference in flight time. (Bordier et al., 2016) There is some evidence indicating that reduced immune response in honeybees could be due to their evolution of social behavior shifting the immune response from the individual to the group (López-Uribe et al., 2016) It is unclear if this lack of change could be attributed to the social life of honeybees, or if this is a trait unique to honeybees due to other parts of their biology. If the reduced internal immune response is due to social behavior, we will see a gradual decrease in internal immune response in bees that are more social, compared to solitary bees.

Discerning the Efficacy of Potential Non-Opioid Pain Drugs Using cAMP Analysis
Matthew Mattoon, Max McDermott

G protein-coupled receptors (GPCRs) are a relatively new discovery in molecular biology and have been fundamental for the development of new drug therapies. GPCRs are receptors within the outer membrane of a cell

that trigger reactions throughout a cell. There are multiple units that attach to the GPCR: the alpha, the beta, and the gamma subunits. A ligand (activating or agonistic molecule) binds to the protein receptor, causing a change in structure that allows the attached subunits to move. These movements can generate various signaling pathways that can change a cell. This experiment focuses on the alpha sub-unit whose movement causes the production of cAMP. Enzyme adenylyl cyclase is responsible for producing cAMP which is vital for many cellular functions, such as gene transcription, metabolism, and muscle contraction. Regulation of cAMP can lead to the inhibition or enhancement of many of these processes following activation of GPCRs. Such regulation already occurs naturally via the alpha subunits, which are highly involved with cAMP production and serve as inhibitory or activating proteins. One such protein is GPR171, which is greatly involved in morphine-induced analgesia (pain-relief). Research from the Bobeck lab has shown that a non-addictive drug that activates GPR171, MS0015203, is capable of enhancing morphine's pain-relieving properties, making it a potential treatment for chronic pain. (McDermott et al., 2019). Fourteen new drugs, synthesized and designed by our collaborator Dr. Sanjai Kumar Pathak, from Queen's College in New York, are based on this MS0015203 structure but with slight structural modifications. This research will attempt to determine which of these modifications to MS0015203 will make it more efficient in inhibiting the production of cAMP, which will indicate which modified ligands have the most potential as new pain-therapies.

Sensitivity and Specificity of Sex for Detecting Differences in the Kinetics of Depth Jumps Performed by NCAA Athletes

Alex Woster

It is well established that female athletes have a greater incidence of lower extremity injuries when compared to males of the same sport. There is interest in using the depth jump as a practical screen for lower extremity injury risk, however, prior research is inconclusive. There is evidence that males and females tend to adopt distinct motor strategies when anticipating and reacting to the landing impact phase of depth jumping. From this, it is reasonable to expect that depth jump kinetics are influenced by sex, yet there is a need for comprehensive analysis. Gaining a better understanding of which kinetic variables are most specific and sensitive to sex could improve the efficacy of using the depth jump as an injury risk screen. Thus, the purpose of this investigation was to evaluate the sensitivity and specificity of sex for detecting differences in the kinetics of depth jumps performed by NCAA Division I basketball athletes. Twenty NCAA Division I basketball athletes (male n = 9, female n = 11; 19.9 ± 1.1 years; 82.6 ± 13.9 kg; 188.6 ± 11.3 cm) volunteered to participate in this investigation. Participants performed 3 trials of depth jumping from drop heights of 0.51, 0.66, and 0.81m. For each trial, vertical ground reaction Forces were captured using a tri-axial Force platform. Dependent measures were estimated from Force data and included peak Force, rate of Force development, peak Force reduction, jump height, ground contact time, and the reactive strength index. The sensitivity and specificity of sex for detecting differences in dependent measures were evaluated using receiver operating curve analyses. Findings from this investigation may support further research and application of the depth jump as a tool to screen for lower extremity injury risk in competitive athletes.

Isolation of halotolerant bacteria from the rhizosphere of Ceanothus velutinusmay lead to contributions in plant health in saline conditions

Jacob Davis, Jyosthna Genesh, Amita Kaundal

As global temperatures have been steadily rising in the past few decades, soil salinity has been steadily increasing in many parts of the world as well. This increase in salinity has proven detrimental and especially challenging for many plant species. The soil directly in contact with the roots of plants is known as the rhizosphere. The rhizosphere hosts plant growth-promoting rhizobacteria (PGPR). PGPR plays a significant role in a plant's ability to deal with stressors such as drought, heavy metal contamination, and extreme cold temperatures. Native plants are known to show versatility to these stressors as well. One such native plant is Ceanothus velutinus (snowbrush), indigenous to the Intermountain West region of North America. In this study, we aim to isolate halotolerant PGPR from the rhizosphere of snowbrush. Rhizosphere samples from snowbrush plants were taken from three elevations in Tony Grove, Utah. Soil from each elevation was resuspended in water at a 10:95 ratio and serially diluted four times at a 1:10 ratio. The last two dilutions were plated onto nutrient agar supplemented with six different concentrations of NaCl (0%, 2%, 4%, 6%, 8%, 10%) and grown at 370C and 280C. We had prolific growth in 2% NaCl concentrations with several dozen colonies in each (as many as one

hundred and sixty) as well as a few dozen colonies in 4% NaCl (as many as thirty-one). We had only one colony grow at 6% NaCl and no growth past that concentration. Thirty-four unique colonies were isolated and purified across all plated samples. We selected twenty-four promising colonies, which were identified by 16s rRNA sequencing. The next step is to test these microbes on three plants, such as Arabidopsis, alfalfa, and maize, for their growth and development under salt stress. The long-term goal is to create a new biofertilizer to increase plant health in saline soils.

Development of a Lethal Rodent Model of Lymphocytic Choriomeningitis Virus Infection for Preclinical Antiviral Drug Testing

Rhett Fackrell, Jonna B. Westover, Jung-Ae Choi, Brian B. Gowen

Lymphocyctic Choriomeningitis virus (LCMV) is an Old World arenavirus belonging to the family Arenaviridae. The natural host is the common house mouse, with about 5% of the population persistently carrying and shedding the virus. LCMV is spread to humans through the aerosolized excrements of rodents or passed from mother to fetus through the placenta. Some of these cases lead to aseptic meningitis or meningoencephalitis with permanent neurological damage possible. Studies indicate that 2-5% of people are positive for serum LCMV antibodies [1]. LCMV infection has also occurred in organ transplant recipients, with nearly all cases being fatal [2]. There are currently limited treatments for LCMV infection, including the antiviral ribavirin which has associated toxicity. This highlights the need for a suitable animal model to evaluate potential antiviral compounds. This research aims to develop a more robust and consistent lethal mouse model of LCMV infection that can be utilized to assess promising antiviral compounds. An animal disease model that is consistently lethal and produces clinical manifestations seen in the human disease will have a dramatic positive effect on identifying successful treatment. This work is especially critical for fetuses that contract the disease congenitally and immunosuppressed organ transplant recipients at the highest risk to the often fatal effects of an LCMV infection. 1. Mathur G, Yadav K, Ford B, et al. High clinical suspicion of donor-derived disease leads to timely recognition and early intervention to treat solid organ transplant-transmitted lymphocytic choriomeningitis virus. Transpl Infect Dis 2017; Aug;19(4):e12707.
2. Amman BR, Pavlin BI, Albariño CG, Comer JA, Erickson BR, Oliver JB, Sealy TK, Vincent MJ, Nichol ST, Paddock CD, Tumpey AJ, Wagoner KD, Glauer RD, Smith KA, Winpisinger KA, Parsely MS, Wyrick P, Hannafin CH, Bandy U, Zaki S, Rollin PE, Ksiazek TG. Pet rodents and fatal lymphocytic choriomeningitis in transplant patients. Emerg Infect Dis. 2007 May;13(5):719-25.

Treatment of Yellow Fever Virus with a Guanosine Analog, Compound X, in a Hamster Model

Abbie Weight, Justin Julander

Yellow fever virus (YFV) continues to cause significant global morbidity and mortality, yet no approved antiviral treatments are available for the disease. A recently developed guanosine analog, Compound X, has shown promise in vitro against multiple flaviviruses. The objective of the present study was to evaluate the in vivo efficacy of this compound against YFV in a hamster model. Varying concentrations of Compound X were tested in different groups of YFV-infected hamsters, and weight and mortality were monitored throughout the course of the study. Serum samples were collected at 4 days post infection (dpi) for virus titer and 6 dpi for alanine aminotransferase (ALT) analysis. Compound X improved survival among hamsters infected with YFV in a dose-dependent manner. This compound warrants further investigation as a promising antiviral treatment for YFV.

Pompilids

Tucker Huppe, Emily Sadler

Many spider wasps display different features. My task is to determine if these different features could be explained by their needed function. The study focuses primarily on determining whether the size of the front legs of Pompilidae that use trap door spiders as a host varies significantly from other Pompilidae. By measuring many features we are able to determine ratios between features to see if there is a significant difference.

Pharmacological Characterization of the Oxytocin Receptor Antagonist L-368,899 for Coyote Receptors
Mckenna Rich, Hillary Ihrig

The neurohormone oxytocin influences many physiological pathways in animals, aiding in social behaviors, pair bonding, social recognition, and maternal behavior. A common strategy used to observe the influence of oxytocin on these behaviors is to disrupt oxytocin signaling, by blocking the oxytocin receptor (OXTR). This blockade can be achieved using antagonists which bind to the receptor and inhibit the subsequent activation of intracellular signaling pathways. We aimed to determine whether the commercially-available OXTR antagonist L-368,899 selectively binds to OXTR in coyote brains. L-369,899 selectively binds to OXTR in primates and has been used in animal behavior studies to block oxytocin-dependent behaviors. Structural homology in oxytocin and vasopressin 1a receptors (AVPR1a) results in binding promiscuity in many of the available antagonists and drugs that are used to target these receptors. Our study compares the binding selectivity of L-368,899 for OXTR over AVPR1a when used in coyote brain tissue (where these two receptors are expressed). We used 6 frozen, unfixed coyote brains (collected opportunistically) blocked coronally into 5 slabs and stored at -80°C until slicing. The blocks were then sliced at 20 micron thickness on a cryostat, mounted on microscope slides, and frozen at -80°C in sealed slide boxes packaged with desiccant packets until experimental use. These frozen and mounted coyote brain slices were subjected to competitive binding autoradiography using increasing concentrations of our antagonist L-368,899 in competition with a consistent concentration of one of two commercially-available radioligands: 1) OXTR radioligand 125I-ornithne vasotocin analog (125I-OVTA) and 2) AVPR1a radioligand 125I-linear vasopressin antagonist (125I-LVA). We quantified the binding density using a calibrated digital densitometry system and generated competition curves, which depict the selectivity of L-368,899. We found L-368,899 has a 70X greater affinity for OXTR when compared to AVPR1a. This result is also demonstrated in the Ki values that we calculated from the competition curves: 12.38 nM for OXTR and 870.7 nM for AVPR1a. While we were able to generate competition curves, unfortunately, many of our slides from the AVPR1a assay did not produce quantifiable results. In order to justify the use of this drug for in vivo studies, further experimentation is needed, although our preliminary analysis suggests L-368,899 has a high binding selectivity for the coyote OXTR.

Establishment of a Coyote Brain Atlas: Counterstaining Techniques in a Canid Brain
Auria Staheli, Nate Johnson

Oxytocin is commonly known as "the love hormone," as it is the neurotransmitter responsible for pair bonding in many mammalian species, including humans. However, it also has other very important and wide ranging functions for physical, emotional, and social well-being. The Freeman neurobiology lab is working to map the location of oxytocin and vasopressin receptors within brains of the common coyote (Canis latrans). This work will permit comparisons with the brains of other pair-bond-forming mammals and will further our understanding of how these transmitters and their receptors affect behavior. However, inferring the locations of these receptors can be difficult and relatively inaccurate without a clear view of the associated neuroanatomical landmarks. For this reason, counterstaining is a vital step in obtaining accurate regional boundaries in any neuroanatomical research--especially when working in an as-yet undescribed species' brain like the coyote. One method to accomplish this is through the use of acetylcholinesterase (AChE) to allow visualization of cholinergic neurons in the brain, providing important anatomical references for study. This method allows the same sections that have previously been processed using autoradiography to be stained with AChE and consequently provides more accurate results since the exact same tissue samples are being examined instead of adjacent sections. Another counterstaining method that is useful for this mapping process is known as Nissl staining, which uses a thionin dye to stain the RNA within neuron cell bodies. This approach reveals the important structural features of the brain's cellular anatomy, providing additional reference points for delineating boundaries between regions. These complementary counterstained sets of brain sections will be used to interpret the results of ongoing research to describe the oxytocin and vasopressin receptor distributions in the brain. These staining methods are used in brain atlases for mice, rats, dogs, monkeys, and humans, which allows a direct comparison of the resulting coyote brain sections to these well defined brain atlas images in order to identify and label the regions of the coyote brain.

Exploring canid monogamy: Characterization of the distribution of oxytocin receptors in the brain of the coyote (Canis latrans)
Trevor Anderson

Oxytocin is a neuropeptide that has been shown to be a factor in species that display social monogamy. Its neural actions are necessary for social memory of familiar individuals of the same species. Much research has been done on oxytocin receptors (OXTR) in the brains of socially monogamous rodents and non-human primates, and these studies have demonstrated a critical role of oxytocin in the neurobiology of social attachment. Coyotes are a unique species in the context of social research because they are socially monogamous and have been shown to also exhibit sexual and genetic monogamy. The goal of the current study is to establish the distribution of OXTR throughout the coyote forebrain in order to compare their receptor map to other known monogamous species and to lay the neuroanatomical foundation for future studies of the oxytocin system of coyotes. In order to map coyote OXTR, we used six brains, 3 male and 3 female, that were opportunistically collected from captive-housed coyotes at the USDA Millville Predator Research Center. The samples were fresh frozen on dry ice within hours of death and sectioned at 20 microns using a cryostat. We processed them using OXTR autoradiography according to procedures that are well established in the literature. Following this we quantified the density of OXTR via optical densitometry and then analyzed the data with an ANOVA. We found high densities of OXTR in many of the areas that have been found to be associated with social behavior in other mammals as well as a sex difference in the central amygdala. Going forward we will quantify the rest of the brain to get a complete map and to analyze for overall sex differences.

Comparing L-389,899 and ALS-II-69 as human-selective oxytocin receptor antagonists
Blake Nielson, Matthew Webb

Oxytocin is a neuropeptide that influences social behavior in animals and humans. One way to test the effects of oxytocin on social behavior is by blocking oxytocin receptors (OXTR) with an antagonist. The commercially-available OXTR antagonist L-368,899 (the "Merck compound") is commonly used for such studies despite inadequate evidence of its affinity and selectivity for OXTR in the brain. The Freeman Lab has used the custom-synthesized antagonist ALS-III-61 (the "Smith compound"), which has high specificity and affinity for OXTR in the brain but is not commercially available. Due to our diminishing supply of the Smith compound, we sought evidence that the Merck compound has similar pharmacological properties as the Smith compound. We performed competitive-binding autoradiography to quantify the binding affinities of these two antagonists in competition with 1) the OXTR radioligand, 125I-ornithine vasotocin analog, and 2) the vasopressin 1a receptor (AVPR1a) radioligand, 125I-linear vasopressin antagonist. Autoradiography was conducted using previously mounted 20-micron sections of human brain tissue from the substantia nigra (source of OXTR; n=5) and the primary visual cortex (source of AVPR1a; n=5). We co-incubated six series of adjacent brain tissue sections from each specimen in increasing concentrations of the Smith and Merck antagonists with a constant radioligand concentration. After quantifying the receptor densities across our binding conditions, we generated competition curves, which demonstrated that as the concentration of the antagonist increases, the binding density of the radioligand decreases. Our data shows that the Merck compound has a slightly higher affinity for AVPR1a than OXTR. We also confirmed that Smith compound has a higher binding affinity to OXTR than does the Merck compound and a better binding selectivity to OXTR over AVPR1a. With such results, we recommend against using the Merck compound (L-368,899) as an OXTR-specific antagonist. Due to some unexpected assay results, we intend to replicate this study to confirm our findings.

***S*econdary effects of stair striping distractions on stair negotiation**
Travis Boman

Stairs can be a concern for injury, with falls negatively impacting one's health. A proposed strategy to reduce fall risk during stair negotiation involves enhancing the visual contrast of stairs, or adding clear demarcations of where the stairs begin and end. Stair negotiation walk speed (m/s), may provide insight on the visual contrast striping effects. In addition, distractions such as mobile phone use during stair negotiation could increase fall risk, and may alter handrail risk. Therefore our secondary (fall risk – primary) objectives were to determine if: (1) if staircase striping would increase walk speed, and (2) if mobile phone distractions would decrease person's handrail use. Our sample consisted of college students at Utah State University using two staircases. Four motion sensor security cameras

recorded students' ascent and descent stair negotiation. In one staircase, alternating 5.5 cm black and white stripes were placed perpendicular on the stair face on the first and last steps. On the descending side, a black stripe was placed on the edge parallel of every descending step. Data collection included walk speed (m/s), handrail proximity (m), handrail use, and distractions (mobile phone use, holding phone only, no mobile phone use). Preliminary data was analyzed via an univariate analysis of variances. Our results suggest that stair striping does not appear to alter walk speed during stair negotiation, while mobile phone distractions do alter handrail use during stair negotiation. Within our college sample, the students may be less likely to benefit from visual contrast striping compared to more vulnerable populations. Ultimately, decreased handrail use while distracted (e.g., mobile phone use) may prevent successful handrail reaches if an impeding fall does occur. Category: Social Science and Education Type of virtual presentation: Record zoom and upload Travis Boman, Christopher Long, Samantha Corbridge, Alex Braeger, Chris Dakin, Sara A. Harper Affiliations: 1 Department of Kinesiology and Health Science, Utah State University 2 Sorenson Legacy Foundation Center for Clinical Excellence, Utah State University Funding: Research was supported by Utah State University Office of Research Undergraduate Research and Creative Opportunity (Mobile Device Use's Impact on Handrail Grasp and Fall Avoidance Strategies: Long, Corbridge), American Heart Association (Postdoctoral Fellowship 20POST34990005: Harper).

Analyzing Fatal Bird-Window Collisions Occurring on USU's C&SS Building, Brigham City, Utah
Jacob Larkin, Taylor Kenyon, Hunter Martin, Madeline Jensen, Cristian Soto, Maria Scott, Braxton Martin

In the United States between 365 - 988 million birds fatally collide with man-made windows annually. As such, windows are a major cause for nationwide bird conservation concerns. Our study was focused on this issue of bird-window collisions. In our study, we are investigating fatal bird-window collisions occurring on the Classroom and Student Services Building (C&SS) at the USU campus in Brigham City, UT 84302 to determine if it is a conservation concern for local bird populations. We have selected this building as a potential location for a high frequency of bird-window collisions for its inclusion of multiple large windows. Several studies have indicated that window area was positively correlated with the amount of bird-window strikes. The objective of the study was to: Investigate the number of fatal bird window collisions that occur on the C&SS. Then determine if our findings were larger than the expected number of fatal window collisions per month for a low-rise non-residential building; the expected number is between 0 – 6 collisions per month. The objective was accomplished through a two-step method. First, we analyzed data obtained through the conduction of daily surveys of the C&SS during the months of August through November of 2020. Surveyors looked for bird-window collision evidence on the building's windows. We then collated our data with survey data obtained in the in the years 2017-2019. We found that the monthly fatal bird-window collisions on the C&SS did not exceed the expected number in the years 2017 – 2020. Despite not falling outside norms, all of the fatalities were unnecessary. We suggest that campus administrators investigate cost-effective mitigation efforts like cloth streamers placed over windows. We shall also continue collecting window collision survey data to obtain a clearer picture on whether or not the C&SS is a significant problem area for bird-window collisions.

Effect of Bird Age on the Likelihood of Fatal Window Collisions at Utah State University's C&SS Building
Taylor Kenyon, Jacob Larkin, Hunter Martin, Brooklyn Kotter, Cristian Soto, Karissa Sears, and Dr. Jessica Habashi

Around 97.6–975.6 million birds fatally collide with windows each year in North America. Bird age could be a contributor to the collisions. The central focus of our research project is to determine if there is a statistically significant relationship between the age of an individual bird and the likelihood of a fatal collision with a human-made window. Personally, collected data regarding window collisions, will be obtained from daily surveys of the Classroom and Student Services (CSS) Building at the Utah State University-Brigham City campus (Brigham City, UT 84302). These data will be combined with census data from three previous years. By examining the plumage of the birds that have collided with the CSS Building to determine their ages, we hope to determine whether individual bird age is a determining factor in fatal window collisions. We have collected data with a small sample size and found a nonsignificant trend with younger birds colliding more often than older birds. This ongoing project aims to obtain enough data to determine whether our initial findings reach significance.

Weather Patterns and Seasonal Effects on Bird-Window Collisions at USU's C&SS Building, Brigham City, Utah
Braxton Martin, Jacob Larkin, Taylor Kenyon, Hunter Martin, Brooklyn Kotter, Cristian Soto, Karissa Sears, and Dr. Jessica Habashi

An estimated 365 to 988 million birds die from window collisions in the United States each year. Weather patterns are likely to contribute to these collisions. Our research pertains to these bird-window collisions. The focal point of our study is to determine if there is a significant relationship between the season/type of weather and the likelihood of birds striking windows. We are conducting a daily survey of the Classroom and Student Services (CSS) Building at the Utah State University-Brigham City campus (Brigham City, UT 84302). We plan to analyze the number of fatal bird-window collisions that are occurring at the CSS Building on a yearly basis. Our data will be combined with data collected at the CSS Building for the past three years. By examining the number of birds that collide with the CSS Building during different seasons, we hope to be able to determine parallels between certain weather conditions and the likelihood of birds to strike human-made windows. If there is a correlation between certain weather and the number of birds colliding with the CSS Building, we will be able to use this information to direct mitigation efforts to stop the increased frequency of bird-window deaths during certain seasons. Data collected year-round will lead to increased understanding of how seasons affect bird strikes on windows. If there is increased bird-window collision activity during a specific season, then mitigation efforts can be primarily focused during that time of year. More research and extended periods of data collection may be necessary to fully understand how weather patterns affect the likelihood of birds striking windows.

Bird-Window Collision Mitigation at USU's C&SS Building, Brigham City, Utah
Hunter Martin, Jacob Larkin, Taylor Kenyon, Brooklyn Kotter, Karissa Sears, Cristian Soto, and Dr. Jessica Habashi

Bird-window collisions a major problem for bird populations worldwide. In the United States alone it is estimated that 365-988 million birds fatally collide with human-made windows annually,[1] and another 16 to 42 million collide in Canada per year.[2] We are investigating the scope of bird-window collisions at the Classroom & Student Services Building on the USU-Brigham City campus. We are performing a daily census to gauge the magnitude of the problem. Should collision hotspots be found, we plan to share methods for mitigation with the campus administration. To that end, we are investigating different methods of preventing bird-window collision. We hope to help make the building a safer place for birds in Brigham City, which is home to a world-famous bird refuge.

Internships:

Utah Department of Health Newborn Screening
Taylor Brynn Anderson

The Utah Department of Health (UDOH) Newborn Screening (NBS) program is a public health program administered under Utah Statute 26-10-6 that aims to give all babies born in Utah the best chance at lifelong health. The infant's blood is collected on Guthrie filter paper cards and then punched into 3.2mm dots to be separated for different testing. Utah currently screens for over 40 disorders, but new tests are added frequently. The criteria for adding a test is that it must have an available screening method and successful treatment options. I assisted in the Mass Spectrometry (MS) laboratory where we screen for many metabolic disorders. MS has had a tremendous impact on NBS due to the ability to screen for multiple disorders at once and by keeping costs lower for families. In the MS laboratory I helped prepare samples, maintain the instruments, run the biochemical assays, and interpret results and discuss those results with the follow up team.

Utah Digestive Health Institute at Tanner Clinic: Internship
Kelley Dean

Purpose: To obtain a better understanding of office medical practice as well as clinical experience in the gastrointestinal field. Significance: Many people take gastrointestinal health for granted; however, as I have seen every day while working at Utah Digestive Health Institute, it can be a cause for a giant concern and for many of our

patients, it is an endless cycle of appointments and medication changes to find what works. It is a lot like investigation work. Method/Approach: I used every opportunity at Utah Digestive Health Institute to learn everything I could. I started as a receptionist around several different offices and in several different specialties. Once I transferred to Utah Digestive Health Institute, I was able to start working towards becoming a medical assistant and also learn the medical billing portion that the medical assistants learn at Tanner Clinic. I have worked very hard to retain as much information as possible in every position to aid in the transition.
Outcomes: I am far more equipped to continue working as a medical assistant and be able to advice patients within the realm of gastrointestinal concerns that a medical assistant is able to give. Alongside this, I am far more educated in common gastrointestinal issues and the typical ways they are treated. Prior to starting my career at Utah Digestive Health Institute, I likely would not have considered a position in gastrointestinal; however, I have realized that it is a fascinating field of medicine.

Lab Technician - National Aquatic Monitoring Center
Aletia James

I'm a head technician for the Buglab. A place that helps determine the health and diversity of lakes and rivers on public lands. It's a joint effort between the National Aquatic Monitoring Center and the Bureau of Land Management to focus on and improve watershed monitoring programs. An important part of my job is sorting through samples of water collected across the western United States and sort the naiads taxonomically, which will help determine the health of those water systems.

Internship with Smithfield Fire and EMS
Breanne Bodrero

I spent the semester interning for Smithfield Fire and EMS as an Advanced EMT. My role was to examine and treat people involved in any traumatic life event that resulted in bodily injury and anyone who experienced a medical emergency. The most common incidents I saw were motor vehicle accidents and emergencies of cardiac, respiratory, and diabetic origin. As an aspiring emergency room doctor, running ambulance calls provides hands on experience in providing basic emergency care, interacting with doctors and ER staff, learning the body's compensatory mechanisms and how to manipulate them for the best patient outcomes, and learning to lead a team in providing medical care.

Hagworm silk synthesis and strength
Joshua Corry

Hagfish have evolved a remarkable antipredation mechanism, in which they are able to excrete a mucin-like slime reinforced with thread keratins (TK's) fibers that allow them to escape. The TK fibers are very fine and have remarkable tensile strength, and because of this, could prove to possess a variety of uses as a biomaterial. However, obtaining these TK's is problematic, as hagfish are impossible to farm for their slime or TK's, and creating the TK's synthetically and spinning them into fibers with the same mechanical properties is not currently possible. In this research, we explore another option, genetically engineering silkworms, which produce a great amount of silk on their own. Through them, we can create recombinant silkworm/hagfish fibers. Hagfish TK's are composed of two proteins, denoted alpha and gamma. These proteins' genes were individually cloned into the silkworm's light chain and heavy chain using Crispr/Cas technology. Recently, the four main strains (LC-alpha, HC-alpha, LC-gamma, and HC-gamma) have been hybridized together through breeding, creating two new strains, LC-alpha + HC-gamma and LC-gamma + HC-alpha. The silkworms were reared and allowed to spin cocoons from which fibers were collected and tested for their mechanical properties. Each TK's average was compiled from samples of eighteen fibers each. Compared to the control, all hagfish-silkworm TK's had a greater diameter, tensile strength, and energy required to break, and all but the HC-alpha TK's had greater elasticity. The pure HC-TK's had the largest diameters, which translated to high tensile strength for the HC-gamma fibers, but strangely, the HC-alpha had the second lowest tensile strength and required energy to break. The LC-fibers had smaller diameters, and the LC-alpha fibers had the most favorable diameter-to-strength ratio of the pure TK's. The LC-alpha + HC-gamma TK's, however, had the

second lowest average diameter than any recombinant TK and a greater tensile strength than any TK overall, proving that it was the most favorable result.