Tarleton Student Research Symposium

March 19-20, 2020

Thompson Student Center
& Mathematics 125

Research Symposium Committee

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Dr. Scott Cook	Department of Mathematics
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Dr. W. Brandon Smith	Department of Animal Science and Veterinary Technology
Dr. Kartik Venkataraman	Department of Engineering and Computer Science
Dr. Yi-Chia Wu	Department of Marketing and Computer Information Systems

		Ballrooms	TSC 219	Math 125
Thursday	8:00–8:30 am	Registration and Poster Setup		
	8:30–10:00 am	Graduate Poster Session		
	10:00–11:00am			Keynote address: Dr. Rajani Srinivasan
	11:00am – 12:00pm			Faculty Workshop: Dr. Scott Cook
	12:00–12:30 pm	Break		
	12:30–1:30 pm		Graduate Oral Presentations 1	
	1:30–1:45 pm	Break		
	1:45–3:00 pm		Graduate Oral Presentations 2	
Friday	8:00–8:30 am	Registration and Poster Setup		
	8:30–10:00 am	Undergraduate Poster Session		
	10:00–11:00 am		Undergraduate Oral Presentations 1	
	11:00am–12:00pm		Undergraduate Oral Presentations 2	
	12:00–1:00 pm	Break		
	1:00–1:30 pm	Awards Ceremony		

8:00–8:30am	**Registration and Poster Setup**	*Ballrooms*
8:30–10:00am	**Graduate Poster Session**	*Ballrooms*
10:00–11:00am	**Keynote Address**	*Mathematics 125*

1. **Title TBA**
   Dr. Rajani Srinivasan

11:00am–12:00pm	**Faculty Workshop**	*Mathematics 125*

1. **Free & easy ways to start analyzing your data with Python**
   Dr. Scott Cook

12:00–12:30	**Break**	
12:30–1:30pm	**Graduate Oral Presentations 1**	*TSC 219*

1. **A forgotten population: The perceptions of lived experiences working as a 911 dispatcher**
   Dawson Stanley & LaShondra Manning
   Presented by Dawson Stanley
   Faculty mentor: Dr. LaShondra Manning

2. **Candidate experience and its cycle in the hiring process: An analysis of student employees**
   Marysol Villeda
   Presented by Marysol Villeda
   Faculty mentor: Dr. Randy McCamey

3. **Response time modeling supports a late interaction account of the size-congruity effect**
   Kristen A. Bowman & Thomas J. Faulkenberry
   Presented by Kristen A. Bowman
   Faculty mentor: Dr. Tom Faulkenberry

1:30–1:45pm	**Break**	
1:45–3:00pm	**Graduate Oral Presentations 2**	*TSC 219*

1. **Removal of microplastics from fresh water using plant derived polysaccharides**
   Rajita Bhuju & Rajani Srinivasan
   Presented by Rajita Bhuju
   Faculty mentor: Dr. Rajani Srinivasan

2. **Counterintuitive no matter how you cut it**
   Nicholas Petela
   Presented by Nicholas Petela
   Faculty mentor: Dr. Jesse Crawford

3. **Implementing and analyzing a co-requisite model for statistics at Tarleton State University**
   Bethany Smith & Rachael Thorpe
   Presented by Rachael Thorpe
   Faculty mentor: Dr. Beth Riggs & Colleen Seaman

4. **Predictive mapping of potentially listed rare plant species**
   Marissa Pensirikul, Hemanta Kafley, Darrel Murray, Heather Mathewson, & Kim Taylor
   Presented by Marissa Pensirikul
   Faculty mentor: Dr. Hemanta Kafley

8:00–8:30am	**Registration and Poster Setup**	*Ballrooms*
8:30–10:00am	**Undergraduate Poster Session**	*Ballrooms*
10:00–11:00am	**Undergraduate Oral Presentations 1**	*TSC 219*

1. **A novel functionalized hay-derived biochar for recovery of phosphorus fertilizer from dairy wastewater**
   Taryn Gibbs & Eunsung Kan
   Presented by Taryn Gibbs
   Faculty mentor: Dr. Eunsung Kan

2. *N***-body adaptive optimization of lattice towers**
   Jaryd Domine, Hakiem Grant, & Wyatt Young
   Presented by Jaryd Domine
   Faculty mentor: Dr. Bryant Wyatt

3. *N***-body simulation of binary star mass transfer**
   Mason A. McCallum & Clayton Tobin
   Presented by Mason McCallum
   Faculty mentor: Dr. Bryant Wyatt

4. **Data mining for variable stars and exoplanets in the archival data of Tarleton telescope using the image-subtraction photometry method**
   Christian Wade & Shaukat Goderya
   Presented by Christian Wade
   Faculty mentor: Dr. Shaukat Goderya

| 11:00am–12:00pm | **Undergraduate Oral Presentations 2** | *TSC 219* |

1. **Peas in a pod**
   Jennifer A. Keele, L. Paige Bielamowicz, Nichole M. Cherry, James P. Muir, W. Brandon Smith
   Presented by Jennifer A. Keele
   Faculty mentor: Dr. W. Brandon Smith

2. **Using kinesthetic methods for teaching chemical concepts in animal nutrition**
   Ashlie N. Thompson & W. Brandon Smith
   Presented by Ashlie N. Thompson
   Faculty mentor: Dr. W. Brandon Smith

3. **It can happen here: A look at American authoritarianism**
   Kristen Clay
   Presented by Kristen Clay
   Faculty mentor: Dr. Patrick Funiciello

4. **Disparities in mortality rates among the US southern states**
   Mackenzie Greer & Subi Gandhi
   Presented by Mackenzie Greer
   Faculty mentor: Dr. Subi Gandhi

| 12:00–1:00pm | **Break** | |
| 1:00–1:30pm | **Awards Ceremony** | *Ballrooms* |

Title TBA

Dr. Rajani Srinivasan (Tarleton State University)
Thursday, March 19, 10:00–11:00am

Abstract forthcoming

Biography

Bio forthcoming

Faculty Workshop
Thursday, March 19, 11:00am–12:00pm, Mathematics 125

- **Free & easy ways to start analyzing your data with Python**
  Dr. Scott Cook
  Do you have data to analyze? Has someone told you "You should try Python - it's really powerful?" Are you hesitating because you think it takes a fancy computer, a lot of effort to setup, or funding? Good news – all you need is an internet connection! Free services like Google Colab let you start analyzing your data with the Python Scientific Stack for free with no setup. You can continue working on the same project from any internet connected computer without transferring files. You can engage your entire class without installing anything on university or personal machines. You can use abundant free tutorials and examples from the internet for just-in-time learning for both yourself and your students. The primary goal of this workshop is to get you started doing better data analysis using Python and its ecosystem of free services. It is meant to show aspiring beginners how to actually begin. If time allows, we will dig deeper into selected Python packages for statistics, machine learning, and visualization. If possible, bring a laptop.

Graduate Oral Presentations 1
Thursday, March 19, 12:30–1:30pm, TSC 219

1. **A forgotten population: The perceptions of lived experiences working as a 911 dispatcher**
   Dawson Stanley & LaShondra Manning
   Faculty mentor: Dr. LaShondra Manning
   911 dispatchers are a population which counseling literature does not acknowledge often, if at all. Seemingly, 911 dispatchers are the first point of contact for callers who are experiencing a crisis and the situation can become detrimental if dispatchers do not respond swiftly and appropriately. While responding to callers, 911 dispatchers have to suppress their emotional reactions to crises which often lingers and impacts their personal lives after calls have ended. While research is slowly emerging in this area, there is not research that provides direct intervention strategies or considerations that focus on how counselors can effectively work with 911 dispatchers. In a neglected, but evolving field, this presentation seeks to address many of the current gaps concerning the mental health considerations needed for 911 dispatchers. In original research conducted by the presenter and a faculty mentor, this presentation will consist of the themes, implications, and results that can provide guidance on how to effectively counsel 911 dispatchers. The development of the themes are guided by rich text terms and direct quotes that adds to the trustworthiness of the study.

2. **Candidate experience and its cycle in the hiring process: An analysis of student employees**
   Marysol Villeda
   Faculty mentor: Dr. Randy McCamey
   The purpose of this paper was to examine the effects of candidate experience in the hiring process. While there is a limited research concerning the effects of candidate experience, research does explain the overall importance of candidate experience to the financial health of an organization. This paper will discuss the effects of customer experience to provide a reference to candidate experience. To add value to candidate experience, surveys will be used to measure the candidate experience of student employees as part of hiring process at a mid-size rural institution. The goal is to track students' experience through the different stages of the hiring process and understand how that experience affects the institution.

3. **Response time modeling supports a late interaction account of the size-congruity effect**
   Kristen A. Bowman & Thomas J. Faulkenberry
   Faculty mentor: Dr. Tom Faulkenberry
   The size-congruity effect occurs when numerical magnitude interferes with judgments of physical size. Either this interference occurs in the encoding stage (early interaction account) or in the decision stage (late interaction account). To discriminate between the two, the shifted Wald distribution is an accumulator model, which has three parameters that provide an index of underlying cognitive processes; drift rate reflects the quality of the information presented, response threshold reflects the level of caution for the response, and nondecision time reflects the speed of encoding and motor responses. We administered a single digit comparison task and manipulated congruency. We found that the drift rate of incongruent trials was significantly smaller than for congruent trials, indicating that incongruent trials required more time for information accumulation than congruent trials. The response threshold of incongruent trials was significantly larger than for congruent trials, indicating that more information is needed to be accumulated before the response. Critically, for nondecision time, there was no significant difference. The combination of a changes in drift rate and response threshold (decision-related parameters) and the lack of change in nondecision time (an encoding parameter) gives support for a late interaction account of the size-congruity effect. These results shed light onto decision-related models of how people process numbers.

Graduate Oral Presentations 2
Thursday, March 19, 1:45–3:00pm, TSC 219

1. **Removal of microplastics from fresh water using plant derived polysaccharides**
   Rajita Bhuju & Rajani Srinivasan
   Faculty mentor: Dr. Rajani Srinivasan
   Microplastics (plastics < 5 mm) originated from the fragmentation of large plastic litter or from direct environmental emission has been identified as one of the major problems the world is currently facing. It is a new type of emerging contaminant that pose threats to aquatic species as well as human beings. The massive usage of plastic products and poor management of plastic waste disposal lead to microplastics being most persistent and problematic. Therefore, effective water treatment and removal of microplastic from contaminated water are of great importance towards microplastics control and to improve the quality of water. Conventional wastewater treatment with primary and secondary treatment processes can remove microplastics from the wastewater up to 99% and most of them are removed already during pretreatment phases. This type of wastewater treatment plant uses various conventional flocculants such as inorganic flocculants and organic polymeric flocculants to aggregate finely suspended microplastics together to form

flocs into the size for speedy sedimentation and clarification. However, the potential problems associated with their use are lack of biodegradability and dispersion of monomers or residual polymers in water that may have adverse effect on the health. Hence, different research is being carried out to discover highly efficient and ecofriendly bio flocculants with the aim to replace the conventional flocculants. Plant derived polysaccharides extracted from Fenugreek (Trigonella foenum graecum), Cactus mucilage (Opuntia ficus indica) Aloe Vera (Aloe barbadensis miller) mucilage, Okra mucilage (Hibiscus esculentus), Tamarind (Tamarindus indica) and Psyllium mucilage (Plantago psyllium) have shown promising results in the removal of microplastics from contaminated water. It offers great alternative for microplastic removal due to the advantages of biodegradability, nontoxicity, high chemical reactivity, wide availability from renewable resources, environmentally friendly and having no toxic effect on the environment. This study will analyze the efficacy of microplastic removal using plant derived polysaccharides in lab scale. The water samples will be collected from Bosque river, Stephenville, TX. Okra, Taro and Aloe vera polysaccharides will be extracted using solvent extraction and precipitation by alcohol which will be treated with acetone and dried at 75 degree Celsius in oven. Varying concentration of the polymers were tested to determine the optimum dose of the polymers for maximum removal. At first, simulated water samples were treated with extracted polysaccharides and flocculation test were done following Standard Jar Test method using PB-700TM Jar Tester. Polymer doses were varied from 0.05g/ml,0.1g/ml and 2 g/ml for the treatment to find the optimal concentration. Then, the tests were carried out with water samples from Bosque river. The samples were observed under the microscope and the microplastics were counted using hemocytometer. Finally, for the analysis of microplastics required spectrophotometric analysis will be done to confirm the results.

2. **Counterintuitive No Matter How You Cut It**
   Nicholas Petela
   Faculty mentor: Dr. Jesse Crawford
   Consider six distinct points in a straight line. Clearly, there is only one way to draw a new line that splits them into two equally sized groups. Now, if you draw those six in a circle, there are three ways to divide them into two groups (unique pairs of subsets). Depending on where they're placed, you get more or fewer lines. What is the maximum? What makes these configurations different? How do we generalize this problem into any even number of dots? Come see the complex and elegant puzzle hiding in a simple pattern in the points and lines.

3. **Implementing and analyzing a co-requisite model for statistics at Tarleton State University**
   Bethany Smith & Rachael Thorpe
   Faculty mentor: Dr. Beth Riggs & Colleen Seaman
   In compliance with HB 2223, the Department of Mathematics at Tarleton State University has implemented a co-requisite model to support TSI-liable students enrolled in MATH 1342 (Elementary Statistical Methods). This group of students were co-enrolled in a new course, MATH 0305 (Foundations of Statistics), during the Spring 2019 semester. Our presentation will provide an overview of the curriculum development for the co-requisite course. Additionally, we will share our model and method for implementation, including the department's process of standardizing MATH 1342. Finally, we will present results analyzing the performance of MATH 1342 co-requisite students versus their non-co-requisite peers to evaluate the effectiveness of the model.

4. **Predictive mapping of potentially listed rare plant species**
   Marissa Pensirikul, Hemanta Kafley, Darrel Murray, Heather Mathewson, Kim Taylor
   Faculty mentor: Dr. Hemanta Kafley
   The status of many native plant species that are potentially rare is a growing concern for conservation agencies. Effective conservation planning warrants understanding of accurate species distribution of the native rare plant species. The selected 17 plants are a Species of Greatest Conservation Need within the state. Collection of species data is from multiple sources: databases, herbariums, and citizen science data. The Maximum Entropy (MaxEnt) model is implemented to the predictive mapping of the rare plant species distribution. Environmental variables were compiled from numerous sources while using the most recent data possible to help predict accurate results. Emphasis on 30-meter spatial resolution for predictor variables in order to sustain fine-scale will help in the prediction of rare plants occurrences. Rare species distribution modeling prompts challenges in obtaining the number of presence data available, lack of true absence, and identifying accurate data. This study will contribute to plant conservation efforts in predicting habitat maps for application in restoring native landscapes. Anticipated results will present strong interactions between environmental variables and rare species persistence that can influence future management practices towards rare plant species.

Undergraduate Oral Presentations 1
Friday, March 20, 10:00–11:00am, TSC 219

1. **A novel functionalized hay-derived biochar for recovery of phosphorus fertilizer from dairy wastewater**
   Taryn Gibbs & Eunsung Kan
   Faculty mentor: Dr. Eunsung Kan
   Runoff from phosphate saturated dairy wastewater has the potential to induce eutrophication in nearby bodies of water, resulting in fatal consequences for the fish and other animals within. The present study investigated a novel calcium hydroxide-coated hay-derived biochar (Ca-BC) for adsorption of phosphate from dairy wastewater. The Ca-BC was comprised mainly of calcium hydroxide and various functional groups resulting in high reactivity between aqueous phosphate and the calcium hydroxide in the Ca-BC. The Ca-BC showed much higher adsorption of phosphate than that of raw manure-derived biochar (raw BC). The maximum adsorption capacity of the Ca-BC was also higher than those of biochar made from various biomatters and functionalization. The Ca-BC also exhibited excellent recovery of phosphorus fertilizer from dairy effluent which could lead to practical application in the field. Overall, the hay-derived, Ca-BC would be a low-cost and effective adsorbent for the recovery of phosphate from water and wastewater sources.

2. *N***-body adaptive optimization of lattice towers**
   Jaryd Domine, Hakiem Grant, & Wyatt Young
   Faculty mentor: Dr. Bryant Wyatt
   Drawing inspiration from the growth and atrophy of muscles, we have developed a weight optimization algorithm for lattice structures. Our model adaptively resizes beams based on their stress, a process that produces rapid results and allows the application of both static and dynamic loads, setting it apart from popular algorithms in this intensely studied field. Truss sizing optimization is differential in nature and heavily dependent on tower geometry, lending it to a computational approach. We have used parallel computation to vastly improve performance and allow live visualization, which helps us to better understand and explain results.

3. *N***-body simulation of binary star mass transfer**
   Mason A. McCallum & Clayton Tobin
   Faculty mentor: Dr. Bryant Wyatt
   Binary star systems are a pair of stars orbiting around a common center of mass. Due to their abundance and unique characteristics, such systems are invaluable sources of astrophysical data. In this study we are concerned with contact binary systems: a pair of stars in physical contact sharing a common envelope. Due to mass transfer between the stars, the structure and evolution of these systems differ greatly from solitary stars (like our Sun). Here we develop an N-body model that simulates evolving contact binary star systems. With this, we study the evolution of contact binaries, in particular the role mass transfer between stars plays in this process.

4. **Data mining for variable stars and exoplanets in the archival data of Tarleton telescope using the image-subtraction photometry method**
   Christian Wade & Shaukat Goderya
   Faculty mentor: Dr. Shaukat Goderya
   Finding Earth like planets in other solar systems is one of the most important and crucial observational activities in astronomy. NASA's Kepler mission, has discovered several thousand extra-solar planets in the constellation of Cygnus. The Tarleton telescope was used to obtain detailed multi-wavelength time series images on several of these extra-solar planets with the aim of recording the transit of the planets observed by Kepler and to perform astrophysical modeling of the transit event. Tarleton telescope image data probably also contains several other variable objects. The goal of this FYRE project is to learn about data mining in astronomy and to use the image-subtraction photometry technique to identify and derive the light curves of all variable objects that may be present in the selected archived data (henceforth called field of view of Interest FOVI).

Undergraduate Oral Presentations 2
Friday, March 20, 11:00am–12:00pm, TSC 219

1. **Peas in a Pod**
   Jennifer A. Keele, L. Paige Bielamowicz, Nichole M. Cherry, James P. Muir, & W. Brandon Smith
   Faculty mentor: Dr. W. Brandon Smith
   Underutilized crops represent an untapped resource in feeding a growing population. Often, these plants can serve a dual-purpose: feeding humans and feeding animals. With a growing population comes an increase in economic status and, with it, a greater demand for meat-based proteins like beef and poultry. Therefore, an

efficient use of overlooked crops would be in feeding livestock. The objective of this experiment was be to determine the variability in nutritive value of underutilized legumes in feeding ruminant animals. Underutilized legumes were identified as cowpea (Vigna unguiculata [L.] Walp.), field pea (Pisum sativum L.), and chickpea (Cicer arietinum L.). Two cultivars, each, were selected from cowpea (Ace and Iron & Clay) and field pea (4010 and Maxum). Samples were dried at $55^{o}C$ and ground to pass through 2- and 1-mm screens. Ground samples (1-mm) were assayed for neutral detergent fiber, acid detergent fiber, and crude protein, and remaining samples (2-mm) were subjected to a batch-culture in vitro digestibility assay. Neutral detergent fiber and acid detergent fiber values were 25.0 and 7.5% from cowpea and 41.1 and 8.3% from field pea. Crude protein means were 22.9 and 20.8% from cowpea and field pea, respectively. Results are interpreted to mean that cowpea and field pea may represent a suitable feedstock for inclusion in livestock diets.

2. **Using kinesthetic methods for teaching chemical concepts in animal nutrition**
Ashlie N. Thompson & W. Brandon Smith
Faculty mentor: Dr. W. Brandon Smith
An educator's goal is to always explain classroom material to his or her students in the most efficient way possible. This, however, is difficult, due to the different types of student learners. One struggle of the typical classroom environment is reaching the educational needs of kinesthetic learners. Kinesthetic learners, also referred to as tactile learners, require engagement outside of standard classroom lectures, such as seeing a chemistry molecule in a tangible form. By incorporating new methods of learning, teachers have the potential to increase classroom understanding among all types of learners. This study explored different styles of student learning and specifically showed how kinesthetic learners could understand basic nutrition concepts more effectively. This was accomplished by taking a sample of Tarleton students and showing them four increasingly tactile models for describing carbohydrate structure, ranging from text on a page to a rearrangeable 3-dimensional model. Each preference of model was taken into account with the corresponding preferred learning style. This study also explored methods that educators could implement to better engage tactile learners. This was accomplished by asking those students to present the nutrition concept using one of the models given. Research gathered from this study provides a new direction for educators to reach kinesthetic learners within the classroom environment.

3. **It can happen here: A look at American authoritarianism**
Kristen Clay
Faculty mentor: Dr. Patrick Funiciello
For decades, American politics have been moving towards authoritarianism. Attempts to force values on American citizens have become part of the norm. However, since the 2016 presidential election, historians, social activists and political scientists have noticed similarities between America today, and Europe of the early-mid 20th century. Attempts at voter suppression and promising to return to "traditional American values" are just part of the authoritarian resurgence in the United States. In particular, the rapid rise of populist authoritarian Donald Trump has shown just how radical American politics have become. The president's refusal to turn over key evidence in his own impeachment proceedings is a throwback to the classic authoritarian tactics of Pinochet and other dictators. In his 1935 novel, *It Can't Happen Here*, Sinclair Lewis writes "A country that tolerates evil means – evil manners, standards of ethics – for a generation, will be so poisoned that it never will have any good end." By allowing a radical authoritarian into the highest position in the land, American politics and society will be altered for generations to come.

4. **Disparities in mortality rates among the US southern states**
Mackenzie Greer & Subi Gandhi
Faculty mentor: Dr. Subi Gandhi
Breast cancer is the most commonly diagnosed cancer among women in the United States. This study was conducted to compare the incidence and mortality rates of breast cancer among women living in Texas and neighboring states, and to explore if mammography was a major contributing factor for these rates. We utilized various secondary data sources from governmental and non-governmental agencies to compare the age-adjusted incidence and mortality rates of breast cancer among women living in Arkansas, Louisiana, Mississippi, Oklahoma, and Texas for the years 2012-2016 and 2013-2017, respectively. Compared to the national incidence rate, all five southern states had significantly higher incidence rates of breast cancer. With the exception of Texas, all four southern states had breast cancer mortality rates that exceeded the national rate. When mammography was explored as a major risk factor for breast cancer incidence and mortality, the data showed that Louisiana had the highest rate of screening, followed by Arkansas and Oklahoma. The disproportionate incidence and mortality rates of breast cancer in the explored southern states indicate that other risk factors, besides mammography, such as place of residence, late detection, limited treatment options, and late age of diagnosis could be contributing to these rates.

Graduate Poster Session
Thursday, March 19, 8:30–10:00am, Ballrooms

1. **Assessment of virulence gene prevalence in Escherichia coli from environmental water samples using qPCR**
Reagan Patterson, Jeff Brady, & Janice Speshock
Faculty mentor: Dr. Jeff Brady and Dr. Janice Speshock
The freshwater fecal indicator bacterium Escherichia coli is known to reside within the gastrointestinal tracts of mammals, and is utilized by regulatory agencies to determine levels of fecal contamination in recreational waters. Unfortunately, these presence-absence tests use common metabolic genes for detection and are unable to determine strain specifics such as virulence factors that more directly impact human health. Quantitative polymerase chain reaction, or qPCR, has been utilized for the detection, quantification, and typing of different microbial agents by identifying specific target DNA sequences or genes. Therefore by utilizing qPCR and specific virulence gene primers, this study aims to identify E. coli strains from water samples that have the potential for a direct human health risk. Positive Colilert tray wells containing water samples from the Bosque and Lampasas River were utilized to complete the E. coli isolate collection. All 443 isolates were verified with two Taqman assasys: EC807 and EC23S857. After verification, isolates were screened for the virulence genes: stx1 (Shiga toxin1), stx2 (Shiga toxin 2), eaeA (Intimin), hlyA (alpha-hemolysin), stla/stlab (heat-stable and heat-labile toxins), PapA (P fimbriae), sfaA and sfaS (S fimbriae), F1C (F1C fimbriae), neuA and neuC (K1 capsule antigen), and kfiB (K5 capsule antigen).

2. **Comparison of near full-length 16S rRNA sequencing to enterolert and quantitative PCR (qPCR) for water quality testing**
Bianca D. Willis, Jeffrey Brady, Janice Speshock, & Stephanie Brady
Faculty mentor: Dr. Janice Speshock
Water is a valuable resource used for everyday consumption therefore, it is important to test for fresh and marine water quality in terms of presence of pathogenic bacteria that may harm public human health. Current methods used include dated culture methods, IDEXX Enterolert system, and quantitative polymerase chain reaction (qPCR) which rely on presence of fecal indicator bacteria.16S rRNA genes are ubiquitous in bacteria, allowing for identification within microbial communities via sequencing. Near full-length 16S rRNA sequencing can be accomplished using transposon-tagging during library preparation. Using computer software, near full-length sequences can be constructed and metagenomic analysis conducted to identify bacterial presence in water samples, specifically pathogenic strains, and can potentially determine probable host sources. This method can detect pathogenic bacteria missed by methods like IDEXX and qPCR, offering higher sensitivity. Since many pathogenic bacteria such as Vibrio, Yersinia, Salmonella, and Shigella are not detected by IDEXX, sequencing will provide detection of pathogens and allow evaluation of health risk. The objective is to compare near full-length 16S rRNA sequencing of water samples collected from the Texas Gulf Coast to Enterolert and qPCR results and assess the ability to predict risk from pathogenic bacteria in water samples from numbers of enterococci.

3. **Diatom characterization in northern Sweden**
Breena Riley, David Seekell, & Victoria Chraïbi
Faculty mentor: Dr. Victoria Chraïbi
Northern Sweden is environmentally vulnerable to the effects of climate change due to its high latitude. Waters in northern Sweden are in relatively pristine condition, so environmental monitoring is only performed annually. Thus, riverine diatom diversity is not well understood because the absence of a need to develop biotic indices. Rivers in the region are highly oligotrophic and nutrient-limited and are exposed to about 24 hours of sunlight daily during the summer season. Many river reaches are reported to be highly turbulent. Prior work with alpine and boreal lakes in Canada and Sweden suggests that lacustrine (lake-dwelling) diatoms are often most strongly associated with pH. Rivers and lakes in the region range from pH $\sim$ 5.5-7.5. Diatoms were collected from sites in the Miellajokka catchment and from sites in Abisko National Park, both of which drain into Tornetrsk Lake. Diatom community structure data from the study will be related to environmental and nutrient parameters taken from sites within the target catchment. The project was sponsored by ASLO (Association for the Sciences of Limnology and Oceonography) through the Limnological and Oceanographic Research Exchange (LOREX), an NSF-funded program. LOREX provides training for student to collaborate with scientists on projects at international locations.

4. **Effects of herbicide exposure on diatom assemblages in a stream mesocosm**
Freya Portales & Victoria Chraïbi
Faculty mentor: Dr. Victoria Chraïbi
Various pesticides are utilized year-long to combat the ever-changing population of biotic organisms that jeopardize the viability of agricultural yields. Texas is currently one of the largest pesticide users and sources of agricultural non-point pollution in North America. The presence, concentration, and ecological effects of

pesticides in Texas streams are not well understood. Diatoms are considered with high regard in terms of their use as bioindicators in determining the overall health of aquatic systems because of their diversity and environmental optima that can be discerned based off of multiple factors, reasonably including tolerance towards toxic compounds. This research project will utilize eight artificial streams in a paired replicate study with controls to experimentally study the potential chronic exposure effects that the common herbicide glyphosate (the main ingredient of RoundUp) may have on the diatom assemblages of the Colorado River at the Timberlake Biological Field Station near Goldthwaite, Texas. Epilithic and epipelic samples will be collected from the Colorado River and cultured in an artificial stream mesocosm. The streams will then be exposed to the pesticide in chronic low concentrations that accumulate over time in the closed system. Diatom communities will be subsampled weekly and enumerated to observe any present effects.

5. **Paleolimnological assessment of harmful algal bloom trends in Texas reservoirs**
Lane Allen, Victoria Chraïbi, Jeff Brady, & Janice Speshock
Faculty mentor: Dr. Victoria Chraïbi
Harmful Algal Blooms (HABs) caused by cyanobacteria and Prymnesium parvum are responsible for economic losses in tourism and fishing industries. The environmental factors that drive bloom formation and toxin production are poorly understood. Paleolimnology is advantageous because it can detect long term trends. This project investigates the dynamics of HABs in Texas reservoirs over the past 100 years in order to identify potential trends of increasing bloom events similar to those occurring in northern lakes, to identify important environmental stressors. Cores were collected from three reservoirs in Texas including two with recorded HABs. Diatom subfossils were collected, and their relative abundance will be used to infer environmental conditions. Sedimentary DNA from those cores will indicate the occurrence of bloom events. The occurrence of events such as floods and drought will be detected using X-ray diffraction. As a supporting proxy for nutrient loading and salinity, the relative abundance of elements 1-92 will be assessed using X-ray fluorescence. The cores will be dated using Cs-137 and Pb-210. The results will provide evidence determining if P. parvum is a native or invasive organism in North America. Finally, this project serves to develop paleolimnological techniques used in reservoirs, which are largely understudied.

6. **Survey for anti-CRISPR proteins encoded by actinobacteriophages**
Tiffany Lujan, Faith Cox, Samantha Conger, Jaime Merrill, Lee Hughes, & Dustin Edwards
Faculty mentor: Dr. Dustin Edwards
Bacteriophages are viruses that infect and lyse bacteria, outnumbering bacterial cells 10 to 1. In response to the overwhelming bombardment, bacteria have evolved anti-phage response mechanisms such as restriction modification, abortive infections, and clustered regularly interspaced short palindromic repeats (CRISPR-Cas) systems. CRISPR-Cas systems act as a barrier against bacteriophages and provide an adaptive immune response by capturing short fragments of viral DNA and incorporating the sequences into the host genome. The sequence is transcribed and bound to Cas proteins to form a complex that surveys the cell for a matching sequence to induce nuclease activity. Some phages can overcome the barrier by encoding proteins that inhibit the CRISPR-Cas system. We hypothesize that actinobacteriophages specific to the host Streptomyces avermitilis encode a type I-E CRISPR system containing anti-CRISPR proteins. The ability to form a prophage in the genome of a CRISPR-Cas-containing cell indicates counter-defence mechanisms. Five sequenced subcluster BD1 bacteriophages previously isolated from host Streptomyces griseus were tested by plaque assay on S. avermitilis. Three enriched environmental samples were isolated using serial dilutions and plaque assays. The characterization of anti-CRISPR proteins shows significant importance for the field of genome editing by adding precision proteins.

7. **The development of a diatom-based index of biotic integrity to assess water quality of Texas streams in compliance with the National River and Streams Assessment**
Heather Foster & Victoria Chraïbi
Faculty mentor: Dr. Victoria Chraïbi
Water pollution is increasing as water availability is decreasing in Texas, causing an immediate need for water quality monitoring. An Index of Biotic Integrity (IBI) is a rapid water quality assessment method; some exist for urban streams in Texas, but small rural streams remain understudied. Diatoms are excellent candidates for an IBI due to their abundance, species-specific environmental optima, and rapid generational turnover, which record the long-term effects of environmental pollutants on a stream community. In Texas, prior National Stream and Rivers Assessment (NRSA) surveys have indicated potentially endemic species in the streams that were sampled; this suggests that creating voucher floras and an IBI of diatoms in more streams, particularly in rural areas, will strengthen the meaningfulness of NRSA assessments in the state. This study aims to develop an IBI for eighteen rural streams in north-central Texas, taking into account seasonal variability and water chemistry measurements for pH, DO, temperature, conductivity, stream velocity, nitrogen, and phosphorus. An IBI for rural Texas streams would be beneficial because there is no routine monitoring of these streams and other established IBIs may be unable to accurately determine

pollution values for these streams because of differing diatom assemblages or environmental stressors.

8. **A tale of drugged drivers**
Melissa Boschwitz
Faculty mentor: Dr. Steven Glassner
The State of Texas defines Driving While Intoxicated (DWI), as a person being intoxicated while operating a motor vehicle in a public place. Texas law defines intoxication as not having the normal use of mental or physical faculties by the introduction of alcohol, controlled substance, a drug, a dangerous drug, a combination of two or more of those substances, or any other substance into the body; or having an alcohol concentration of 0.08 or more. Most commonly, the general public associates DWI in relation to alcohol intoxication; however, recent national research has shown a decrease in alcohol related intoxication arrests and an increase in drug related intoxication arrests. Has the recent opioid crisis and the legalization of marijuana in states proximate to Texas driven an increase in drug related intoxication arrests? And if so, is this trend being observed at a county level, specifically in Hood County, Texas? With its nearness to both Stephenville and Fort Worth, the effects of alcohol and drug related driving can be felt by Tarleton students, faculty, and their families. This research can be used to initiate future training for police and prosecutors in combatting the DWI problem in its efforts to protect our families.

9. **Factors affecting juvenile opioid usage**
Courtney Walker
Faculty mentor: Dr. Olga Semukhina
This study looks at how parental involvement and religious ties affect opioid pain reliever and heroin usage in juveniles age 12–17 years old in a nationally representative sample when controlling for gender, family income, race, and sex. The survey was completed by the Substance Abuse and Mental Health Services Administration within the U.S. Department of Health and Human Services. The data set used is a compilation of the 2002-2017 survey results of the National Survey on Drug Use and Health with a sample size of 194,354 juveniles. By using a set of ordinal binary logistic regressions. Findings show that both the parental involvement and religion ties are statistically significant in decreasing the likelihood of using either opioid pain relievers or heroin by juveniles. The parental involvement is slightly more important than religious ties in the case of opioid pain relievers, but both are equally significant when predicting likelihood of using heroin.

10. **Outlook of domestic violence victims after seeking assistance**
Michael Thomas & Tara Shelley
Faculty mentor: Dr. Tara Shelley
Domestic violence is a complicated societal issue, partly because of the negative internalized victimization brought on by the effects from victims' various types of abuse. It is hypothesized here that domestic abuse victims who seek assistance are more likely to have a positive emotional outlook, rather than a negative emotional outlook, as documented through client intake satisfaction survey responses. Researchers further hypothesize that merely the victim's personal decision to seek assistance, helps facilitate their anticipated positive emotional outlook.

11. **Balancing the the yin and yang of integration**
Tu Nguyen
Faculty mentor: Dr. Anne Egelston
The Sustainable Development Goals (SDGs) are considered as the "blueprint" for sustainable development toward 2030. The United Nations designed this framework to integrate and glue the three dimensions of sustainable development. Thus, the SDGs provide a platform to promote cooperation and the sharing of knowledge, power, and resources across multiple disciplines. However, because of the limited resources invested in sustainable development, this common ground can also be a battlefield where goals or actors compete for attention and resources. Therefore, a decision-making framework that reduces these negative relationships and competition is needed. This research proposes a theoretical framework that optimizes the system's connectivity and distribution of effort based on the United Nations Statistics Division's indicator score. Consequently, this tool will allow policymakers to systematically make decisions that best reflect the "development as a whole" characteristic of the SDGs.

12. **"One lone basketball": History of women's physical education at Tarleton State University**
Jesse Brock, Mikayla Morris, Arianna Stegall, Joshua Willis, Adam Freeman, Anna Gober, Lane Senn
Faculty mentor: Dr. Kayla Peak
As an academic unit, the history of Kinesiology at Tarleton State University (TSU) can be traced back to 1921. With the program's centennial anniversary approaching, it is important to highlight important people, events, and physical activity courses pertaining to the early years of the program. During the 1921-1922 academic year, the department was titled the Department of Physical Education. Over the next several decades, physical education courses were segregated by gender (men and women). This presentation will tell

a narrative of the history of Women's Physical Education at (TSU) based on findings from archival research in TSU's special collections and archives. In essence, the timeline of Physical Education includes overcoming gender inequality, as the program was allotted one basketball in 1921, to having a separate gymnasium for women's physical activity and athletics in 1952. At the heart of the narrative of Women's Physical Education is Laura Fellman, who was a professor and coach at TSU for over three decades. In conclusion, the archival photographs included in this presentation, as well as the information found within JTAC and Grassbur yearbooks, provide more insight and understanding to the rich history of Kinesiology at TSU.

13. **Motivational sustainability through wellness in athletic training**
Matthew Golden, Steve Simpson, & Amy McKay
Faculty mentor: Dr. Steve Simpson & Amy McKay
This research was conducted to analyze the dimensions of wellness of the athletic training profession in District 6 of the National Athletic Trainers Association. Currently studies show that wellness is a tangible way to focus on stress management as well as aid in the growth and development of an individual. Guidelines have been created to find and target specific stressors through survey, but an actual intervention has not been implemented. Participants were collected on a voluntary basis to complete the National Wellness Institute's Wellness Survey Online. Participants had 4 weeks to complete the survey they received through email. Once the deadline was met data was ranked by a point system, positive questions were given positive points and negative questions were given negative points. Of the 712 responses (306 Male and 406 Female) the National Athletic Trainers Association's District 6 showed to score the lowest in the social dimension of wellness. It is necessary to work on all areas of wellness in order to realize your full potential. The goal of this survey was to assist athletic trainers in prioritizing self-care and promoting a culture that involves an introspective look at one's self which leads to an untouched level of growth and development. More research is necessary, and, methods of implementation need to be created to boost different dimensions.

14. **Physical fitness sex differences of ROTC cadets**
Ty Hill & Andrew Wolfe
Faculty mentor: Dr. Andrew Wolfe
Occupational requirements of military personal necessitate optimal levels of physical fitness; suboptimal levels yield detrimental operations. Consequently, female physical readiness and abilities in comparison to the male soldier fitness level is frequently questioned. Qualitative reports denounce masculine advantages, however, quantitative measures explaining sex differences in physical fitness of military personal remains unclear. Clarifying the physical fitness difference of male and female militants was the purpose of this investigation. A Freedom of Information Act request provided the researchers with Army Physical Fitness Test (APFT) results (Raw 2-mile run, Raw 2-minute push-ups, Raw 2-minute sit-ups, Standardized 2-mile run, Standardized 2-minute push-ups, and Standardized 2-minute sit-ups), and Leadership Development Assessment Course field physical fitness scores for male ($n = 657$) and female ($n = 178$) Reserve Officers' Training Corps (ROTC) cadets from a southwestern ROTC brigade. An independent samples t-test was applied to analyze group means for raw and standardized APFT scores of male and female cadres. No statistically significant differences were identified between APFT or field physical fitness scores of male and female cadets. Brownson (2014) suggested that sex differences should not interfere with physical fitness or physical occupational performance, and based upon qualitative reports female militants possess adequate, and sometimes superior, leadership, physical, and job performance in comparison to male counterparts. These results complement qualitative reports and suggests female ROTC cadets possess occupationally sufficient physical abilities.

15. **Use of blood flow restriction training to achieve strength and hypertrophy gains and the implications for rehabilitation**
Rachel Young & Jennifer Lancaster
Faculty mentor: Dr. Jennifer Lancaster
Low-load blood flow restriction training has been shown to produce similar effects in muscle strength gains as traditional high-load resistance training with as little as 20-30% of an individual's one rep max as compared to the traditional 60-80% one rep max training load (Faltus et al. 2018). The purpose of this study is to assess outcomes of low-load blood flow restriction training and determine if it is a viable and applicable option in the rehabilitation setting. On the first visit anthropometric measurements will be taken (height, weight, thigh circumference). On the second visit (there will be 48 hours between visits) 1 RM for hamstring curl and squat will be established using a 2 second metronome to ensure equal eccentric and concentric contractions during the movement, and a familiarization with the training design and procedures. Ideal estimated occlusion will be determined using the guidelines established by Loenneke et al. (2014). Each treatment group will complete 2 sessions per week for 6 weeks. During the study period participants should remain recreationally active but should refrain from lower extremity strength training to ensure that gains seen are from the established treatment and not outside training programs. During training sessions, the

high-load group will perform 3 sets of squat and 3 sets of hamstring curls at 80% of their 1 RM to exhaustion. The low-load BFR group will perform 3 sets of squat and 3 sets of hamstring curls at 20% of their 1 RM to exhaustion, occlusion will be released between exercises. The control group will continue their regular training regimen without intervention. Each treatment group will complete a session RPE and perceived recovery status scale each session throughout the duration of the study. The study is still ongoing but will conclude before the symposium.

16. **Big jumps or little steps: Fighting gerrymandering with random walks**
Suzie Tovar & Preston Ward
Faculty mentor: Dr. Scott Cook
Courts at all levels are struggling with the increasingly pressing and complex issue of political gerrymandering. Deadlines for the post-2020 census redistricting are quickly approaching. At the heart of our difficulties to fairly divide ourselves in voting district lies a math problem how do we measure fairness? How can we use that measure to draw fair district boundaries? Our project is part of nationwide collaboration of mathematicians, demographers, lawyers, mapmakers, political leaders, and citizens attempting to develop tools for this purpose. We will survey Markov Chain Monte Carlo methods used in the PA Supreme Court case and our recent work to improve and apply it to more states. We will discuss several commonly used compactness metrics and present a new idea called transit time compactness that aims to measure cohesiveness of people, not just land.

17. **Magic squares of squares**
Preston Ward
Faculty mentor: Dr. Jeremiah Bass
A magic square is a 3×3 array of distinct positive integers whose columns, rows, and diagonals have a common sum. We know how to generate these and they are well known. Now take the same array, but each entry must also be a perfect square. Can you still construct the array? This question was first posed by Euler in the 1770s and has remained unanswered since then. Through our efforts we have designed multiple algorithms to search for these magic squares of squares, and have found interesting evidence that if you have the four common sums focused around the center of the array (the middle rows, columns, and diagonals) then we conjecture that you cannot have more than four sums. Our efforts have also extended to embedding these arrays into a graph space which allows for us to look for them in linear time.

18. **Anonymity in group interaction**
Keesha Green, Alison Beason & Edgar Jimenez
Faculty mentor: Dr. Jonali Baruah
Stages of innovation such as brainstorming, selection, and refinement have become important in promoting creativity among groups (Watts, Steele, Medeiros, & Mumford, 2019). Research shows more original ideas are produced in anonymous groups than identifiable groups (McLeod, 2011). Research has not yet shown the effects that anonymity has on groups that are selecting and refining quality ideas. The current study tested the hypothesis whether the anonymous groups will produce ideas of the highest originality and feasibility in the refinement stage of innovation. A total of 83 participants were randomly assigned to 12 groups for the non-anonymous (identified) condition and 15 groups for the anonymous condition. The groups participated in three stages of innovation: brainstorming, selection, and refinement. The dependent measures were originality (uniqueness) and feasibility (applicability). In terms of originality, there was a significant main effect of the stages of innovation, $F(2, 22) = 35.545$, $p < .001$. The refinement stage ($M = 3.205$, $SD = 0.128$) contained ideas that were more original than the generation ($M = 2.7$, $SD = 0.061$) and the selection stage ($M = 2.395$, $SD = 0.075$). There was a significant interaction between stages of innovation and anonymity condition, $F(2, 52) = 3.39$, $p < .05$.

19. **Comparative analysis of aquaponic lettuce using 1" & 2" plugs in net pots, beaverboard & vertical towers**
Ashley L. Medeiros & Hennen D. Cummings
Faculty mentor: Dr. Hennen D. Cummings
Aquaponics is a sustainable farming method using fish, plants, and bacteria in a recirculating system without the presence of soil, pesticides, or synthetic fertilizers. These systems provide an alternative to conventional crop production and aquaculture which pose environmental hazards. Currently, aquaponics has an increasing international following yet utilization of aquaponics in the U.S. is lagging and further research is necessary to convince current hydroponic, aquaculture, and conventional farmers to make the transition to aquaponics. There are no existing studies examining productivity of crop production using popularly used aquaponics systems. The objectives of this study are to compare lettuce grown in vertical towers to deep water culture (1 Beaverboard rafts and Styrofoam housing net pots) using coco coir plugs from seedling trays to determine if using less coco coir impacts efficiency, economics, and quality of lettuce production. Once experimentation is concluded, our results will help guide current and prospective aquaponics farmers towards choosing the

most efficient way to produce lettuce crops.

20. **Monitoring wildlife communities within riparian areas**
Kathryn L. Burton, Heather A. Mathewson, & Darrel Murray
Faculty mentor: Dr. Heather Mathewson
Wildlife communities can be influenced by changes in riparian zones, such as water levels and vegetative composition. Land restoration practices are used to improve the ecosystem and monitoring of land changes is necessary to evaluate the effectiveness of the practices. In Palo Pinto County, Texas, we are surveying vegetation, avian, invertebrate, and mammal communities within specified riparian buffer zones for occupancy and changes in communities. We used stratified random sampling to establish 20 points across the riparian buffers to monitor multi-year, landscape-scale changes. We conduct surveys within each of four seasons. At each point, we conduct avian point counts for all species seen or heard, and we use pitfall traps, bee pan traps, aquatic d-nets, and vacuum sampling to sample invertebrate communities. We use a point-center-quarter method for vegetation surveys to obtain canopy cover, herbaceous cover, species composition, and vegetation structure using Daubenmire frames, densiometers, and DBH measuring methods. Additionally, we have a game camera established at each point and we take photo documentation of the point site. To compare local-scale impacts of specific land management activities, including brush management, prescribed burns, and native seed plantings, we will survey each community before and after every management activity. Over the 5+ years of this project, we will be able to determine effectiveness of land restoration activities on these wildlife communities.

21. **Predictive mapping of two potentially listed rare plant species in Texas**
Jordan Craven, Hemanta Kafley, Heather Mathewson, Darrel Murray, & Kim Taylor
Faculty mentor: Dr. Hemanta Kafley
Using historical collections, herbaria databases, and citizen science records, presence-only data of occurrence for Texas trillium (Trillium texanum) and Rough-stemmed aster (Symphyotrichum puniceum scabricaule) are being used to model potential habitat throughout the state of Texas. Predictive models will be created using MaxEnt and a number of environmental variables including bioclimatic data (WorldClim), solar radiation, soil layers (Web Soil Survey), and geological features (USGS). The contribution of each environmental variable will be assessed using a jackknife test. Our goal is to determine the areas of suitable habitat for each of the species and to determine where present-day populations may be found. Using diagnostic ROC curves and AUC values, the predictive ability of the models can be assessed. We hope to find that these models accurately predict known presence locations and new sites that have thus far gone undocumented by both scientists and citizen scientists. These models will then be validated using data collected from field surveys performed by the Botanical Research Institute of Texas (BRIT). These models will be integral in the future management of these plant species, especially if they were to become listed in the state of Texas.

Undergraduate Poster Session
Friday, March 20, 8:30–10:00am, Ballrooms

1. **The effect of the U.S.-China trade war on soybeans**
   Glenn Conover & Jacob Manlove
   Faculty mentor: Dr. Jacob Manlove
   The study attempts to find the effects of the U.S.-China Trade War on soybean stocks. Specifically, the returns for Archer Daniels Midland and Bunge were analyzed over the duration of the trade war. A risk-adjusted return model was used to to find first the expected returns of the stocks during the trade war to compare the actual returns they had.

2. **Determining through qPCR if Treponema bacteria are present on flies collected from a dairy farm**
   Reese Thibodeaux, Barbara Jones, Jeff Brady, & Sonya Swiger
   Faculty mentor: Dr. Barbara Jones
   The objective of this research was to determine if flies, captured from a dairy farm, carry Treponema bacteria on their legs and heads. Digital dermatitis is a bacterial infection that cause lesions above the heal bulbs on cattle hooves. Treponema bacteria are present on the lesions of an infected hoof. However, transmittance is not known. Flies were captured from a local dairy farm known to have cows infected with digital dermatitis. Mesh sweep nets were used to collect the flies and were stored in a plastic crate with a fabric opening until transported to the lab. Only the heads and legs of the fly were cut off with a scalpel to use in the DNA extraction. Flies (n = 417) had DNA extracted using a Qiagen Blood and Tissue Kit. DNA from one tube was used thrice in the qPCR reaction to analyze if any DNA from Treponema bacteria were present. No indicators that Treponema bacteria were present on any of the flies collected existed. Further analysis should be conducted to confirm if flies carry Treponema bacteria, and to analyze if Treponema bacteria is transmitted through other potential vectors.

3. **Fast food fiber: A random effects model for nutritive value of takeout containers as feedstock**
   Melissa A. Drury, L. Paige Bielamowicz, Jennifer A. Keele, Nichole M. Cherry, James P. Muir, & W. Brandon Smith
   Faculty mentor: Dr. W. Brandon Smith
   In livestock husbandry, feed costs represent one of the greatest inputs in the production cycle. Innovations aimed at reducing these costs are of extreme importance and great value to the stakeholder. Along these lines, wastes from anthropogenic enterprises represent the next line of evaluation and possibility in livestock nutrition. The objective of this study was to assess the variability in nutritive value of discarded food wrappers and takeout containers from the fast food industry. Samples were collected from faculty and staff at Tarleton State University during spring 2018. Samples were sorted by source restaurant and type of container. Sorted samples were ground to pass through 2- and 1-mm screens. Ground samples (1-mm) were assayed for neutral detergent fiber, acid detergent fiber, acid detergent lignin, and crude protein, and remaining samples (2-mm) were subjected to a batch-culture in vitro digestibility assay. Neutral detergent fiber values ranged from 67.4 to 94.4%, with a mean value of 85.3%. These values are greater than what is normally observed in forage species; however, cellulosic material in papers would be processed where forage fiber is not. Thus, results are interpreted to mean that takeout containers and food wrappers may represent an inexpensive (or free) fiber source for formulating livestock diets.

4. **Flower power**
   Lauren Nix & W. Brandon Smith
   Faculty mentor: Dr. W. Brandon Smith
   The use of by- or co- products in livestock production is a novel concept. However, as adoption of a novel feed ingredients increases, the cost efficiency of its use generally decreases. Therefore, discovery of novel feed ingredients is a worthwhile academic pursuit. Our objective is to evaluate the variability in nutritive value of nursery waste, primarily flower stems and clippings, as a sustainable and viable feedstock. Floral waste was obtained from a local florist (University Flowers/College Etc., Stephenville, TX), and botanical separations were performed to isolate individual plant species as well as plant part (flower, stem, leaf) within species. Isolated samples were dried at 55^oC and ground to pass through 2- and 1-mm screens. Ground samples (1-mm) were assayed for neutral detergent fiber, acid detergent fiber, and crude protein, and remaining samples (2-mm) were subjected to a batch-culture in vitro digestibility assay. Neutral detergent fiber and acid detergent fiber values were 28.3 and 18.5%, 53.7 and 44.7%, and 45.9 and 35.1% from flowers, stems, and leaves, respectively. Results are interpreted to mean that floral waste may represent a suitable feedstock for inclusion in livestock diets.

5. **Heritability of digital dermatitis in lactating Holstein dairy cattle**
   Grace Canny

Faculty mentor: Dr. W. Brandon Smith & Dr. Barbara Jones

Digital Dermatitis (DD) is a contagious bacterial hoof infection. The objective of this study evaluated the heritability of DD resistance in Holstein cattle. Cattle were scored on a M0 (early lesions) to M4 (chronic lesions) scale. Blood samples were collected on lactating cows (n = 45) from the coccygeal vein. Thermo Scientific GeneJet Whole Blood Genomic DNA Purification Mini Kit was utilized following per manufactures protocol to isolate genomic DNA from 200 microliters of whole blood collected from each cow. Through candidate gene approach, we utilized four SNP's per evaluating the genetic correlation of DD resistance. PowerUp SYBR Green Master Mix was applied to the four SNP's to test variation. The master mix and purified DNA was run through a Roche Lightcycler PCR machine for the amplification of fragments of the 3UTR of Interleukin-8 (IL8) gene and exon 3 of Toll-Like Receptor 4 (TLR4) gene. SAS software was utilized to determine the frequencies of different genotypes present amongst the resistant and affected animals. Chi-Squared test of SNP Bta-IL8 cDNA resulted in a probability value of 0.03. The SNP shows there is a positive association between the genetic potential for resistance to developing DD.

6. **Livestock literacy: Evaluating ideal concentrations of starch and protein for ensiling**
   Natalie Finn, L. Paige Bielamowicz, & W. Brandon Smith
   Faculty mentor: Dr. W. Brandon Smith
   Per unit energy, fiber is one of the most expensive components of feeding a ruminant animal. For this reason, there has been a heavy investigation on the use of human industry by- or co-products to help offset this cost. However, increasing popularity of waste by-products often brings an increase in price. The objective of this experiment was to determine the ideal concentrations of starch and nitrogen to effectively ensile newspaper as a feedstock. The experiment was conducted as a replicated central composite design. In each of the four replications, treatment combinations were generated to represent central points of corn starch and urea inclusion. Replications were used to simulate grain silage, grass silage, and high and low combinations thereof. Newspapers were obtained from the Dick Smith Library and JTAC News at Tarleton State University (Stephenville, TX). Samples were cut into strips (approximately 4.0 x 30.2 mm) using an office shredder. The shredded newspaper was inoculated with varying amounts of corn starch and urea, and water and inoculant were added to achieve 45% dry matter. Central points for corn starch were 35.5, 1.3, 35.5, and 1.3% dry matter, respectively, for grain silage, grass silage, high combination, and low combination. Central points for urea were 4.0, 6.4, 4.0, and 6.4% dry matter, respectively, for grain silage, grass silage, high combination, and low combination. Samples were sealed using a food-grade sealer and allowed to ferment for 35 d. A subsample was frozen for assay of pH and silage acids. The remaining sample was dried at 55°C and ground to pass through 2- and 1-mm screens. Visual assessment indicated that starch addition was the governing factor for improvement of fermentation.

7. **Moo-vie snacks: Inclusion of popcorn, newspaper and crawfish shells as a non-feedstock silage production**
   L. Paige Bielamowicz, Michaela Nix, & Jennifer Keele
   Faculty mentor: Dr. W. Brandon Smith
   As the future of agricultural sciences, it is imperative that student scientists seek to investigate alternatives to help improve production. Using anthropogenic waste as potential feedstock, we are engaging in an innovative wave of agricultural research. While previous research in our laboratory has evaluated newspaper, waste popcorn, and crawfish shells as feedstock, their potential for ensiling represents an alternative avenue for upcycling and long-term storage. The objective of this experiment was to determine the optimum concentrations of newspaper, waste popcorn, and crawfish shells for ideal silage fermentation. This experiment was conducted as a Box-Wilson composite design with four replications. Popcorn was obtained from a local movie theatre (ShowBiz Cinema, Granbury, TX), newspaper was obtained from the Dick Smith Library and JTAC News at Tarleton State University (Stephenville, TX), and crawfish shells were collected from local crawfish boils. Prescribed amounts of shredded newspaper, ground crawfish shells and heads, and waster popcorn were thoroughly mixed, and water and inoculant were added to achieve 25% dry matter for grain silage, grass silage, high combination, and low combination. Samples were sealed using a food-grade sealer and allowed to ferment for 35 d. Visual assessment of silages indicated that popcorn may serve as a suitable carbohydrate source for silage.

8. **SNAIL2 mutation associated with heterotopic polyodontia in beef cattle**
   Taylor Karr, Courtney Hendley, Jeff Brady, W. Brandon Smith, & Jolena Waddell
   Faculty mentor: Dr. Jolena Waddell
   Heterotopic polyodontia (HP) is teeth outside of the dental arcades that form inside a branchiogenic cysts. HP has recently been demonstrated in a group of related beef calves. This type of defect is usually suspected to be a result of an environmental toxin. Pedigree analysis of the particular group of cattle suggested a simple recessive mutation, as there were multiple common ancestors. Based on Chi-Square analysis of qPCR melt curves of genomic sequence, SNAIL family transcriptional Repressor 2 (SNAIL2) was determined to be

significantly different ($p = 0.03$) for HP calves. SNAIL2 codes for a transcription factor that is involved neural crest cell development. This difference supports the hypothesis of a recessive mutation affecting neural crest cell migration and differentiation, creating a genetic form of heterotopic polydontia. qPCR products will be sequence, then a detection assay will be developed for identification of carriers. Creating a proactive genotyping assay to prevent this defect in the future will benefit any affected breeds in the cattle industry.

9. **Systematic supplementation: An abbreviated systematic review and meta-analysis of beef cattle supplementation**
Kyla N. Miller & W. Brandon Smith
Faculty mentor: Dr. W. Brandon Smith
It is often stated that supplementation of beef cattle is a method for inexpensive and efficient production benefits. However, literature disagrees as to where the threshold of diminishing returns exists, and if this threshold is different for different feedstuffs. Without a solid foundation from which to make recommendations related to supplementation, any notion as to its benefit is nothing more than conjecture. Therefore, our objective was to, through a systematic review and meta-analysis, determine the global response of beef cattle to energy supplementation, and to elucidate differences that exist in this response based on feedstock. A brief systematic review was conducted to determine the effects of supplementation on beef cattle. This systematic review was broad in scope, and the specific meta-analysis was used to narrow the focus to only energy supplements. Searches were conducted in AGRICOLA (USDA National Agricultural Library), ProQuest's Agricultural and Environmental Science Collection, GALE's Agriculture Collection, and ProQuest's Agriculture Science Database. Boolean phrases were narrowed to eliminate publications not published in English and those that do not focus on beef cattle. References were narrowed to include only those unique publications (no duplicates) that measured production parameters and only those that dealt with commodity feedstocks (eliminating references to probiotics and minerals). Response data was recorded from each remaining publication. Data were analyzed using the generalized linear mixed models of SAS v. 9.4 to determine the global response of beef cattle to energy supplementation.

10. **Development of a triplex quantitative PCR assay for avian retroviruses**
Faith Cox, Jaime Merril, Tory Perlichek, Jason Hardin, & Dustin Edwards
Faculty mentor: Dr. Dustin Edwards
Reticuloendotheliosis virus (REV) an immunosuppressive avian retrovirus that infects Galliformes, Passeriformese, and Anseriformes. REV infects B cells, a component of blood. Once infected, REV establishes a lifelong infection. Modern REV testing utilizes a duplex quantitative polymerase chain reaction technique (qPCR) developed by the Texas Veterinary Medical Diagnostic Laboratory. We modified this technique to a triplex TaqMan qPCR assay to test simultaneously for REV and an emerging avian retrovirus, lymphoproliferative disease virus (LPDV). LPDV has not yet been tested for in Texas, but has been found in neighboring states. We designed an amplification for pan-avian GAPDH as a cDNA extraction control, REV env, and LPDV env genes to test for viral infection. Primers and hydrolysis probes were designed using software to determine targeted conserved regions of the DNA. GAPDH and REV probes have double nonfluorescent quenchers to reduce false positives. LPDV probe was designed as single non-fluorescent probe. Target duplexed DNA sequences were ordered to act as positive amplification controls and serial diluted to known concentrations to act as a standard curve ranging in 1x108 to 1x101 molecules/μL to quantify proviral DNA in blood samples. Reaction conditions and primer-probe concentrations were optimized and reactions performed in triplicate.

11. **Discovery and isolation of microbacteriophage Balloony**
Abigail Quirl, Jocelyn Hodges, Abigail Ballard, Faith Cox, & Dustin Edwards
Faculty mentor: Dr. Dustin Edwards
Antibiotic resistance is increasing in prevalence, challenging current treatments for bacterial infections. Bacteriophages, viruses that infect bacteria, offer a potential solution to the issue. Bacteriophage Balloony was isolated in a soil sample collected from a compost pile in Morgan Mill, Texas using Microbacterium foliorum NRRL 24224 SEA as a host. Following two rounds of serial dilutions and plaque assays, Balloony produced round clear, medium plaques with clear edges revealing a lytic life cycle. Negative-staining Transmission Electron Microscopy (TEM) revealed a siphoviridae morphotype with a long, non-contractile tail estimated to be 100 nm and an icosahedral capsid which appears to be 50 nm in length. DNA was extracted and measured at 23 ng/μL by NanoDrop spectrophotometric reading, with the graph peaking over 230 nm rather than 260 nm due to excess amounts of salts. Balloony was archived at Tarleton and at the Pittsburgh Bacteriophage Institute at a titer of 8.4×10^{10} pfu/mL.

12. **Discovery and isolation of microbacteriophage Titoz**
Gustavo Vazquez, Samuel Munoz, Faith Cox, & Dustin Edwards
Faculty mentor: Dr. Dustin Edwards
Bacteriophages are viruses that infect bacteria. As bacteria mutate and become resistant to modern day

antibiotics, alternative therapies must be explored. Bacteriophages may serve as a potential solution to be administered to patients with bacterial infections. Bacteriophage Titoz was isolated from an enriched soil sample using Microbacterium foliorum NRRL B-24224 SEA at 29° C. Soil was collected from underneath a hay bale on a farm in Dublin,Texas. Two rounds of serial dilutions and plaque assays showed a 4-5mm plaque morphology that consisted of uneven large circular rings. Negative-staining Transmission Electron Microscopy (TEM) showed siphoviral morphology, containing a 150 nm non-contractile tail and a 55 nm diameter isometric head. DNA extraction was unsuccessful. Titoz was archived at Tarleton and the Pittsburgh Bacteriophage Institute archives at a titer of 2×10^{10} pfu/mL.

13. **Discovery and isolation of microbacteriophage Virsces**
Alondra Martinez, Joanna Gonzalez, Faith Cox, & Dustin Edwards
Faculty mentor: Dr. Dustin Edwards
Bacteriophages are viruses that infect bacteria and offer an alternative treatment to antibiotic resistant infections. Virsces is a siphoviral bacteriophage directly isolated using Microbacterium folirum NRRL 24224 SEA as a host. Virsces was collected from a soil sample underneath a hay feed sack at 29° C in Stephenville, Texas (31.955552 N, 98.327712 E). Following two rounds of serial dilutions and plaque assays, Virsces produced opaque plaques clustered closely together ranging in different sizes. Virsces was imaged through a transmission electron microscope and shown to have a 125nm non-contractile tail and a 45nm icosahedral capsid. Phage DNA was extracted then characterized with restriction enzymes Hae II, Hind III, Nsp I, Sal I, Sac II and loaded on a 0.8% agarose gel. Gel electrophoresis was inconclusive. Virsces was entered into the Actinobacteriophage Database and archived at Tarleton and at the Pittsburgh Bacteriophage Institute at a titer 1.3×10^{9} pfu/mL.

14. **Discovery and isolation of microbacteriophage Wednesday**
Samantha Conger, Faith Cox, & Dustin Edwards
Faculty mentor: Dr. Dustin Edwards
We isolated novel bacteriophages, viruses that infect bacteria and are a potential novel therapeutic for antibiotic resistant infections. Actinobacteriophage Wednesday was isolated by incubating a soil sample taken out of a compost bin in Morgan Mill, Texas with host Microbacterium foliorum NRRL 24224 SEA at $29^{o}C$. Following two rounds of serial dilutions and plaque assays, Wednesday produced medium to large-sized lytic plaques. Negative-staining Transmission Electron Microscopy (TEM) showed Wednesday to have Siphoviridae morphology with an non-contractile tail approximately 100nm long and an icosahedral capsid approximately 50 nm in diameter. DNA was extracted using a zinc chloride method and digested with the restriction enzymes HaeIII, HindIII, NspI, SacII, SalI and resolved on a 0.8% TBE agarose gel. Sequencing by the Pittsburgh Bacteriophage Institute was unsuccessful, but indicated a possible unknown modification to the viral DNA. Wednesday was archived at Tarleton and the Pittsburgh Bacteriophage Institute at a titer of 6.67×10^{10} plaque forming units per mL.

15. **Isolation and annotation of microbacteriophage Fizzles**
Skyler Adams, Gabrielle Spotz, Faith Cox, & Dustin Edwards
Faculty mentor: Dr. Dustin Edwards
Bacteriophages are a potential novel treatment for bacterial infections. Bacteriophage Fizzles was directly isolated from host Microbacterium foliorum NRRL 24224 SEA incubated with a soil sample from an ant nest in Stephenville, Texas. Following two rounds of serial dilutions and plaque assays, Fizzles formed small, lytic plaques with turbidity throughout the plaque. Negative-staining transmission electron microscopy showed Fizzles has Siphoviridae morphology with an approximate tail length of 150 nm and capsid diameter of 50 nm. Phage DNA was extracted with a modified zinc chloride precipitation method and then sequenced to 2719-fold genome coverage by the Pittsburgh Bacteriophage Institute using Illumina Next Generation Sequencing to determine a double-stranded DNA genome of 62,078 base-pairs that contains direct terminal repeats of 181 base-pairs. Whole-genome sequence analysis using a suite of bioinformatic software revealed Fizzles has 68.2% G+C content and 104 protein-coding genes transcribed rightwards (48.1% of genome) and leftwards (51.9% of genome), and encodes for structural proteins, histidine triad nucleotide binding protein, hydrolase, MazG-like nucleotide pyrophosphohydrolase, HNH endonuclease, RuvC-like resolvase, DNA primase/helicase, RecA-like DNA recombinase, and nucleotide pyrophosphohydrolase. Fizzles is a cluster EG bacteriophage and most closely related to Microbacterium phages Squash and Margaery.

16. **Application of biomolecules for the absorption of crude oil from ocean surface water**
Kholton Tidwell-Courtney & Colton Breitenbach
Faculty mentor: Dr. Rajani Srinivasan
The properties of plant-based polymers were observed and compared to the properties of polyacrylamide, a synthetic polymer, by means of experimentation. When polyacrylamide degrades in the environment it turns into acrylamide, a substance linked to birth defects, cancer in animals, and nerve damage. The purpose of these experiments was to study the efficiency of biopolymers for crude oil removal and compare the results

with polyacrylamide. This study was done to estimate the practical application of biopolymers in removing crude oil from ocean surface water. Crude oil was injected into several different containers of water and each treated with a different polymer (polyacrylamide, fenugreek, or psyllium) or used as a control group then the percent oil removal was calculated. A time trial for all experiments was conducted to determine the minimum amount of time for the polymer treatments to adsorb to the crude oil. The biopolymers, fenugreek and psyllium, were able to surpass the crude oil sorption of polyacrylamide and achieve it in the smallest time frame; but the maximum efficiency of each polymer was not discovered in the experiments conducted. Psyllium has the highest percent oil removal of the biopolymers observed in previous experiments, rationalizing the inclusion of more polymers with similar functionality will be explored.

17. **Measurement of urinary sulfate levels in horses and pigs**
Bethany R. Rothrock, Shea A. Andrews, John D. Goode, & Linda D. Schultz
Faculty mentor: Dr. Linda Schultz
Using a Conductometric Titration Method Sulfur is an essential element for mammals, although the body cannot utilize sulfate salts as a source. Sulfur need is met by ingestion of sulfur containing proteins, which produce sulfate upon breakdown. This sulfate ion is a major electrolyte in body fluids such as serum and urine. Urinalysis is a noninvasive technique for diagnosis and evaluation of many disease states, although sulfate is seldom measured because urine is a complex mixture containing potentially interfering substances. The best standard method currently available is ion chromatography (IC), which is costly and not widely available. Our laboratory has measured sulfate levels in artificial urines using conductometric titration (CT), which is simple and inexpensive, with good results. This study has been expanded to include domestic animals which can provide adequate urine volumes to evaluate CT as an alternative method. A group of mixed breed pigs and a group of primarily quarter horses were studied. Analysis was complicated by high phosphate levels in pig urine, but this was successfully removed by precipitation as magnesium ammonium phosphate prior to sulfate titration. Horse urine samples contained no phosphate, but some samples contained high carbonate levels, which were measured by titration with acid. Results were verified by IC.

18. **No-slip billiards with gravity**
Bethany Rothrock, Hakiem Grant, Christopher Cox, & Scott Cook
Faculty mentor: Dr. Scott Cook & Dr. Christopher Cox
The mathematical billiard model of colliding particles has been widely studied for over a century. It continues to provide new insights into dynamical systems and inform applications from quantum billiards to diffusion of gases to robot motion planning. Recently, an alternative "no-slip" billiard model has arisen that introduces a mechanism for exchange of linear and angular momentum within rigid body collisions. Though standard billiards have been studied extensively in the presence of external forces, little is known about no-slip billiards under force. We give new experimental and analytic results for no-slip billiards under external force, modeling systems with gravity. This work was done in summer 2019 in the Computational Mathematics at Tarleton (CMAT) National Research Experience for Undergraduates Program (NREUP) sponsored by the Mathematical Association of America.

19. **A predator-prey model for largemouth bass and channel catfish**
Trace Patterson
Faculty mentor: Dr. Christopher Mitchell
Largemouth bass and Channel catfish are considered highly common freshwater sport fish. They are highly-populated and can be found in almost any lake in Texas. They tend to be overfished and must be restocked in order to attract fishers. The goal of this project was to create a model to analyze the predator-prey relationship between these two types of fish and determine how best to find populations at healthy levels. The data used has been taken from several sources and uses averages from the studies to fit to the differential equation model. With this data, equilibria are found and analyzed to determine parameter ranges where co-existence is possible. Future work will include introducing water level/water quality to the pond to see how the overall health of the pond effects the fish populations.

20. **Exploring the relationship between aphrodisiac and anti-aphrodisiac chemicals in a model for**
Pieris brassicae **and the Trichogramma wasp**
Dashon Mitchell, Abigial Ballard, & Aurod Ounsinegad
Faculty mentor: Dr. Christopher Mitchell
This presentation will focus on the interactions between two insects the large cabbage *Pieris brassicae*, and the Trichogramma wasp. Females butterflies produces an aphrodisiac that help them attract a mate so they can reproduce and lay eggs. However, this can attract too many males. So to counter this, males produce an anti-aphrodisiac which discourages other males from trying to reproduce with the same butterfly. However, certain species of wasp can detect this anti-aphrodisiac, using the trail to find where the female butterflies lay their eggs in order to parasitize the eggs. In order to study the relationship between these two chemicals and their effect on the interactions between the species, a system of differential equations was used. The

model results show that there are levels of anti-aphrodisiac consistent with the literature which allow for co-existence of both species. The effects of too much of each chemical was also explored, showing how each species can drive the other to extinction. The next steps are to improve the model by including environmental changes, and more species.

21. **Parameter estimation and simulation of bacteriophage infection model**
Abigail Ballard
Faculty mentor: Dr. Keith Emmert
Bacteriophages are a class of viruses that infect and destroy bacteria. For this reason, they are an emerging focus in research due to their potential use in treating antibiotic resistant bacterial infections. Tarleton State University, as part of the international HHMI SEA-PHAGES bacteriophage discovery program, is working on an interdepartmental project between the biology and mathematics departments to create a mathematical model for the complexity of bacteriophage infection of host cells. A system of $4n + 1$ differential equations were derived to model these interactions. This system of equations was then used to simulate results for the infection outcomes of the different populations. These results were then evaluated in search of equilibria for populations in a given parameter space. It is our hope that these simulated equilibria can be used to identify infection outcomes for bacteriophages used in clinical settings to speed up testing before usage and effectively improve patient outcomes.

22. **An examination of the effects of nano-engineered materials on bacterial growth and kinetics**
Lucas Ringo & Lynal Albert
Faculty mentor: Dr. Lynal Albert
Nanotechnology has revolutionized technology and innovation in a wide range of fields including environmental engineering, biomedical engineering, textiles, food processing, cosmetics and pharmaceuticals. The recent surge in the use of engineered nanoparticles may pose a threat to living organisms and the environment thus causing them to be identified as emerging contaminants of concern. Moreover, as nanoparticles promise further advancement and progress in these and many other fields the likelihood of producing more engineered nanoparticles in the future is certain. These nanoparticles will eventually be released into the environment and can become potential pollutants. Our research goal is to study the effect of the most predominantly used engineered nanoparticles on the growth and survival of microorganisms. Adverse effects if present can trigger an imbalance in ecosystems and may affect even higher forms of life including humans. Growth kinetics and survival of bacteria are both key parameters that are being examined experimentally. The results of this study can serve as a fundamental basis in the selection of nanoparticles for various applications and also in the safe design and engineering of nanoparticles.

23. **Fluid flow through pipes**
Samuel Oyeleye
Faculty mentor: ???
This project aims to formulate computational fluid dynamic (CFD) models capable of illustrating turbulent flow in selected pipes, and then calculating the pressure (in meters) drop at designated entry and exit flow areas. The result is then compared with experimental result to see if they match.

24. **Light curve analysis of Asteroid 3017**
Arthur Alvarez & Michael Hibbs
Faculty mentor: Dr. Michael Hibbs
The goal of the research was to define the spin rate, shape, and size of asteroid 3017. Data was collected during the few weeks in August/September 2019, using Tarleton's 0.81 m telescope to collect the light intensity changes over time. Detailed light curves were constructed, analyzed, and compared with similar data collected at Tarleton when this asteroid was last in opposition with Earth, July 2014. In addition, data was taken using B, V, and I standard broadband filters to see if it was possible to asteroid taxonomy or surface composition.

25. **Light curves of three asteroids**
Colleen DePaola & Michael Hibbs
Faculty mentor: Dr. Michael Hibbs
There is a massive disparity between the number of identified asteroids and those which are fully characterized. The most useful method of characterization available today is light curve photometry. These Light curves were obtained using Tarleton's 0.81 m telescope. Data analysis was used to determine the astrometry (orbital position) and spin rate.

26. **Mental health and its associated comorbidities**
Chelsea Mowles
Faculty mentor: Dr. Subi Gandhi
The public health burden of mental health is rising in the United States, which may be an indication of a lack of care for those with this condition. Evidence suggests that more than fifty percent of patients

diagnosed with mental disorders have one or more chronic medical conditions such as diabetes and cardiovascular disease. Alternatively, there is evidence that those with chronic medical conditions are at risk for the development of mental disorders. Numerous risk factors have been linked to both mental disorders and chronic conditions including, childhood trauma, excessive and chronic stress, and low socioeconomic status. This study aims to highlight the intimate relationship that exists between mental health disorders and other chronic conditions and explain their close relationship with health behaviors, particularly substance abuse. This study further underscores the fact that it is important to design interventions and make policy recommendations that target mental health, chronic conditions, and substance abuse behaviors collectively for the significant reduction of morbidity and mortality associated with these health outcomes.

27. **A comprehensive study of parasites of the Texas state bison herd**
SaraBeth Boggan, Kristin Herrmann, Donald Beard, & Heather Mathewson
Faculty mentor: Dr. Heather Mathewson & Dr. Kristin Herrmann
Parasites can have a significant effect on the typical growth and weight gain of any species, in our case we are evaluating Bison. Texas Parks & Wildlife Department (TPWD) biologists are charged with the management of the Texas State Bison herd at Caprock Canyons State Park, Briscoe County, Texas, and base their management plans on restoring native prairies to preserve the historic herd. To improve their management plan, we have started a comprehensive study of the micro and macro parasites of the herd. The objectives of this study are to 1) determine the presence and prevalence of micro and macro parasites, 2) identify the species of micro and macro parasites present, and 3) determine if treatment of the herd for parasites is necessary in the Texas State Bison herd. We will collect fecal samples from a treatment and control group of cows and juveniles. For this study, TPWD biologists will not provide treatment to 50% of tagged females during the winter and summer treatment months, thus allowing them to serve as controls. We will test all samples using the Modified McMaster test. Thus far, preliminary results have suggested the presence of Coccidia, Trichostrongylus spp., and Moniezia spp. Findings from this study will provide TPWD with data concerning the presence and prevalence of micro and macro parasites found in the herd.

28. **Grazing effects of bison on native plant and insect diversity**
Molly Koeck, Adam Mitchell, Heather Mathewson, & Donald Beard
Faculty mentor: Dr. Heather Mathewson
A remnant herd of Southern Plains Bison (Bison bison) is preserved at Caprock Canyons State Park (CCSP) in Briscoe County, Texas. Caprock Canyons State Park bases their management plans on preserving native Texas prairies for their bison herd. Our goals are 1) to identify the effects of bison grazing at CCSP on native plant and insect diversity and 2) to assist TPWD with determining ecological carrying capacity of the CCSP bison herd. In 2018, 20 3x3-m grazing enclosures were set up at random locations in the state park. We will use a paired design by selecting a 3x3-m grazed area proximate to the enclosure that represents similar soil and topography. At both grazed and ungrazed areas, we will survey vegetation using Daubenmire quadrat frames to determine plant diversity, litter depth, and abundance. We will use a Robel pole to measure grazing restraint, which is represented by plant height. For woody vegetation, we will use a point-centered-quarter method to determine density of woody vegetation. We will survey for arthropods using pitfall traps and bee bowls to target pollinators and dung beetles. The data collected from this research will be used to produce a TPWD management plan for CCSP.

29. **Predator detections associated with northern bobwhite nests and mortality locations**
Brandon Consalus, John Palarski, & Heather Mathewson
Faculty mentor: Dr. Heather Mathewson
Northern bobwhite (Colinus virginianus; hereafter bobwhite) is an upland nesting galliform most commonly found in the southern regions of the United States. Recent estimates suggest that bobwhite populations are declining at 4% per annum. A large contributor to bobwhite mortality is predation. Our objectives are to 1) asses meso-predator abundance on a 1011 ha site in the Cross Timbers ecoregion of Texas where 167 bobwhites were recently reintroduced, and 2) evaluate change in meso-predator land use throughout the bobwhite breeding season. As the bobwhite breeding season progressed throughout 2019, we recorded the number of meso-predator sightings at each camera location, GPS coordinates of bobwhite mortalities, and GPS coordinates of both successful and unsuccessful nest sites. Findings from this study will illuminate how meso-predator abundance changes in response to an influx of wild bobwhite.

30. **Recreationist effect on bison movement through a state park**
Cody Carter, Daniel Wilcox, & Heather Mathewson
Faculty mentor: Dr. Heather Mathewson
Recreational use in state parks can affect mammalian carnivore movement on the landscape. Caprock Canyons State Park (CCSP) is a leading influence in Texas ecosystem restoration efforts. CCSP managers focus heavily on restoration and conservation efforts of wildlife and natural resources within the park. CCSP has successfully reintroduced American bison (Bison bison), black-tailed prairie dog (Cynomys ludovicianus),

and restored large areas of mesquite and juniper dominated brushland to prairie habitat. The objective is to examine the effects of human recreation on the distribution of predators on the property. In 2017 we began monitoring movement of medium and large mammals using 15 scent stations and game cameras located 30m from hiking trails. In 2019 we distributed 15 cameras along the hiking trails paired with each of the scent stations. The camera traps were placed perpendicular to the trails in order to measure trail use by humans. We will examine changes in predator detections at scent stations to changes in trail use. Which will give us an estimate on how recreational trail use effects movement of the mammalian carnivores. This data will help us determine if humans on the landscape effect the predator movement.

31. **Short-term movements of translocated northern bobwhite in central Texas**
Elizabeth Brogan, John Palarski, Heather Mathewson, Bradley Kubecka, & Dale Rollins
Faculty mentor: Dr. Heather Mathewson
The decline of the northern bobwhite (Colinus virginianus; hereafter bobwhites) has resulted in local, regional, and statewide extirpation across its range. Within the Cross Timbers ecoregion of Texas, this decline is evident and remnant populations exist across a fragmented landscape. To reverse this decline, translocation has emerged as a possible solution to restock remnant populations in restored habitat. Site fidelity post-release is crucial to the success of a translocation effort. Although mostly sedentary, bobwhites possess the ability to make large movements which can lead to decreased survival over time. In April 2019, we released 167 wild-trapped bobwhites on a 1,011 ha area in Erath County, Texas. We fit 5 males with backpack-style GPS transmitters. Our objective was to describe short-term movements of translocated bobwhites. The GPS transmitters obtained daily fixes at 0800, 1530, 1930, and 2200 hrs CST for 3 weeks post-release. These times were selected to represent morning foraging, afternoon loafing, evening foraging, and roosting. Moreover, this information allowed us to monitor initial movement patterns of translocated bobwhites upon release. Individual core home ranges varied from 2.70 to 12.28 ha for all 5 birds, and they did not move more than approximately 400 m from their release site.

32. **STEAMing up content with an integrated approach**
Britney Torres & Chrissy Inchausti
Faculty mentor: Dr. Erin Pearce
STEM (science-technology-engineering-mathematics) education is becoming more prevalent in science classrooms across the United States of America; however, many students are being taught STEM components separately instead of in an integrated approach. For STEM to be most effective, inquiry-based learning and problem- based learning must be implemented. The purpose of this study is to identify the effects (if any) that an undergraduate-created science-technology-engineering-agriculture-math (STEAM) integrated unit had on middle school student achievement. Prior to instruction, the undergraduate team created a content assessment that was validated by experts. This pre-test over content was administered prior to instruction. Five lessons were taught to students in a science classroom using an integrated STEAM approach. Following the lesson, the middle school students took the post-test. Data was collected and analyzed using a paired t-test. The resulting p-value was less than 0.05, suggesting that the students' content knowledge increased after the STEAM lessons.

33. **Student interest in integrated STEM education**
Aleesha Barrett & Veronica Rivera-Comas
Faculty mentor: Dr. Erin Pearce
The importance of STEM (science, technology, engineering, and math) in classrooms is gaining attention across the country. Many teachers attempt to implement this style of education into their classroom; however, these attempts often do not incorporate each element of STEM education effectively. This research study was designed to test if an integrated approach to STEM education would increase students' interest in STEM. The research was conducted in a seventh-grade class over the course of five days at a local middle school. An interest survey was given both before and after the STEM unit. Each day that research was conducted in the seventh-grade class, a member of the research team was responsible for teaching an integrated STEM lesson. This unit involved lessons over various natural disasters.

34. **Perceived wellness of college professors, faculty and staff**
Molly Fenoglio & Andrew Wolfe
Faculty mentor: Dr. Andrew Wolfe
With the current rise in obesity, researchers are placing greater importance on overall wellness. The World Health Organization defines wellness as a state of complete physical, mental and social well-being, and not merely the absence of disease or infirmity. Wellness is thought to be a crucial component to living a higher quality of life, previous studies suggest that physical activity could play a large role in overall perceived wellness. However, current research does not dive deeper into the impact physical and psychological activity has on overall wellness. Purpose: The purpose of this research was to determine the effect physical activity has on the perceived wellness of college professors, faculty and staff. The participants were asked to complete

the Perceived Wellness Survey, a 36-item, 6-point Likert scale assessment from 1. "Very strongly disagree" to 6. "Very strongly agree". This assessment measures the following 6 dimensions of wellness, physical, psychological, social, emotional, intellectual and spiritual with 6 questions for each dimension. A Pearson correlation was used to determine the relationship that the psychological dimension had on the physical, emotional, spiritual, social and intellectual dimensions. There were 49 participants in the sample. The sample self-reported that physical wellness significantly correlates with psychological wellness ($r = .290$, $p = .043$, $n = 49$). However, physical wellness does not significantly correlate with the remaining 4 dimensions. The psychological dimension significantly correlates with the emotional dimension ($r = .344$, $p = .015$, $n = 49$), the spiritual dimension ($r = .510$, $p < .001$, $n = 49$), the social dimension ($r = .499$, $p < .001$, $n = 49$) and lastly, the intellectual dimension ($r = .357$, $p = .012$, $n = 49$). Physical activity is very important in maximizing your overall wellness. The physical dimension may not directly correlate with the other dimensions, however, because it significantly correlates with the psychological dimension and this dimension correlates with all of them, physical activity indirectly impacts the 5 dimensions.

35. **Physical fitness differences between ROTC Ranger Challenge cadets and regular ROTC cadets**
Sarah Matthews, Andrew Wolfe, Matt Laurent, Andi Green, & Ty Hill
Faculty mentor: Dr. Andrew Wolfe
Physical fitness has proven its worth for military personal, as a whole, and individually. A high physical fitness level serves as an influencing variable to completion of special military operation initiation trainings (i.e. BUD/S Training). Consequently, militant whom possess a higher level of physical fitness may gain greater occupational advancement opportunities/placement. Pre-commissioned military programs requiring rigorous physical activity participation, superior to typical physical training (PT), may yield optimal physical capacity for cadets seeking special military operations commission, and/or alternative military placement involving physically demand responsibilities. The fitness level of cadets enrolled in military programs requiring elevated PT standards compared to cadets in "regular" pre-commission programs necessitates examination. The purpose of the current research was to examine the physical fitness levels, according to Army Physical Fitness Test (APFT) results, of the Reserve Officer Training Corps (ROTC) Ranger cadets ($n = 15$) compared to Regular ROTC cadets ($n = 78$). Cadets participated in a 12 week Ranger ROTC training program (undulated resistance training; speed, agility, and quickness training; and high intensity interval ruck training) or 12 weeks of the "regular" ROTC calisthenics (i.e. push-ups, sit-ups, bodyweight squats, long-distance running). Upon completed of the training protocols, an APFT was conducted to identify physical fitness level of cadets. An independent sample t-test ($p < .05$) analyze the mean difference between raw scores, standardized scores, and overall APFT scores of Ranger and Regular cadets. Significant differences were recognized between Ranger and Regular cadets for all aspects of the APFT: Raw 2-minute push-up $t(91) = 4.281$, $p < .001$; Raw 2-minute sit-up $t(91) = 3.842$, $p < .001$; Raw 2-mile run $t(91) = -3.993$, $p < .001$; Standardized 2-minute push-up $t(91) = 3.369$, $p < .001$; Standardized 2-minute sit-up $t(91) = 3.668$, $p < .001$; Standardized 2-mile run $t(91) = 3.857$, $p < .001$; and overall APFT $t(91) = 4.130$, $p < .001$. These results illustrate a drastic difference in physical fitness level among cadets and suggest the elevated fitness level of Ranger cadets may serve as an ample foundation to future military placement and operations.

36. **Sex differences power output at maximal load during the barbell back squat**
Lyndsey McCallister & Andrew Wolfe
Faculty mentor: Dr. Andrew Wolfe
When maximal muscular power outputs are examined relatively, sex differences appear to be non-existent. In terms of absolute power, however, significant differences persist between sexes. In both cases, the majority of metrics are obtained at optimal loads for power outputs. However, little is known in regards to differences in power outputs at maximal strength capacity of men and women. The current investigation aimed to identify sex differences of concentric (C) and eccentric (E) power measures at maximal load of the barbell back squat (SQ). A total of 8 participants (4 men and 4 women) completed one experimental exercise session testing SQ 1-Repetition maximum (1RM) following the National Strength and Conditioning Association 1RM protocol. A Bar Sensei (accelerometer) was attached to the barbell during the 1RM test, and used to collect C and E Average Power (AP), Peak Power (PP), Average Force (AF), Peak Force (PF), Average Speed (AS), Peak Speed (PS), as well as C POP-100, Distance of Movement (DM), and Mass Lifted (ML). An independent-sample t test identified statistically different C PF ($p = 0.04$), C AF ($p = 0.03$), ML ($p = 0.03$), E PF ($p = 0.03$), E AF ($p = 0.03$), E PP ($p = 0.03$) and E AP ($p = 0.047$) between men (C PF 2054.1 ± 825.7 N; C AF 1685.4 ± 630.4 N; ML 367.5 ± 133 lbs.; E PF 1821.7 ± 633 N; E AF 1646.3 ± 597.9 N; E PP 762.4 ± 248.4 W; and E AP 428.5 ± 130.4 W) and women (C PF 940.2 ± 178.3 N; C AF 792.7 ± 143.1 N; ML 178.8 ± 33.5 lbs.; E PF 896.5 ± 138.9 N; E AF 803.5 ± 146.7 N; E PP 361.15 ± 137 W; and E AP 230.6 ± 90.7 W). Contrariwise, no significant differences were indicated for C POP-100 (p=0.39), C PS ($p = 0.95$), C AS ($p = 0.70$), C PP ($p = 0.13$), C AP ($p = 0.19$), DM ($p = 0.46$), E PS ($p = 0.66$), and E AS ($p = 0.93$) of men (C POP-100 $.21 \pm .15$ m/s; C PS $.80 \pm .15$ m/s; C AS $.44 \pm .29$ m/s; C PP 1471.7 ± 727.8

W; C AP 824.9 ± 698.3 W; DM .42 ± .23 m; E PS .52 ± .24 m/s; and E AS .29 ± .11 m/s) and women (C POP-100 .14 ± .04 m/s; C PS .82 ± .44 m/s; C AS .36 ± .23 m/s; C PP 727.8 ± 446 W; C AP 292.6 ± 196.7 W; DM .31 ± .15 m; E PS .45 ± .15 m/s; and E AS .30 ± .10 m/s). These results provide further explanation of sex-differences in power production. The difference in C PF, C AF, ML, E PF, E AF, and E PP complement results of pervious sex-differentiating reports. However, men and women produce C POP-100, C PS, C AS, C PP, C AP, DM, E PS, and E AS at equivalent load percentage provides novelty to the current literature. Further research is needed to explain reasoning of male and female power differences and similarities, and to determine sex-specific training implication for improvement in power performance.

37. **Sex specific responses to perceptually regulated work-to-rest ratios during strength training**
Aaron Rinehart
Faculty mentor: Dr. Andrew Wolfe
Recovery has long been an important training variable, receiving increased attention within the scientific literature. While there has been considerable attention to intersession recovery, less is known about optimizing intrasession recovery. Additionally, growing evidence suggest women may experience relatively less fatigue with greater acute recovery as opposed to men when exercising at similar intensities. However, relatively little is known regarding the impact of self-regulated within session recovery between men and women during resistance training. Therefore, the purpose of the research is to examine the sex specific responses to perceptually regulated work-to-rest ratios during strength training. Participants (n = 14; 7 men, 7 women) completed two sessions. Session one consisted of obtaining each individual's one-repetition maximum (1RM) for squat (SQ) and bench press (BP) using the National Strength and Conditioning Association standardized procedures. Following a minimum of 48 hours of recovery, participants performed 5 sets of 6 repetitions at 80% of their 1RM for SQ and BP (experimental session). Immediately following each set of work (SW), rating of perceived exertion (RPE) using the OMNI RPE scale for resistance training was recorded. Participants utilized the Perceived Recovery Status (PRS) scale to guide their recovery. Participants were instructed that when they reach a 7 (out of 10) begin their next set. Following completion of the SQ participants were given 15 minutes before completing the same procedure for the BP. Results from an 1-Way ANOVA, indicate no statistically different (SQ: SW1 $p = 0.88$; SW2 $p = 0.18$; SW3 $p = 0.53$; SW4 $p = 0.19$; BP: SW1 $p = 0.09$; SW2 $p = 0.07$; SW3 $p = 0.28$; SW4 $p = 0.25$) time to recovery between men (SQ: SW2 109.6 ± 40.4; SW3 136.9 ± 37.4 ; SW4 191 ± 82.5; SW5 178.7 ± 79.7; BP: SW2 137.3 ± 45.9; SW3 173.6 ± 88.3; SW4 170.6 ± 133.5; SW5 194.7 ± 133.1) and women (SQ: SW2 115.6 ± 89.9; SW3 109 ± 36.5; SW4 111 ± 53.9; SW5 122.6 ± 69.4; BP: SW2 94.4 ± 39.3; SW3 102.1 ± 88.3; SW4 109 ± 56.2; SW5 127.4 ± 54.4). However, there was a large effect size of sex time to recovery as calculated by Cohen's d (SQ: SW1 $d = 0.09$; SW2 $d = 0.74$; SW3 $d = 1.19$; SW4 $d = 0.76$; BP: SW1 $d = 1.02$; SW2 $d = 1.15$; SW3 $d = 0.65$; SW4 $d = 0.72$). While no statistical difference was found, the self-selected recovery time between men and women indicated women self-select shorter recovery periods on both SQ and BP, with no differences in volume of work. These findings support the notion that women may experience either relatively less fatigue during exercise or can recovery from similar intensities faster than men. Further work is needed to determine optimal work-to-rest ratios between men and women during resistance training and what implications this may have on training adaptations.

38. **A deeper look into Systems Discontinuance**
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Systems Discontinuance is a crucial step in the Systems Development Life Cycle, but there is very little research available as compared to the other parts of the SDLC. The replacement of a system can be extremely crucial, especially in medical situations where that system could be a matter of life or death (Berinato, 2003). Outdated systems also pose a security threat, such as the recent ending of Windows 7 support. This specific discontinuance includes a cessation of security patches, leaving everyone who still uses this operating system connected to a network extremely vulnerable to cyber attacks. This study takes a closer look into the specific discontinuance practices of successful companies through brief interviews of IT professionals. This study will also give insight and clarity on how discontinuance fits into the SDLC and its relationship with the other steps.