Assessment of Heritage Dexter Cattle for Cow-Calf Performance Traits  
(Abstract/Poster #1601)

The objective of this project is to evaluate an alternative cattle breed for small-scale beef production. The Dexter is a heritage dual-purpose breed from Ireland that is distinctively small in stature. Little is known about their production attributes although Dexters have become popular among small-scale farmers in the US. Over a three-year period, 68 cows (2 to 12 yrs. of age) were managed on the TSU research farm under a low-input, grass-based, spring-calving system at one cow/acre. Across 126 summer cow matings, calving rate was 80% and weaning rate was 74%. Mean calf birth weight was 54 lbs. Calves were weaned at an average 200 days of age. Mean cow weight at weaning was 665 lbs. and hip height averaged 44 in. The average commercial beef cow weighs about 1,300 lbs. Unadjusted calf weaning weights averaged 303 lbs. and 205-d adjusted calf weights averaged 328 lbs. Dam age and calf sex corrections were not applied. Cow efficiency (weaning calf weight: cow weight) was 45% for unadjusted calf weights and 47% using 205-d adjusted weights. Preliminary cow performance data were comparable to values for commercial breeds. This on-going project represents a novel institutional effort to evaluate Dexter cow-calf performance in the US.
Lethality induced by pathogen-blocking bacteria increases with grandmother age
(Abstract #1602)

Wolbachia is a maternally transmitted bacteria currently at the forefront of vector control efforts to combat a variety of arthropod-borne diseases including Zika, dengue, and malaria. These efforts utilize the drive capability of Wolbachia-induced cytoplasmic incompatibility (CI) to spread the pathogen-suppressing wMel Wolbachia into mosquito populations. CI's success as a drive mechanism is the result of embryonic lethality that an infected male induces when his modified sperm fertilizes an uninfected egg. Wolbachia-infected eggs, however, are rescued from this lethality and thus hold a fitness advantage that encourages Wolbachia's spread. Despite control of the numerous factors affect the penetrance of CI-lethality, wMel-induced CI remains highly variable, significantly inhibiting its study. Here, we demonstrate that paternal grandmother age critically impacts the strength of wMel-induced CI in D. melanogaster. Specifically, older virgin females have higher Wolbachia titers than their younger siblings and resultantly load more Wolbachia into their infected sons that induce stronger CI. We term this result the Paternal Grandmother Age (PGA) effect and discuss implications for continued research on the genetic and functional basis of CI and the wMel infection in D. melanogaster.
Maia Harley
Senior
Biology
Tennessee State University
Dr. Dafeng Hui

*The Vulnerable Population to Climate Changes (Abstract/Poster #1603)*

A vulnerability is a feeling no individual or group of people would ever like to feel. World disaster, poverty, and several other circumstances can lead to the unfortunate state of vulnerability. One of the most vulnerable populations in America and worldwide are victims of disasters such as extreme drought and flooding. For example, many residents in Houston were affected by Hurricane Katrina, particular the low-income families. Many of those are African-American families who have lived in low-land, flood-prone areas. These people are one of the world’s most vulnerable populations because of the higher chance of them being affected by unforeseen disasters, than people who reside in different locations. Those low-income families may not have enough funds to take care of diseases, especially during the flooding caused by climate change. People have issues finding resources and thriving in their circumstance because of their vulnerability. In this case, people can no longer live in fear of danger when they may not be able to financially support having healthcare or health insurance. Universal free health care is potentially sustainable by the government, and the positives outweigh the negatives when considering maintaining people's health and safety.

Andy Watkins
Sophomore
Biotechnology Technician
Southwest Tennessee Community College
Dr. Juliann Waits

*External morphological variation in Thomomys sp. from California (Abstract/Poster #1604)*

Populations of *Thomomys* sp. in California have been assigned to several species, mainly because they have variable habitat preferences and rarely overlap. The distribution of *Thomomys* ranges from southern Oregon south into Chihuahua, Nuevo Leon, Sinaloa, Sonora, and Baja California. External morphological variation was analyzed using body measurements - total length, tail length, hind foot, and ear. Morphological measurements of each sex were compared. Specimens showed considerable variation in external morphology.
Application of Control Algorithms to a 3-RPR Parallel Manipulator Mechanism (Abstract/Poster #1605)

The objective of this research was to apply the developed control algorithms for robotic mechanisms to the 3-RPR robotic mechanism. The 3-RPR Parallel Manipulator (PM) is a specific type of robotic mechanism that has three robotic arms attached to an end-effector which can complete various tasks within a 2-D workspace. The specific control algorithms applied to the 3-RPR include the forward and inverse kinematics, a singularity analysis, a workspace calculation, and a singularity-free workspace calculation, where these control algorithms allow an end-user to effectively plan work paths for the 3-RPR’s end-effector based upon their outputs. These control algorithms are to eventually be implemented into a previously constructed 3-RPR PM system, which will act as a lecture aid and framework for other departmental research for the MTSU Engineering Technology department.
Brittany Anderson  
Senior Biology  
LeMoyne-Owen College  
Dr. Moniruzzaman Syed

*Preparation and Characterization of Nano Crystalline Silicon Thin Film using Sol-Gel Method (Abstract/Poster #1606)*

Nano silicon powders were prepared by an elongated period grinding and subsequently mixed in sol-gel of Tetraethylorthosilicate and ethanol solution. The silicon dioxide films synthesized from the sol-gel solution were preliminary studied in the term of the optical property as a refractive index (n) by varying the aging time. By using a Fourier transform infrared spectroscopy technique, the obtained x-composition values of the SiOx films were extended from 1.1 to 1.98 with increasing time of the aged sol-gels. The prepared films from the precursor of nano-silicon powder suspension were characterized by Raman spectroscopy, XRD, AFM, and SEM measurements in order to obtain more understanding of the chemical composition and silicon nano-crystallite quality, respectively. AFM and SEM measurements suggest that we successfully achieved crack free SiO\textsubscript{2} buffer layer with homogeneous grain distribution at a higher aging time. It is also suggested that the diameter of NC-Si dot and the average grain size were estimated around ~ 8.33nm and ~ 5.4 nm respectively. Presenting the spectral broadening and the frequency downshifting from 525.35 cm\textsuperscript{−1} was caused by the quantum size effect.
Highly Piezoelectric PVDF Powder: Mechanochemical Synthesis and Characterization
(Abstract/Poster #1607)

The transformation of PVDF from its non-piezoelectric to piezoelectric phase has attracted a lot of study among researchers. With different methods exploited to obtain the piezoelectric PVDF phase such as: crystallization from melt, annealing at high pressure, stretching at low temperature and poling with the application of high electric field, a direct and more effective processing route could be achieved using the planetary ball-milling process, whereby mechanical energy can be used to manipulate a chemical reaction. In this work, we report on the direct mechanochemical synthesis and characterization of piezoelectric β-phase PVDF from the commercial PVDF mixture by high-energy ball milling dry process. A methodical evaluation of the ball-milling parameters, specifically the changes in rotational speed and time duration would elucidate the mechanism of the phase transition reaction. The characterization results of the obtained product via XRD, micro-Raman, and SEM will also be discussed.
Effects of Precipitation Changes on Leaf Chlorophyll Content: Multiple Approaches
(Abstract/Poster #1608)

Precipitation will have a significant influence on plant growth and leaf characteristics. Leaf chlorophyll content as an important indicator of leaf N status could be significantly influenced by precipitation. How switchgrass leaf chlorophyll content is influenced by precipitation has not been well investigated. In this study, we set five different precipitation treatments from drought to ambient and to wet, and measured leaf chlorophyll contents using four different methods. Three chlorophyll meters (SPAD-502, CCM 200 and At-Leaf) and one destructive spectrophotometric method were used to measured switchgrass leaf chlorophyll contents under different precipitation treatments. We found significant correlations between the readings of SPAD-502 and At-Leaf but the readings of CCM 200 were lower and had no correlations with SPAD-502 and At-Leaf. We are comparing the meter readings with the spectrophotometer measurements and will determine which meter provide the best fit. Further studies will be conducted to investigate the measurements at different plant growth stages.
Dimensional attention learning for working memory (Abstract/Poster #1609)

The human brain contains a working memory (WM) system that supports learning while performing tasks. One of WM’s essential functions is focusing attention on different stimulus dimensions in the presence of distractions. The Working Memory Toolkit (WMtk), a software library, was developed to assist in integrating an artificial neural network (ANN) based WM into robotic systems by attenuating the details of ANN design and providing a simple symbolic encoding interface. Training the neural nets in the WMtk is rendered difficult when faced with distracting stimuli. As a resolution, we developed a biologically inspired attention filter to help the neural net distinguish between stimuli. We created an alternative tabular implementation of the value function to ensure that implementation is feasible and to determine the source of problems in the neural network. The tabular value function was found to be able to solve such problem despite the distractions. Our results suggest this is due to the precise nature of tables compared to the approximate nature of neural networks.

Lipase Responsive Releases of Antibiotics from Cross-linked Chitosan Particles
(Abstract/Poster #1610)

Targeted drug delivery system provides an effective method of delivering a high concentration of antibiotics to treat an infected area with lower toxicity to surrounding tissues compared to systemic delivery. Chitosan, a biodegradable polymer derived from chitin, has versatile uses and can be used as a drug delivery vehicle for antibiotics. When cross-linked with polyethylene glycol dimethacrylate, nanoparticles can be formed in a water-in-oil emulsion. Lipase, an enzyme that breaks down fatty acids and lipids, breaks down ester bonds in the cross-linked chitosan beads, which may serve as a bacteria responsive system to release the antibiotics. The aim of this study was to measure the elution of the antibiotic Vancomycin over an eight-day period with various concentrations of Lipase added at days 2, 5, and 7. The goal was to see if adding lipase would cause more Vancomycin to elute in comparison to days without lipase added.
DNA double-stranded breaks (DSBs) within a chromosome can be deleterious in maintaining genome stability. Rarely, de novo telomere addition occurs in which the enzyme telomerase adds telomere sequences at the DSB. Certain locations in the yeast genome, called Sites of Repair-Associated Telomere Addition (SiRTAs), incur de novo telomere addition at higher than normal frequencies following a DSB. Telomere addition at these sites is mutagenic since it results in terminal deletion but may also prevent chromosome loss in the face of an otherwise unrepaired DSB. We describe a method to identify and characterize SiRTAs that utilizes CRISPR to insert potential SiRTAs in a standardized location. This approach allows any sequence to be assayed for its ability to support telomere addition at a DSB. In analyzing cells that had amplified the SUL1 gene in response to sulfate deprivation, multiple independent chromosome rearrangements were identified in which a new telomere seemed to be added within TTG-rich repeats of the SNF5 gene (Eng, Dunham, and Brewer, unpublished data). Using the standardized approach, we show that this region of SNF5 is a hotspot of chromosome truncation following a DSB, suggesting that this sequence promotes the resolution of complex chromosome rearrangements through de novo telomere addition.
The Tumor Metastasis Suppressor CD82 Localizes to the Perinuclear Region of MDA-MB-231 and Du145 cells (Abstract #1612)

The intracellular trafficking of proteins determines its function and overall fate. The metastatic tumor suppressor CD82 is found on the plasma membrane and within intracellular compartments in the cell. CD82, a tetraspanin, is also known to sequesters other membrane-spanning proteins into Tetraspanin Enriched Microdomains, TEMs, and is thought to influence their trafficking and function. To our knowledge, the intracellular trafficking route of CD82 has not been determined. The objective of this project was to determine the intracellular trafficking route of CD82. We used the steady-state staining technique to determine the overall distribution pattern of CD82 distribution within the cancer cells. The systems that we used included the metastatic breast cancer cell line MDA-MB-231 that express endogenous wild type CD82 and the metastatic prostate cancer cell line Du145 CD82 wild type transfectants. In both the DU145 CD82 WT transfectants and MDA-MB-231 cancer cell lines, we found that CD82 localizes to the perinuclear region of the cell. These findings suggest that CD82 localization may be similar, if not the same, in different types of cancer. We also discovered that the confluency conditions of the cells determine the localization of CD82 in the DU145 CD82 WT cells. These findings suggest that CD82 localization may affect the protein function.
Several cancers are known to develop when the body’s normal mechanism stops working. Multiple treatments have been developed to fight those cancers and the survival rates are improving. However, patients whose cancers metastasize are not as fortunate. The metastasis suppressor CD82/KAI1 is a member of the Tetraspanin superfamily of glycoproteins that suppresses metastasis by multiple mechanisms. In this study, we investigated the effect that transfected CD82 WT has on the prostate cancer cell line Du145 and to confirm the effect of CD82 WT in the breast cancer cell line MDA-MB-231. For this study, we used to scratch assay technique. The results were analyzed and suggest that CD82 inhibits cell migration. However, more studies need to be performed to determine if there is a significant inhibition.

CpG Methylation Inhibits Prolidase Promoter Driven Transcription
(Abstract/Poster #1614)

Prolidase, a cytosolic exopeptidase, is encoded by the PEPD gene in humans. Prolidase is the only enzyme which can cleave dipeptides containing hydroxyproline and plays an essential role in protein metabolism, collagen turnover, and matrix remodeling. In initial studies, we observed a dense CG-rich portion around the transcription start site, suggesting a possible role of promoter methylation in transcriptional regulation. From the human genome, we cloned the human PEPD promoter and inserted it into a luciferase reporter construct. Next, we performed in vitro methylation of the promoter using SssI methyltransferase which methylates DNA CpG islands. Methylation was confirmed by BstUI digestion. The CpG methylation significantly inhibited PEPD promoter activity in comparison to the unmethylated construct. We believe these results will generate new knowledge on the molecular regulation of prolidase and provide better insight in our understanding of the regulation of prolidase expression in various physiological and pathological conditions.
Alkaline water is reputed for its role in weight loss and hydration. Radon is an odorless, tasteless, and colorless gas that is present in the environment. Its presence has been documented numerous times in water sources. Radioactive substances can enter the body through ingestion. For this research, the concentrations of Radon-222 were investigated in various samples of alkaline water and estimates of the annual dosages in humans based on the rate of consumption will be assessed. Radon concentration data was obtained using a Durridge RAD7 Radon Monitor on the Watt 250 protocol. The collected data was used to determine whether certain water samples which contained substantial amounts of Radon-222 could pose a risk for cancer in humans. Water samples used in this research were Aqua Hydrate, Body Armor, Simple Truth, Kroger Alkaline, Kangen Water, Defiance, and Qure. Analysis of the data concluded that each water sample contained Radon-222. The pH levels for these samples were also measured. The data for radon concentration, pH, and the evaluation of the cancer risk will be discussed.

Sequence data for the Cyt b gene from mitochondrial DNA was used to identify individual pocket gophers to species from various localities in California. Sequences were compared to known samples provided from GenBank and species recognition delineated. Location of Thomomys bottae individuals was compared to known distribution from the literature. Changes in the species historical distribution will be discussed.
Natalie Butler, Zahra Rasuli  
Sophomore, Junior  
Chemistry  
Fisk University  
Dr. Natalie Arnett

_Determining the Viability of 1,3-Propanedithiol as an Additive for Repairing Hair Damage (Abstract/Poster #1617)_

Water impurities in Nashville water supply can severely damage the strength and flexibility of a person’s natural hair structure. The damage occurs due to breakage at the sulfur-sulfur bond cite along the hair strand. Reestablishment of these sulfur bonds could strengthen the structure of the hair and possibly lead to preventive care of the hair over longer periods of time. As a part of an NSF-TIPS and CAREER funded research labs in polymer chemistry, the purpose of this experiment was to develop an additive for hair products to improve damage caused by water impurities. In this research, 1,2-propanediol and 2-propanethiol were used as the additive and the representative damaged hair strand, respectively. 1,2-propanediol in acetone, which is FDA approved, was added to 2-propanethiol in ethanol along with hydrogen peroxide as a radical generator to prepare the additive named NATRA®. FTIR illustrated the formation of sulfur monoxide bonds, which would resemble the reestablishment of disulfide bonds within damaged hair, by verifying S=O bonds at 985 cm⁻¹. TGA affirmed the thermal stability of the additive with less than 1 wt.% of NATRA degrading at 600°C. Images of hair stand in NATRA for 24 hours showed the hair was repaired and strengthened.
Characterizing dopamine neuron genes in the model organism C. elegans
(Abstract/Poster #1618)

Dopamine is an important neurotransmitter that functions in the brain. Unregulated levels of dopamine are associated with various human health conditions such as Parkinson’s, Amyotrophic Lateral Sclerosis, depression, and drug addiction. Currently, we are identifying dopaminergic neuron genes and their impact on the regulation of the dopaminergic pathway in the model organism Caenorhabditis elegans, which has similar genes to those in human. Through cell-specific RNA sequencing, we have identified over 500 genes enriched in dopamine neurons. We describe the characterization of two of these, HSP-12.6 and pals-8. HSP-12.6 is a heat shock protein homologous to human alpha-crystallin B. PALS-8 is uncharacterized but shares some homology with ALS2-CR12 in mice, which phenotypically presents in loss of voluntary movement and has connections to ALS in humans. To test dopamine neuron function in C. elegans, we performed a dopamine-related movement assay, the swimming-induced paralysis (SWIP) assay. Mutations in pals-8 cause a slight defect in dopamine-related movement, but mutations in HSP-12.6 have a faster swimming-induced paralysis than wild-type C. elegans. Now, we are confirming the dopamine-dependence of these effects through genetic experiments and hope to gain further insight into the molecular mechanism of these proteins in regulating dopamine neuron function.
Farah Ismail  
Junior  
Biochemistry  
Tennessee State University  
Dr. Margaret Whalen  

*Exposure of human immune cells to Triclosan alters synthesis of IFNγ*  
(Abstract/Poster #1619)  

Triclosan is a synthetic chemical with an antibacterial function that inhibits the growth of microorganisms, which is used in many consumer products. IFNγ is a cytokine that is specialized for innate and adaptive immunity against viral infections and in controlling tumor. As a pro-inflammatory cytokine, inappropriately elevated levels of IFNγ can cause chronic inflammation, which enhances the progression of certain cancers. Earlier studies showed that TCS exposure increases IFNγ secretion from immune cells, we hypothesize that this increase in secretion may be due to TCS-induced increases in synthesis of IFNγ. The aim of this study is to investigate whether TCS alters the synthesis (secretion + intracellular levels) of IFNγ from human immune cells. Human PBMCs were treated with 0-5 μM TCS for 24 h, and 48 h. IFNγ secretion was measured by ELISA, and the intracellular levels were measured by western blots. It appears that exposure to certain concentrations of TCS for 48 h increased the synthesis of IFNγ. The ability of TCS to increase IFNγ synthesis in vitro suggests the potential for TCS exposures to produce chronic inflammation.
Feasibility of the Hexoskin™ Biometric Shirt Use in a Focused Breathing Study
(Abstract/Poster #1620)

Slow breathing exercises are integral to the practice of yoga and have shown to have calming effects. In the practice of Viniyoga, slow breathing is taught through close observation by the instructor. The purpose of this study was to determine the feasibility of using, Hexoskin™ (a biometric shirt) in a randomized control trial (RCT) and compare its functionality to that of the direct observation of a trained instructor. During a 12-week slow breathing program, participants were monitored with the Hexoskin twice with the instructor (at 4-6 weeks and 10-12 weeks) and were asked to practice with the device at home. Practices with the Hexoskin were recorded and analyzed using Vivosense software for the length of exhalation (Te) and length of inhalation (Ti). We then correlated the Hexoskin measured (Ti/Te) ratio versus the observed (Ti/Te) ratio. Ninety-seven participants were analyzed and practiced a mean of 4.8 ± 1.2 sessions at home with the Hexoskin™ shirt. Adherence to Hexoskin during home sessions was high among study participants. In addition, the significant correlation between direct observation and Hexoskin measurement may indicate that the Hexoskin shirt may serve as a useful tool to aid new practitioners in slow breathing exercises.
Comparison of the Degradation and Viability of Polyesters as Sewing Cuff of Valves in Heart Valve Transplants (Abstract/Poster #1621)

Heart valves are the tissue which controls blood flow within the heart. Aortic stenosis is one major condition which requires a heart valve transplant to be rectified. There are two types of valve replacements which are mechanical and biological heart valve replacements. The polymer used in the current state of the art mechanical valve replacement is polyethylene terephthalate (PET) due to its durability, longevity, and biocompatibility. However, this material causes the tissues surrounding the sewing cuff of the valve replacement to bleed and form blood clots, therefore a material that is more elastic or less rigid in texture is needed. The objective of this research is to synthesize polyethylene succinate (PESu) via step growth polymerization to compare with the current state of the art poly(ethylene terephthalate) (PET). Additionally, a biocompatible polymer that offers similar properties to PET will also be investigated. Fourier Transform Infrared Spectroscopy (FTIR) and Thermal Gravimetric Analysis (TGA) will be carried out to verify the polymer structures. Degradation properties will be assessed at 37°C (body temperature) and 7.4 pH over two weeks. The goal of these test will be to establish which polymer has greater longevity and/or biocompatibility compared to PET.

Mitochondrial DNA analysis of Thomomys talpoides in California (Abstract/Poster #1622)

Sequence data for the Cyt b gene from mitochondrial DNA was used to identify individuals to species (Thomomys talpoides) from various localities in California. Sequences were compared to known samples provided from GenBank and species recognition delineated. Location of identified individuals was compared to known historical species distribution. Changes in the species historical distribution will be discussed.
Importance of IHNV transmission in dead rainbow trout (Abstract/Poster #1623)

Diseases are a global problem that impacts wild fish ecology and economy from aquaculture. A better understanding of pathogen transmission can greatly improve disease management. Infectious hematopoietic necrosis virus (IHNV) can cause widespread fish mortality in juvenile salmonids. Dead fish can continue to shed the virus after death. However, no studies have quantified the impact of transmission dynamics of IHNV post-mortem i.e. transmission from dead fish to live fish. To determine if IHNV shed from fish is still infectious after fish death, we quantified the transmission efficiency and shedding kinetics of two different IHNV strains over time post-mortem using a cohabitation method in rainbow trout. We found that IHNV strains shed from dead fish were infectious during a few days post-mortem. However, a lack of transmission was observed after Day 4 post-mortem. We also found that the quantity of virus shed was high throughout the experiment and likely not directly correlated to the transmission efficiency. Based on our findings, management may want to consider removing fish more quickly after death.
Maleiah Carroll  
Senior Biology  
LeMoyne-Owen College  
Dr. Loretta Jackson-Hayes, Rhodes College

*Determining Protein Domains Involved in the Protein Kinase C/SepA Interaction in the Filamentous Fungus Aspergillus nidulans (Abstract/Poster #1624)*

Cell division in filamentous fungi involves coalescence and subsequent constriction of a contractile actomyosin ring (CAR), as in yeasts and metazoans. In fungi, constriction of the CAR is followed by deposition of cell wall material resulting in a septum. In the model organism, *Aspergillus nidulans*, many proteins are involved in septation including protein kinase C (PkcA) and the formin SepA. Previously our lab demonstrated that PkcA and SepA reside in a CAR localized complex. The current study focuses on the physical relationship between PkcA and SepA. Specifically, we set out to determine which PkcA domains are responsible for its physical interaction with SepA. Recently, we showed that the actin-nucleating FH2 domain of SepA mediates its interaction with PkcA. PkcA contains two N-terminal HR1 domains, C1 and C2 regulatory domains, and a C-terminal catalytic domain. The experimental procedures performed are a polymerase chain reaction of truncated *pkcA* sequences and ligation into pGBK7 yeast two-hybrid DNA-binding domain plasmid. Yeast two-hybrid was used based on its utility in determining protein interactions. We determined that the HR1A domain of PkcA is necessary for its interaction with SepA.
Marcus Comer  
Freshman  
Environmental Science  
Tennessee State University  
Drs. De’Etra Young, Tom Byl, and Rickard Toomey

*Characterizing Lampenflora using Fluorescence Probes (Abstract/Poster #1625)*

Aquatic algae have adapted to live in terrestrial environments, even in the cave passages at Mammoth Cave National Park. Cyanobacteria (blue-green algae) and Chlorophyta (green algae) are the two main algae that grow on the cave passages in proximity to the tour lights. These algae growths in the cave are called lampenflora. The lampenflora are considered a nuisance because they are not part of a natural cave flora and cyanobacteria have been shown to produce toxins, thus, posing a danger to cave fauna. The objective of this research was to develop a quick, reliable tool that could be used to characterize the lampenflora, provide an estimate of biomass and differentiate between cyanobacteria and Chlorophyta. The lampenflora were characterized using a dual-channel fluorescence-based sensor, with a channel for chlorophyll a, found in all algae, and a channel for phycocyanin that is found in freshwater blue-green algae. The ratio of chlorophyll a to phycocyanin provided a quick way to characterize the algal community. The intensity of the reading provided some indication of biomass but maxed out when the cave wall was above 60% covered with lampenflora.
Shakarah Nelson
Junior
Environmental Science
Tennessee State University
Drs. De’Etra Young, Tom Byl, and Rickard Toomey

*The Production of Microcystin Toxin by Nostoc and Lampenflora Algae*  
(Abstract/Poster #1626)

Cyanobacteria are prokaryotes with photosynthetic capabilities commonly found in marine and freshwater environments. Fossil evidence indicates they were prolific in the pre-Cambrian oceans 3.5 billion years ago and helped to give rise to the oxygen-rich atmosphere. Cyanobacteria continue to thrive and have adapted to live in terrestrial environments, including *Microcystis, Oscillatoria, Leptolyngbya, Planktothrix, Nostoc, Dolichospermum* and *Hapalosiphon* which were identified growing near lights in the cave passages at Mammoth Cave National Park. During preliminary cyanotoxin testing, 10 out of 11 cave sites with visible algae tested positive for microcystin toxin (total concentration range of 0.154 to 2.59 µg/L using ELISA). No microcystins were detected at control cave sites where algae were not visible. Another common terrestrial cyanobacterium, *Nostoc commune*, found growing along gravel paths on the surface had microcystin concentrations ranging from 0.0 to 96 µg/L. These preliminary findings raise the question of what are the environmental signals that trigger the production of toxins in terrestrial environments.
Alia Burrows, Aaliyah Jatta
Seniors
Engineering Technology, Supply Chain Management
University of Memphis
Dr. Stephanie Ivey

Transportation Operations: Education and Training Database for Workforce Outlook
(Abstract #1627)

The transportation field is ever growing. Within the next few years, it has been projected that over half of the transportation workforce will reach retirement age. The mission of Southeast Transportation Workforce Center (SETWC) is to coordinate existing regionally based programs, plans, and processes and to strategically create partnerships to ensure that students and persons seeking workforce reentry, career transition, or career advancement are aware of opportunities, required education, skills, training, and ladders to success within the regional transportation workforce. As an initiative to increase awareness of the various programs related to transportation, a database was developed to encompass the many routes that a student could follow within their post-secondary education in order to prepare for a career in the transportation industry. The database includes undergraduate, graduate, technical and continuing education courses, and training offered in the United States. The project was prepared for the United States Department of Transportation, the Federal Highway Administration and the Department of Labor in accordance with the Transportation Systems Management and Operation (TSMO) Plan. The TSMO plans are used to provide management, operations stakeholders, and planners guidance. With the database, they can develop objectives, operations goals, performance measures, and strategies.
Activation of Small Molecules with Frustrated Lewis Pair Chemistry (Abstract #1628)

Small molecule activation by frustrated Lewis pairs (FLPs) has been a rapidly expanding area of chemical research for the last 15 years. FLPs facilitate the activation of small molecules by polarizing small molecule substrates, such that they are heterolytically cleaved. Our objective is to create inexpensive and practical methods that exploit FLP reactivity to activate methane and other small molecules. In the pursuit of designing such FLPs, we have focused on synthesizing bulky Lewis acids containing substrates with an acidic zinc ion at the center of a tripodal ligand. In this work, we will examine different ligand components by varying steric bulk and exploring the resulting reactivity with small molecules.

Production of Biodegradable Polymer Using Low-Cost By-products from Biofuel Industry (Abstract/Poster #1629)

Poly-3-hydroxybutyrate (PHB) is a type of inclusion body that is accumulated inside certain bacterial cells. The physical properties of PHB are comparable with petroleum-based plastics in terms of biodegradability, biocompatibility, and UV resistance. Many studies have been conducted to explore the potential to produce and use PHB as an alternative material to petroleum-derived aliphatic esters. Based on an economic analysis, the carbon source accounts up to 50% of the total production costs of PHB. Glycerin is a major byproduct from biodiesel industry. The hydrocarbon molecules in glycerin may provide a good producing efficiency of several bacterial strains (*Bacillus cereus* tsu1, *Bacillus megaterium*) when cultured on glycerin substrate. After incubation on solid and liquid media containing glycerin as the sole carbon sources, bacteria were sampled at different time points. Bacteria were stained with Sudan black and examined under a microscope to observe PHB accumulation. At the end of the incubation period, bacterial cell biomass was harvested to extract PHB by dispersing in 6% sodium hypochlorite and chloroform. The PHB extracts were digested in concentrated sulfuric acid and diluted (1: 250). The yield and purity of PHB were determined based on absorbance at 235 nm on a spectrophotometer.
Cierra S. Thornton  
Senior  
Information Technology  
LeMoyne-Owen College  
Dr. Andrew Olney, University of Memphis

*Expertise Search (Abstract/Poster #1630)*

Finding reviewers for academic journal articles can be extremely challenging. A recent study found that the first set of reviewers asked to review an article only accepted 22% of the time and that the difficulty in finding reviewers made it less likely for an article to be accepted, regardless of quality (Scientometrics, 2017). *Review Finder* is a program to assist with matching reviewers to target academic journal articles. *Review Finder* allows editors to search for reviewers using reviewer-written papers on a single-page application. A single-page application (SPA) is a web application that loads a single HTML page. SPAs dynamically update as users interact with the application. When using *Review Finder*, editors would submit target article keywords or abstract in the query box. The query then gets compared to potential reviewers’ paper abstracts saved in a database. The Jaccard coefficient is used to compare the query to the abstracts. The Jaccard coefficient is a function of the union and intersection of overlapping words in the query and an abstract. *Review Finder* then sorts the coefficients and provides the top five matching reviewers.

Allegra Howard  
Senior  
Biology  
LeMoyne-Owen College  
Dr. Athena Davenport, University of Tennessee Health Science Center

*Study of the Microbiome of Estradiol Induced Rats (Abstract/Poster #1631)*

The goal of my internship was to concentrate on the microbiome of the estradiol-induced Augustus Copenhagen Irish (ACI) female rats to monitor the specimens’ microbiome and compatibilities to human breast cancer tissues. This experiment creates a doorway to the bigger examination of the malignant cancerous tissue such as exploring the causes of the present microbiome, specific targeting of the protein associated with the present microbiome, and that leading up to possible cures to eliminate cancerous bacteria presented in the breast tissues. The overall technique subjected to determine the correspondence between the cancerous tissues from the rat and human breast samples was immunohistochemistry which is involves selected antigens, proteins, in the cells by exploiting specific binding antibodies. Details of immunohistochemistry techniques and findings will be presented.
Reanalyzing the Neos Experiment Through Computational Modeling
(Abstract/Poster #1632)

In observing anomalies such as the reactor anomaly, which reports the disappearance of neutrinos with respect to the number that is expected, the existence of a fourth, sterile neutrino has been proposed as the possible solution. Several reactor experiments which record and analyze neutrino flux, such as the NEOS (Neutrino oscillations at short baseline experiment) project, have taken place to obtain evidence for this claim. The purpose of this experiment is to reanalyze the NEOS experiment in order to verify the procedure and analysis taken by the original experimentalists, as well as increase the accuracy of the experiment's analysis through computational modeling. This is done in order to observe the experiment's significance in reference to a 4-neutrino model, which is hypothesized as the solution to several reactor neutrino disappearance anomalies. The conventional chi-squared function, which focuses on the neutrino flux, is used in the program in order to address this. The model is created using a comprehensive program which does various calculations of the oscillation probability and the chi-squared values. A comparison will be made between the model and the experimentalists results, as well as between the methods that were used to achieve this model and the experimentalists' methods.
Structural and Functional Characterization of Acinetobacter baumannii Superoxide Dismutase B (Abstract/Poster #1633)

Acinetobacter baumannii is a nosocomial pathogen which can infect the respiratory tract, skin, soft tissue, and the urinary tract. The global health threat that A. baumannii poses is underscored by the identification of multiple drug-resistant strains that are impervious to all available antibiotics. Prior studies have proposed that enzymes contributing to reactive oxygen species detoxification, including superoxide dismutase B (SODB), are essential virulence factors of A. baumannii. In this study, we aim to understand the role of SODB in antibiotic resistance of A baumannii by revealing the structure-function relationships of this critical virulence factor. SODB was expressed recombinantly from E. coli and purified to >95% homogeneity using metal affinity, ion exchange, and size-exclusion chromatography. SODB is a thermally stable protein with a T_m of 60.2°C as determined by differential scanning fluorimetry. We assessed the enzyme’s activity using a water-soluble tetrazolium salt assay and determined the activity to be 0.2095 µg/U. Additionally, we crystallized SODB and collected diffraction data to 1.45 angstroms resolution. Future work entails determining the crystal structure of SODB and using in silico approaches to identifying potential inhibitors. In total, these studies will potentially allow for the development of new strategies to overcome the spread of A. baumannii.
Ariel Thorson  
Junior  
Molecular Physiology and Biophysics  
Vanderbilt University  
Dr. David A. Jacobson

*Mechanism of GLP-1 Regulation of Calcium Influx to Beta Cells and Delta Cells*  
*(Abstract #1634)*

Glucagon-like peptide-1, GLP-1, is an incretin secreted postprandially, which stimulates pancreatic insulin secretion and inhibits glucagon secretion to help maintain glucose homeostasis. It is known that calcium influx is required for both beta-cell insulin secretion as well as delta-cell somatostatin secretion. Importantly, delta cells and beta cells are electrically coupled under high glucose conditions via gap junctions. However, the mechanism by which GLP-1 modulates the coupling between beta-cells and delta-cells and their calcium influx kinetics that is required for hormone secretion is not fully understood. Therefore, the purpose of this study is to determine how GLP-1 regulates calcium influx in beta cells and delta cells and the effect of electrical coupling on this modulation. Pancreatic islets were harvested from transgenic mice expressing genetically encoded calcium indicators (GCaMP6s) specifically in delta-cells or beta-cells. The islets were perfused with different glucose concentrations with or without GLP-1 and the changes in calcium were determined. Islets were exposed to GLP-1 under high glucose and low glucose conditions, and their intracellular calcium levels were recorded by confocal microscopy. The results of this study could have further application in determining the mechanism through which GLP-1 works to tune glucose homeostasis.
Characterization of CUL9 function during human cortical differentiation
(Abstract/Poster #1635)

E3 ubiquitin ligases attach ubiquitin to a specific protein, often targeting that protein for degradation by the proteasome. Cullin-RING ligases (CRLs) are the largest family of E3 ubiquitin ligases and play critical roles in early neurodevelopmental processes. We are currently studying the poorly characterized CRL Cullin-9 (CUL9) using human pluripotent stem cells (hPSCs) and standardized protocols of cortical differentiation as a model of the early stages of neurodevelopment. Our data indicate that CUL9 plays a role in cortical differentiation. Specifically, aberrant levels of CUL9 expression can impair proper differentiation of hPSCs into human neural precursor cells (hNPCs) and lead to abnormal morphology of neural rosettes, a structure indicative of self-renewing, multipotent hNPCs. Our research indicates that levels of PAX6, a neuroectoderm transcription factor, remain elevated beyond its usual timeframe in the CUL9 depleted cells. We believe that this abnormal expression of PAX6 alters the expression of other neuronal markers that regulate later stages of cortical differentiation. In the future, we hope to validate our findings from the CUL9 knockdown cell line by replicating the experiments with a CUL9 knockout cell line.
Dilovan Yahya  
Senior  
Biology  
Tennessee State University  
Dr. Dafeng Hui  

*Effects of Precipitation Treatments on Switchgrass Biomass and Yield (Abstract #1636)*

Plant biomass and yield are often influenced by climatic factors such as precipitation. But how switchgrass biomass, particular yield, are influenced by precipitation has not been well investigated. We have conducted a field precipitation experiment with switchgrass since 2013. The experiment used randomized complete block design with 5 precipitation treatment levels (-50%, -33%, ambient, +33%, and +50%). We measured switchgrass leaf physiology and biomass, and also yield in 2018. The results showed that precipitation significantly influenced leaf photosynthesis and biomass and biomass varied among years. We also found that responses of biomass to precipitation were asymmetric. We are working on to test whether yield was significantly influenced by precipitation in 2018. We will continue the field measurements and quantify the interannual variation of biomass and yield.

Sebastian Sanchez  
Sophomore  
Mechanical, Aerospace, and Biomedical Engineering  
University of Tennessee, Knoxville  
Dr. Eric Wade  

*Effects of Attentional Focus Training on Ladder Based Stability (Abstract/Poster #1637)*

An effective way to learn motor skills and improve performance is adopting an external focus of attention during skill acquisition. This is done by having someone focus on the intended action of a movement rather than focusing on the technique behind it. In this experiment, two groups of participants with previous safety training were compared to each other in order to determine if the group that adopted an external focus of attention were more stable in ladder-based tasks. The goal of the experiment was to investigate different training approaches to decrease the severity and the frequency of ladder-based injuries for construction workers. These results may have implications for the design of future ladder training and safety-related tasks.
Miranda Moore
Sophomore
Biology
Middle Tennessee State University
Dr. Danielle D. Brown

_Giant anteater (Myrmecophaga tridactyla) mothers may teach their calves what ‘not to eat’ (Abstract/Poster #1638)_

During a prey scent preference experiment with captive giant anteaters living at the Nashville Zoo (USA), two anteater mothers actively inhibited their dependent calves from investigating non-nourishing but innocuous scents. An exact binomial test showed a statistically significant tendency for the dams to ignore the scents themselves after obstructing the calves’ investigation. This is the first known documentation of what appears to be ‘teaching’ behavior in Xenarthra and a rare example of a non-human animal discouraging feeding and smelling behaviors that aren’t adversely affecting its young.

Sarah Mikhail
Senior
Biology
Middle Tennessee State University
Dr. Danielle D. Brown

_Does the use of a ‘Sonic Net’ Disturb the European Starling (Sturnus vulgaris) and Deter them from the Murfreesboro Airport? (Abstract/Poster #1639)_

Avian wildlife is considered a nuisance problem at airfields. Deterring starlings (Sturnus vulgaris) from flocking on airfield runways was achieved in one study by playing a ‘sonic net’ continuously. The frequencies overlap with the frequencies the birds use for communication. The focus was on interrupting the nesting and roosting behavior of starlings in a 727 aircraft used for maintenance training at the Murfreesboro, TN airfield. We predicted that, following the introduction of a noise stimulus similar to a sonic net, there would be fewer birds roosting on the plane and nests would be abandoned. We observed birds at the 727 aircraft and a control site; later, we placed a BirdXpeller Pro speaker on a pole. It played 8 different clips of ‘white noise’. There was not a significant decrease in the number of birds before and after the sound stimulus was introduced. We compared the amplitudes and frequencies of the sound files played by the BirdXpeller Pro and the sonic net used successfully in the previous study. Compared to the sonic net, the white noise stimuli we used had lower amplitudes. We believed that a single speaker is not enough to create a net that covers the plane.
Structural Optimization of $\text{Cs}_2\text{HfX}_5\text{X}_1$ Scintillators (Abstract/Poster #1640)

Luminescence is a material emitting light. I worked with scintillators, which is when through a radioactive source a crystal will emit light. When scintillator crystals absorb gamma or x-rays their atoms become excited and jump energy states. However, they quickly return back to their lower energy state and for this to happen they must release a photon of energy which is visible light. A well-known working scintillator is Cesium Hafnium Chloride or CHC. We try to improve its scintillating properties by making CHX$_5$X$_1$ or CHX where X is a combination of Br, I, or Cl. We use elements similar to Chlorine in order to start from what we know and adjust the compound little by little in order to find a better scintillator. The aim of my summer research was to produce optimized crystal structures. To do this I used the Density Functional Theory or DFT which is one of the many complex theories to calculate the optical, mechanical, vibrational properties of materials. My research results will then be used by Crisel Florez, a grad student, who will use the crystal structures to detect the electric and optical properties. Then she will predict the properties of the elements that will be grown in the future.

Water Quality in Tennessee and the Effects it has on Residents of Varying Incomes (Abstract/Poster #1641)

Water quality has an impact on people everywhere. Currently, the water quality in Tennessee and the health risks associated with drinking it are being investigated. Based on EWG’s 2017 water quality reports, 10% of samples analyzed for lead, Tennessee is over 1 ppb. The following 10 contaminants were found above health regulations: total trihalomethanes, chloroform, bromodichloromethane, dibromochloromethane, radium-228 and 226, chromium, chlorate, atrazine, perfluorooctanoic acid, and haloacetic acids. Ongoing investigations are examining the health risks associated with these contaminants and how they vary from higher and lower income areas in Tennessee.
Cara London  
Senior  
Engineering Science  
Vanderbilt University  
Dr. Janie Moore  

*In Vitro Competitive Inhibition by N-benzyl-N-(2-{2-oxo-2H,3H-[1,3]oxazolo[4,5-b]pyridin-3-yl}ethyl)methanesulfonamide Targeting Urate Oxidase (UOX) on Aspergillus flavus (Abstract/Poster #1642)*

Worldwide there is a need for innovative approaches for reducing the growth of toxigenic fungi such as the Aspergillus genus. Food and grain spoilage due to this fungal infestation, and its toxic metabolites, Aflatoxin, link to liver disease and immunosuppression, are global economic and health issues. The development of a pre-harvest solution to infection by Aspergillus flavus would be more cost efficient and reduce the large health impact that aflatoxin infection linked disease causes. Prior study has shown purine metabolism is a recognized potential target for new antifungal drugs. However, there is limited research related to Aspergillus flavus and its purine degrading enzymes. There is also a need to uncover the consequences of an underperforming urate oxidase (UOX) in A. flavus as this information is necessary for the identification of high performing drugs. The objective of this research project was to determine the efficacy of ZINC00017061130 inhibiting the growth of Aspergillus flavus by targeting the UOX enzyme. This project built upon a hypothesis based on in silico binding simulation by using an in vitro disc diffusion test. The test drug did not significantly inhibit the growth of A. flavus which indicates that further research is needed to classify targets for the A. flavus uricase.
Production and Investigation of Chitin Nanofibril/Polycaprolactone nanocomposite fiber mats (Abstract #1643)

PCL, Polycaprolactone, is a biodegradable polymer that is known to be characteristically tough, flexible and biocompatible. In addition, PCL is known to have superior rheological and viscoelastic properties. Due to PCL’s hydrophobic nature, lack of bioactivity, and limited mechanical strength, it is important to consider blending it with other biopolymers. Particularly, in this experiment, Chitin, a biopolymer, is noted to offer many favorable properties such as non-toxicity, high crystallinity, biocompatibility, and biodegradability. Chitin nanofibrils are produced and are used as a form of Nano-filler. Utilizing electrospinning, the formation of Nanocomposite fiber mats was made possible. Generally, characteristics, such as morphology, mechanical, and surface wettability were studied via scanning electron microscopy and other forms of analysis. The Polycaprolactone-Nanofibril combination is expected to provide a significant improvement in the mechanical strength of the PCL, as well as thermal behavior, and surface wettability.
Tyra Shaw  
Sophomore  
Biology  
LeMoyne-Owen College  
Dr. Mekel Richardson

CD82 mediated cell-cell adhesion is calcium-dependent in MDA-MB-231 cells  
(Abstract/Poster #1644)

Cancer metastasis is the number one cause of cancer-related deaths worldwide. Cancer metastasis occurs when individual cells break off from the primary tumor and settle at distant sites. Cell-cell and cell-matrix adhesions play a pivotal role in this process. Cell-cell adhesion is the ability of cells to adhere to each other through interactions of cell adhesion molecules, CAMs, and occurs in either a calcium-dependent or calcium-independent manner. CD82 is a cancer metastasis suppressor that has been shown to play a role in regulating cell-cell and cell-matrix adhesion. The objective of this study is to characterize the CD82 mediated cell-cell adhesion occurring in the metastatic prostate, Du145 and metastatic breast, MDA-MB-231 cell lines. We used the hanging drop aggregation assay for the characterization. We found that MDA-MD-231 cells tightly adhered together to each other in the presence of calcium. We also found that the cells loosely, if at all, adhered together in the absence of calcium. These results suggest that CD82 mediated cell-cell adhesion occurs in a calcium-dependent manner. We also found that the Du145 transfectant cells tightly adhered together in the presence and absence of calcium. These results suggest that the CD82 mediated cell-cell adhesion is calcium independent.
This research worked on perfecting a system we refer to as Multiplexed Structured Image Capture (MUSIC), which is a means to increase the field of view during imaging. MUSIC functions by first using a beam splitter to separate the light into two paths (i.e. channels), where each channel applies a unique spatial modulation pattern to the light passing through it. Once this is established, the light in the second channel is offset by an adjustable mirror to allow for the light entering the camera from the second channel to provide different information from a separate section of the overall image being captured. By doing this, both channels contribute information simultaneously during camera exposure and can even be overlapped. Processing the information after capture allows the two channels to be separated by way of Fourier analysis and then stitched back together for viewing. Here I will demonstrate MUSIC using schlieren imaging.
Introduction of Dichloromethyl Triazine (DCMT) Comonomers into Poly(arylene ether sulfone) for Fuel Cell Applications (Abstract/Poster #1646)

Fuel cell technology is gaining interest because it offers carbon neutral emissions and better efficiency than standard internal combustion engines. However, current polymeric membranes used in fuel cells are limited, along with membrane synthesis being expensive and hazardous. Poly (arylene-ether-sulfone) (PAES) offers a low-cost alternative to modern polymer membranes due to its thermal properties, good film-forming properties, and high mechanical strength. High degrees of sulfonation is required for comparable ion exchange capacity to leading proton exchange membranes (PEM), but increased sulfonation levels lead to a decrease in membrane mechanical properties. The focus of this research is to stabilize PAES at high levels of sulfonation through post modification reactions. 2,4-dichloro-6-methoxy-triazine (DCMT) was incorporated into the PAES structure to stabilize the mechanical deficiencies caused by high sulfonation. A two-step polymerization process was utilized in the stabilization of the DCMT copolymer structure by first preparing comonomers with various bisphenols and DCMT; then incorporating these comonomers into the PAES structure. The resulting polymers were analyzed using various techniques.
Ms. Joey Danielle Batts  
Junior  
Biochemistry  
Tennessee State University  
Dr. David A. Padgett

*Modified Health Impact Assessments (HIA) for Two Environmental Justice Communities in New Orleans, LA, and Mobile, AL (Abstract/Poster #1647)*

The purpose of these health impact assessments (HIA) is to shed light on the ongoing health issues within the Lower Ninth Ward community in New Orleans, Louisiana, and the Africatown community in Mobile, Alabama. The objectives are as follows: identify the specific issues pertaining to each community, provide information on these issues to stakeholders, and recommend possible solutions. The Centers for Disease Control and Prevention (CDC) defines an HIA as “a tool that can help communities, decision makers, and practitioners make choices that improve public health through community design.” The Lower Ninth Ward community was significantly affected by Hurricane Katrina in 2005 and was one of the last places to receive assistance. Africatown was founded by Africans who survived the last (illegal) shipment of slaves to the United States in 1860. The residents are working hard to preserve their heritage and history while neighboring industrial facilities are exposing them to pollution and degrading their homes. Scoping methods using geographic information systems (GIS) indicated that these communities are vulnerable and disproportionately face environmental hazards. The final results of the HIAs identify specific issues impacting the populations’ health and provide recommendations for practical solutions.

Alexis Gwynn  
Senior  
Biology  
Vanderbilt University  
Dr. Bob Fox

*Binocular Rivalry and Suppression (Abstract #1648)*

Binocular rivalry is the inconstancy in perception caused by two competing stimuli; one stimulus from the right eye, the other from the left. This rivalry creates perceptual dominance and suppression. Objects alternate between dominance and suppression and certain factors can increase or decrease the time of suppression. The hypothesis for this semester was if the number of arms or intensity decreased then the suppression duration would increase.
Antibiotic Resistance of Three Strains of Chromobacterium Violaceum
(Abstract/Poster #1649)

Chromobacterium violaceum (CV) is a highly versatile organism apart of the
Neisseriaceae family of Proteobacteria. Chromobacterium violaceum was initially
discovered unexpectedly by an Italian researcher by the name of Bergonzini. Chromobacterium violaceum is known to produce a natural antibiotic, Violacein, which
can be used to treat colon cancer, breast cancer, as well as other diseases. In these
studies, the effects of antibiotics were observed on three strains of CV isolated from the
Tennessee Copper Basin. It was hypothesized that these strains would have multiple
antibiotic resistance. The strains were plated onto Luria-Bertani (LB) agar media. After
streaking the plates with the three different strains of CV an Antibiotic Disk Dispenser
was positioned over the plates placing eight different antibiotics onto the agar plates. The eight antibiotics used were Vancomycin (Va), Ofloxacin (Ofx), Netilmicin (Net),
Spectinomycin (Spt), Trimethoprim (Tmp), Polymyxin (Pb), Amikacin (An), and Ampicillin (Am). Over 48-hour period observations of the effects, the eight different
antibiotics were observed on the three strands of CV. The table below provides the
data observed. It was found that Ofloxacin, Netilmicin, Spectinomycin, and Amikacin
inhibited the growth of the three strains. Interestingly, Vancomycin, Trimethoprim,
Polymyxin, and Ampicillin did not effectively inhibit the growth of the organisms. Thus,
the strains did not show multiple antibiotic resistance. However, further studies are
needed to understand the effect of Vancomycin on CV6 and the observed effects of
Trimethoprim, Polymyxin, and Ampicillin on the CV strains.
Assessment of Semi-aquatic Turtle Assemblages and Bait Preference in Middle Tennessee Wetlands (Abstract/Poster #1650)

Turtle mark-and-recapture studies can be used to assess the health of the turtles in a specific ecosystem (e.g. wetland) and that of the habitat itself. Turtles are biologically beneficial because they feed on diseased and weakened fish and contribute to nutrient cycling via consumption of dead or decaying animal matter. Assessing the capture patterns and successes of various baits can help to evaluate how bait type may affect the turtle species caught in a trap. The goal of this project is to monitor species diversity patterns of freshwater turtles in 20 wetlands across a disturbance gradient in middle Tennessee from May through October 2018. The turtles were captured in baited hoop nets with a variety of bait types (i.e., tuna, dog food). We recorded species identification, and life stage of each capture and mass, plastron length, and the carapace length of 10 random individuals of each species at each site. We captured 5 total species throughout the survey period, which included the Common Snapping Turtle (*Chelydra serpentina*), Stinkpot (*Sternotherus odoratus*), Spiny Softshell Turtle (*Apalone spinifera*), Northern Map Turtle (*Graptemys geographica*), and the Red-eared Slider (*Trachemys scripta elegans*). The data collected shows the correlation between the turtle’s sex, age, species with the net size and the type of bait used.
Kristen Stigger  
Junior  
Agricultural Sciences  
Tennessee State University  
Dr. Arvenza Clardy

*Geological Agriculture: The Effects on Growing Plants with River Rock Without the Usage of Soil (Abstract/Poster #1651)*

Geological agriculture is the growing of plants in an all-rock or gravel environment, without the use of soil and fertilizers. A study was conducted by Richard C. Campbell discussing the advantages of growing food in river rock without using fertilizers or soil. “To Soil Less” was founded by Campbell in 2010 to research river rock as a fertilizing source. Campbell’s research uncovered that sedimentary rock has nutrient organic matter within the formation of the rock and its capability of supporting plant life. With reading Campbell’s research, the research proved that testing river rock would be something beneficial for our future. One problem that we have is the run-off of fertilizers entering our lakes and streams. If we can implement the practice of using river rock to grow our foods, that can produce a great taste, we will be able to continue to help build upon our natural resources. Using geological agriculture, I will examine the difference between soil grown seeds, and rock grown seeds and their different taste, and different nutritional value of growing food from out of the rock.

Betsy Akpotu  
Sophomore  
Biotechnology Technician  
Southwest Tennessee Community College  
Dr. Juliann Waits

*Analysis of mtDNA variation in the CytB gene of Blarina carolinensis from Meeman Biological Field Station (Abstract #1652)*

*Blarina carolinensis* were collected from Meeman Biological Field Station, University of Memphis, Shelby County, TN. DNA was isolated and the mitochondrial cytochrome *b* gene was amplified and sequenced. Sequences from Southern short-tailed shrews were compared to those housed in Genbank. Variation in haplotypes on a small geographic scale is elucidated.
A Novel Device Design for the Detection of Malaria Biomarker in Cases of Low Parasite Density (Abstract/Poster #1653)

Malaria is a tropical disease caused by parasitic infection. Conventional diagnostic techniques are often incompatible in areas with endemic malaria infections due to resource shortages such as electricity and trained technicians. In these areas, malaria is detected by rapid diagnostic tests (RDTs), more specifically a lateral flow assay (LFA). An LFA is a cost-effective point of care device that captures biomarker sandwiched between a printed antibody and a labeled antibody to produce a positive signal on the test strip. Current malaria RDTs fail to detect low-parasite-density infection. In such cases false negatives lead to a lack of patient treatment, furthering illness progression and spread. To solve this issue, we will develop RDTs consisting of a flow-through assay with a gliding membrane that concentrates low-density biomarkers obtained from a 2-mL sample, a larger volume than conventional RDTs can handle, for delivery onto an LFA. The sample will flow through a zinc-iminodiacetic acid functionalized membrane to capture and concentrate biomarkers. The biomarker-containing membrane will be slid over and eluted, in a small (~125 µL) volume, onto an LFA. As an effect of the increased biomarker concentration being delivered to the LFA, signal intensity and sensitivity will be improved.
Spectral Data of Perfluorooctanoic Acid with Iron (III) (Abstract #1654)

This presentation is part of the Peroxisome Proliferator-Activated Receptors-alpha (PPAR-α) research. Professor Hamada et al, as part of the PPAR-research, has reacted the metabolic agonist Clofibric acid with a variety of metal ions (2016, 2017, and 2018). Part of the PPAR-Research is the reaction of the Non-Metabolic agent PerfluoroOctanoic Acid with a variety of metal ions. We have gathered the UV-Vis-Spectra of the free PFOA, free Fe³⁺, and that of the Fe³⁺: PFOA reactions in different ratios. We also studied the IR-spectra for the same reaction system and the UV-Vis pattern in aqueous solutions under ambient conditions. It turned out that there are a wonderful reaction pattern and a nice trend in the number of protons (H⁺'s)-released from the reaction of free PFOA, Fe³⁺, and Fe³⁺: PFOA in 1:1, 1:2, 1:3, 1:4, and 1:5 reaction mixtures. It appeared that the numbers of H⁺ are 1, 3, 4, 5, 6, 7 and 8 respectively to the reactions' ratios mentioned above. Both the UV-Vis and IR spectra proved the participation of the carboxylate of PFOA in the binding of the Fe³⁺ metal ion. All of these data will be discussed.
Electrospun Branch Clusters: A New Approach to Tissue Engineering
(Abstract/Poster #1655)

Osteoarthritis is a growing healthcare concern. The healing potential of the tissue is limited due to the avascular nature of articular cartilage. Electrospun templates were minced into fibrous branched-clusters for use as novel tissue engineering template building blocks. Branched-clusters were separated by size and characterized with regards to branch length. These branched-clusters were then combined in culture with porcine chondrocytes to create three-dimensional constructs. Templates (fiber diameter 1.1 ± 0.4 µm) were electrospun using a blend of collagen II (2.4 mg/mL) and polydioxanone (PDO) (100 mg/mL) in 1,1,1,3,3,3-hexafluoro-2-propanol (HFP). Half of the constructs in each group were cultured in the presence of 50 ng/mL TGF-β and 10^{-7} M dexamethasone, while the other half had no additional additives. Image analysis indicated significant differences (p<0.05) in the branch lengths between the small (65 ± 27µm) and medium (334 ± 227 µm) branched clusters. Constructs of all groups showed live cells present throughout their volume, indicating adequate nutrient/waste diffusion to avoid necrotic core formation. These results promote a potential avenue to create tissue-engineered articular cartilage for the treatment of osteoarthritis.
Lung Cancer is the leading cancer killer in both males and females in the United States. Most patients with lung cancer undergo Thoracic Surgery, in order to completely remove the tumor and nearby lymph nodes in the chest. Since the survival rate of lung cancer patients is staggeringly low, models in machine learning were used on a dataset from UC Irvine to determine key features that may contribute to the death toll. Machine learning uses artificial intelligence to train models on datasets to determine patterns and/or outputs. The machine learning algorithms Artificial Neural Network and Support Vector Machine were used to predict the survival of lung cancer patients one year after Thoracic Surgery. The Support Vector Machine had the best training and testing scores when using the polynomial kernel. The features that play the most significant are the Diagnosis, Zubrod Scale, Tumor Size, Pain before surgery, Dyspnea and Smoking. Overall, machine learning is an effective way to predict the survival of patients with Lung Cancer undergoing Thoracic surgery. The features that were found to be most impacted depict that the diagnosis, state before surgery, and the history habits of the patient play a pivotal role in determining their survival.
Biofilm formation on implanted materials increases the risk of infection. Infections that are due to biofilm are intrinsically less susceptible to antibiotic therapy. In this study, Mannitol, a sugar alcohol, was blended with chitosan acetate to activate bacterial metabolism and increase the antibiotic susceptibility of biofilm. Blends of Mannitol, chitosan, and poly(ethylene glycol) have been developed into an injectable, degradable antibiotic delivery system, but have the potential to elute acidic by-products as they naturally degrade in the body. In this study, the pH values of different paste formulations will be evaluated over a 7-day period. The paste is made by adding Mannitol in 2% or 0% (control) weight/volume (w/v) to 1% w/v chitosan, 1% w/v polyethylene glycol solutions in 0.85% volume/volume acetic acid. Solutions are frozen, lyophilized, and ground before hydration with phosphate buffered saline (PBS) solution at a 2.5 mL/g ratio. 0.3 mL (n=3) of each paste type will be injected into 10 mL of deionized water or 10 mL of PBS, incubated at 37°C, with the pH taken every day and a media refreshment every two days. Results of these studies will guide future development of clinical protocols using this novel local antibiotic delivery system.
Amaris Daniels  
Junior  
Agricultural and Environmental Sciences  
Tennessee State University  
Drs. Hui Li and Suping Zhou

*Study of Bacterial Strain Paenibacillus polymyxa for Its Cellulolytic Activity*  
(Abstract/Poster #1658)

Paenibacillus polymyxa is a Gram-positive, endospore-forming bacterium found in soil and in plant rhizospheres. It is reported to have endoglucanases and avicelase activity. The objective of this study was to characterize the cellulase proteins and cellulolytic activity of Paenibacillus polymyxa BGSCID: 25A2 on various natural cellulosic substrates. The bacteria were inoculated in M9 minimal medium (M9 minimal salt-5X 11g/L, casamino acid 5g/L, 1M MgSO4 2ml, 1M CaCl2 0.1mL, 10% w/v Thiamine-HCl 0.01mL) supplement with carboxymethylcellulose sodium salt and ground switchgrass powder. Cultures were sampled for 12-24 h at 4 h intervals. The culture was filtered through a 0.20 μM Stericup Filtration System (EMD Millipore). The flow-through was used to extract proteins which were analyzed using 2-D gel electrophoresis, and cellulases were identified using peptide mapping. The extracellularase activity was measured using Congo-Red plate and glucose assay kits as well as the DNS spectrometry method. The authors wish to thank Dr. Jason de Koff for providing switchgrass biomass.
Michael Davies  
Senior  
Mechanical Engineering  
Vanderbilt University  
Dr. Sankaran Mahadevan

*Damage Adaptive Maneuvering Resilient Structures for Extended Maintenance-Free Operations (Abstract #1659)*

The overarching goal of the project is to achieve resilient system performance through *Information Fusion, Probabilistic diagnosis and prognosis, and System control and reconfiguration*. Information fusion involves fusion of information gained from heterogeneous sources of data, such as ultrasonic sensors, strain gages, etc. Probabilistic diagnosis and prognosis require the construction of dynamic Bayesian networks and enable quantification of aleatory and epistemic uncertainty. System control and reconfiguration are achieved by optimization of system parameters underdiagnosis and prognosis uncertainty. For the College Qualified Leaders program, non-destructive testing assesses the fatigue crack growth in AL 7075 specimen using ultrasonic pitch-catch was studied. Specifically, crack growth detection in 6in. by 15in. aluminum plate that is subjected to cyclic loading was performed. The results of ultrasonic pitch-catch data were compared to the ‘true’ value of the crack length estimated using a high-resolution image of the cracked specimen. The results can be used to build a damage-index-to-damage map that will allow us to accurately and easily determine the state of existing damage in both land and air vehicles.
Keeping It Moving: Genetic Analysis of the Dopamine Transporter Structure and Function in DAT-1 Coding Variants Derived from the C. elegans Million Mutation Project

(Abstract/Poster #1660)

The nematode Caenorhabditis elegans was introduced and optimized by the Million Mutation Project (MMP, http://genome.sfu.ca/mmp/) for the study of DA signaling. The library of ~2,000 mutagenized worm strains was sequenced at a depth of 15X genome coverage. On average, ~9 new non-synonymous alleles per gene, whose characterization can reveal novel links to protein structure and function. To date, we have confirmed the behavior of four of these lines consistent with DAT-1 loss of function assessed by the presence of Swimming-induced paralysis (SWIP). The dopamine (DA) transporter (DAT) is a polytrophic, membrane protein that utilizes the co-transport of Na+ and Cl- ions to energize the rapid re-uptake of DA from the synapse in order to terminate extracellular DA signaling and facilitate re-release. As worm synaptic structure in general, and the expression of DAT, in particular, are conserved across phyla, studies with the orthologous Caenorhabditis elegans protein model provide the opportunity to probe fundamental questions of transporter structure and function in vivo. Results from the successful genetic cross of mutant worms with cat-2 tyrosine hydroxylase (TH, CAT-2) loss of function mutant lines and reserpine assays will be used to determine the impact of DAT-1 missense alleles on DAT function and in DA neurons.
Growing Bitter Melon in Tennessee (Abstract #1661)

Bitter Melon, *Momordica charantia*, is a member of the squash family and is very popular in Asian, African, Caribbean, Indian, and Middle Eastern countries. Bitter Melon has bumpy skin and ranges from light to dark yellowish green in color and oblong in shape as the bitter melon matures and ripens it turns yellowish-orange. Ripen fruits are bitter in taste. Bitter Melon is very common in Asian and Indian dishes. In Chinese cooking, Bitter Melon is usually stir-fried with pork, used in soups, and consumed as a tea. In Northern India, Bitter Melon can be stuffed with spices and prepares by cooking in oil. It is prepared or served with yogurt to offset the bitterness. In Southern India, Bitter Melon is mixed with coconut and stir-fried with various spices. In the Caribbean, Bitter Melon is sautéed with onion garlic until crisp.

Jose Perez, William Singleton II
Juniors
Biology
Fisk University
Drs. P Freeman and J. S. Goodwin

Activity at the Synapse: The Co-localization of the Dopamine Transporter in HEK-239 Cells. A Paradigm Shift in Research (Abstract/Poster #1662)

The embedding of authentic research into the undergraduate molecular cell biology course afforded every student a hands-on opportunity to engage in state-of-the-art research using equipment that is either inaccessible or unavailable at most minority-serving institutions of higher learning. In collaboration with Dr. Goodwin at Meharry Medical College, inquiry-based learning was initiated through the co-localization of the YFP-tagged dopamine transporter (DAT) on the surface of HEK-293 transfected cells. The inquiry-based learning was followed by computational skill-set mastery via the analysis of data generated from live-cell quantitative imaging fluorescence recovery after photobleaching (FRAP) to calculate the diffusion coefficient and mobile fraction of DAT at the plasma membrane. Finally, fluorescence resonance energy transfer revealed interactions between the pre and post-acceptor bleached images via CFP (Cyan Fluorescent Protein) and YFP (Yellow Fluorescent Protein) overlay. Most importantly, the investigation led to the identification of students with demonstrable skill-sets for bench research.
Iesha Brown
Senior
Chemistry
Tennessee State University
Dr. Koen Vercruysse

*Using the Synthesis of Melanin to Develop Anti-oxidant Assays or to Search for Anti-oxidants* (Abstract/Poster #1663)

We have explored the synthesis of melanin as the basis for an easy-to-use anti-oxidant assay, suitable for laboratory classes in biochemistry. Melanin can be synthesized from a wide variety of precursors and under conditions that involve oxygen-mediated or reactive oxygen species (ROS)-mediated (generated through the combination of Fe^{2+} and H_{2}O_{2}) reaction conditions. We have established a simple anti-oxidant assay using the synthesis of melanin from pyrogallol and used it to study the anti-oxidant properties of L-ascorbic acid, lime or lemon juice. In addition, we have explored the anti-oxidant properties of L-ascorbic acid using the synthesis of melanin from dopamine or pyrogallol under air- or ROS-mediated oxidation conditions.
Studies in EEG analysis from human subjects have demonstrated that beta oscillations carried perceptual information in spatial patterns across the cortex featuring amplitude and phase modulation occurrences when the subjects were engaged in task-oriented activities. A hypothesis was tested that synchronized patterns could be found in the scalp EEG of two human subjects engaged in the same activity. Signals were recorded (ms) from scalp electrodes and band-pass filtered. The Hilbert transform gave the analytic phase, which segmented the EEG into temporal frames, and the analytic amplitude, which expressed the pattern in each frame as a feature vector. Methods applied to the EEG were adapted from Pockett, et al. through a systematic search of the alpha, beta, delta, gamma, and theta spectrum. Temporal patterns of EEG amplitude and phase modulation were found that could be classified with respect to stimulus. The patterns were found in the alpha-beta range (15–30 Hz). Our results suggest that the scalp EEG can yield information about the timing of episodically synchronized brain activity in higher cognitive function, so that future studies in brain–computer interfacing can be better focused.