Title: Elevated triglyceride levels are associated with cognitive impairment in animal models of hyperglycemia and chemotherapy treatment

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Department: Drug Discovery and Development; Anatomy, Physiology and Pharmacology
College/School: Harrison School of Pharmacy; College of Veterinary Medicine

Description:

Various endogenous and exogenous factors, including hyperglycemia and chemotherapy treatment have been shown to contribute to the cognitive impairment (CI). Currently, there are few biochemical markers that correlate with CI, and those that do exist require expensive or invasive techniques to measure accurately. Therefore, we sought to determine hematological markers as predictors of CI in valid rodent models of streptozotocin induced hyperglycemia (STZ) and a chemotherapy [doxorubicin and cyclophosphamide] treatment (CT). Cognitive impairment was observed in both the STZ and CT models. Blood hematological markers were analyzed in the rodent models of CI and compared to their respective control group. There was a significant increase in creatinine kinase and lactate dehydrogenase in the CT group. Glucose levels were significantly increased in the STZ group. With regard to BUN, there was a significant increase in the STZ group, however there was a decrease in the CT group. Interestingly, triglycerides were significantly elevated in both the STZ and CT groups. Previous studies with human subjects have shown a potential link between the increase in triglyceride levels and cognitive impairment. Likewise, our data indicates a possible correlation with an increase in triglycerides to cognitive impairment in animal models. This suggests elevated levels of triglycerides may prove to be a potential, non-invasive, hematological marker for the increased risk of CI in these animal models. However, further studies are necessary to determine the causal relationship between elevated triglyceride levels and CI.

Title: Combined etodolac and α-tocopherol as a novel therapeutic approach for Alzheimer disease treatment

Primary Author (and presenter): Abdallah, Ihab M.
Additional Authors: Elfakhri, Khaled H.; Brannen, Andrew D.; & Kaddoumi, Amal
Department: Drug Discovery and Development
College/ School: Harrison School of Pharmacy

Description:

Alzheimer's disease (AD) is a complex neurodegenerative disorder with multiple dysfunctional pathways. Therefore, a sophisticated treatment strategy that simultaneously targets multiple brain cell types and disease pathways could be advantageous for effective intervention. In our lab, we established a cell-based assay model (HTS) to evaluate promising drugs for their ability to enhance the blood-brain barrier (BBB) integrity and improve clearance of amyloid-β (Aβ). Etodolac and α-tocopherol were selected as promising drugs for further investigation. Both drugs were tested separately and in combination for the purpose of targeting multiple pathways including neuroinflammation and oxidative stress. Transgenic 5XFAD mice were divided into 4 group and treated with vehicle, etodolac, α-tocopherol, or both drugs combination. Compared to either drug alone, the combination significantly enhanced the BBB function, decreased total Aβ load correlated with increased expression of major transport proteins, promoted APP processing towards the neuroprotective and non-amyloidogenic pathway, induced synaptic markers expression, and significantly reduced neuroinflammation and oxidative stress. In conclusion, this study highlights the significance of combination therapy to simultaneously target multiple disease pathways, and suggest the repurposing and combination of etodolac and α-tocopherol as a novel therapeutic strategy against AD.

Title: New insights on the redox properties of two- and three dimensional supported vanadium oxide catalysts: A Raman-Spectrokinetics Study
Primary Author (and presenter): Adams, William R.
Additional Authors: Moncada, Jorge & Carrero, Carlos A.
Department: Chemical Engineering
College/School: Samuel Ginn College of Engineering

Description:

While metal oxide catalysts have held an eminent role in industrial scale reactions for the selective oxidation of hydrocarbons, there remains a desire to better understand the correlation of molecular structure and chemical nature in these systems. Among the transition metal oxide catalysts implemented for the production of olefins and oxygenates, those containing vanadium have demonstrated the most potential. Recently, we have employed a novel spectrokinetic approach with Raman spectroscopy to gain unique insights on the structure-reactivity relationships of silica supported vanadium oxide catalysts. We define spectrokinetics as an *operando* spectroscopic methodology in which reaction rates are obtained directly from spectroscopic data. In prior seminal work, redox reactions with a series of ternary metal oxide catalysts were time-resolved using pulsed injections of gaseous reagents while following by MS and monitoring the evolution of the (dispersed) vanadyl Raman transition. Reaction rates were obtained from the Raman-spectrokinetic data, as well as the MS data, which enabled us to distinguish the contribution of a specific active site (the V=O evolution) from the overall bulk oxidation rate (determined via MS), which, coupled with the surface structure information afforded by the entire Raman spectra, provided insights into synergistic effects in the multicomponent systems studied. With our current work, we endeavor to improve upon the Raman-spectrokinetic approach by studying a series of V-SiO_2 catalysts at different metal loadings containing both 2D and 3D vanadium species, providing two distinct Raman transitions that can be monitored (998 and 1032 cm^{-1}). Tracking these two signals during reduction and oxidation reactions, unique rate information from two separate surface species was obtained. The Raman-spectrokinetic experiments were then coupled with XRD experiments to elucidate how the size of the particles present further impacted the redox properties.

Title: When risks are worth taking: The surprising relationship between maximizing and risk taking

Primary Author (and presenter): Adcock, Michelle, L
Additional Authors: Haas, Amelia; Willits, Taylor
Department: Department of Psychology
College/School: College of Liberal Arts

Description:

The current study examines the relationships between Big Five personality factors and an individual's general risk propensity. Previous research on these constructs has focused on domain-specific risk taking behavior (e.g., health or financial risk taking) and only recently has a measure been developed to examine general risk taking propensity. The current study adds to the literature by 1) further validating the GRiPS scale and 2) introducing unique variables such as an individual's decision making strategies. A total of 352 participants were surveyed and analyses were run using hierarchical regression. Overall, our results supported the relationships found in the initial validation of the GRiPS scale, as well as the existing research surrounding the Big Five and domain-specific risk taking. Specifically, Extraversion and Openness were positively related to risk taking, whereas Conscientiousness and Neuroticism were negatively related to risk taking. Our results expanded on the risk literature and GRiPS research by introducing maximizing (i.e., the decision making tendency to pursue the optimal choice) as a predictor of risk taking. Results indicated that maximizing significantly accounted for variance in individual risk taking beyond the variance accounted for by the Big Five traits. Currently, the extant literature regarding domain-specific risk taking and decision making tends to frame risk taking as a sub-optimal strategy. Interestingly, and in contrast to our predictions, the tendency to maximize had a positive relationship with risk taking propensity. Implications will be discussed.

Title: Type 1 diabetes and the closed loop system
Primary Author (and presenter): Agee, Lauren G.
Additional Author: Ellison, Kathy
College/ School: School of Nursing

Description:

Diabetes is a prevalent medical condition in today's society affecting children and adults that is forecasted to become a larger epidemic in the future. Many recent technological advances, including the closed loop insulin delivery system (HCL), have been designed to help better control diabetes. The purpose of this project is to determine how effective the HCL system is at lowing HbA1c, stabilizing blood glucose and improving health and quality of life. This project will be conducted at Atlanta Diabetes Association (ADA) on 15-20 patients of any gender/background, ages 13-70 with a HbA1c >7%. The outcomes measured will be glucose stability (as shown by comparison in glucose trends before/after), HbA1c (as shown by venous lab draws) and perceived health and life quality (measured by scores from the SF12v2 questionnaire). Qualifying patients at ADA will be asked to participate, consent and baseline data will be collected (questionnaire 1 and HbA1c 1), then the HCL system will be obtained. At the end of a four-week period a follow up visit will be conducted at ADA where final data will be collected (HbA1c 2 and questionnaire 2). Glucose trends will be monitored and evaluated online through *CareLink.* Baseline to final data will be uploaded and compared in SPSS. The project is in process. Demographic data tests will be run in SPSS (such as mean, median and mode) to evaluate differences in patient population. The paired samples test will also be conducted to evaluate differences in before and after data to help determine effectiveness of the system. The project should hopefully show improvement in all three outcomes of improve HbA1c, glucose control and quality of life. This technology will help control and limit diabetic complications at this office setting and a longer project timeframe will only warrant more positive results.

Title: Insect diversity in a loblolly pine stand infected with *Leptographium terebrantis*
Primary Author (and presenter): Ahl, Jessica B.
Additional Authors: Nadel, Ryan & Eckhardt, Lori
College/School: School of Forestry and Wildlife Sciences

Description:

Insects are known to play a major role in tree health in the Southeastern United States, causing damage and vectoring pathogens into tree tissues. Of particular interest are root feeding beetles and weevils that often go unnoticed until damage is already complete, vectoring pathogens such as Ophiostomatoid fungi. These fungal invaders occlude xylem and stain wood, reducing lumber value, slowing growth, and can kill trees prematurely. A commercial loblolly pine stand in Eufaula, Alabama was monitored for twenty-five months as mature trees were inoculated with one of these fungi. Insects were retrieved bimonthly for diversity and population dynamics with two types of traps – pitfall and panel based – to collect both ground-based and airborne insects in the area. Collected insects were identified to family level where possible and further sorted by morphospecies. Ultimately, we obtained 676 morphospecies in 149 families, encompassing 16 orders. Bark-feeding beetles and other species of concern were collected from both pre- and post-inoculation periods, but insect diversity mainly was affected by seasonal variation, with peaks in late spring and early summer. On a local scale, higher numbers of an invasive bark beetle, *Xylosandrus germanus*, may represent a need for increased plant diversity in the area as a way to combat invasion and spread of disease. These results provide a snapshot of insect diversity for the area and pave the way for an ongoing study to determine the long term impact this pathogen has on insects.

Title: Using hyperspectral interferometry to identify fungal spores on bark beetles of concern – can it be done?
Primary Author (and presenter): Ahl, Jessica
Additional Authors: Beach, James & Eckhardt, Lori
College/School: School of Forestry and Wildlife Sciences

Description:

Bark-feeding beetles and weevils continue to play a major part in tree health and decline, vectoring fungi and introducing pathogens into tree tissues. Some ophiostomatoid fungal pathogens occlude xylem and stain wood, reducing lumber value and killing trees prematurely. Current methods of identification can take weeks before management options can be recommended and are based on morphological and molecular tools. Based on previous work, hyperspectral interferometry has been shown to be able to locate and size microscale features on the surface of these beetles in the near-infrared range, with oscillations created by the reflected light spectra. This paves a way for the hypothesis to determine if it is possible to identify fungal spores to genus-species based on their reflectance. Using three fungal species naturally found on one of these beetles of concern, we set out to answer this question, using black seed beads and actual beetles as substrate for spores. We found that two of our three species can be differentiated from each other using hyperspectral methods. Additional work is needed to determine a more autonomous method for identifying species.

Title: Development of an *in vitro* model of obesity-linked colorectal cancer using PDX 3D tumors and insulin resistant adipocytes
Primary author: Ahmed, Bulbul
Additional Authors: Hassani, Iman; Anbiah, Benjamin; Habbit, Nicole; Lipke, Elizabeth A.; & Greene, Michael W.
Department: Nutrition, Dietetics and Hospitality Management
College/School: College of Human Sciences

Description:

Colorectal cancer (CRC) is the third most common cancer, and the second leading cause of cancer-related death among men and women. A strong relationship between obesity and CRC has been observed. However, the mechanistic link is still elusive because relevant experimental models are lacking. Our objective in this study was to establish and characterize an innovative *in vitro* model for investigating the link between obesity and CRC. Mature adipocytes (3T3-L1 cells) were used to induce insulin resistance (IR) by treatment with TNFα (20ng/ml) and hypoxia (1% O_2 and 5% CO_2). To maintain the insulin resistance state over the course of 72 hours, glucose (4.5g/L) and FBS (10%) were added to the cultures. Insulin resistance was verified by performing RT-PCR, western blot, and Oil Red O staining. To examine insulin sensitivity, mature adipocytes were treated with or without TNFα and hypoxia for 24 hours in serum-free media and then stimulated with 50nM insulin for 15 minutes. We observed that insulin-stimulated pAkt ^{ser473} phosphorylation was reduced significantly ($p < 0.05$) in IR treated cells compared to untreated adipocytes. RT-PCR was conducted using samples collected every 24 hours over the course of the TNFα and hypoxia treatments. Our results show that insulin sensitive genes GLUT4 and Adiponectin were decreased significantly; however, the pro-inflammatory gene MCP1 was increased significantly. We observed a significant reduction in the levels of lipid content following hypoxia of Oil Red O staining. Patient-derived xenograft (PDX) tumors from patients with stage IV CRC adenocarcinomas were subcutaneously propagated for 3-4 passages *in vivo* in NOD-SCID mice, then dissociated and encapsulated within a biosynthetic protein-coupled polymer, polyethylene glycol-fibrinogen, to create the 3D engineered PDX CRC tumors. The 3D PDX CRC tumors were co-cultured for 29 days with either insulin resistant or sensitive adipocytes; fresh adipocytes were replaced every 72 hours to maintain an insulin resistant or sensitive microenvironment. Results show that the total colony area of co-cultured 3D engineered PDX tissues significantly increased ($p < 0.05$) in the insulin resistant microenvironment as compared to the insulin sensitive 3D engineered PDX tissues. Our results show that induction of an insulin resistance microenvironment stimulated PDX CRC tumor growth in our novel *in-vitro* co-cultured model.

Title: Comparative water relations and desiccation tolerance of invasive pest ants in the southeastern United States to native ant species

Primary Author (and presenter): Ajayi, Olufemi S.
Additional Authors: Appel, Arthur; Li, Chen; Fadamiro, Henry
Department: Entomology and Plant Pathology
College/School: College of Agriculture

Description:

The success of invasive insects can be linked to their impressive tolerance to abiotic stressors including high temperature and desiccation. Little is known about such responses in the alien-invasive *Solenopsis* species (Hymenoptera: Formicidae). *Solenopsis* species are economically important species in the southern United States. Established species include *S. invicta, S. richteri* and *S. invicta* × *S. richteri*. They keep spreading and displacing native ants, including *S. geminata*, causing about $7 billion in annual losses in the U.S. Initial Mass (IM), Percentage of Total Body Water (%TBW) and Cuticular Permeability (CP) are critical to desiccation tolerance in terrestrial insects. We investigated a plausible physiological mechanism, namely desiccation tolerance by which these invasive and mesophilic ants may be limited in their distribution and spread as they compete with the xeric-adapted native ant. The objective was to compare the IM, CP and %TBW of some invasive and native fire ants of the southeastern U.S. We hypothesized that the invasive ant species will resist water loss more (lower CP) or similar compared with the native. Results of CP showed that among the invasive ants, *S. invicta* < *S. richteri*, while the native *S. geminata* was similar to all invasive ants. This suggests that CP could be a useful tool to predict invasive species spread over the southeastern U.S. and beyond, especially as climate change poses ecological challenges to the world.

Title: A review of acceptance schedule of payment for asphalt pavements in Alabama
Primary Author (and presenter): Ajede, Akeem A.
Additional Authors: Yin, Fan; Tran, Nam; & Blackburn, Lyndi
Department: Civil Engineering
College/School: Samuel Ginn College of Engineering

Description:

This study was conducted to review the current acceptance schedules of payment for asphalt pavements used by the Alabama Department of Transportation (ALDOT) and determine if they are representative of the current contractors' performance. Contractor quality control (QC) and state verification data of forty-five Superpave HMA projects across all nine ALDOT divisions were compiled into a database and analyzed using statistical analysis tools. The statistical analysis was conducted to determine the overall mean deviation and standard deviation of contractor QC and state verification data for asphalt content (AC), voids in the total mix (VTM), and in-place density, and compare with those in the current ALDOT acceptance schedules of payment. In addition, the two-population differences between the contractor QC versus state verification data as well as validated versus unvalidated contractor QC data of AC and VTM were evaluated. Statistical analysis shows that contractor QC and state verification data have statistically equal means for both AC and VTM, but the standard deviation of contractor QC data is significantly lower than that of state verification data. In addition, the variability of AC, VTM, and in-place density data of the database was found to be significantly lower than those considered in the current ALDOT acceptance schedules of payment. Based on the overall standard deviation values determined from the current database, the allowable deviations from the specified target values would be reduced by approximately 50 percent for AC and VTM, and by about 34 percent for in-place density.

Title: Non-competitive inhibition of proteasome by kinase inhibitors
Primary Author (and presenter): Akintola, Olasubomi A.
Additional Authors: Smith, John & Kisselev, Alexei
Department: Drug Discovery and Development
College/School: Harrison School of Pharmacy

Description:

Inhibitors of Bruton's Tyrosine Kinase (BTK) and inhibitors of the proteasome are currently in use for treatment of hematologic malignancies. While the proteasome is necessary for protein homeostasis in all mammalian cells, BTK is unique to some B cell malignancies. However, BTK inhibitors and LU-102, a specific inhibitor of the ß2 site of the proteasome have previously been shown to synergize in hematologic malignancies which do not express BTK, at a 100-fold higher concentration than is needed for complete inhibition of BTK, suggesting an off-target effect of these BTK inhibitors. Triple Negative Breast Cancer (TNBC), a cancer with poor prognosis and no current targeted therapy, also does not express BTK. We found that LU-102 and a specific BTK inhibitor, CGI-1764, are de-facto synthetically lethal to TNBC cells, and that effect of other BTK inhibitors varied from similar synergy to no synergy. This data further supports the idea that synergy is due to off-target effects of BTK inhibitors. We have now found through enzymatic analysis, measuring 7-amino-4-methylcoumarin (AMC) release from proteasome substrates of TNBC cell lysates and purified proteasomes isolated from rabbit muscle, that CGI-1764 is a non-competitive, allosteric inhibitor of all catalytic subunits of the proteasome 20S proteolytic core and exerts its effect in a unique, dose-dependent manner. Another kinase inhibitor, rapamycin and its closed ring analogs, were previously shown to inhibit proteasome allosterically, we further found that many other FDA-approved protein kinase inhibitors block proteasome allosterically. These findings may pave the development of more potent allosteric inhibitors of the proteasome, and that kinase inhibitors should be screened for inhibition of the proteasome as potential off-target effect.

Title: Energy-efficient consolidation of virtual machines in clouds
Primary Author (and presenter): Al Tekreeti, Taha
Additional Authors: Cao, Ting
Department: Computer Science and Software Engineering
College/School: Samuel Ginn College of Engineering

Description:

In modern cloud computing environments, there is a tremendous growth of data to be stored and managed in data centers. Large-scale data centers demand high utilization of computing and storage resources, which lead to expensive operational cost for energy usage. Such an enormous increase in energy consumption makes it crucial to develop energy-efficient cloud computing platforms housed in data centers. Energy consumption cost is the highest cost of operating and maintaining a data center and; for this reason, numerous methods have been proposed to manage resources in an energy-efficient way in data centers. Evidence shows that consolidating virtual machines (VMs) can conserve energy consumption in clouds through VM migrations. VM-consolidation techniques, however, inevitably induce a burden on performance. This problem is more pronounced when it comes to real-time applications. To address this issue, we propose a holistic solution - *EGRET* - to boost energy efficiency of cloud computing platforms by seamlessly integrating the DVFS scheme with the VM-consolidation technique. EGRET is a CPU-resource scaling strategy driven by cycles requires to completing real-time jobs running on VMs before their specified deadlines. EGRET dynamically determines the most energy-efficient strategy by issuing a command to either scale CPU frequencies on a VM or marking the VM as underutilized. If the VM is tagged as underutilized one, then EGRET will migrate running jobs from this VM to the others. After the migrations are completed, EGRET shutdowns the underutilized VM to preserve power. We conduct extensive experiments to evaluate the performance of EGRET. The experimental results show that EGRET substantially improves the energy efficiency of cloud computing platforms.

Title: mTOR inhibition protects the blood-brain barrier in two mouse models of Alzheimer's disease

Primary author (and presenter): Al-Rihani, Sweilem B.[1]
Additional authors: Elfakhri, Khaled[2]; Ebrahim, Hassan Y[2]; El Sayed, Khalid[2]; Kaddoumi, Amal[1]
Department: [1]Drug Discovery and Development
College/ School: [1]Harrison School of Pharmacy; [2]School of Pharmacy, University of Lousiana at Monroe

Description:

In the absence of new therapeutics, the number of cases of Alzheimer's disease (AD) – estimated to be more than 5.4 million currently – will rapidly increase in the coming decades. Current treatments provide, at best, only modest and temporary symptomatic relief, without altering the underlying mechanisms that led to the onset. Several studies in aging and Alzheimer's disease showed that the blood-brain barrier (BBB) integrity is compromised, which could contribute to the disease pathology. The BBB breakdown could range from mild disruption of tight junctions (TJs) with enhanced BBB permeability to chronic integrity loss with altered transport of molecules across the BBB, brain hypo-perfusion and inflammatory responses. Recently, we have developed a high-throughput screening (HTS) assay to identify hit compounds that have the potential to treat AD pathology. Our HTS assay is based on screening for compounds that enhance or protect the integrity of a cell-based BBB model with cerebral amyloid angiopathy (CAA) characteristics. Results of this screen identified an analogue of usnic acid (UA1) as a potential compound to protect the BBB model against Aβ toxicity. Usnic acid is a lichen-derived secondary metabolite with a unique dibenzofuran skeleton and is commonly found in lichenized fungi of the genera Usnea that we recently reported its potential as a novel inhibitor of the mammalian/mechanistic target of rapamycin (mTOR). mTOR pathway inhibition and autophagy induction have recently gained much attention as neuroprotective targets to improve cognitive function in mouse models of AD. In this study, we aimed to test whether mTOR inhibition by UA1 protects the BBB integrity and function in two AD mouse models, namely 5XFAD as an AD mouse model and TgSwDI as a CAA mouse model. Our finding demonstrated inhibition of mTOR abrogates BBB breakdown in both models. In addition, UA1 induced autophagy that was associated with a significant reduction in Aβ accumulation and related pathologies, and improved memory function.

Title: Strike (with) a pose: Neural networks are easily fooled by strange poses of familiar objects

Primary Author (and presenter): Alcorn, Michael A.
Additional Authors: Li, Qi; Gong, Zhitao; Wang, Chengfei; Mai, Long; Ku, Wei-Shinn; & Nguyen, Anh
Department: Computer Science and Software Engineering
College/School: Samuel Ginn College of Engineering

Description:

Deep neural networks (DNNs) are increasingly common components of computer vision systems. When handling “familiar” data, DNNs are capable of superhuman performance; however, inputs that are dissimilar to previously encountered examples (but that are still easily recognized by humans) can cause DNNs to make catastrophic mistakes. Here, we present a framework for discovering DNN failures that harnesses 3D computer graphics. Using our framework and a self-assembled dataset of 3D objects, we investigate the vulnerability of DNNs to “strange” poses of well-known objects. For objects that are readily recognized by DNNs in their canonical poses, DNNs incorrectly classify 97% of their pose space. Further, DNNs are highly sensitive to slight pose perturbations; for example, rotating a correctly classified object as little as 8° can often cause a DNN to misclassify. Lastly, 75% to 99% of adversarial poses transfer to DNNs with different architectures and/or trained with different datasets.

Title: Fetal programming effect of rumen-protected methionine on Angus-Simental heifer offspring's performance and PPARg gene expression
Primary Author (and presenter): Alfaro, Gaston F.
Additional Authors: Rodning, Soren; Walz, Paul; & Moisá, Sonia J.
Department: Animal Science
College/School: College of Agriculture

Description:

An extensive body of literature reported positive effects of Rumen-Protected Methionine (RPM) on dairy cattle, however, little is known about its performance on beef cattle. The objective of this study was to assess the effect of RPM supplementation on Angus-Simmental heifer's offspring during late gestation, lactation, and after weaning (~65d), focusing on early adipogenesis. Ninety days prior to calving, 22 Angus-Simmental heifers were stratified by body weight (454 ± 85 kg; BW) and randomly assigned to dietary treatments: 1) Control diet (CTRL), and 2) Control diet + RPM (RPM). Dams had access to Bermuda hay *ad libitum*, and a soy hull:corn gluten based supplement and calves to creep feeding before weaning. After weaning, calves were allocated by dietary treatments (RPM and CTRL) based on their dam's treatment. Calves received Bermuda hay *ad libitum* and early-wean feed supplement after weaning. Offspring's BW and *Longissimus Dorsi* (LM) skeletal muscle samples were obtained on days 0, 25, 50, 100 after weaning. Messenger RNA was extracted from LM for RT-qPCR analysis. There was a tendency for RPM calves to be heavier at birth compared to control calves ($P = 0.07$). Although, no differences in BW were detected at weaning and after weaning ($P = 0.20$). Calves average daily gain between birth and weaning was greater for RPM calves as compared to CON ($P = 0.02$), suggesting a greater milk production, with no differences after weaning ($P = 0.53$). RT-qPCR results showed a treatment × time interaction, a treatment and a time effect for *PPARg* gene expression. *PPARg* was greater in RPM at weaning and, it was upregulated from 50 to 100 days after weaning in RPM calves ($P < 0.01$). In conclusion, dam's RPM supplementation during late gestation increased offspring's BW when inside the womb and probably their milk production. Offspring's RPM supplementation after weaning potentially stimulates an early differentiation of adipocytes in LM samples, detected by *PPARg* upregulation.

Title: Gene-regulation control of muscle fatigue during beef cattle transportation with rumen-protected methionine supplementation
Primary Author (and presenter): Alfaro, Gaston F.
Additional Authors: Rodning, Soren; Novak, Taylor; & Moisá, Sonia J.
Department: Animal Science
College/School: College of Agriculture

Description:

U.S. beef production chain is composed by different participants generally located distant among them; therefore, shipping is required for cattle at least once in their lifespan. The aim of this study was to determine the effect of Rumen-Protected Methionine (RPM) supplementation on muscle fatigue gene network, creatine synthesis (CKM), and Reactive Oxygen Species (ROS) metabolism after a transportation simulation. Angus heifers (n = 18) were stratified by body weight (408 ± 64 kg; BW) and randomly assigned to dietary treatments: 1) Control diet (CTRL), and 2) control diet + RPM. After a successful adaptation period to Calan gates, animals received a common diet of Bermuda hay *ad libitum* and a soy hulls and corn gluten feed-based supplement. After 45 days under supplementation, animals were loaded onto a 32 × 7 ft. trailer and transported for 22 hours in a 1.7-miles oval test track. Skeletal muscle biopsies, BW and blood samples were obtained on day 0 (Baseline), 43 (Pre-transport, "PRET"), and 45 (Post-transport, "POST"). No significant differences between RPM and CTRL heifers were observed on average daily gain between Baseline and PRET ($P = 0.41$). Control heifer's shrink was 8% while RPM heifers shrink was 10% ($P = 0.29$). Cortisol level decreased after transportation, but no differences were detected between treatments ($P = 0.94$). Messenger RNA was extracted from skeletal muscle tissue and gene expression analysis was performed by RT-qPCR. Results showed that *AHCY* (Creatine synthesis pathway), *SSPN* (Sarcoglycan complex), *DNMT3A* (DNA Methylation), and *SOD2* (Oxidative Stress-ROS) were upregulated ($P < 0.05$) in CTRL between baseline and PRET and, decreased between PRET and POST ($P < 0.05$) while it remained constant for RPM. Furthermore, CKM was not affected by treatments ($P = 0.11$). In conclusion, neither muscle fatigue nor creatine synthesis related genes were affected by RPM. However, RPM could have an effect on ROS production after a long-term transportation.

Title: Investigate the effect of aging on oxidative stress and mitochondrial functions in male Capra aegagrus hircus reproductive system
Primary Author: Alghenaim, Fada
Additional Authors: Majrashi, Mohammed; Almaghrabi, Mohammed; Beamon, Haley; Moore, Timothy; Bradford, Chastity; & Dhanasekaran, Muralikrishnan
Department: Drug Discovery and Development
College/School: Harrison School of Pharmacy

Description:

The most common disease states / pathological conditions affecting Capra aegagrus hircus (goat) scrotum are epididymitis, Fournier's gangrene (fasciitis of the scrotum and groin), Henoch-Schonlein purpura, hydrocele, hypogonadism, orchitis, scrotal abscess (infection of the scrotum), scrotal wall cellulites, spermatocele, testicular torsion and varicocele. These pathological conditions associated with scrotum or testicles can lead to pain, swelling, tenderness, and lump. Interestingly, the function of decreases with age leading to various complications. However, the etiology associated with the decreased function of scrotum is not understood well. Hence, in this study we elucidated the role of oxidative stress and mitochondrial functions during aging in goats. Scrotums from Kiko goats of three different age groups were obtained. The three age groups were: Neonates (13-20 days), prepubertal (108-124 days), Adult (above 6 months). Oxidative stress markers and mitochondrial Complex I and IV activities were measure spectrophotometrically / fluorimetrically. During the process of aging, there was significant increase in the markers of oxidative stress (Reactive oxygen species, nitrite, protein carbonyl and lipid peroxides), decreased antioxidant (glutathione) and reduced mitochondrial functions (decreased Complex-I and IV activities). Thus, aging has a direct correlation with augmented oxidative stress and decreased mitochondrial functions and this can lead to decreased reproductive function.

Title: Novel acrylic-polyurethane based graft-interpenetrating polymer networks for transparent application

Primary Author (and presenter): Alizadeh, Nima
Additional Authors: Agrawal, Vinamra; Celestine, Asha-Dee; & Auad, Maria
Department: Polymer and Fiber Engineering
College/School: Samuel Ginn College of Engineering

Description:

Polymers are known to show a wide range of characteristics like high impact and tensile strength which make them useful for different applications. Interpenetrating polymer networks (IPNs) created by combining two different types of polymers provide a novel avenue for improving overall polymer properties. In this research, acrylic-polyurethane based graft-interpenetrating polymer networks, which are transparent and possess high mechanical properties are synthesized. Chemical crosslinking points between the two polymeric systems are used to decrease the degree of phase separation. Therefore, the degree of transparency and thermo-mechanical properties of the polymers increase. The effects of changing the percentage of acrylic polymer precursors and the percentage of the acrylic copolymer and polyurethane on the stiffness, glass transition temperature, transparency, fracture toughness and phase separation of the IPN are studied by using a number of characterization methods. The data showed that the flexibility of the polyurethane phase and the high glass transition and rigidity of the acrylic copolymer give improved strength and stiffness to the IPN in addition to high impact strength. Moreover, excellent transparency of the IPN networks with different percentages of the acrylic copolymer precursors are obtained. For modeling the system, assumptions are made on linear elasticity behavior and small deformation of the IPNs. MATLAB is used for determining the prony series coefficients which are needed for modelling the relaxation process of the IPNs. As a future work, the framework will be extended to hyperelastic behavior and large deformation of the IPNs.

Title: Work-family conflicts role in resource depletion of cognitive, emotional, and physical resources

Primary Author (presenter): Allen, Randi
Additional Authors: Vaughn, Jacob; S. & Shifrin, Nicole
Department: Psychology
College/School: College of Liberal Arts

While there is an abundance of research linking work-family conflict (WFC) to a host of negative outcomes, including compromised physical and mental health, there has been little research dedicated to understanding how the work-life interface influences these health outcomes. Identifying the mechanisms that underlie the relationships between work and life factors and health and well-being is essential in the development of effective organizational interventions and programs designed to support employee health and well-being. The present study explores the relationship between WFC and physical health, testing the depletion of cognitive, emotional, and physical resources as mediators of this relationship. Three time points of data were collected through Amazon's Mechanical Turk (MTurk) using a 30-day time lag. Path analysis using MPlus was conducted to test the hypothesized pathways. It was observed that each of the three resources had a unique mediating effect on the relationship between work interference with family (WIF) versus family interference with work (FIW) and physical health. WIF was significantly related to depletion of all three resources, while FIW was only significantly related to the depletion of emotional and cognitive resources. These findings suggest that the depletion of energy-related resources stemming from WIF versus FIW impact physical health in different ways.

Title: Vocal dose for rhythm-based indoor cycling instructors: with and without amplification
Primary Author (and presenter): Allison, Lauren H.
Additional Authors: Sandage, Mary, Ph.D., CCC-SLP; Weaver, Aurora, Ph.D.
Department: Communication Disorders
College/School: Liberal Arts

The purpose of this investigation is to explore the voice of cycling instructors with and without amplification to better understand and characterize their voice physiology. In a study of 8 instructors, the vocal fold distance dose and perceived phonatory efforts (PPE) were quantified in instructors with and without amplification. It was hypothesized that vocal dose and PPE would both lower in the amplified condition. Participants were instructed to teach a typical class with data collection equipment in place, using the same choreography and playlist in both trials. Pretrial questionnaire showed: 62.5% experienced sore throat and voice changes post class. Results yielded that female average vocal dose was 2,608 meters with amplification and 2,322 meters without amplification, both exceeding recommended safety limits. Mean PPE was 77.6% without amplification and 46% with amplification. The hypothesis that vocal dose would decrease in the amplified voice was not supported. The hypothesis that PPE would lower in the amplified condition was supported. Lowered PPE was present despite a higher vocal dose in amplified conditions. This could be due to psychological reliance on amplification. Inconsistent findings between usage of the amplification system and vocal dose quantified data results could be caused by lack of amplification training, which 62% of participants that reported. Given the preliminary nature of this investigation, generalizability of the findings to fitness instructors as a heterogeneous group are limited. Findings lead to the following recommendations: decrease music volume, strategic coaching, avoidance of extensive speaking during high resistance exercise, increase nonverbal coaching, and avoid instructing double classes.

Title: GC-MS analysis of regioisomeric substituted N-Benzyl-4-Bromo-2,5 dimethoxyphenylamines – derivatives of the NBOMe series of drugs of abuse

Primary Author (and presenter): Almalki, Ahmad
Additional Authors: Clark, Randall & DeRuiter, Jack
Department: Drug Discovery and Development
College/ School: Harrison School of Pharmacy

Description:

The halogenated 25-NBOMe compounds such as 25B-NBOMe (N-(2'-methoxybenzyl)-4-bromo-2,5-dimethoxyphenyethylamine) represent a new class of hallucinogenic drugs. These compounds were first reported in the scientific literature in 2003 as derivatives of the psychedelic phenethylamine 4-substituted-2,5-dimethoxylphenethylamines. The pharmacological actions of the 25-NBOMe drugs appear to result from their potent full agonist action at the serotonin 2A ($5\text{-}HT_{2A}$) receptors in the CNS. Based on their unique structural properties and the potential for multiple isomeric forms, compounds of the NBOMe structural class can be challenging to identify by the standard analytical techniques employed by forensic drug testing laboratories. To gain better insights into the analytical challenges posed by this novel class of drugs, we prepared a series of six N-(dimethoxybenzyl)-4-bromo-2,5-dimethoxyphenylamine regioisomers. These six compounds represent derivatives of 25B-NBOMe where an additional methoxy-group is added onto the common N-benzyl substituent of the core NBOMe structure. The compounds were prepared from commercially available precursor materials and their electron ionization mass spectra (EI-MS) were found to be quite similar, yielding nearly identical fragment ions. The 2',3'-dimethoxybenzyl regioisomer gave a unique fragment ion of significant abundance in the EI-MS at m/z 136. Baseline gas chromatographic resolution of the six regioisomers was achieved using a midpolarity phase of 50% phenyl and 50% dimethyl polysiloxane and the more crowded dimethoxy substitution patterns eluted first under temperature programming conditions. The EI-MS analysis of the TFA-derivatives of these regioisomers allowed for differentiation and specific identification of all six of the regioisomers based on a combination of different base peak ions (m/z 151 or 242/244), unique fragment ions (m/z 136 and m/z 263),and differences in the relative abundance of ions at m/z 121 and m/z 91.

Title: Design, synthesis and pharmacologic activity of
novel psychoactive substituted piperazines

Primary Author (and presenter): Almaghrabi, Mohammed
Additional Authors: Ahmad Almaki; Mohammed Majrashi; DeRuiter, Jack; Clark, Randall C.; & Dhanasekaran, Muralikrishnan
Department: Drug Discovery and Development
School: Harrison School of Pharmacy

Description:

Over the past decade, a number of synthetic piperazine compounds have appeared in the illicit drug market in the US and abroad and these compounds represent a novel class of designer drugs. The most common piperazines encountered to date include benzylpiperazine (BZP), m-chlorophenyl piperazine (mCPP) and 1-(3-trifluoromethyl-phenyl) piperazine (3-TFMPP). BZP produces stimulant effects similar to d-amphetamine although only one-tenth as potent. The phenylpiperazines, such as 3-TFMPP, appear to produce their effects by interacting with serotonergic receptors. We have designed and synthesized a number of structurally novel piperazine derivatives in an attempt to further explore the receptor binding profiles and pharmacologic activities of this drug class. The first series prepared are hybrid analogues which contain the molecular framework of both BZP and TFMPP in a single structure. These derivatives were prepared by reacting commercially available 2-, 3- and 4-TFMPP with benzaldehyde in the presence of a borohydride reducing agent. The second series are substituted derivatives of the hybrid analogues which contain additional methoxy- and methylenedioxy substituents in the benzyl aromatic ring. Such substitutions in other psychoactive drug series frequently results in compounds with unique receptor binding and pharmacologic profiles. This second series were synthesized by a direct displacement reaction with 3-TFMPP and the corresponding substituted benzyl halide in presence of triethylamine. The structures and purities of all products were confirmed by standard spectroscopic techniques.

Title: Effect of tumor-microenvironment on liposome nanoparticles uptake and biodistribution in prostate cancer

Primary Author (and presenter): Alnaim, Ahmed S.
Additional Authors: Jasper, Shanese L.; Davis, Joshua; Quach, Nhat D.; & Cummings, Brian S.
Department: Drug Discovery and Development
College/School: Harrison School of Pharmacy

Description:

Exploiting differences in tumor pathophysiology can enhance the delivery and antitumor activity of chemotherapeutics encapsulated in drug carriers. Pegylated-sterically-stabilized liposomes (SSL) can stably entrap drug, alter drug disposition, improve antitumor activity and minimize toxicity. However, control of their drug-release kinetics has limited their clinical potential. Secretory phospholipases A2 (sPLA2) are excreted and over expressed in a variety of tumors, e.g., up to 22-fold in prostate. These enzymes degrade phospholipids preferentially and have been hypothesized as targets to control drug release from lipid-based nanoparticles, such as liposomes. While they have shown activity in preclinical models, the clinical performance of these formulations has been limited. The goal of these studies was to gain insights into how sPLA2-targeted liposome formulation (SPRL) alter drug release and uptake, specifically examining the role of sPLA2 and its membrane receptor (PLA2R1). Studies were performed using a metastatic-derived human prostate adenocarcinoma cells (PC-3) and a PLA2R1 knock-down variant (PC-3-PLA2R-KD) while varying supplementation of $sPLA_2$ enzyme isoforms (IIA, X, V). Circulation half-life and tumor deposition was similar for both formulations, suggesting the enhanced pharmacological activity is related to release/uptake after drug extravasation. *In-vitro* studies showed that PC-3-PLA2R-KD cells had greater DiR fluorescence of both formulations than wild PC-3 after 48 hr. Moreover, SPRL had greater uptake than SSL formulation ($p<0.05$) beyond 24 hr. *In-vivo* studies showed greater uptake of SSL and SPRL in the PC-3-PLA2R-KD tumors. Overall these data suggest that PLA2R1 plays an important role in the performance of SSL and SPRL formulations. Further studies are needed to gain insights into the clinical significance and to determine if presence of PLA2R1 can be used to identify specific patient populations that would respond to treatment with SPRL.

Title: Cellulose nanocrystal-based MEMS sensors for potential applications
Primary Author (and presenter): Aloba, Sulihat
Additional Authors: Nori Uma Madhuri; Kitchens, Christopher; Davis, Virginia; & Ashurst, William.
Department: Chemical Engineering
College/School: Samuel Ginn College of Engineering

Description:

Microelectromechanical systems (MEMS) devices were fabricated for the first time using a dispersion of cellulose nanocrystals (CNCs) and single-walled carbon nanotubes (SWNTs). These are promising for use in biosensing applications, particularly in point-of-care diagnostics. The addition of SWNTs modified the mechanical and electrical properties of the devices compared to previously produced CNC MEMS. For comparison, paper MEMS force sensors in the form of cantilever beams were created using graphite as the piezoresistive component. These devices are inexpensive, disposable, and can be fabricated within a short time using simple equipment such as a pencil, scissors, and copper foil. The fundamental principle of the force sensors is based on the piezoresistive effect which causes a change in the electrical resistance of the beam when a mechanical strain is applied. An array of four paper-based piezoresistive cantilever beams were fabricated and characterized. CNC MEMS are expected to show better sensitivity than paper MEMS due to the ability to fabricate smaller higher strength structures. CNC MEMS are promising for numerous fields, particularly as single-use sensors in various analytical applications.

Title: Evidence of CXCR7 negative signaling to the ERK1/2 pathway in human coronary artery smooth muscle cells

Primary Author (and presenter): Alqurashi, Thamer
Additional Authors: Chuang, Wang & Jianzhong, Shen
Department: Drug Discovery and Development
College/ School: Harrison School of Pharmacy

Description:

Whether CXCR7 is a signaling or non-signaling scavenger receptor is still in debate. Our previous study showed that during monocyte-to-macrophage differentiation, CXCR7 mediates positive signaling to the p38 and JNK, but not the ERK1/2 signaling pathways. Here, we studied the expression and signaling function of CXCR7 in human coronary artery smooth muscle cells (HCASMC). Real-time RT-PCR analysis detected medium level of CXCR7 mRNA expression in HCASMC, which was significantly upregulated by TNFα stimulation. Ligand screening assay found that among all the commercially available CXCR7 ligands, TC14012 was unexpectedly found to inhibit the phosphorylation of ERK1/2 in a time- and dose-dependent manner. This new ERK1/2-inhibitory effect of TC14012 was not due to cell toxicity, and it was not mimicked by CXCR4-selective antagonists, including AMD3100, AMD3645 and IT1t. Since TC14012 is a CXCR4 antagonist and CXCR7 agonist, our data suggest a potential role of CXCR7 in the negative signaling to the ERK1/2 pathway induced by TC14012 in HCASMC. This was supported by the fact that when CXCR4 was blocked by TC14012, SDF-1 switched signaling property from ERK1/2-stimulatory into ERK1/2-inhibitory effect. In addition, we found that TC14012 also suppressed the basal and SDF-1-induced phosphorylation of MEK1, a direct upstream kinase for ERK1/2. Furthermore, we found that TC14012 dose-dependently inhibited HCASMC proliferation induced by 5% FBS, consistent with the well-known cellular function of EKR1/2 signaling pathway. Selective activation of CXCR7 by TC14012 mediates a novel negative signaling to the ERK1/2 MAPK pathway, leading to a suppression of HCASMC proliferation. The finding highlights that CXCR7 may be a new drug target in combating stenosis or re-stenosis coronary artery diseases.

Title: Rapidly dissolving polymeric microneedles for intraocular delivery of Cyclosporine A
Primary Author (and presenter): Alrbyawi, Hamad
Additional Authors: Ramapuram, Jay
Department: Drug Discovery and Development
College/School: Harrison School of Pharmacy

Description:

Cyclosporine A (CsA) is a cyclic undecapeptide belongs to immunosuppressant class. Its main mechanism of action is inhibition of the production of cytokines involved in the regulation of T-cell activation. CsA possesses anti-inflammatory activity in the treatment of ocular diseases such as uveitis, vernal keratoconjunctivitis and dry eye disease. Local (ocular) administration of CsA became the preferred method of delivery for treatment of ocular inflammatory diseases because non-ocular administration might cause systemic adverse effects such as nephrotoxicity, hypertension and anemia. However, due to its large molecular weight and hydrophobic nature (low aqueous solubility), developing of drug delivery strategies to enhance ocular bioavailability are highly beneficial. Using of topical formulations limit the amount of CsA capable of penetrating to the posterior segment because of permeation barriers, lacrimation and lymphatic clearance. On the contrary, biodegradable microneedles patches can be used to bypass the tear film and sclera, maximizing the amount of CsA delivered to the posterior segment. Biodegradable microneedle patches were fabricated using polyvinylpyrrolidone (PVP) polymer and CsA as the active pharmaceutical ingredient. Furthermore, they were characterized for dissolution time and *ex vivo* permeation. PVP microneedles showed rapid dissolution that ranged from 4 to 5 minutes. Ex-vivo ocular drug distribution studies in a whole procine eye perfusion model showed a significant increase in the drug levels various ocular tissues such as cornea, sclera, iris, ciliary body, retina etc. in comparison to topically applied ophthalmic emulsion. Thus, dissolving microneedles have a potential in the ocular delivery of CsA to the posterior segment of the eye.

Title: Cytotoxicity of hispolon in melanoma (B16BL6) cell lines

Primary author (and Presenter): Alsaqr, Ahmed
Additional authors: Majrashi, Mohammed A.; Alhowail, Ahmad; Dhanasekaran, Murali; Arnold, Robert; & Babu, R. Jayachandra
Department: Drug Discovery and Development
College: Harrison School of Pharmacy

Description:

The current chemotherapy drugs are associated with serious toxic effects hence there is a great need of novel, safe and effective drugs for the treatment of melanoma. Hispolon is a small molecular weight polyphenol from *Phellinus linteus,* which has hepato-protective, antioxidant, anti-inflammatory and anti-proliferative activities. Hispolon has been reported to induce apoptosis in gastric cancer, hepatocellular carcinoma, myeloid leukemia cells. However, its activity in the melanoma cancer is not clear. In this study, we have generated cytotoxicity data in B16BL6 cells by measuring various biological markers. The cells were exposed to hispolon at various concentrations ranging from 5 to 50 µM and expression of various markers such as nitrite, lipid peroxidation, caspase 1 and 3 activity, complex I and IV inhibition, reactive oxygen species induction, bcl-2 and Bax genes expression were studied. We have established that hispolon is a potent inducer of reactive oxygen species, inhibits the expression of bcl-2 gene, promotes the expression of Bax gene promotes expression of caspase enzymes; inhibits complex I and IV, stimulates nitrite content and lipid peroxidation levels, all are associated in cell death or apoptosis. We are further investigating the mechanism of chemotherapeutic potential of hispolon.

Title: Design of hispolon and doxorubicin nanoparticles for melanoma treatment
Primary author (and Presenter): Al Saqr, Ahmed
Additional authors: Alrbyawi, Hamad; Arnold, Robert; Babu, R. Jayachandra.
Department: Drug Discovery and Development
College: Harrison School of Pharmacy

Description:

Co-delivery of Doxorubicin (Dox) and Hispolon (His)using a liposomal system in B16BL6 melanoma cell lines for synergistic cytotoxic effects was investigated. Liposomes were prepared in certain molar ratio (55:40:5 mol% of DSPC/ cholesterol/PEG2000-DSPE, respectively) using lipid film hydration method and loaded with doxorubicin and hispolon (ratio of 1:10). Liposomes were characterized by measuring size, polydispersity index, release profile and drugs content. In addition, vitro cytotoxicity, in vitro cell apoptosis, and cellular uptake were evaluated. Liposomes exhibited high drug encapsulation efficiency (>90%) and small size (~ 103 nm). The release profile of doxorubicin and hispolon from liposome was determined by dialysis method. As expected, liposome formulation showed slower release compared to free Doxorubicin solution as additional time required for the release of drug from the liposome lipid bilayer. Enhanced cytotoxic effects were noticed between doxorubicin and hispolon in B16BL6 tumor cell lines. Liposome loaded with doxorubicin and hispolon exhibited the highest cytotoxicity against B16BL6 cells. IC50 was 0.05 µM and 0.5 µM for liposome loaded with doxorubicin and hispolon and doxorubicin solution, respectively. On the other hand, liposome loaded with doxorubicin and hispolon also displayed significant increase in cytotoxicity compared to the commercially available liposome formulation (DSPC/Cholesterol/doxorubicin). IC50 was 0.05 µM and 0.1 µM for doxorubicin-hispolon liposome and doxorubicin liposome formulation, respectively. Moreover, liposome loaded with doxorubicin and hispolon showed highest cell apoptosis against B16BL6 melanoma cell line. Loading both doxorubicin and hispolon in liposome enhanced cell killing as well as apoptosis more than liposome loaded with doxorubicin alone. Our results showed that such co-loading delivery could serve as a promising therapeutic approach to improve clinical outcomes against melanoma.

Title: Design and synthesis of selective DNA minor groove alkylators against cancer
Primary Author (and presenter): Alturki, Mansour S.
Additional Authors: Smith, Forrest
Department: Drug Discovery and Development
College/School: Harrison School of Pharmacy

Description:

Normal and tumor cells lack DNA structural differences; chemotherapy Targeting DNA are reserved for serious and life threatening diseases such as cancer. Antineoplastic agents like alkylators form covalent bond with DNA and block its replication causing adverse effects such as fatigue, bone marrow depression, hair loss, and many other serious side effects because they lack selectivity towards the DNA of cancer cells. The anti-tumor agents (+)-CC-1065 and duocarmycins were first isolated in 1978. Their structure elucidation revealed a complex molecule composed of 3 pyrrolo-indole subunits that are capable of alkylating DNA, there have been numerous reports focused towards the synthesis of these bioactive compounds and their analogs due to their high potency and site specificity towards the minor groove of DNA followed by alkylation of AT region. Furthermore, the pyrrolobenzodiazepine (PBD) class of compounds that comprises of Anthramycin and its analogs of the pyrrolobenzodiazepine (PBD) class of compounds bind selectively to CG within the minor groove. In addition, minor groove binders such as Distamycin have proven to increase DNA sequence specificity within AT region. Hybridization or mix-n-match drug design strategy provides a useful tool for designing hybrid drugs that is capable of showing more than one mechanism of inhibition at a specific target as a means of overcoming the multidrug resistance problem associated with many antineoplastic agents. Recently, designing and synthesizing of such hybrid compounds have sparked the interest of many drug discovery programs in the hope of improving cancer therapeutics, however, no such data has been released, and no further progress has been reported for combining the structural features of both the CPI, PBD, and minor groove binder classes, in one structure as possible DNA sequence specific cross linker. In this study, the hybrid agent was designed by a rational drug design strategy called hybridization and showed a comparable docking score to distamycin, however, was higher than duocarmycin and anthramycin and displayed a good fit within the crystal structure of minor groove of DNA by using Schrodinger software. Also, two synthetic routes were developed to synthesize the hybrid compound.

Title: Facile approach to polycyclic 3-unsubstituted tetrahydroisoquinolonic acids
Primary Author (and presenter): Alturki, Mansour S.
Additional Authors: Clark, Randall; Deruiter, Jack; & Smith, Forrest
Department: Drug Discovery and Development
College/School: Harrison School of Pharmacy

Description:

There have been numerous reports of polycyclic compounds containing 2,3-disubstituted tetrahydroisoquinolonic acids utilizing the Castagnoli–Cushman reaction or CCR, which have shown to hold tremendous potential in drug discovery and development, as antimalarial agents, kinase (CDK8) inhibitors, GPR40 antagonists, topoisomerase I inhibitors, apoptosis inducers, and antidiabetics. However, no such data has been released, and no further progress has been announced for polycyclic 3-unsubstituted tetrahydroisoquinolonic acids, which sparked our interest in this scaffold. The CCR is somewhat limited by the lack of structurally diverse anhydrides and herein we report a general method into these anhydrides utilizing the Stille reaction. The anhydride for the CCR was prepared by formation of the methyl ester 3 of the commercially available 1,4-dihydroxy-2-napthoic acid 2 followed by selective benzylation 4 and triflation 5. A Stille reaction was used to prepare the diester 6 which was converted to the anhydride 8 under standard conditions. Reaction of the anhydride 8 with 1,3,5-triphenyl-1,3,5-triazinane 9 was accomplished under mild reaction conditions to give 3,4-dihydro-2-N-phenyl-4-carboxy-9-benzyloxybenzo[1,2-f] isoquinoline-1-one, 1.

Title: Spatial effects of rural Mennonite communities on Jaguars
Primary Author (and presenter): Anderson, Cullen, C
Additional Authors: Steury, Todd; Kelly, Marcella
Department: Wildlife Sciences
College/School: Forestry and Wildlife Sciences

Description:

Jaguars (*Panthera onca*) face various anthropogenic pressures (e.g. poaching, deforestation, habitat fragmentation) throughout their range. However, certain human communities may pose greater threats to jaguars and their habitats than other communities due to differential land use and attitudes towards jaguars. In Belize, European Mennonites create large "clear cut" agricultural operations that destroy enormous tracts of forest, which makes these communities significant destructive forces in Belize's rural areas. Current development practices could exclude jaguars from occupying habitat around Mennonite communities when compared to indigenous communities. Using recent camera trap data on jaguars and environmental data from four study sites in Belize, we compared jaguar habitat use between Mennonite and non-Mennonite rural agricultural communities to determine whether jaguars respond differently to these communities. We provide estimates of odds of detection and odds of habitat use of jaguars for all study sites. The results of this study allow for more informed, effective conservation efforts of jaguars, other wildlife, and Belize's tropical forests.

Title: Varying polymer matrix composition of engineered prostate tumor tissues to mimic the full range of tumor stiffnesses found *in vivo*

Primary Author (and presenter): Anderson, Luke S.
Additional Authors: Habbit, Nicole; Suresh, Joshita; & Lipke, Elizabeth
Department: Chemical Engineering
College/School: Samuel Ginn College of Engineering

Description:

Among the leading causes of death today, cancer is an extremely complex and diverse group of diseases. Like most cancers, prostate cancer tumors contain both spatial and temporal heterogeneities, including variations in tumor tissue stiffness. These complexities make the drug development process very arduous and render current *in vitro* testing platforms nearly useless in predicting drug safety and efficacy in the human body. The purpose of this study was to explore how to more effectively model the native tumor microenvironment *in vitro* through control and modulation of the three-dimensional (3D) engineered tumor tissue stiffness. More specifically, this study aimed to fabricate cell-laden poly(ethylene glycol)-fibrinogen (PF) hydrogels that encompass the entire range of tumor stiffnesses observed *in vivo*, thus mimicking the native microarchitectural cues provided to tumor cells. To modulate the hydrogel matrix stiffness, varying amounts of excess poly(ethylene glycol)-diacrylate (PEGDA) was added to the polymer precursor solution. PC-3 prostate cancer cells and BJ-5ta fibroblasts were then encapsulated and maintained in co-culture for 29 days *in vitro*. A live/dead assay was performed to verify the cells remained viable post-encapsulation and throughout long-term culture. Phase contrast imaging was also performed at timed intervals to monitor encapsulated cell colonization and changes in tissue area. The Young's modulus of the engineered tumor tissues was quantified from force versus displacement data collected from parallel plate compression testing. As expected, increasing the percentage of excess PEGDA significantly increased the Young's modulus of the engineered tumor tissues. Mechanical stiffness data additionally showed that the full range of stiffnesses observed *in vivo* was replicated *in vitro*. The results of this study indicate that the engineered tumor tissues more accurately model native tumors *in vitro* than current drug testing platforms.

Title: Use of OpenFOAM for 3D reactive transport modelling at pore scale
Primary Author: Anjikar, Ishan S.
Additional Authors: Starchenko, Vitaliy; Qin, Fanqi & Beckingham, Lauren
Department: Civil Engineering
College/School: Samuel Ginn College of Engineering

Description:

Geologic storage of CO2 in deep saline formations is a promising means of reducing atmospheric CO2 emissions. Once injected, due to high temperature and pressure, CO2 dissolves in brine present in the formation and reacts with formation minerals resulting in dissolution and precipitation reactions. These geochemical reactions may lead to changes in the porosity and permeability of the formation and the rate and extent of these reactions is not well understood. In this work, we are studying the rate and extent of calcite dissolution at the pore scale and the impact on formation properties using a direct numerical simulation method. OpenFOAM, an open source CFD software, was used to simulate reactive flow for a sample from a prospective CO2 Storage Complex in Kemper County, Mississippi, USA (Project ECO_2S). Here, a sample from the Paluxy formation, a prospective reservoir, was analyzed using 3D X-ray Computed Tomography. The 3D image was then converted to a 3D pore network mesh. The continuity, Navier-Stokes, and advection diffusion equations were used to simulate flow through the 3D mesh where the calcite dissolution rate was calculated using the transition state theory rate law. It was assumed that calcite was the only reactive mineral present in the system, for simplicity purpose. Here, the pore space mesh was updated after each time step when dissolution occured, depending on the amount of calcite dissolved. The “Establishment of Early CO2 Storage Complex in Kemper, MS” project is funded by the US Department of Energy’s National Energy Technology Laboratory and cost sharing partners.

Title: Preparation and evaluation of topical gel containing acyclovir and lidocaine for the treatment of herpes simplex virus infections

Primary Author (and presenter): Annaji, Manjusha
Additional Authors: Rangari, Shivani & Babu, R. Jayachandra
Department: Drug Discovery and Development
College/school: Harrison School of Pharmacy

Description:

Herpes simplex virus (HSV) is a pathogen often present both in immunocompetent and in immunocompromised patients, that causes diseases with different degree of severity. Existing acyclovir topical formulations do not provide adequate penetration of the drug through the skin. Therefore, there is a need for improved acyclovir topical formulation for the treatment of Herpes labialis. Herpes infections are also associated with significant pain because the disease originates at the nerve endings. Hence, it is beneficial if lidocaine is co-delivered with acyclovir. The present investigation aims at developing a topical gel formulation for simultaneous delivery of acyclovir and lidocaine. Solubility studies were carried out in different solvents to assess the solubility behavior so as to select the appropriate solvents for developing a gel formulation. In vitro drug release and skin permeation studies were performed using Franz diffusion cells. PEG 400, propylene glycol, pharmasolve and glycerol increased the aqueous solubility of acyclovir whereas lidocaine is found to be highly soluble in Transcutol, ethanol, propylene glycol and pharmasolve. Based on the higher skin permeation obtained by PEG 400, transcutol and pharmasolve, topical gels were prepared for better skin contact time and to enhance drug permeation. In vitro skin permeation studies showed significantly higher skin permeation of acyclovir as compared to a commercial topical formulation, Zovirax ointment.

Title: The effects of changing frontal conditions on aircraft performance and flight planning
Primary Author (and presenter): Arata, Peyton G.
Additional Authors: Riley, Mary
Department: Aviation
College/School: Liberal Arts

Description:

Safety is at the forefront of aviation and understanding the weather and its effect on the airplane is one of the most important ways to stay safe. Weather fronts are especially important to aviators, because they bring about a change in temperature, pressure, and winds that can affect the route of flight, altitude of flight, and aircraft performance in flight. This requires the pilot to understand how the airplane responds to changes in the atmosphere and correct for those changes accordingly.

My research is focused on these frontal conditions and how they affect the airplane, and the magnitude of impact they have on the flight. The United States is an extensive land mass, with different types of weather spanning from coast to coast. This presents a tricky challenge to aviators, especially those who fly long spans across the nation. Student pilots, in particular, often do not have enough time in an airplane and lack flying experience to make fully informed decisions about what route and altitude to fly in changing frontal weather conditions.

Through my research I hope to provide student pilots with a better understanding of how changing frontal conditions affect the flight, which will hopefully allow them to develop an intuition when flight planning that will increase safety for these new pilots. In order to be successful, I will review the FAA regulations, scholarly journal and magazine articles, and conduct interviews with flight instructors and experienced pilots to better understand aircraft performance in changing frontal weather conditions.

It is hoped that this research will help student pilots make better decisions about flights into frontal weather conditions

Title: Aufbau rules for solvated electron precursors: The case of $Li(NH_3)_4$ and $Na(NH_3)_4$
Primary Author (and presenter): Ariyarathna, Isuru R.
Additional Authors: Pawłowski, Filip; Ortiz, Vincent; & Miliordos, Evangelos
Department: Chemistry and Biochemistry
College/School: College of Sciences and Mathematics

Description:

Ground and excited states of $Li(NH_3)_4$ and $Na(NH_3)_4$ complexes were studied employing high level computational methods. The highest singly occupied molecular orbital in each case is spherically diffused around the nuclear skeleton. Such a system can be pictured as an electron surrounding a $[M(NH_3)_4]^+$ core. Each of these molecules can be considered a superatom mimicking alkali-metals. Interestingly, the outer electron of these complexes can be excited in to p, d, and s shaped orbitals. The observed shell model (1s, 1p, 1d, 2s, and 2p) is similar to the previously studied shell order of $Be(NH_3)_4^+$. Two of the $M(NH_3)_4$ complexes where M=Li/Na, can bind together to make a stable dimer similar to how two H atoms produce H_2 molecule.

Title: Story of the super atomic $Mg(NH_3)_{x=4,5,6}$
Primary Author (and presenter): Ariyarathna, Isuru R.
Additional Authors: Pawłowski, Filip; Ortiz, Vincent; & Miliordos, Evangelos
Department: Chemistry and Biochemistry
College/School: College of Sciences and Mathematics

Description:

High level *ab initio* methods were employed to study the neutral and mono-charged species of the $Mg(NH_3)_4$, $Mg(NH_3)_5$, and $Mg(NH_3)_6$ complexes. In the cationic, neutral, and anionic magnesium-ammonia complexes one, two, and three electrons orbit around a $[Mg(NH_3)_x]^{2+}$ core respectively, where x=4,5,6. $Mg(NH_3)_4$, $Mg(NH_3)_5$, and $Mg(NH_3)_6$ complexes are shown to have tetrahedral, trigonal bipyramidal, and octahedral geometries. The anions of the studied complexes are found to have positive electron affinities illustrating their stability over the respective neutral complexes. The outer electrons of these complexes are found to reside hydrogenic type orbitals. The observed shell model for these complexes follows the 1s, 1p, 1d, 2s, 2p, 1f, 2d sequence, which is similar to the jellium model. Here we report and compare optimal geometries, excitation energies, ionization energies, and energetics for several electronic states of titled complexes.

Title: Improving estimation of leaf wetness duration using machine learning with climate reanalysis data

Primary Author (and presenter): Asadi, Parisa
Additional Authors: Tian, Di
Department: Crop, Soil and Environmental Sciences
College/School: College of Agriculture

Description:

Leaf wetness duration (LWD) is one of the most critical parameters involved in the development of plant diseases, which makes monitoring of LWD essential to manage weather-related crop diseases. The purpose of this study is to explore the potential of using machine learning techniques with climate reanalysis dataset to estimate leaf wetness duration. Random Forest (RF) model and the baseline Classification and Regression Tree (CART) model are developed to generate estimates of leaf wetness duration. ERA-5, a climate reanalysis dataset, is used to as input into the machine learning models. The RF model takes relevant auxiliary variables from ERA-5 such as solar radiation, vapor pressure, and evapotranspiration during the growing season in addition to the variables used in the baseline CART model. The modeled LWD estimates are evaluated using in situ observations at 16 sites in Alabama. The result shows that RF model has better performance compared to the baseline CART model. The results also indicates that the estimation of leaf wetness duration using RF model improves given the reduced root mean square error and mean absolute error compared to CART. This study suggests that combining machine learning with global climate reanalysis can accurately estimate LWD, and it would be particularly valuable when there is no in situ observation data available.

Title: Bio-oil based wood composite
Primary Author (and presenter): Asafu-Adjaye, Osei A.
Additional Authors: Celikbag, Yusuf; Street, Jason; Via, Brian; Peresin, Maria; Auad, Maria & Adhikari, Sushil
Department: Forest Product Development Center
College/School: School of Forestry and Wildlife Science

Description:

This study investigated the feasibility of using the bio-oil produced from fast pyrolysis process as part of Epoxy/polymeric diphenylmethane diisocyanate (pMDI) binder system for Oriented Strand Board (OSB) production. The bio-oil was obtained from the pyrolysis process of loblolly pine wood. The effect of the resin content and the Epoxy/pMDI to bio-oil ratio on the physical and mechanical properties of the OSB was examined. The properties include internal bond, modulus of rupture, modulus of elasticity, thickness swelling, and water absorption. The effect of adding acetone into the pMDI/bio-oil resin on the properties of OSB was also investigated. The results showed that the incorporation of acetone reduced the viscosity of the adhesive by up to 64 percent, from which the efficiency for resin spraying on the flakes was improved. The higher the bio-oil content, the lower the mechanical strength of OSB obtained. However, the Epoxy/pMDI resin with bio-oil content of 25 percent showed comparable bonding properties to those of pure pMDI resin.

Title: Conservation reserve program and timber price in the US south
Primary Author (and presenter): Assogba, Noel Perceval
Additional Authors: Daowei, Zhang
College/School: School of Forestry and Wildlife Science

Description:

The Conservation Reserve Program (CRP) represents the largest environmental program in the US. In this paper, we estimate the effect of CRP on the price of sawtimber in the US south using a reduced form model. This reduced form model was derived from the market clearing condition between the demand and supply of sawtimber on the US south market. The results of the estimation based on time series data covering the period 1960-2017 suggest that the CRP had a negative effect on the price of sawtimber. This effect is estimated at 48%.

Title: Effect of dietary supplementation of layer hens with a hydroxy-analogue of selenomethionine on performance and egg quality

Primary Author (and presenter): Avila, Luis P.
Additional Authors: Puron, Diego; Sierra, Mario; Aragon, Luisa; Starkey Jessica; & Starkey, C harles
Department: Poultry Science
College/ School: College of Agriculture

Description:

Se sources (SeS) are added to layer hens' feed, as it is metabolically important for immunity, reproduction, and health. The purpose of this experiment was to evaluate the effect of 2 dietary SeS on layer hen performance, Haugh units (HU), and Se content of eggs (µg Se per 100 g). A 12-wk randomized complete block design experiment was conducted. Dietary treatments were: 1) negative control without added Se (Se0; 0.07 mg per kg of feed), 2) sodium selenite (SeSod; 0.37 mg per kg), and 3) hydroxy-analogue of selenomethionine (SeHDXM; 0.37 mg per kg). Added SeS provided 0.30 mg of Se per kg of feed. 42 wk-old White Dekalb layer hens (n = 420; 1.6 kg BW) were deprived of added SeS for 4 wk before the 8-wk Se feeding period. There were 6 complete blocks with 12 replicate cages with 7 hens per cage (420 cm^2 per hen). All hens were fed equal amounts of feed per wk (104 g per hen per d). Measured variables were: laying rate (%), egg weight (g), egg mass (g), feed conversion ratio (FCR), and mortality (%). HU were measured in unwashed eggs (n = 250) collected at wk 8 and stored at room temperature (21 ˚C) for 0, 1, 2, 3, 4 wk post-collection. Se content was determined in eggs (n = 80) collected at wk 4 and 8. Data were analyzed using the GLIMMIX procedure of SAS (V9.4). Means were declared different when $P < 0.05$. SeS did not impact egg mass ($P = 0.166$), mortality ($P = 1.000$), or FCR ($P = 0.106$). Hens fed Se0 laid the heaviest eggs (63.28 g; $P = 0.004$). Laying rate was improved in hens fed SeHDXM (96.36%) compared with hens fed SeSod (94.70%; $P = 0.023$). At wk 4, eggs from hens fed SeHDXM had the lowest Se content ($P = 0.031$), but at wk 8, Se content of eggs was similar among all treatments ($P = 0.724$). SeS did not alter HU at wk 0, 1, 2, or 4 post-collection. Eggs from hens fed SeSod and SeHDXM retained higher HU at 3 wk post-collection ($P = 0.015$). Overall, neither added SeS improved hen performance compared with Se0; however, egg quality (HU) was improved by added Se.

Title: Spiroid design optimization in a rotating continuous bioreactor for enhanced oxygen transfer

Primary Author (and presenter): Avvari, Rithvija
Additional Authors: Hanley, Thomas & Todd, Paul
Department: Chemical Engineering
College/School: Samuel Ginn College of Engineering

Description:

Bioreactors have great potential to provide optimum conditions for cell culture and play an important role in increasing cell productivity in both scientific and pharmaceutical areas. Increasing cell survival rate and extending cell lines to large scale production is always a point of interest industrially. Two major limitations on cell growth are oxygen transfer and shear stress. Roller bottles are used for these criteria, but they are limited to batch operation. Therefore, research on continuous bioreactors requires new methods to improve mixing and mass transfer to increase cell production. The high shear stress from mechanical impellers typically results in greater cell death, especially for mammalian cells. An internal spiroid in a rotating continuous bioreactor provides an alternative for enhanced oxygen transfer and mixing to produce more viable cells. The tubular spiroid collects liquid and gas from the partially-filled rotating bioreactor near the reactor exit and delivers the gas and liquid to the reactor entrance. The mass transfer coefficients were estimated for the reactor with and without the spiroid using theoretical models to determine the projected increase in oxygen transfer. These values are compared to published experimental values at various rotational rates. Calculated volumetric mass transfer coefficients provided a basis for optimizing the design of the spiroid. Further studies include computational fluid dynamic simulations to find optimum dimensions of the spiroid and cultivating different cell culture for higher yields.

Title: Geospatial mapping and analysis of the global distribution of poly- and perfluoroalkyl substances (PFAS)

Primary Author (and presenter): Ayers, Meredith A.
Additional Authors: Wang, Danyang; Viticoski, Roger; Mulabagal, Vanisree; & Hayworth, Joel
Department: Civil Engineering
College/School: Samuel Ginn College of Engineering

Description:

Poly- and perfluoroalkyl substances (PFAS) represent a broad suite of synthetic chemicals that are ubiquitous in the environment and are linked to alarming health effects such as cancer, immune dysfunction, and endocrine disruption in both humans and wildlife. For the past decade, communities in academia and industry alike have been keenly interested in evaluating the global distribution of PFAS and the environmental and human health risks associated with exposure. Although the total number of experiments aiming to address risk and aid in future regulation decision support continues to grow, the concentrations of PFAS applied in these experiments vary widely by scientific discipline. A holistic understanding of the occurrence, distribution, and concentrations of these compounds in natural systems is imperative to progressing knowledge regarding the human health effects, environmental behavior, and fate of PFAS. Thus, this research aims to geospatially synthesize existing data in scientific literature to determine concentration levels of PFAS that are pertinent to humans, biota, and ecosystems. The spatial and statistical results of this study can be utilized by toxicologists, physiologists, pharmacologists, engineers, and scientists of various disciplines to design realistic exposure and risk experiments. Additionally, the current study may provide focused insight regarding the current state of PFAS contamination across the globe.

Title: A novel and universal laser-based approach for synthesis of atomically-thin 2D quantum materials

Primary Author (and presenter): Azam, Nurul
Additional Authors: Ahmadi, Zabihollah; Yakupoglu, Baha; Elafandi, Salah; & Mahjouri-Samani, Masoud
Department: Electrical and Computer Engineering
College/School: Samuel Ginn College of Engineering

Description:

Since the discovery of graphene in 2004, a significant amount of interest has grown on the other 2D layered materials such as transition metal dichalcogenides (TMDCs) which show unusual properties associated with their firmly defined dimensionalities. Especially, tunable electronic properties of 2D TMDCs materials are vital for their applications in optoelectronics. Many efforts have been developed from both top-down and bottom-up perspectives to fabricate mono- and few-layer TMDCs including micromechanical exfoliation, chemical exfoliation, hydrothermal synthesis, physical vapor deposition and chemical vapor deposition (CVD). However, the synthesis of these materials is still challenging due to the complexities associated with the existing synthesis methods such as lack of controllability, complex gas phase dynamics, waste of precursor due to career gas, limited reproducibility. In this paper, a laser-assisted synthesis approach will be introduced which has overcome most of the critical problems in the current synthesis methods. Importantly, a generalized synthesis perspective for semiconducting TMDC monolayers (such as MoS_2, $MoSe_2$, WSe_2, and WS_2) will be presented.

Title: Does lower energy expenditure increase reward-related cortical/brain activity and reward pursuit?
Primary Author (and presenter): Bacelar, Mariane
Additional Authors: Cheval, Boris; Boisgontier, Matthieu; Feiss, Robyn; Miller, Matthew
Department: School of Kinesiology
College/School: College of Education

Description:
Physical inactivity is a poorly understood and worldwide health problem. A recent theory contends that this pandemic may be explained by brain processes inherited from evolution. These processes would make us perceive low energy expenditure as a reward. However, direct empirical evidence testing the rewarding value of behaviours minimizing energetic cost is lacking. If this theory is correct, opportunities to earn rewards associated with low energy expenditure should elicit greater reward pursuit, as characterized by faster behavioural responses and increased response preparatory neural activity than rewards associated with higher energy expenditure (Hypothesis 1); and rewards associated with low energy expenditure should trigger greater reward-related neural activity (Hypothesis 2). We tested these two hypotheses. In each trial of the task, participants attempted to quickly respond to a target on a computer screen, then received reward feedback and retrieved a token or no reward feedback and no token. In half of the trials, participants increased energy expenditure by standing up to retrieve the token, whereas the other half required participants to minimize energy expenditure by remaining seated to retrieve the token. Neural activity was recorded with EEG throughout the task. Response preparatory neural activity was assessed using the contingent negative variation (CNV) component, and reward-related neural activity was assessed using the reward positivity (RewP) component. Response times were also indexed. Dependent t-tests showed no differences in response time, CNV, or RewP between standing up vs. remaining seated trials, thus suggesting that energy expenditure had no influence on these outcomes. These findings do not support the theory that minimizing energy expenditure is rewarding. Future studies should investigate the factors that likely interact with the rewarding value of energy cost minimization such as cognitive resources or recent exercise history.

Title: Deep tissue imaging of B16 melanoma in mice by multispectral optoacoustic tomography (MSOT)

Primary author (and presenter): Bahauddin, Ammar A.
Additional author: Panizzi, Peter
Department: Drug Discovery
College/ School: Harrison School of Pharmacy

Description:

Melanoma is the deadliest and the most aggressive type of skin cancer. This is due to its capability to metastasize through the lymph nodes to distant sites and organs all around the body. Liver, lungs, bones and brain are most often affected by these metastases. Patients who are diagnosed early have a 5 year survival rate of 97 - 99%. On the other hand, those who have metastatic melanoma have a 10 - 40% survival rate. Therefore, early detection of melanoma increases the survival rate for those patients. One of the diagnostic tools that is used for pre-clinical studies to detect and predict melanoma at its early stages is molecular imaging. Multispectral Optoacoustic Tomography (MSOT) imaging is a novel-imaging tool for preclinical studies that uses photoacoustic signal to gain structural and functional information. It allows real-time observation of endogenous markers such as oxygenated and deoxygenated hemoglobin. Moreover, it allows the user to track more specific absorbance chromophores such as melanin within deep tissue and in high resolution. We studied the metastatic potential of different melanoma cell lines by the use of MSOT and standard histology. Mice models were prepared by injecting the mice with B16 melanoma through intravenous and intradermal routes. We followed tumor growth and imaged the mice using MSOT every 5 days. MSOT was able to detect melanoma in lungs, liver and kidneys. These organs are distant from the site of administration, which indicates that melanoma had traveled and metastasized away from the original site. Furthermore, after collecting the organs, histological analysis by hematoxylin and eosin staining confirmed the presence of melanoma and its metastasis. Our next step is to examine some compounds that might have potential anti-tumor effect. Taken together, detecting melanoma at early stage could be crucial to successful melanoma treatment.

Title: Dyslipidemia in the elderly
Primary Author (and presenter): Bailey, Frankqunetta S.
Additional Authors: Ellison, Kathy
College/School: School of Nursing

Description:

There is strong evidence that statins cause adverse effects among the elderly because of co-morbidities and poly-pharmacy. Studies have demonstrated that myopathy and myalgias have been associated with statins and contribute to falls. Evidence-based guidelines recommend prescribers use caution before starting statins, obtain baseline labs, monitor labs during therapy, and discontinue statins with a life expectancy of less than two years. The purpose of this project was to provide recommendations to prescribers for stopping statins for patients with a limited life expectancy, in an effort to improve quality of life, comfort, and decrease falls. The target population included adults (60 and older), on hospice, who take statins, and have had one fall. Following participant agreement, participants completed a questionnaire assessing their quality of life and comfort, and their statin was discontinued. The questionnaire was repeated prior to completion of the project. The questionnaires were compared to identify if quality of life and comfort improved, and the medical record was reviewed to identify falls since implementation. The project is in progress. Descriptive statistics will be used to describe the patient's age, falls, and diagnosis. Follow-up data will include falls after implementation. All participants questionnaires, pre-post mean scores will be compared with paired t-tests (alpha=0.05). Discontinuing statins among patients with a limited life expectancy can improve quality of life, comfort, and decrease falls. Using caution before prescribing, obtaining labs, and monitoring patients can decrease adverse effects, and further implementation of the project is warranted.

Title: Development of a musical chord stimulus to assess cortical neural functioning
Primary Author (and presenter): Baker, Gena
Additional Authors: Krishnamurti, Sridhar & Weaver, Aurora
Department: Audiology
College/School: College of Liberal Arts

Description:

The purpose of this study was to develop a musical stimulus for cortical neural functioning in musicians versus non-musicians. Skoe and
Kraus found that brainstem and subcortical function dynamically changes following musical training. Though limited, other studies such as Pallesen et. al. have reported that musical expertise is associated with structural and functional changes in the brain that underlie facilitated auditory perception. In the current study, brainstem and cortical electrophysiological testing was completed on musicians and non-musicians. The click evoked auditory brainstem response (ABR) was used for neural synchrony purposes. Speech evoked ABR (BioMark) was used to correlate with behavioral tasks. Music evoked cortical P1N1 responses were recorded to look at the number of neurons in the auditory cortex available for musical processing. For the study, the Major A chord stimulus was developed using MATLAB programming software. Electrodes were placed on forehead and mastoid locations to record click-evoked ABR, speech-evoked ABR, and chord-evoked P1N1 cortical responses. Click-evoked ABR waves were found to be similar in both musicians and non-musicians, indicating that the basic brainstem functionality was similar across these groups. In both groups, speech-evoked brainstem response was found to be significantly correlated to behavioral (speech in noise) tasks. It was found that the size of the cortical response (P1N1 amplitude) was the most significant outcome when looking at the effects of musical training. Individuals with music training had a higher P1N1 response in the left ear compared to non-musicians. Because the left ear is contralaterally connected to the right hemisphere of the brain, we postulate that the higher P1N1 amplitude may reflect the plasticity of right hemisphere function in individuals receiving musical training.

Title: Soy isoflavones regulate testicular androgen secretion at all stages of development in the male rat

Primary Author (and presenter): Bamidele, Jeminiwa O.
Additional Authors: Knight, Rachel C.; Molina, Erica M.; Bradley**,** Samantha M.; Fischer, John F.; & Akingbemi, Benson T.
Department: Anatomy, Physiology and Pharmacology
College/School Name: College of Veterinary Medicine

Description:

Soy formulas contain isoflavones at final concentrations above 100 μM which achieve blood concentrations of 300-600 ηM in infants after ingestion. Soybeans contain the isoflavones genistin and daidzin, which are hydrolyzed in the gastrointestinal tract to their aglycones genistein and daidzein. Daidzein is further metabolized to equol in about 30% of the population. Our previous study indicated that perinatal exposure of male rats to isoflavones interferes with proliferative capacity in Leydig cells and affected testicular hormone secretion. Testosterone (T), which supports male reproductive development, is mostly produced by testicular Leydig cells. The objective of the present study is to determine the influence of timing of exposure of isoflavones on testicular androgen secretion and demonstrate that isoflavones act directly in Leydig cells. Male Long-Evans rats were maintained on control, soy-based (SBM) or the control diet supplemented with genistein and daidzein (G+D) for 14 days, i.e., from postnatal days (PND) 21-35 (infantile exposure), 35-49 (pubertal exposure) and 75-90 (adult exposure). At sacrifice, blood was collected to obtain serum, which were analyzed by radioimmunoassay (RIA) to measure T concentrations. Testicular explants and isolated Leydig cells were incubated in DMEM/F12 culture medium without and with 100 ηg/ml ovine LH for 3 h. Aliquots of spent media were then analyzed by RIA to measure T production. Results showed that feeding of both SBM and G+D diets decreased serum, basal and LH-stimulated T concentrations across all three stages of development ($P<0.05$); this effect was most profound with the adult exposure. Follow-up experiments were performed *in vitro* to confirm that genistein acts directly in Leydig cells. Primary cultures of immature Leydig cells isolated from 35-day old male rats were incubated in DMEM/F12 culture medium containing 0, 0.01, 0.1 1 and 10 μM genistein for 18 h. At the end of treatment, aliquots of spent media were analyzed by RIA to measure T production. The concentration of genistein causing half-maximal inhibition of T secretion (IC_{50}) was estimated at 36.2 ηM ($P<0.05$). The onset of genistein inhibition was determined to be 10 h (control: 216±5 versus genistein: 166±5 ηg/10^6 cells; $p<0.05$). Altogether, the data showed that testis at all stages of development are sensitive to regulation by soy isoflavones acting, at least in part, directly in Leydig cells.

Title: Turning up the heat on interpretability of deep neural networks
Primary Author (and presenter): Bansal, Naman
Additional Authors: Patel, Jay & Nguyen, Anh
Department: Computer Science and Software Engineering
College/School: Samuel Ginn College of Engineering

Description:

The breakthrough paper by Alex Krizhevsky in 2012 has led to an exponential rise in the popularity of deep learning algorithms among the scientific community. Deep neural networks (DNNs) have become ubiquitous and goto solutions for all kinds of problems such as image recognition, object detection, digital forensics, recommender systems, etc., which were supposed to be unthinkable in the past decade. Even after all these advances, interpretability remains an Achilles' heel of DNNs. With the increase in the use of deep models for critical tasks such as medical diagnosis, self-driving cars, credit systems, it has become imperative to open the mystery of these black boxes. To this end, various visualization techniques have been proposed that center around attributing the network results to the dimensions of input features, thereby creating a heatmap/saliency map. However, due to their qualitative nature, an observer is still vulnerable to the confirmation bias while interpreting it as the model explanation. Based on our initial experiments, we hypothesize that the heatmap methods do not correspond to the actual reasoning of the network. To corroborate our hypothesis, we design a testing methodology to quantify the performance of the saliency maps under various circumstances. In our research, we come up with a strategy to generate the ground truth which will help us quantitatively verify the explainability of the heatmap methods. We believe that our test setup could work as a benchmark for the new techniques and will further support the community to design inherently interpretable networks.

Title: Physico-chemical characterization of lignins from different sources for synthesis of lignin based epoxy resin

Primary Author (and presenter): Bansode, Archana S.
Additional Authors: Adams, Stephen; Barde, Mehul; Elder, Thomas; & Auad, Maria L.
Department: Chemical Engineering
College/School: Samuel Ginn College of Engineering

Description:

Lignins are now considered as the main aromatic renewable resource, formed in nature by the radical polymerization of p-coumaryl alcohol, coniferyl alcohol, and sinapyl alcohol, bearing p-hydroxyphenyl (H), guaiacyl (G), and syringyl (S) units, respectively. They serve as an alternative feedstock for the synthesis of chemicals and polymers for the development of renewable materials. So, in this study, we are focusing on the structural characteristics of various lignin such as Kraft lignin (Indulin AT), lignosulfonate lignin (Borresperse CA and Borresperse 3A) and Organosolv lignin. The functional group of lignin is analyzed by FTIR (Fourier-transform infrared spectroscopy), Py-GCMS (Pyrolysis–gas chromatography-mass spectrometry), 2D HSQC (Heteronuclear Single-Quantum Correlation), 31P NMR (Phosphorus-31 nuclear magnetic resonance spectroscopy), methoxy group content. Additionally, the thermal properties of lignin are studied with DSC (differential scanning calorimetry) and TGA (thermogravimetric analyzer). The combined data provide valuable information on the structure and composition of the lignin. To determine the average molar mass (Mw) and polydispersity (PD) of the lignin macromolecule by Gel permeation chromatography (GPC), the derivatization of lignin through acetylation is carried out to enhance the solubility of lignin. Epoxidation of lignin is a way to develop its application potential. The development of lignin-based epoxy resin is a promising way to use as a substitute for petroleum-based epoxy resin. So, we are working on epoxidation of lignin through various systems. The epoxidation reaction is monitored by FTIR (Fourier-transform infrared spectroscopy) and 31P NMR (Phosphorus-31 nuclear magnetic resonance spectroscopy).

Title: Identification of southern crabgrass (*Digitaria ciliaris*) biotypes resistant to postemergence- applied pinoxaden herbicide

Primary Author: Basak, Suma
Additional Authors: McElroy, Scott J.
Department: Crop, Soil, and Environmental Sciences
College/ School: College of Agriculture

Description:

Southern crabgrass (*Digitaria ciliaris* (Retz.) Koeler) is a competitive annual grass weed that commonly infests turfgrass, roadsides, wastelands and major cropping systems throughout the southeastern United States. Acetyl-coenzyme A carboxylase (ACCase) inhibiting herbicides including cyclohexanediones (CHD), aryloxyphenoxypropionates (AOPP), and pinoxaden are used as a selective graminicide for postemergence grass weed control in annual and perennial cropping systems. Two biotypes of southern crabgrass (R_1 and R_2) with confirmed resistant to CHD and AOPP were collected from sod production fields in Georgia. A susceptible biotype (S) was collected from Alabama. Studies were conducted to determine the primary mechanism for resistance in these two resistant biotypes and to determine if the resistance to pinoxaden herbicide was present in these two biotypes. Increasing rates of pinoxaden (0.09 to 23.5 kg a.i. ha^{-1}) were evaluated for control of R_1, R_2 and S biotypes. The resistant biotypes for CHD and AOPP herbicides were resistant to pinoxden at the lower rate relative to the susceptible biotype. The susceptible biotype was completely controlled at rates 11.8 and 23.5 kg a.i. ha^{-1} resulting in no aboveground biomass at 14 DAT. Pinoxaden rates at which tiller length and above-ground biomass would be reduced by 50% (I_{50}) and 90% (I_{90}) for R_1, R_2 and S ranged from 7.2 to 13.2, 6.9 to 8.7 and 0.7 to 2.1 kg a.i. ha^{-1}, respectively for tiller length and 7.7 to 10.2, 7.2 to 7.9 and 1.6 to 2.3 kg a.i. ha^{-1}, respectively for above-ground biomass. The amplification of the carboxyl-transferase domain of the plastidic ACCase by standard PCR and the transcriptome profiling by RNA sequencing revealed a single Ile-1781-Leu amino acid substitution in these resistant biotypes. Research, therefore, confirms that in addition to conferring resistance to CHD and AOPP herbicides, Ile-1781-Leu also confers resistance to pinoxaden.

Title: Diffusion tensor imaging of Huntington's disease in sheep at 3T MRI
Primary Author (and presenter): Batcho, Erin, C
Additional Authors: Gotoor, Sai Sheshan Roy; Perumal, Raj; Keller, Marianne; Kuchel, Tim; Chandra, Sundeep; Howland, David; Deshpande, Gopikrishna; Gray-Edwards, Heather; Denney, Thomas S
Department: Electrical Engineering
College/School: Engineering

Description:

Huntington's Disease (HD) is a dominantly inherited progressive neurogenerative disorder caused by an expansion of the CAG sequence of the huntingtin (HTT) gene in exon 1. In 2008, a humanized HD sheep transgenic model was developed to provide a model that recapitulates adult onset HD. High field (3T) MRI was utilized to determine if the HD sheep exhibit traditional neurodegenerative changes of HD, which has been shown as a loss of connectivity and volume in white matter tracts of the brain. In previous studies, humans with HD have exhibited higher values of apparent diffusion coefficient (ADC) and lower values of fractional anisotropy (FA). Using diffusion tensor imaging (DTI), data was analyzed from normal and transgenic sheep using both a region of interest (ROI) analysis and a tract-based analysis to detect white matter alterations. The diffusion images were acquired on a 3T SIEMENS Skyra scanner using a 2D EPI diffusion sequence. For each region drawn, the means and standard deviations of ADC, FA, Radial Diffusion, and Axial Diffusion were computed. Within the ROI analysis, there were statistically significant differences in the ADC mean in the occipital cortex, the Radial Diffusion SD in the right internal capsule, as well as the ADC SD, Axial Diffusion SD, and Radial Diffusion SD in the corpus callosum. Within the tract-based analysis, there was a statistically significant difference in the FA mean, FA standard deviation, and Radial Diffusion mean within both the left and right internal capsules, the FA mean and the Radial Diffusion mean within the left caudal internal capsule, the FA mean in the parietal cortex, as well as the ADC mean, Radial Diffusion mean, and Radial Diffusion SD in the occipital cortex. While further studies are needed to validate these trends, these results suggest that the HD sheep model exhibits MR based changes that are consistent with human patients and these modalities may be objective measures for testing of novel therapeutics.

Title: Complementary aromatherapy supporting patients with anxiety
Primary Author: Beck, Olivia E.
Additional authors: Peterson, Mary
College/ School: School of Nursing

Description:

Patients with anxiety are currently treated with the standard of care including pharmaceutical and mental health counseling. However, patients are still endorsing symptoms of anxiety. Studies have strongly suggested the use of complementary therapy in conjunction with the standard of care to aid in managing anxiety symptoms. The purpose of this project was to implement complementary therapy in the form of aromatherapy to improve outcomes for patients with anxiety. The target population included adults (18-55 years old) with anxiety in a primary care clinic. Following participant agreement, participants completed a validated anxiety screening tool, State Trait Anxiety Inventory scale (STAI). The project leader then reviewed the instructions of how to administer the aromatherapy in home. Essential oils were supplied. A follow up STAI tool was administered at 2-week intervals for a total of 6 weeks to assess anxiety scores and patient adherence with complementary therapy. The project is in progress. Descriptive statistics will be used to describe the patient population, anxiety scores, prevalence of anxiety symptoms, and patient adherence. Follow-up data will include number and percent who adhered to treatment. Among those with baseline anxiety scores, the pre-post STAI mean scores will be compared with paired t-tests (alpha=0.05). Including complementary therapy with the standard of care for patients with anxiety has the ability to improve patient outcomes. Complementary treatment of anxiety symptoms among patients with anxiety are achievable in this primary care office setting and further implementation of the project is warranted.

Title: Modelling of pore networks built from analysing micro-CT images of the Paluxy formation for a better understanding of its porosity and permeability evolutions

Primary Author (and presenter): Bensinger, Jacob Haber
Additional Authors: Beckingham, Lauren; Jeffrey Steinwinder
Department: Civil Engineering
College/School: Samuel Ginn College of Engineering

Description:

Kemper County in Mississippi is home to several subsurface reservoir formations that are promising for carbon dioxide storage including the Paluxy Formation that sits at 5100 meters underground. This sandstone formation is notable for its high average porosity and permeability. The average porosity has been found to be 32% and the permeability has been measured as high as 16 Darcy. Carbon dioxide sequestration and storage technology is being widely studied as an emissions remediation tool and quantifying the viability of subsurface reservoir formations is a major aspect of the overarching research goal. It needs to be known how a formation will evolve under the reactive conditions that occur when CO_2 is injected at a wellsite. This work uses a 3D micro-CT image of an actual core drilled out of the Paluxy formation to create a representative 3D binary image of the pores and grains. This 3D image is analyzed by the PNExtract code (Raeini, 2017). In this code, the maximal ball theorem is used to inscribe pores and determine the pore and pore-throat sizes and connectivity of the sample. A pore network model (PNM) is then built in MATLAB by sampling random pore sizes and connections from the image-obtained pore and pore-throat size distributions of the Paluxy formation. This PNM is computationally efficient and able to simulate the larger formation's behavior. This work will evaluate the porosity and permeability relationship of the Paluxy Formation under reactive and non-reactive conditions.

Title: Personal values and their impact on HospiQuality and customer satisfaction
Primary Author (and presenter): Bernard, Shaniel A.
Additional Authors: Rahman, Imran & Beldona, Srikanth
Department: Hospitality Management
College/School: College of Human Sciences

Description:

This study identifies the underlying constructs in personal values and investigate how these sub-constructs influence two measures of service evaluation; one being HospiQuality, which is a proposed contextual measure of the quality of hospitality performance and the other being customer satisfaction, which is a globally accepted generic measure of service evaluation. Three samples of data were collected at various stages of the development and testing process; however only the results from Sample 3 are discussed in this paper. The findings confirm HospiQuality as a strong antecedent of customer satisfaction and presented a compelling case for the inclusion of HospiQuality as a measure of performance in hospitality enterprises. More specifically, the relationships between personal values, HospiQuality and customer satisfaction were distinctive. The implications for hospitality marketing professionals, hoteliers and industry professionals are discussed.

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Title: Rejuvenate: Re-development of Opelika's 1st Avenue
Primary Author (and presenter): Bhalerao, Rajas Narendra
Department: Political Science
College/School: College of Liberal Arts

Description:

The need for urban design is of utmost importance for increasing economic activity in any city. Similarly, Opelika, AL has a lot of potential to increase their economic activities with introducing more walkability, bike plans and commercial activities inside the city limits. The main focus of this research is on the Pepperell Mill and Village which is situated on 1st Avenue, Opelika. Pepperell Mill and Village was constructed in the year 1925 and played a major role in overall development of Opelika, AL. Today, the Mill is abandoned and this affects the overall property value of the neighborhood. To solve this, the research gives importance to redevelopment of the Pepperell Mill and Village to increase property value and economic activity in the neighborhood.

The Village consisted of around 223 properties which included church, school, daycare, and around 100 residential houses. The company produced textile and was operable till 2006 but in 2013, a fire broke damaging almost 70% of the mill area. Currently, most of the mill buildings are abandoned and the condition of the road outside the mill (1st Ave) is quite bad. Currently, the City of Opelika has plans to redevelop the 1st Avenue for the same reasons as the research. The research suggests to include commercial complex and other schemes which will surely help the citizens of Opelika. The research also showcases the quantitative data including demographics, income level, property values, etc. With this research, the overall city will be benefited with increase in job opportunities and economic activities.

Title: Copper bactericides; spray or not to spray!
Primary Author (and presenter): Bhandari, Rishi R.
Additional Authors: Newberry, Eric & Potnis, Neha
Department: Entomology and Plant Pathology
College/School: College of Agriculture

Description:

Copper bactericides have been used since decades for the control of bacterial plant pathogens. Repeated use of copper bactericides against bacterial spot (BLS) xanthomonads have evolved copper resistance systems which are encoded in the plasmid and are transferred between the strains in the field. This continuous use of copper has created a selection pressure on these bacteria where we recently identified several copper-tolerant *X. perforans (Xp*) strains collected between 1990-2016 that do not contain these large plasmids and the copper resistance is mediated by genomic island in chromosome. These findings have led to several questions: Do plasmid-borne copper tolerant strains still exist? How similar is plasmid-borne copper resistance operon to that of chromosomally encoded operon? Are chromosomal copper resistance loci subject to horizontal gene transfer? If so, what is the mechanism of transfer? Here we present some clues to resolve dilemma of to spray or not to spray copper-based pesticides and to inform our disease management strategies.

Title: Understanding Holocene deformation within the Bellingham basin in the northwestern Cascadia (WA)

Primary author (and presenter): Bhattacharya, Rahul
Additional author: Wolf, Lorraine
Department: Geosciences
College/ School: College of Sciences and Mathematics

Description:

This study tries to understand the Holocene faults and upper plate deformation within a forearc basin in Northwestern Washington, known as Bellingham basin. The forearc tectonics in Northwestern Washington is influenced by migration and rotation of crustal blocks in the upper plate of the Cascadia subduction zone. For this study, ground based gravity and aeromagnetic datasets have been used to create different anomaly maps and a 2.5D forward model. This study also uses wavelength separation technique to create vertical derivative maps and understand the shallow subsurface deformations in the form of surface lineaments. The 2.5D model profile extends a length of more than 30 km from the Canadian border, southwest through the Bellingham basin to the north of Lummi Island. The profile is further constrained by geologic data, LiDAR data, and well-log information. The gravity data along the profile exhibit two highs on either end that straddle a gravity low in the central part of the basin. The magnetic data are characterized by three anomalies of high values, separated by moderately high values in the western section of the study area. Two northwest-southeast-trending faults, the Birch Bay and Drayton Harbor faults, appear as distinct lineations caused by high gradients in vertical derivative anomaly maps. These lineations project into the basin and correspond to offsets in layers included the cross-sectional model. The best-fit gravity model shows the Birch Bay fault cutting through a south-verging anticlinal structure (northeast side up). The Drayton Harbor fault, however, is not clearly expressed in the subsurface gravity model, but forms a prominent lineation in the magnetic data. Understanding these Holocene fault dynamics can provide useful insights for assessing earthquake hazards in the North-western Puget lowland.

Title: Does contact information powered by deep learning boost protein threading?
Primary Author (and presenter): Bhattacharya, Sutanu
Additional Authors: Bhattacharya, Debswapna
Department: Computer Science and Software Engineering
College/School: Samuel Ginn College of Engineering

Description:

Template-based modeling is one of the most successful approaches for protein structure prediction. However, reliably and accurately selecting optimal template proteins from a library of known protein structures having similar folds as the target protein, a template-based modeling technique known as threading, remains challenging, particularly for non- or distantly-homologous protein targets. To systematically analyze the effect of inclusion of contact information powered by deep learning in improving the accuracy of protein threading, we develop a new threading algorithm by incorporating various sequential and structural features, and subsequently integrate residue-residue contact information as an additional scoring term for threading template selection. The inclusion of contact information attains statistically significantly better threading performance compared to a baseline threading algorithm that does not utilize contact information when everything else remains the same ($p < 0.02$). Experimental results also demonstrate that our contact-based threading approach outperforms the popular threading method MUSTER ($p < 0.01$) on Test500 dataset and contact-assisted ab initio folding method CONFOLD2 (0.638 vs 0.58, respectively; $p < 0.001$) on PSICOV-150 dataset. Finally, our work outperforms recent state-of-the-art contact-assisted protein threading methods EigenTHREADER and map_align based on average TM-score of the top ranked model (0.45 vs 0.43 and 0.45 vs 0.39, respectively) in a blind manner using protein targets from the recently concluded 13th Critical Assessment of protein Structure Prediction (CASP13) experiment. Our study illustrates that the inclusion of contact maps, predicted by deep convolutional residual neural network, is a promising avenue in protein threading to ultimately help improve the accuracy of protein structure prediction.

Title: MOOSE: Models of I/O-intensive applications on virtual machines
Primary Author (and presenter): Bhattacharya, Tathagata
Additional Authors: Wang, Ye; Mao, Jianzhou; Peng, Xiaopu; & Zhang Chaowei
Department: Computer Science and Software Engineering
College/School: Samuel Ginn College of Engineering

Description:

We construct resource-utilization models for virtual machines running on cloud computing systems. This study is motivated by rapid growth in demand for computation resources in data centers and widespread of cloud computing. Modeling system behaviors of clouds is a grand challenge, because the resource utilization in VMs are heterogeneous in nature due to variability in workload conditions. We address this challenging issue by uniquely (1) objectifying the usage prediction of virtualized resources and (2) predicting the performance trends of programs running on clouds. At the heart of the modeling system, we pay particular attention to CPU cores, disk size, main memory space, and input data volume, which serve as important factors for the developed prediction module. We devise two resource-utilization prediction algorithms driven by two distinctive sets of I/O benchmarks, where one algorithm deals with execution time and another revolves around input data size. We investigate the correlation between the CPU/disk utilization and VM live migrations. Our system aims at not only providing performance optimization for virtualized resources, but also ensuring service level agreement (SLA) and Quality of Service (QoS). The model has minimalistic mean squared error and fits the curve quite well, thereby advocating for the efficiency of the algorithm. The case studies conducted in this project draw the comparisons between the performance of striped and monolithic disks as well as bringing forth the problem of cache coherence that causes hindrance to the experiment. We also deal with the cache-coherence problem to improve the accuracy of our prediction algorithms.

Title: Engineering antibodies and antibody-like scaffolds using AUBIE (Algorithm for Ultra-rapid Binding Interaction Engineering)
Primary Author (and presenter): Bhattacharya, Ritankar
Additional Authors: Chauhan, Varun; Pantazes, Robert
Department: Chemical Engineering
College/School: Samuel Ginn College of Engineering

Description:

Antibodies/Immunoglobulins (Ig) are essential immune proteins for defending the body against invading pathogens. They are widely used as therapeutics to treat diseases. However, designing antibodies in the laboratory can be time consuming, expensive and can end up being inefficient in binding with the specific epitope. Thus, to find a solution to this problem, antibodies and antibody-like scaffolds are being designed computationally and tested in the laboratory. These include nanobodies (Nb), bivalent antibodies, single chain variable fragments (scFv), single chain variable fragments conjugated to constant domains (scFv-Fc), fibronectin domains (Fn3), etc. These alternative scaffolds offer several advantages such as higher tumor penetration and lower cost of design, while retaining high binding affinity and specificity. To rapidly design these proteins, our lab developed an Algorithm for Ultra-rapid Binding Interaction Engineering (AUBIE). Here, we present the results of applying AUBIE to designing several varieties of binding proteins against various antigenic epitopes. Results include: antibodies that bind the same epitope on HER2 as Herceptin, a multi-billion dollar medication; antibodies that bind an alternative epitope on HER2 that can be cross-linked with Herceptin to increase receptor internalization; Fn3 domains that bind *Campylobactor jejuni* membrane proteins for use in biosensors; Fn3 domains to distinguish between methicillin-resistant *Staphylococcus aureus* and non-antibiotic resistant *S. aureus*; and Nbs that bind Interleukin-3 for targeting cancer vaccines. These results demonstrate how AUBIE can be quickly used for designing highly-promising binding proteins for a variety of biomedical applications.

Title: Variable long-term effect of coarse-woody debris dam restoration on water quality and ecosystem function in southeastern Coastal Plain streams
Primary author (and presenter): Bickley, Sam
Additional authors: Isenberg, Daniel; Griffiths, Natalie; Helms, Brian; & Feminella, Jack
Department: School of Forestry and Wildlife Sciences
College/ School: College of Agriculture

Description:

Use of coarse woody debris (CWD) additions is a simple restoration technique to mitigate effects of disturbance in stream ecosystems by increasing organic matter retention and habitat complexity for biota. Unfortunately, studies designed to assess post-restoration efficacy over the long term (i.e., >10 y after restoration) are rare. We evaluated efficacy of CWD additions in 4 disturbed coastal-plain streams 14 years after restoration (2003), by comparing restored streams to 3 unrestored streams over a 3-year period (2016-2018). We found nutrient uptake and stream-metabolism rates initially increased, then decreased over time, whereas water-quality parameters remained unchanged. In 2017, we again measured ammonium uptake, stream-metabolism, and water-quality metrics. Ammonium uptake, stream-metabolism, and water-quality did not differ between restored and unrestored streams, suggesting that CWD dams had temporally variable effects on water-quality ecosystem function after 14 years. Watershed-level disturbance is predicted to be an important driver of ecosystem function in these streams, although high interannual variability, perhaps because of high year-to-year hydrologic variation, may require more multi-year studies to better document the temporal dynamics of systems in terms of how they respond to restoration.

Title: When do herbivorous insects compete? A phylogenetic meta-analysis
Primary Author (and Presenter): Bird, Gwendolyn M.
Additional Authors: Kaczvinsky, Chloe; Wilson, Alan; & Hardy, Nate
Department: Entomology and Plant Pathology
College: College of Agriculture

Description:

When herbivorous insects interact, they can increase or decrease each other's fitness. As it stands, we know little of what causes this variation. Classic competition theory predicts that competition will increase with niche overlap and population density. And classic hypotheses of herbivorous insect diversification predict that diet specialists will be superior competitors to generalists. Here, we test these predictions using phylogenetic meta-analysis. We estimate the effects of diet breadth, population density, and proxies of niche overlap: phylogenetic relatedness, physical proximity, and feeding-guild membership. As predicted, we find that competition between herbivorous insects increases with population density and phylogenetic and physical proximity. Contrary to predictions, competition tends to be stronger between than within feeding guilds and affects specialists as much as generalists. This is the first statistical evidence that niche overlap increases competition between herbivorous insects. However, niche overlap is not everything; complex feeding guild effects indicate important indirect interactions.

Title: Telemonitoring of patients with heart failure in rural areas using a smartphone app
Primary Author (and presenter): Blackmon, Harold T.
Additional Authors: Peterson, Mary H.
College/ School: School of Nursing

Description:

Hospitalization from heart failure exacerbation continues to burden the healthcare system, and management of this disease has been studied rigorously. One intervention used is telemonitoring equipment (e.g., smartphones) to monitor patients in the home environment. Hospital readmissions for heart failure can potentially be reduced with improved self-management by patients at home. The aim of this project was to implement use of a smartphone app to improve heart failure self-management and medication adherence among patients residing in rural areas and thereby reduce hospital admissions. The target population included adults (18 years and older) with chronic heart failure who live in a rural setting and own a smartphone. Following recruitment of participants, agreement letters were signed and a pre-project questionnaire (Minnesota Living with Heart Failure Questionnaire, MLHFQ) were completed and scored. Participants downloaded the smartphone app and education was provided on the use of the app. App usage was tracked weekly and readmissions to the hospital were documented. At completion of the project, participants completed the post-project MLHFQ. The project is in progress. The patient population and heart failure class will be compared using descriptive statistics. The Pre and post MLHFQ scores will be analyzed using paired t-tests (alpha=0.05). Number of hospital readmissions will be calculated and analyzed using continuous/interval ratio data. Telemonitoring of patients with heart failure can improve self-management and decrease the number of hospital admissions for patients with this chronic disease. Weekly monitoring of weight, blood pressure, medication adherence and diet adherence can lead to earlier detection and intervention of worsening heart failure symptoms. The earlier provision of appropriate treatment can prevent heart failure exacerbations that lead to hospitalization.

Title: Determining kinetic chain efficiency among female handball athletes
Primary Author (and presenter): Blackstock, Sarah
Additional Authors: Kirkham, Caroline; Brittain, Abigail; Gascon, Sarah; & Oliver, Gretchen
Department: Kinesiology
College/School: College of Education

Description:

Handball is a hybrid sport requiring athletes to perform explosive, dynamic, and physical maneuvers while executing various throwing and shooting mechanics. The overhead throwing motion requires sequential segmental movement throughout the kinetic chain to achieve the desired outcome. A lack of fundamental throwing mechanics can result in increased injury susceptibility as well as decreased performance. Therefore, the aim of this study was to examine kinetic chain efficiency via segmental velocities between elite and novice female handball players. Twenty-one female handball (Novice: n=12, 26.07±3.77 yrs, 176±4 cm, 73.85±6.79 kg; Elite: n=9, 27.22±6.06 yrs, 173±4 cm, 73.85±6.79 kg) players volunteered. Participates were instructed to perform three maximum effort run-up jump shots to a goal located at 9 m. Kinematic data were collected using an electromagnetic tracking system (100Hz) synced with MotionMonitor®. Data were analyzed at the throwing events (foot contact, maximum shoulder external rotation, ball release, and maximum shoulder internal rotation) and averaged across the three trials. A 2 x 4 repeated measures ANOVA revealed no significant differences in segmental velocities of the humerus and forearm at ball release between the group of elite and novice handball athletes. Although no statistical difference was found, it should be noted that from a sport application perspective, the slightest increase in segmental velocities could make the difference in performance outcomes. In the current study, the elite players exhibited higher humeral angular velocities at ball release. The event of ball release is a crucial position to optimize ball velocity and decrease the risk of injury. Further research should evaluate the differences in ball velocity to determine if there are statistically significant differences between elite and novice handball athletes. Additionally, further evaluation into joint kinetics between elite and novice handball players is warranted.

Title: The gender wage gap in the United States: impacts and solutions
Primary Author (and presenter): Blankemeyer, Elyse, N.
Department: Environmental Design
College/School: Architecture, Design and Construction

For my Environmental Design research project, I looked into the issue of the gender wage gap in the United States. I chose to research this particular issue because it is one that impacts half of the population and will begin to impact my own life in a more direct fashion in the upcoming years. On average in the United States, a woman makes 77.9 cents for every dollar made by a man. The goal of this project was to study the gender wage gap's causes and impacts in the United States. My research was focused around academic journals, scholarly articles, and the Global Gender Gap Report, comparing the wage gap in the United States to those of other countries, and what the contributing factors may be. Contributing factors of the wage gap include lack of women in government positions, access to higher education, occupational segregation, the Motherhood Penalty, and Nonflexible work hours. Significant consequences of this wage gap include increased poverty rates among women, inability to pay off student loans, and a later retirement age.

Title: Improving sustainable awareness and living
Primary Author (and presenter): Boehle, Benjamin, E
Department: Environmental Design
College/School: Architecture, Design, and Construction

The goal of this project is to inform the general public of the possibilities sustainable building provides, both financially as well as in terms of efficiency. Secondly, this project highlights the positives of sustainable living and disproves the stigma that people have associated with the idea of obtaining an energy efficient home, such as impoverished homes and gentrified areas. The project explores the costs and benefits of implementing various environmentally friendly options inside and outside a home and the overall impact each option has. Multiple case studies were used to analyze the impacts of sustainable housing at different scales, such as on a single home, community of homes, or a larger region of housing. Each case study showed the diversity of options as well as obstacles to overcome in the future. Research has shown that efficient options are readily available for both new builds as well as retrofitting the built environment. Furthermore, as technology has improved, the upfront cost for a sustainable home is continually decreasing and the long-term ownership benefits of these energy efficient homes includes significant financial savings.

Title: St. Elisabethen Hospital healthcare design
Primary Author (and presenter): Bone, Alex, M
Additional Authors: Munroe, Robbyn; Morris, Katherine.
Department: Interior Design
College/School: Human Sciences

Our team will present a design solution for a pediatric trauma unit located within a large-scale hospital in Frankfurt, Germany. The hospital system, at large, provides care for current Air Force service members stationed at Ramstein Air Force Base and their families, but it also serves as a trauma center for civilian children injured in conflicts within the Middle East region.

Our design solution focuses on evidence-based design interventions in the pediatric unit of the hospital – interventions that will improve the safety and comfort of these expatriate pediatric patients and their families. These children are airlifted in, sometimes separately from their parents, and so may feel alone, helpless, and afraid in new surroundings. The design solution provides an efficient layout with simplistic wayfinding for non-German and non-English speaking visitors. By providing a well-designed layout for the pediatric unit that focuses on the needs of both the patients and the pediatricians we can offer easier and faster access to rooms, equipment and more with the help of wayfinding. The design also features positive distractions for children and families from a variety of cultural and ethnic backgrounds. The goal of the design is to encourage healing and help provide a stress-free environment for all. We want to help do our part to help make the patients and their families visit to the hospital as pleasant as possible, and for the doctors to have a stress free working environment.

Title: People or profit? Right-to-farm laws and their implications for rural people
Primary Author (and presenter): Boutwell, Crystal J.[1]
Additional Authors: Ashwood, Loka[1]; Kuehn, Lindsay[2]; Bousquet, Kimberly[3]; & Franco, Allen[3]
Department: [1]Agricultural Economics and Rural Sociology, [3]Food & Agricultural Law
College/School: [1]College of Agriculture, [2]Farmers' Legal Action Group, [3]University of Arkansas School of Law

Description:

Over the past couple of decades, large agricultural operations have started to overtake rural America. Within a nation captured by the allure of profit, the State has supported this movement by adjusting the language of agricultural legislation to enable industrial operations to profit, even if it comes at the cost of small farmers and rural communities. One such type of legislation is the Right-to-Farm law. Each state has a version of the Right-to-Farm law and while they were originally intended to protect farmers from nuisance suits resulting from urban sprawl, the language has changed over the past 30 years since the first one was enacted and the defendants using these laws as defense are increasingly large corporate operations. Right-to-Farm laws, and how they are used and/or manipulated by large corporate operations, have incredible implications for rural communities. Our preliminary work on this topic has shown that almost half of the states' statutes remove local governance and grant immunity from nuisance suits to any agricultural operation that has existed for at least one year. The lack of discussion around these laws allows industrial agriculture to continue depriving rural people of their fundamental rights to enjoy their property. In order to fight for better legislation in their state, rural communities need to know not only what their Right-to-Farm laws say, but what that tangibly means for them. In order to understand how large corporate agriculture operations utilize the language of Right-to-Farm laws to marginalize rural communities, the authors of this study have compiled and analyzed every court case that has cited the corresponding state Right-to-Farm law, as well as the original and current language of all 50 laws. Our analysis suggests that in states where the Right-to-Farm law's language grants immunity to operations that have been in existence for one year or more, half of the prevailing defendants are CAFOs (Concentrated Animal Feeding Operations). Yet in states where the statute only protects operations that have been in existence before the plaintiffs moved into the neighborhood, when the court rules in favor of the defendant it is never a CAFO; in contrast the defendant in those cases is always a sole proprietor of an agricultural operation or in other words, a small farmer. Our results have complicated implications for rural communities since CAFOs pose both an economic and health risk to communities and investors of these operations are typically not from the communities that their operations are housed in. It is time that rural communities know who their legislators are truly protecting with these laws.

Title: Survey and defect analysis of thin film $SrTiO_3$ h-MBE growth
Primary Author (and presenter): Bowers, William T
Additional Authors: Thapa, Suresh; Tiller, Faith; Comes, Ryan;
Department: Physics
College/School: COSAM

$SrTiO_3$ (STO) is a uniquely versatile semiconducting oxide perovskite that can be doped and engineered for countless electronic applications including High-K Gate Oxides, photoconductors, and substrates for other oxide crystals. In the interest of maximizing the performance of STO in these applications, it is desirable to minimize defects, during the growth of STO films. We have performed a survey of growth parameters during Hybrid MBE (h-MBE) deposition of STO, using quantitative feedback from sources including: Growth RHEED patterns, in-situ X-Ray Photoelectron Spectroscopy, Atomic Force Microscopy, and Rutherford Backscattering. Our preliminary results confirm a growth window around T=1000, P_{ttip}=50 mTorr, first reported by Bharat Jalan et. al, characterized by low surface defect density and good film stoichiometry. Understanding parameters for h-MBE STO growth will allow for cleaner film growth and ultimately higher quality devices.

Title: Increasing knowledge in patients with hypertension
Primary Author (and presenter): Bowman, Mollie M.
Additional Author: Howell, Eleanor
College/ School: School of Nursing

Description:

Hypertension is known as the silent killer because of the lack of symptoms, and if left untreated, hypertension can result in life-threatening pathological conditions. Research evidence confirms that patient education contributes to lower blood pressure readings and greater adherence to lifestyle changes in adults with hypertension. Educating patients increases their knowledge of hypertension and its management and makes patients feel more in control of their disease. The purpose of this project was to assess the effect of education delivered in a primary care setting on patients' blood pressure control measurements and adherence to lifestyle changes. The target population included adults (age 18 and older) with a diagnosis of hypertension. Following participant agreement, baseline blood pressure measurements were taken and participants completed two questionnaires: the CDC Blood Pressure questionnaire and the High Blood Pressure questionnaire from Community Health First. The provider and project leader reviewed the results to guide treatment recommendations. Patient education was delivered on hypertension and lifestyle changes. At a 6-week follow-up appointment, blood pressure measurements were taken and participants completed the two questionnaires again. The project is in progress. Descriptive statistics will be used to describe the patient population, the blood pressure measurements, and the blood pressure questionnaire results. Dependent t-tests will be used to measure changes in knowledge, lifestyle, and blood pressure measurements before and after the educational intervention. Educating patients about hypertension, blood pressure measurements, and lifestyle changes can help patients achieve lower blood pressure readings and allow patients to feel in control of their health. Assessing patients' knowledge of hypertension is achievable in this primary care setting and further implementation of the project is warranted.

Title: Influence of broiler chicken stunning method on carcass blood loss
Primary Author: Boyal, Ranjit S.
Additional Authors: Lawley, Ella; Berganza, Ileana, M; Starkey, Jessica; & Bourassa, Dianna
Department: Poultry Science
College/School: College of Agriculture

Description:

Consumer attitudes towards improving animal welfare have led to increased investigation assessing stunning methods for broiler chickens including electrical stunning and controlled atmosphere stunning (CAS). CAS is perceived to improve animal welfare because the animal is unconscious before being shackled for slaughter. However, during religious Halal slaughter, birds are required to die from blood loss and not by stunning methods. To assess the potential for using CAS systems for Halal slaughter, research is needed regarding cessation of heart activity in relation to blood loss. CAS has not been widely adopted due to the high expense and unknown physiological impacts of using carbon dioxide gas during poultry stunning. In this study broiler chickens were stunned using an electrical waterbath, CAS, or no stunning followed by exsanguination. Electrocardiograms (ECGs) were recorded with a DSI PhysioTel telemetry device (DSI) during each stunning method and analyzed using Ponemah software. The non-stunned treatment was included as a control group. Weight of blood lost over time was recorded on an individual bird basis. The main effect of stunning methods on blood loss and time of death was statistically analyzed with SAS data analysis software. Birds electrically or non-stunned lost significantly more blood within the first two minutes compared to CAS birds (P=0.0044). Within two minutes electrically and non-stunned lost 144.61 g (88%) and 135.1 g (92%) of blood, respectively, while CAS birds only lost 56.6 g (39%). However, at the time of death as determined by electroencephalogram, the final weight of blood loss for electrically, non-stunned, and CAS birds (163.9 g, 147.3 g, and 145.6 g, respectively) was not significantly different (P=0.4494). Although, stunning broiler chickens using a CAS system initially hinders the loss of blood, ultimate blood loss is not affected at the time of death.

Title: Investigating LAP-initiated photocrosslinking for the formation of engineered cardiac tissue

Primary Author: Bradley, Gabrielle, C.
Additional Authors: Finklea, Ferdous; Lipke, Elizabeth
Department: Chemical Engineering
College/School: Engineering

Cardiovascular disease is the leading cause of death in the world. Tissue engineering offers a possible treatment for this pandemic through the use of engineered cardiac tissue (ECT). In our lab to form ECTs, human induced pluripotent stem cells are combined with a biomaterial, PEG-fibrinogen, photocrosslinked to form a hydrogel, and then undergo direct differentiation. Photocrosslinking provides the ability for crosslinking to occur at mild conditions, such as physiological or ambient temperature and pH. Previously, ECTs were successfully formed using the photoinitiator, Eosin Y; however, Eosin Y has autofluorescence that overlaps with commonly used fluorophores in cell imaging assays and genetically encoded indicators. This project investigates the ability to use the photoinitiator, lithium acylphosphinate (LAP), for crosslinking of PEG-fibrinogen hydrogels at two different wavelengths, 365nm and 405nm. Two light sources were used for achieving these wavelengths. After determining appropriate LAP concentration and crosslinking times, the mechanical properties of acellular hydrogels were determined using parallel plate compression. There were no significant differences between LAP 365 hydrogels and Eosin Y hydrogels, with Elastic Moduli of 540 Pa and 520 Pa, respectively. However, the LAP 405 hydrogels were significantly softer with an Elastic Modulus of 266 Pa. Following encapsulation of hiPSCs on day -3, high cell viability was maintained within LAP hydrogels. Cardiac differentiation was initiated on day 0, and the LAP tissues significantly grew between days 3 and 7. Cardiac differentiation occurred efficiently within LAP-ECTs with over 70% of the cells expressing cardiac markers. These findings show that LAP overcomes the challenge of the autofluorescence of Eosin Y and can be used to form ECTs from hiPSCs. Future studies will be done to study the electrophysiology of ECTs using a cell line with a genetically encoded voltage reporter.

Title: Evidence and influence of copper vacancies in p-Type $CuGaO_2$ mesoporous films
Primary Author (and presenter): Bredar, Alexandria R. C.
Additional Authors: Blanchet, Miles; Comes, Ryan; & Farnum, Byron
Department: Chemistry and Biochemistry
College/School: College of Sciences and Mathematics

Description:

The development of effective hole transport materials for solar cell architectures is important for effective renewable energy implementation. p-Type delafossite $CuGaO_2$ has been investigated in several heterojunction solar devices (dye-sensitized, quantum dot, and perovskite solar cells), but has achieved limited success. A fundamental understanding of the carrier density and transport properties of this material is crucial to its implementation in solar devices. We report $CuGaO_2$ nanocrystals that were hydrothermally synthesized and characterized physically and electrochemically as mesoporous thin films. Powder X-Ray diffraction demonstrates a preferred orientation of nanocrystals within the film structure, as observed by the enhancement of the (00l) peaks. Films were annealed under low and high temperatures (100-300 ^oC), with oxygen or argon atmospheres, and the resulting effects on electrochemistry of films were measured. Cyclic voltammetry shows an increase in non-faradaic current with increased annealing temperature, as well as a quasi-reversible redox feature ($E_{1/2}$ = 0.1 V vs $Fc^{+1/0}$). This feature has been assigned to a Cu^{II}/Cu^{I} redox couple, associated with surface defects. X-ray photoelectron and energy dispersive spectroscopies provide evidence for Cu^{II} surface defects and copper vacancies in the nanocrystal structure. Electrochemical impedance spectroscopy revealed that $CuGaO_2$ films had high conductivities ($\sigma \sim 10^{-5}\ \Omega^{-1}\ cm^{-1}$) consistent with the presence of a large density of hole carriers, induced by copper vacancies. The hydrothermal synthesis method of $CuGaO_2$ nanocrystals appears to hold significance to the presence of defects in the nanocrystals.

Title: Utilizing text messages to prevent congestive heart failure exacerbation
Primary Author (and presenter): Bridgman, Jessica B.
Additional Author: Gibson-Young, Linda
College/ School: School of Nursing

Description:

Monitoring blood pressure and weight daily is key in preventing congestive heart failure (CHF). With increasing CHF prevalence, utilizing text messages to monitor blood pressure and weight increases adherence and knowledge for sudden weight gain and blood pressure changes. The purpose of this project is to explore text message reminders as an intervention targeting adherence with blood pressure and weight monitoring. Ultimately, we aim to prevent CHF exacerbation and hospitalization. Target population included patients 65 years of age or older with a known CHF diagnosis and access to a mobile device. Once recruited and consented, patients were provided a demographic questionnaire and exchange of text information occurred. Patients received a weekly text where they responded with daily blood pressure and weight. After six weeks, all data was reviewed by the team leader and an evaluation survey was provided. Patients rated their overall satisfaction with the project. At this time, we do not have final outcomes. A total of X patients consented to participate in the small test of change and X completed it. Pre/post data will be collected from each participant and entered in Excel. Descriptive statistics will be used to describe data which will include: age, gender, race, ethnicity, access to a mobile device, and ability to work a mobile device. The satisfaction survey will be collected and evaluated. Blood pressure and weight will be measured after the project to evaluate the effectiveness, and the pre-post PHQ-9 mean scores will be compared with paired t-tests (p value). Monitoring blood pressure and weight by receiving a reminder weekly via mobile device increases compliance among CHF patients 65 years and older. Sending text messages daily by utilizing the software suggested will provide accurate results and increase compliance even more.

Title: Psychological states, injury, and functional movement within collegiate students: A relationship analysis

Primary Author: Brittain, Abigail
Additional Authors: Gascon, Sarah & Oliver, Gretchen
Department: Kinesiology
College/School: College of Education

Description:

In recent years, functional/preventative medicine, has gained public attention. Such practices are aimed at treating the causes of chronic disease rather than the symptoms of disease. Although a vast body of research has linked certain lifestyle factors to chronic disease, a diminutive amount of research has investigated lifestyles and movement ability. The purpose of this study was to assess the relationships between psychological lifestyle factors, health history, and functional movement, as defined by the functional movement screen (FMS). Twenty college students (22.7 ± 1.2 yrs; 181.4 ± 7.7 cm; 88.6 ± 19.4 kg) were recruited to participate. Participants completed the FMS under the instruction and grading of a FMS level 1 certified researcher. Following the FMS, participants completed a questionnaire which included rating their overall happiness, stress, athleticism, well-being, and enjoyment of school. Data were transformed using Z-scores prior to running a Pearson product correlation. Results revealed a negative correlation between FMS and enjoyment of school ($r = -0.549$, $p = 0.012$), and a positive correlation between injury history and stress ($r = 0.489$, $p = 0.029$). The current study suggests that relationships between psychological states, injury, and functional movement patters exists. Specifically, individuals who performed better on the FMS reported enjoying school less, and those who reported greater stress were more likely to have a history of serious injury. The relationship between enjoyment of school and FMS scores, suggest that academic stressors may have adverse effects on movement capabilities. Exploration into identification of such stressors is essential to future adolescent health. The positive correlation between injury and stress observed in the current study agrees with previously accepted associations. In depth analysis of specific injury-prone movement patterns seen in individuals with high amounts of stress is needed.

Title: Improving patient compliance among pregnant adolescents with a community-based educational plan
Primary Author: Broughton, Mohneke V.
Additional Author: Watts, Sarah
College/ School: School of Nursing

Description:

Within the United States, adverse maternal and neonatal outcomes continue to occur and are associated with adolescent pregnancies. Studies have demonstrated 24 % of all reported pregnancies occur in the adolescent population. The department of Health and Human Services have recommended initiatives, policies, and strategies to mitigate disparities among pregnant adolescents. The purpose of this project was to address factors contributing to disparities among this population. The target population includes pregnant adolescents (13-19 years of age). The educational intervention occurred in a group setting and focused on behavioral or lifestyle modifications. A survey was employed to compare demographic variables and knowledge attainment from pregnant adolescents at Mobile County Teen Center's program. Implementation of evidence based educational intervention occurred at monthly meeting in a group setting. A pre-test was completed prior to implementation and a post-test following one week post implementation. The project is ongoing. Upon analyzing the descriptive statistics of pre and post survey data, findings will indicate whether perceived knowledge of exercising, proper body mechanics, and health eating habits during pregnancy were achieved. Among those demographic variables baseline data, the pre-post knowledge attained mean scores will be compared with paired t-tests (alpha=0.05). With attainment of behavioral and lifestyle modifications, pregnant adolescents demonstrate a significant improvement in overall health for mom and neonate. The three primary educational topics delivered focused to reduce maternal and neonatal mortality. Evidence based literature suggested providing pregnant adolescents in low to middle class the education, tools, and available resources can have a positive impact on health disparities and improvement in socioeconomic status.

Title: Computational studies of the air oxidation mechanism of dinoflagellate luciferin
Primary Author (and presenter): Brown, Thomas
Additional Authors: Channell, Kirsta G.; Donnan, Patrick H.; Mansoorabadi, Steven O.
Department: Department of Chemistry and Biochemistry
College/School: College of Sciences and Mathematics

In dinoflagellates, an enzyme known as luciferase acts on the substrate luciferin in a photochemical reaction that produces light. Purified luciferin is extremely sensitive to oxidation and will oxidize if exposed to atmospheric oxygen concentrations. The air oxidation product is different from that of the enzymatic reaction and is formed without the emission of light. The reaction mechanism for the air oxidation of luciferin is currently unknown. An investigation into this process and comparison with previous studies on the enzymatic reaction may give insight into the way in which luciferase suppresses the air oxidation reaction and tunes the reactivity of luciferin towards bioluminescence. We have performed density functional theory (DFT) calculations of possible intermediates along proposed reaction coordinates. These calculations, combined with transition state analyses, will provide insight into the kinetics and thermodynamics of these competing reactions of luciferin. Preliminary data suggests that the reaction is sensitive to pH and base catalyzed.

Title: Comparison of soybean injury and yield response to low-dose dicamba particle drift and vapor

Primary Author (Presentor): Browne, Frances B.
Additional Authors: Li, Steve & Price, Katilyn
Department: Crop, Soil and Environmental Sciences
College: College of Agriculture

Description:

Recent commercial launch of new dicamba technology has led to increased applications in row crops and high numbers of drift complaints across the US. Dicamba off-target movement can occur through particle drift, vapor drift, or tank contamination. However, the source and dosage of dicamba are often difficult to determine and observable symptomology is not always associated with yield loss. Field studies were conducted in Macon County, AL to compare sensitive soybean response to simulated dicamba particle and vapor drift. Broadcast applications of dicamba ranging from 0.03 to 140.28 g ae ha^{-1} were used to simulate particle drift in 2017 and 2018. Vapor drift was simulated in 2018 through plastic tunnels placed over soybean to concentrate vapor emitted from soil pans treated with dicamba at dosages ranging from 0.56 to 11183.51 g ae ha^{-1}. Visual injury was recorded at 1, 3, 7, 14, and 21 days after treatment (DAT) in addition to yield at harvest. Furthermore, foliar concentrations of dicamba were analyzed at 1, 7, and 21 DAT in 2017. Data indicate 84-92% of initial concentrations are metabolized within the first 7 days. Soybean visual injury resulted from particle drift steadily increased with higher dosages up to 90% for 140.28 g ae ha^{-1}. Compared to the non-treated control, yield losses resulted from particle drift were correlated to dosage with losses of 7% at 0.70 g ae ha^{-1} increasing to 90% at 140.28 g ae ha^{-1}. Alternatively, soybean visual injury resulted from vapor exposure did not exceed 43% regardless of dosage and yield was not significantly reduced. Data suggests visual injury is a poor indicator of yield loss and soybean response is likely to vary with different sources of non-target exposure.

Title: Gross domestic product as a predictor of zoonotic pathogen prevalence in cats
Primary Author (and presenter): Brownlee, Joi R
Department: Wildlife Sciences
College/School: Forestry and Wildlife Sciences

In recent years, there has been an increasing interest in the role that domestic and feral populations of cats (Felis catus) may play in disease transmission, particularly of zoonotic pathogens that may be transmitted to humans. Immunocompromised individuals, small children, pregnant women and the elderly may be at particular risk for such infections. Reducing the number of infected felines may aid in preventing the exposure of zoonotic pathogens to susceptible populations. Therefore, identifying factors that influence the rates of zoonotic infection among domestic and feral domestic cats is crucial. Secondary analysis of data collected from more than 100 independent studies analyzing 88 different pathogens in 30 countries and territories provide insights into infection in feral, domestic, and owned cat populations. Preliminary analysis suggests an inverse correlation between gross domestic product (GDP) per capita and increased risk of zoonotic pathogen prevalence in cats. These findings may provide information on infection risk in cats and thus allow for the development of effective management techniques that reduce the risk of transmissible zoonoses to susceptible wildlife and human populations.

Title: Joint forces: How do parasitic mites and neonicotinoid insecticides simultaneously affect honey bee food glands?

Primary author and presenter: Bruckner, Selina
Additional authors: Baker, Christian L.; Salem, Adler J.; & Williams, Geoffrey R.
Department: Entomology and Plant Pathology
College/School: College of Agriculture

Description:

Neonicotinoid insecticides and the ectoparasitic mite *Varroa destructor* are known to independently cause lethal and sub-lethal effects in honey bees. Despite the importance of both stressors to honey bees, as well as their ubiquitous nature, few have investigated the effects of simultaneous exposure. Recent studies demonstrated independent negative effects of neonicotinoids and *V. destructor* on nursing worker hypopharyngeal glands (HPGs). Because of the importance of HPGs to brood food production for all honey bee types (queen, worker, drone), we examined the effects of simultaneous neonicotinoid and *V. destructor* exposure on HPGs by performing a fully crossed experimental design. We obtained known age cohorts of worker honey bees from 24 colonies which were previously fed with pollen patties for 49 days. Half the colonies received patties that contained field-realistic concentrations of neonicotinoids (3.25 ppb thiamethoxam), whereas the other half received patties without neonicotinoids. Workers from each colony were artificially emerged, assessed for *V. destructor* parasitism, and allocated to one of four treatments: 1. No neonicotinoid / No *V. destructor*, 2. No neonicotinoid / Yes *V. destructor*, 3. Yes neonicotinoid / No *V. destructor*, and 4. Yes neonicotinoid / Yes *V. destructor*. Workers were maintained in laboratory cages with sugar syrup and pollen patties for 10 days, the typical age of nursing, before being decapitated for HPG examination. Here we discuss the effects of neonicotinoid insecticides and *V. destructor* parasitism, alone and in combination, on HPG size. Our findings will contribute to a better understanding of neglected stressor interactions and their effects on honey bee health.

Title: Role of mineralogy in controlling shale fracture formation
Primary Author (and presenter): Brunhoeber, Olivia M.
Additional Authors: Iloejesi, Chidera & Beckingham, Lauren
Department: Civil Engineering
College/School: Samuel Ginn College of Engineering

Description:

Enhanced Oil Recovery (EOR) is the process of increasing oil production through the injection of gases or chemicals into existing oil wells. CO2 injection is a favorable form of EOR because it lowers CO2 concentration in the atmosphere through natural sequestration. This is due to CO2 reacting with the formation fluids, lowering the pH of the soil and creating conditions favorable for mineral reactions. To better understand the rate and extent of these reactions, a study is being conducted to determine the mineralogy present at the fracture surface. It is believed that a specific mineral or bond can pose a weak spot where an underground fracture would be more likely to occur. This information would be beneficial to understanding the risk and performance of this process.

Title: A musical and historical analysis of jazz trombone performance and its technical adaptation in the bebop era and beyond
Primary Author: Brunner, Anderson, P.
Department: Music
College/School: Liberal Arts

While the trombone's popularity has grown extensively in popular settings over the last half century, the instrument was one of the last to fully insert itself into what many consider to be the most important movement in jazz history, the bebop movement. Pioneered by jazz greats Charlie Parker and Dizzy Gillespie, the style itself was characterized by brisk tempos, intricate rhythmic patterns, and rapid chord changes. This strong emphasis on an instrument's technical facility caused many to consider bebop outside the trombone's technical capability. Many trombone players of the time adopted performing on the valve trombone in order to play faster technical lines without the constraints imposed by using the traditional slide. However, it was those few players who viewed the slide not as a constraint but as a musical tool, who would eventually become the most accomplished trombonists of the Bebop Era.

My research centers around the technical capabilities and improvisational style of trombonist J.J. Johnson, who many consider to be the father of bebop trombone playing. The focus of this study is to analyze the ways in which Johnson was influenced by early masters of the bebop style (specifically Parker and Gillespie) improvisationally and stylistically. This analysis also includes significant historical information relating all three performers. This analysis focused on a variety of different tunes spanning multiple genres, including blues, standard, ballad, 'I Got Rhythm' contrafact, and bebop melodies.

My research used Dr. David Baker's rubric for assessing improvisational analysis, which accounted for multiple aspects of each player's improvisation, including use of dramatic devices, scale preferences, common ii-V patterns, rhythmic and melodic patterns, preferred chord extensions and other more instrument specific devices Though common trends were evident between all three players in these categories, I discovered that each performer was able to utilize specific idiomatic devices unique to their instrument though performing in the same genre.

Title: Implementing an exercise program for the management of chemotherapy-related fatigue
Primary author (and presenter): Bryan, Rachel C.
Additional authors: Ellison, Kathy Jo
College/ School: School of Nursing

Description:

Fatigue is the most commonly reported side effect among the cancer patient receiving chemotherapy. Even though fatigue is a substantial problem in cancer patients, it is often dismissed or unaddressed by providers. There is significant evidence that supports reducing chemotherapy-related fatigue by implementing exercise in patients who are undergoing chemotherapy. The purpose of this project was to implement an exercise program for cancer patients to reduce chemotherapy-related fatigue (CRF), improve physical function, and enhance quality of life. The target population includes adult cancer patients who are currently undergoing chemotherapy treatment in an oncology outpatient infusion center. Following participant agreement, participants completed a baseline demographic survey, a validated fatigue scale (MD Anderson Brief Fatigue Inventory [BFI]), and a validated physical function and quality of life questionnaire (SF 36v2 survey). Participants were given a home-based exercise regimen to follow. Participants completed the same survey and questionnaires halfway through project and upon completion of project. The project leader reviewed and analyzed collected data and results. The project is in progress. Descriptive statistics will be used to describe the patient population, the prevalence of fatigue symptoms and improvement of quality of life and physical function, treatment recommendations, and patient adherence to exercise program. The pre-post survey and questionnaires (BFI, SF 36v2) mean scores will be compared with paired t-tests (alpha=0.05). Implementing an exercise program for cancer patients undergoing chemotherapy can reduce CRF, improve physical function and enhance quality of life. Early implementation of an exercise program for fatigue management among cancer patients undergoing chemotherapy is achievable in the outpatient infusion center and further implementation of the project is warranted.

Title: Cloning, expression and purification of human mitochondrial molecular chaperone Tid1
Primary Author (and presenter): Buckhannon, LaQuandra
Additional Authors: De Bovi Pontes, Carolina; Morgan, Emily; Truong, Thinh Q.; & Ciesielski, Grzegorz L.
Department: Chemistry
College/School: Auburn University at Montgomery – Science

Description:

Molecular chaperones play an important role in the folding and maintenance of the cellular proteome. Tid1 is a mitochondrial Hsp40 chaperone involved in mitochondrial import and folding of proteins within the mitochondrial matrix. Additionally, Tid1 has been found to co-localize with mitochondrial nucleoids and to interact directly with the catalytic subunit of mitochondrial DNA polymerase gamma (Pol γ), which facilitates the mitochondrial DNA replication process. Homologous Hsp40 chaperones have been found relevant for DNA replication processes in prokaryotes and viruses. The goal of our research is to investigate the putative role of Tid1 in the human mitochondrial DNA replication process. Here we present results of cloning, expression and purification of Tid1. We amplified two splice variants of Tid1, $Tid1_S$ and $Tid1_L$, using PCR. Next, we inserted the target sequences into the pETite N-His SUMO vector applying the Expresso® T7 SUMO cloning and expression system. Target proteins were produced in *Escherichia coli* Hi-Control BL21 (DE3) cells and purified using nickel (NiNTA) affinity chromatography. In the future, we will evaluate the direct interaction of Tid1 isoforms with the subunits of the Pol γ holoenzyme, as well as test whether the presence of Tid1 isoforms affects the catalytic properties of Pol γ.

Title: Integrated methods combat cyanobacterial blooms and off-flavors in the aquaculture and drinking water industries
Primary Author: Buley, Riley P.
Additional Authors: Gladfelter, Matthew & Wilson, Alan
Department: School of Fisheries, Aquaculture, and Aquatic Sciences
College/School: College of Agriculture

Description:

Cyanobacterial blooms are a prominent issue of concern in the aquaculture and drinking water industries. Select cyanobacterial species produce secondary metabolites that are toxic to humans and animals, while others produce unwanted off-flavors in the fillets of farm-raised fish and drinking water of local municipalities, causing a sizable economic impact to the southeastern United States. Because of these issues, aquaculture and water resource managers have employed multiple approaches to reduce the occurrence and severity of bloom events, including biological, physical, and chemical control methods. Previous research on control methods has produced promising results, but research combining control method types has rarely been seen. In this study, we assessed the effectiveness of hydrogen peroxide, a chemical control, in combination with the large-bodied, generalist grazer zooplankter, *Daphnia pulicaria*, possessing cyanobacteria-tolerant genotypes, as a biological control. Study objectives strive to find combinations of both control types to first reduce bloom density with hydrogen peroxide, and then prevent bloom reoccurrence using the grazing abilities of *D. pulicaria*. Further, treatment combinations were observed for their effectiveness against off-favors. A recent field experiment found that hydrogen peroxide effectively reduced cyanobacterial densities, while keeping the densities of beneficial, non-toxic green algal species relativity unaffected. Surprisingly, *Daphnia* grazing had no significant effect on algal or cyanobacterial abundance. It was also observed that neither hydrogen peroxide nor *Daphnia* significantly decreased the occurrence of off-flavors. These findings suggest that sources other than cyanobacteria were producing off-flavors, and that neither hydrogen peroxide nor *Daphnia* grazing reduced these concentrations; a clear limitation of both control types. It is recommended that resource managers determine the source of their off-flavors before employing control types.

Title: Neuroprotective effects of mushrooms
Primary Author (and presenter): Burgess, Bethany N
Additional
Authors: Lee, Wooseok; Fujihashi, Ayaka; Govindarajulu, Manoj; Ramesh, Sinhu; Deruiter, Jack; Majrashi, Mohammad; Almaghrabi, Mohammad; Nadar, Rishi; Moore, Timothy; Agrawal, Dinesh; Dhanasekaran, Muralikrishnan
Department: Drug Discovery and Development,
College: Pharmacy

Mushrooms have extensively been used not only as a dietary intake but also for the treatment of various central nervous system (CNS) and peripheral nervous system (PNS) disorders. At its early stages, accumulated evidence has suggested that culinary-medicinal mushrooms may play a significant role in the prevention of many age-associated neurodegenerative disorders, such as Alzheimer's and Parkinson's diseases. Therefore, further research and efforts have been devoted to a search for more mushroom species that may improve memory and cognitive functions and, in addition, to prevent the progression of dementia and neurodegeneration. Such mushrooms include *Hericium erinaceus, Ganoderma lucidum, Lignosus rhinocerotis*, *Pleurotus giganteus, Sarcodon scabrosus*, *Antrodia camphorata*, *Paxillus panuoides, Mycoleptodonoides aitchisonii* and several other species. This review focuses on the various above mentioned neuroprotective, culinary-medicinal mushrooms and the bioactive secondary metabolites isolated from them. The mushrooms' extracts from basidiocarps/mycelia or isolated compounds have been known to decrease neurotoxicity through various neuroprotective molecular mechanisms such as: anti-acetylcholinesterase activity, neurite outgrowth stimulation (neuritogenic), nerve growth factor (NGF) synthesis (neurotrophic), enhancing mitochondrial functions, reduce endoplasmic reticulum (ER) stress, in addition to antioxidant, and anti-inflammatory effects. Therefore, mushrooms can be considered as useful therapeutic agents in the prevention, management and/or treatment of neurodegenerative diseases.

Title: The non-isentropic solution to the Taylor-Culick Profile for cylindrical and slab rocket motors

Primary Author (and presenter): Burnham, Kelly, C
Additional Authors: Majdalani, Joseph
Department: Aerospace Engineering
College/School: Engineering

In this study, the compressible Taylor-Culick profile in axisymmetric geometry is considered. Unlike previous work in which isentropic flow conditions are assumed, the formulation that was obtained is derived directly from the energy and momentum equations for a calorically perfect gas. This approach is asymptotic, based on a Rayleigh-Janzen expansion in powers of γM_w^2, where M_w is the wall Mach number and γ the ratio of equivalent specific heats. The resulting approximations are carried out to order M_w^4 and described is a cylindrical chamber from the headwall to the critical region where sonic conditions are established. Numerical simulations are also carried out for the purpose of verification.

Title: Evaluation of nondestructive testing methods to assess concrete deterioration
Primary Author: Burrow, Elliott D.
Additional Authors: Jetzel, Christian & Schindler, Anton
Department: Civil Engineering
College/School: Samuel Ginn College of Engineering

Description:

Evaluating the condition of in-place concrete structures is critical as agencies work to optimize the effective timing, scope, and methods for preventive maintenance, repair, and replacement of our infrastructure. Concrete deterioration is often not visually detectable from the surface. Once it becomes visible from the surface, it may be too late to cost-effectively rehabilitate the in-place concrete. However, many nondestructive test (NDT) methods exist which can help with early detection of deterioration within a concrete element. Therefore, the objective of this project is to identify NDT methods that can accurately detect and characterize the in-place condition (e.g., voids, delaminations, cracks, corrosion, etc.) of concrete structures. In order to inquire into these test methods' capabilities, laboratory specimens were made that contain intentionally created defects and deteriorated concrete. However, it can be difficult to create deteriorated concrete as it normally presents in field conditions. Therefore, another objective of this project is to create defects that are representative of those encountered in actual structures. Experimental work evaluated inserting defects made of plastic, foam, water, clay, or poor-quality concrete into otherwise high-quality concrete slabs or by intentionally corroding the rebar in an accelerated fashion within the concrete by applying an electrical current. Each NDT method will be evaluated to determine their strengths and limitations by considering accuracy, precision, ease of use, speed, and cost. Based on these results, the best NDT methods to implement will be recommended.

Title: Developing MATLAB code for analysis of engineered cardiac tissue
Primary Author (and presenter): Bush, Michaela, Z
Additional Authors: Ellis, Morgan. Finklea, Ferdous. Lipke, Elizabeth
Department: Chemical Engineering
College/School: Engineering

Engineered cardiac tissue (ECT) is being created in the Lipke Lab to replace damaged heart tissue due to the fact that cardiac muscle cells, cardiomyocytes, do not regenerate after disease or damage. One way to measure the functionality of ECT is through optical mapping; this experiment involves recording high-speed videos of fluorescence changes caused by calcium traveling through ECT. My research focuses on developing a custom MATLAB program for analyzing the calcium transit duration and conduction velocities in 3D-ECT. Because the tissues are 3D heterogeneous structures, not all the pixels in the video can be analyzed. I have created multiple methods for removing the bad pixels. Initially, pixels that do not contain ECT are isolated and filtered out based on their lowered value and range of luminosity. Pixels that lack a good wave trace are then filtered out based on dissimilarity to good pixels. Once bad pixels are removed, the time that each wave occurs, the edge value, for every pixel is determined by selecting a luminosity value only reached during calcium depolarization (during a rapid increase of luminosity). In cases where an incorrect number of waves is detected, surrounding data is used to determine the times corresponding with real waves. Using this data, the calcium transit durations can be found at 50% and 80% repolarization. The direction the wave travels is found using the gradient function in MATLAB, which finds the velocity at each point and generates a quiver plot. I have also written a code for creating a graphic to visualize the wave propagation, called an isochrone map. The quiver plots, combined with the isochrone map, act as a guide to find the conduction velocity. The conduction velocity is found by determining the velocity between several sets of two faraway points from the edge data with the same wave directionality. Using this code, we can determine how closely the action potential propagations in our ECT mimic those seen in the native heart.

Title: Improving diabetes management with technology
Primary Author (and presenter): Byrd, Jenna J.
Additional Authors: Ellison, Kathy
College/ School: School of Nursing

Description

Diabetes affects around twenty-nine million Americans. The American Diabetes Association states that diabetes is the seventh leading cause of death in the US. Much of the disease may be managed by simple lifestyle changes, although evidence suggest noncompliance is a major component to the mortality and morbidity rates. Evidence-based guidelines recommend incorporating diabetes management and education into everyday life. The purpose of this project is to implement a mobile application in order to better diabetes management and improve health outcomes for diabetics. The target population included adults over the age of 18 diagnosed with diabetes (type 1 or 2) in a primary care setting. Following a participant agreement, participants will complete a diabetic questionnaire (including daily blood sugar checks, age, gender, ethnicity). The participant will be introduced to a mobile application and encouraged to use it to log their blood sugars. The mobile application then generates the logged blood sugars into PDF format. Patients will email the PDF to the project leader every 2 weeks and the data will be stored in an excel spreadsheet. Over a 6-week period, the logs will be used in comparison to the questionnaire baseline measurement to detect an increase in daily blood sugar checks and usefulness of the app, which will then suggest an improvement in blood sugar outcomes. The project is in progress. Descriptive statistics will be used to describe patient population, diabetes statistics, recommended treatments, and patient adherence. Collected data will include the number of patients who increased in number of daily blood sugar checks over the 6-week period of using the mobile application and the usefulness of the mobile application. Utilizing mobile phone applications can be a beneficial way to engage people to take control of their diabetes management and increase their overall health outcome. Further implementation of the project is warranted.

Title: Effect of mixed infestations on plant-mediated host location in the parasitoid *Microplitis croceipes*

Primary Author (and presenter): Byrd, William, B
Additional Authors: Morawo ,Tolulope; Fadamiro, Henry
Department: Entomology and Plant Pathology
College/School: Agriculture

Parasitoids (parasitic wasps) are beneficial insects that lay their eggs inside/on other pest insects, eventually killing the host. Thus, they can be used in biological control programs as an alternative to chemical pesticides in crop production. Plants emit different odor blends (volatiles) when infested by various species of herbivorous insects. Parasitoids use these plant odors to locate their hosts. However, few studies have investigated the effect of mixed insect infestations on host location in parasitoids. *Microplitis croceipes* is a relatively specialized parasitoid that only parasitizes the larval stage of *Heliothis/Helicoverpa* species, including *Heliothis virescens* (tobacco budworm), which is a serious pest of cotton. In this study, we investigated whether attraction of *M. croceipes* to herbivore-induced plant odors is affected by mixed insect infestations on host plant. Cotton plants were infested with (i) *H. virescens* larvae (host), (ii) a non-host herbivore and (iii) host and non-host herbivores. Attraction of female parasitoids to plants exposed to single infestations i.e., *H. virescens*-infested plant and non-host herbivore-infested plant was tested in separate Y-tube olfactometer bioassays. Preference of parasitoids among plants exposed to single infestations and mixed infestation (host and non-host) was tested in four-choice olfactometer bioassays. It is hypothesized that parasitoids will show greater attraction to host-infested plants, compared with non-host-infested plants, and that mixed infestation will affect behavioral response of parasitoids due to changes in plant odors. The significance of the results to the biological control potential of parasitoids is discussed.

Title: Examination of sibling relationships in college-aged adults
Primary Author: Cage, Benjamin B.
Additional Authors: Samek, Diana
Department: Human Development and Family Studies
College: Human Sciences

Description:

Alcohol use and abuse is common among college-aged students (Johnston et al., 1988). It is also known that increased alcohol use is associated with problematic outcomes such as alcohol dependence, driving after drinking alcohol, having alcohol related injuries, and having unprotected sex (CDC, 2011; Hingson et al., 2009). In earlier adolescence (11-18), sibling relationship factors are considered to be key predictors in alcohol and substance use (Samek et al, 2011; Samek et al, 2018). It is unclear though if sibling factors are as relevant to alcohol use in college or if this is a developmentally limited phenomena. The purpose of this study is to evaluate the relationship between sibling relationship factors and college student alcohol use problems. The College Experiences Study (N=209) will be used to address this. We will examine if sibling support is associated with alcohol use disorder symptoms in the first and second year of college and whether this varies by sibling gender composition and age difference. Results will be completed by the time of the symposium. If the hypotheses are supported, results would suggest sibling relationships may continue to foster or offset alcohol use problems later than previously believed, and would suggest that sibling relationship factors should be considered by universities in combatting problematic alcohol use on campus.

Title: Magnet patterned superparamagnetic Fe3O4/Au core-shell nanoplasmonic sensing array for label-free high throughput cytokine immunoassay
Primary Author (and presenter): Cai, Yuxin
Additional Authors: Zhu, Jingyi & Chen, Pengyu]
Department: Materials Engineering
College/School: Samuel Ginn College of Engineering

Description:

Rapid and accurate immune monitoring plays a decisive role in effectively treating immune-related diseases especially at point-of-care, where an immediate decision on treatment is needed upon precise determination of the patient immune status. Derived from the emerging clinical demands, there is an urgent need for a cytokine immunoassay that offers unprecedented sensor performance with high sensitivity, throughput and multiplexing capability, as well as short turnaround time at low system complexity, manufacturability and scalability. In this paper, we developed a label-free, high throughput cytokine immunoassay based on a magnet patterned Fe_3O_4/Au core-shell nanoparticle (FACSNP) sensing array. By exploiting the unique superparamagnetic and plasmonic properties of the core-shell nanomaterials, we established a facile microarray patterning technique that allows the fabrication of uniform, self-assembled microarray in a large surface area with remarkable tunability and scalability. The sensing performance of the FACSNP microarray was validated by real-time detection of four cytokines in complex biological samples, showing high sensitivity (~ 20 pg/mL), selectivity and throughput with excellent statistical accuracy. The developed immunoassay was successfully applied for rapid determination of functional immunophenotype of leukemia tumor associated macrophages, manifesting its potential clinical applications for real-time immune monitoring, early cancer detection, and therapeutic drug stratification towards personalized medicine.

Title: Stream rehabilitation and sedimentation modeling
Primary Author (and presenter): Calhoun, Jessica L.
Additional Authors: Waid, Charles; Prior, Beth; O'Donnell, Frances
Department: Civil Engineering
College/School: Samuel Ginn College of Engineering

Description:

Stream Restoration/Stream Rehabilitation is an emerging best management practice used across the United States. Stream Restoration improves water quality by establishing bank stabilization, enhancing aquatic habitat, and facilitating sediment transport. Moores Creek in Lannett, Alabama has been specified by the Environmental Protection Agency on its Clean Water Act (CWA) 303(d) list for sedimentation and macroinvertebrate (fecal coliform as of 2018). In 2017, a 1000-foot portion of the creek and tributary were rehabilitated to improve the streams health and remove portion of the creek from the 303(d) list. Sampling was performed at 14 sites along the creek and tributary to test for turbidity, Total Suspended Solids (TSS) and Dissolved Oxygen (DO). The samples from the stream showed the stream stabilizing, being hit with a ten-year storm and consequently destabilizing, before stabilizing again. There are two areas on the right bank that have eroded since the completion of the rehabilitation project. A 2-D HEC-RAS 5.0.3 model was created to determine if bank erosions within the rehabilitated segment created the excess sedimentation in the in-stream pool structures or if it was sediment that was transported from upstream and deposited in the segment. The depths and velocities in the model were analyzed and compared with stage and velocities annotated when the samples were collected. Additionally, the HEC-RAS sediment transport simulation and water quality analysis were run to understand how the rehabilitated streams function.

Title: Prospective associations between peer victimization, academic performance, and academic efficacy.

Primary Author (and presenter): Calhoun, Alyssa, B
Additional Authors: McConnell, Leanna; Hinnant, Ben
Department: Human Development and Family Studies
College/School: Human Sciences

Peer victimization is broadly defined as receiving negative treatment from peers, including physical, verbal, or psychological abuse. Approximately 10% of children report experiencing frequent peer victimization and 50% report experiencing occasional peer victimization. Rates of peer victimization peak around the transition to middle school, which may be related to realignment of peer networks and competition for social status. Furthermore, many children experience elevated distress related to school adjustment over the transition to middle school due to changing class structure and academic rigor. Self-determination theory suggests all people must meet needs of competence, relatedness, and autonomy. However, victimization by peers has been found to threaten school belonging (relatedness) and performance (competence), due to its association with negative perceptions about school, avoidance of school, and lower academic achievement. Accordingly, the goal of the present study is to examine the direct relationships between peer victimization, academic performance, and school commitment as well as whether academic performance or efficacy moderate associations between peer victimization and academic outcomes.

Data were collected from a comprehensive longitudinal study, spanning birth through adolescence. The study included an initial sample size of (N = 1,364) and was collected by The National Institute of Child Health and Human Development (NICHD) Study of Early Child Care and Youth Development (SECCYD). The present study uses a subsample of participants who completed follow ups through age 15 (N = 958). Experiences of peer victimization and academic performance were measured in grades 4 through 6, school commitment was measured in grade 5, and academic efficacy in grade 6.

Title: Reconstruction of big data in parallel storage systems
Primary Author (and presenter): Cao, Ting
Additional Authors: Taha Khalid Al Tekreeti and Xiaopu Peng
Department: Computer Science and Software Engineering
College/School: Samuel Ginn College of Engineering

Description:

In this project, we develop a novel data reconstruction scheme for parallel storage systems in modern data centers. We advocate for erasure-coded data storage systems to archive warm data (a.k.a., unpopular data), which have limited number of accesses or updates. Different from hot or cold data, warm data have to be treated in a distinctive way to optimize system performance and storage-space utilization. We pay particular attention to efficient data reconstruction in which faulty data nodes are rebuilt and recovered. To achieve this goal, we employ two machine learning algorithms to offer online data reconstruction in erasure coded storage systems. Our data reconstruction technique is conducive to recovering faulty nodes while optimize high read performance for end-users who are accessing data residing on the faulty nodes. Our system is reliant on a file clustering mechanism to group files into multiple clusters, in each of which files share similar data types, topics, contents, and to name just a few. Furthermore, we implement a recommendation module where a recommendation list is created by keeping track of user accesses. The recommendation list, in turn, provides predictions on files that are likely to be accessed in the not-too-distant future. The recommendation module is responsible for computing similarities among users, thereby setting priority levels for data blocks to be reconstructed. We implement our data reconstruction scheme in an erasure-coded parallel storage system to recover files with a guidance from the recommendation list. Our experimental results confirm that our system speeds up the data recovery of parallel storage systems while maintaining a high data access performance for online users.

Title: The effect of surface treatment to enhance bonding properties
Primary Author (and presenter): Cardozo, Alejandro Ariel
Additional Authors: Via, Brian & Peresin, Maria Soledad
Department: Forestry
College/School: School of Forestry and Wildlife Sciences

Description:

Wood composites are one of the most popular choices as a construction material in the US due to their renewability, properties, cost and appearance. In these composites, the adhesives are responsible for linking the pieces of wood together to withstand forces and moisture exposure. One of the most popular kinds of adhesives employed worldwide are obtained by the polymerization of phenol and formaldehyde to make a thermosetting polymer. Although these polymers present excellent bonding performance, there is a growing concern because of the environmental and health issues that arise from their utilization. Specifically, formaldehyde is a known toxic and carcinogenic compound and removal is currently being pursued. One way to decrease formaldehyde release is to ensure there is enough phenol in the blend for reaction. To achieve this, our research intends to study and evaluate the bonding properties of the Novolac-type resin, where an acidic media and excess of phenols are used. Nitric acid will be used to activate the wood surface in order to enhance the linkage between the wood and adhesive. The final target of this research will be to produce an Oriented Strand Board which uses this new adhesive system while meeting standards and industry requirements.

Title: Investigating the neuroprotective effects of dexamethasone against MPTP-induced neurotoxicity

Primary Author : Carlton, Mary Claire
Additional Authors: Karuppagounder, Senthilkumar; Majrashi, Mohammed; Almaghrabi, Mohammed; Alghenaim, Fada; & Dhanasekaran, Muralikrishnan
Department: Drug Discovery and Development
College/School: Harrison School of Pharmacy

Description

Inflammation, oxidative stress, mitochondrial dysfunction, and altered GABA levels are associated with the progressive, irreversible degeneration of dopaminergic neurons in the substantia nigra in Parkinson's disease (PD). Nigral dopaminergic neurodegeneration results in massive loss of dopamine in the striatum. Novel and effective drugs that can reduce the neurotoxic mechanism can block the striatal dopamine depletion leading to neuroprotection in Parkinson's disease. Hence, we elucidated the neuroprotective effects of dexamethasone in a valid Parkinsonian animal model. 1-methyl-4-phenyl-1,2,3,6-terahydropyridine (MPTP) is a potent dopaminergic neurotoxin that causes selective loss of nigral dopaminergic neurons and causing PD like symptoms in mice. In this study, we investigated the behavioral, neurochemical and biochemical effects of dexamethasone in MPTP-treated mice. Dexamethasone significantly improved the behavioral defect induced by MPTP, scavenged the free radical and altered the major endogenous antioxidant molecules and striatal GABA levels leading to neuroprotection. Thus, anti-inflammatory drugs can be used as an adjuvant to levodopa/carbidopa or with a dopamine agonist to reduce the rate of neurodegeneration.

Title: Prevalence of parasitic microorganisms in backyard chicken flocks in Alabama
Primary Author (and presenter): Carrisosa, Miranda C.
Additional Authors: McCrea, Brigid; Macklin, Kenneth S.; & Hauck, Rüdiger
Department: Poultry Science
College/School: College of Agriculture
Description:

In recent years, there has been an increased interest in people owning backyard chicken flocks. Most owners tend to lack the knowledge of proper biosecurity measures and risk of disease transmission. This could potentially be a problem when backyard flocks become reservoirs for various pathogens – including coccidia, flagellate parasites, and potentially zoonotic *Cryptosporidium* species or *Blastocystis* species. The current study involves the investigation of 84 fecal samples from 62 different backyard flocks throughout the state of Alabama collected in summer 2017 and 2018. Each sample was examined by microscopy using the McMaster chamber to count coccidia oocysts and nematode eggs (*Heterakis* spp./*Ascaridia* spp. and *Capillaria* spp.). Oocysts were detected in 73% of flocks, *Heterakis*/*Ascaridia* eggs in 20%, and *Capillaria* eggs in 24%. DNA was extracted from purified oocysts of the backyard samples in which oocyst were present and qPCR using *Eimeria* spp. genus specific primers were used to confirm microscopy results. Coccidia species were determined by next generation amplicon sequencing of the partial 18S rDNA and cytochrome oxidase I genes. *Eimeria acervulina* and *Eimeria brunetti* were the most prevalent species. Following, DNA from one fecal sample from each flock was extracted and PCR for flagellate and other parasites. *Histomonas meleagridis*was detected in 4.9% of the flocks, *Tetratrichomonas gallinarum* in 18.0% of the flocks, *Cryptosporidium* spp. in 16.0% of flocks, and *Blastocystis* spp. in 88.5% of the flocks. The results of this study help to understand the prevalence of parasites in backyard flocks and the resulting risks for human health and commercial poultry flocks.

Title: Diabetes risk screening in overweight/obese adults at risk for type 2 diabetes
Primary Author: Carroll, Carrie L.
Additional Authors: Ellison, Kathy
College/ School: School of Nursing

Description:

Evidence supports diabetes risk screening tools to increase the identification and risk of diabetes. Evidence-based guidelines recommend screening high risk patients for type 2 diabetes annually in patients 45 years and older or younger with major risk factors. Guidelines also support individualized physical activity and dietary meal plan to reduce diabetes risks. The purpose of this STOC project was to implement a screening tool to increase identification of diabetes risk and provide individualized plans of care. Target population included overweight/obese adults 18 years and older in an outpatient hematology/oncology/diabetic education office. Following participant agreement, participants completed the FDA Diabetes Risk Assessment Tool. Results were reviewed to guide individualized plans of care. Individualized physical activity and dietary meal plans were prescribed. At six-weeks, individualized plans, weight, HbA1c, BMI were evaluated, and follow-up screenings scores were assessed for change. The project is in progress. Descriptive statistics will be used to describe the patient population, level of diabetes risk at initial and 6-week follow-up visit, and treatment recommendations. Follow-up data will include diabetes risk assessment scores, weight, HbA1c, and BMI. Pre-post mean diabetes risk assessment scores will be compared with paired t-tests to evaluate for significant improvements in outcomes (alpha= 0.05). Screening for diabetes in high risk adults showed an increase in identification and providing appropriate individualized physical activity/dietary meal plan. Routine diabetes screenings for high risk adults and implementation of individualized treatment plans is achievable within this office and should be continued to obtain further results.

Title: Mortality and behavioral effects of common turfgrass insecticides against Fall armyworm (Spodoptera frugiperda)
Primary Author (and presenter): Carroll, Elijah, P.
Additional Authors: Held, David; Carson, Kendra
Department: Entomology and Plant Pathology
College/School: Agriculture

The Fall Armyworm, *Spodoptera frugiperda* (J.E. Smith), is a prevalent pest to most species of turfgrass. Several turfgrass insecticides have been documented as effective controls against fall armyworm. The objective of this study was to determine residual efficacy of several turfgrass insecticides against fall armyworm in terms of crawling distance knockdown rate and mortality rate. A field trial was set up to evaluate 7 commonly used turfgrass insecticides (zylam, Triple Crown T&O, Acelepryn, Ference, Permetrol, Onyx Pro, and Provaunt). 4 m^2 plots of Tif-Sport Bermuda grass were treated with listed insecticides (3 replicates per treatment). 10 larvae were positioned onto each plot within approximately 5 cm from the center of each plot and tested for crawling distance within 3 hours of initial placement and challenged at 1, 7, 14, 28, and 42 days residual. The recovered larvae were taken back to the lab and tested for mortality at each day residual. A separate lab trial was also conducted, using the 7 initial insecticides along with two biological controls (Spinosad and Dipel). Larvae were incubated into separate petri dishes along with Tifway-419 Bermuda grass cut from treated plots. The larvae were tested for mortality at 24, 48, and 96 hours after incubation and challenged at 1, 3, 7, 14, 28, and 42 days residual. Results and implications will be discussed during the symposium.

Title: Mapping an invasive species using a free and simple remote sensing technique
Primary Author (and presenter): Cash, James S.
Additional Authors: Anderson, Christopher
College/School: School of Forestry and Wildlife Sciences

Description:

Chinese privet (*Ligustrum sinense*) is a non-native invasive shrub that is widely distributed across millions of acres of the Southeastern United States. There are many negative ecological consequences of privet invasions, including reduced native biodiversity and limited forest regeneration. Controlling privet is a costly endeavour that requires proper planning and budgeting to be successful. A key step in the planning process is estimating the acreage and location of privet that needs to be controlled. The goal of this research is to evaluate the use of a free and simple remote sensing method to map privet invasions in hardwood forests. Moderate resolution multispectral imagery can be obtained from the US Landsat or European Sentinel programs for free. An analysis technique known as supervised classification is then applied using the free QGIS software package. Supervised classification involves selecting a few training areas on the image where privet (or any other land cover of interest) is known to be located. The program then highlights everywhere else on the image that matches the spectral signature of the training areas. This technique is simple enough to be utilized by biologists, foresters, and land managers with minimal GIS experience. The basic 3-step process involved in using supervised classification to map privet and the accuracy results from our field study are presented in this poster. Preliminary assessments suggest that satisfactory mapping accuracy can be achieved with much less effort compared to more traditional mapping approaches.

Title: Ecology of human West Nile prevalence in Atlanta, Georgia
Primary Author (and presenter): Castaneda, Nicole J.
College/School: School of Forestry and Wildlife Science

Description:

West Nile Virus (WNV) has caused hundreds of human deaths and has cost the United States of America more than 58 million dollars each year since its first emergence in 1999 (Staples et al. 2014). To understand the ecology of West Nile prevalence and its influence in an urban setting, we will build on preliminary results to test several hypotheses related to either mosquito or avian habitats. Based on preliminary data, three hypothesis were formulated. Our first hypothesis states that an increase of avian diversity will decrease the risk for WNV in an area. This is due to the dilution effect, which states that higher biodiversity will lessen the chance for viral outbreaks (Ostfeld and Keesing 2000). If a forest patch has mainly only Corvid species, which often carry West Nile, then there would be a higher chance for a mosquito to infect a corvid. However, if the forest patch had a larger variety of bird species, it would decrease the probability of a mosquito finding a corvid to continue the cycle and increasing the infection risk. Our second hypothesis looks into whether or not forest patches composed primarily of deciduous trees provide more breeding habitats for mosquitoes. Our third hypothesis states that neighborhoods with older houses will have a higher risk for West Nile because they have older sewer systems that create problems such as combined sewer overflow (CSOs). Often these discharges create stagnant pools of dirty water that the mosquitoes need to reproduce (Vazquez-Prokopec et al. 2010). In addition to having older sewage systems, low-income neighborhoods also tend to have tires and empty pots that also provide the habitat needed for mosquito reproduction (Lockaby et al. 2016, Rios et al. 2006, Reisen et al. 2008). To address these questions, we have established a new series of plots in Atlanta that span ranges of forest patch size, pine composition, and socioeconomic scenarios.

Title: Royal residence: The architecture of the affluence
Primary Author (and presenter): Cawthorn, Kristen C.
Additional Authors: Rodriguez, Angel J.; Luebkemann, Ben; Davis, Emily; & White, Rayven
Department: Architecture, Planning and Landscape Architecture
College/School: College of Architecture, Design, and Construction

Description:

Since its earliest conception, architecture has served the wealthy. Breakthroughs in form, structure, and materiality consistently arose through the commissions of the upper class. As a result, many significant architectural works were built by and for those of a high status. Status, therefore, is the focus of this project. Specifically, the reflection of status in the built environment. Status may be revealed in the scale, medium, and construction methods of a building. The dictionary of architectural terms that has been assembled and defined thus addresses the varied manifestations of wealth in architecture, specifically in the residences of the ruling class. Throughout history, the wealthy have maintained a standard of living above those of lower status. This higher standard was largely achieved through the creation of luxurious architectural environments. In fact, architectural services were largely reserved for the upper class, with lower classes not receiving the same access to architectural planning and design. Even today, only those with substantial funding are able to commission structures. Architectural design has been and still is an outlet for the wealthy and influential to display their affluence. A variety of information may be found on this site. The primary purpose of the project is to develop the theme of architectural affluence, specifically in royal residences, through the assembly of an architectural dictionary. This series of entries may be found under the "Alphabetic Entries" tab. Each of these entries analyzes a unique word and its association to the theme of royal residences. The site also includes information regarding the methodology of the project. This section delves deeper into the theme of the project and provides further information on the research that has been conducted. The methodology section can be found under the corresponding tab. Additional information regarding the authors, editors, and creators of this site is located under the "About Us" tab. All citations used throughout the site may be found under the "Bibliography" tab, and personal reflections from the authors of the project are located under "Project Reflection".

Title: The role of western acculturation and consumer ethnocentrism in predicting apparel consumption behavior amongst Indian consumers

Primary Author (and presenter): Chakraborty, Swagata
Additional Authors: Sadachar, Amrut
Department: Consumer and Design Sciences
College/School: College of Human Sciences

Description:

Purpose of the study was to understand (i) the role of western acculturation (WA) in influencing ethnocentrism in apparel consumption (ETH) among the Indian consumers; (ii) if the country of residence (RES; India vs. the U.S.) influences the relationship between WA and ETH; (iii) if consumer cosmopolitanism (CC) influences the relationship between ETH and attitude toward western apparel brands (BA); (iv) if BA influenced purchase intentions from the western clothing brands (PI). The study proposed that (H_1) WA influences ETH; (H_2) RES of moderates the relationship between WA and ETH; (H_3) WA positively influences BA; (H_4) ETH negatively influences BA; (H_5) CC positively influences BA; (H_6) CC moderates the relationship between ETH and BA; (H_7) CC strengthens the relationship between WA and BA; (H_8) BA positively influences PI; (H_9) WA influences PI. Data was collected through online survey in Qualtrics with Indian consumer panels of Amazon Mturk residing in the U.S. and India, falling under the age group of 19 years and above, belonging to middle- or upper class. The useable sample size was 550. The variables of interest were measured by extant scales. Hypotheses were tested through SEM in Mplus. H_1-H_5, H_8, and H_9 were supported. The total variance explained in ETH, BA, and PI were 56.5%, 48.3%, and 77.6%, respectively. Therefore, even though with high western acculturation, positive attitude toward western clothing brand increases, Indians residing in both India and the U.S. have low purchase intentions from the western clothing brands when they have high ethnocentrism in apparel consumption. Indians residing in the U.S. are more ethnocentric in their apparel consumption behavior than Indians residing in India. However, with high consumer cosmopolitanism, Indians can have high positive attitude toward the western clothing brands, translating to a high purchase intention from the western clothing brands, even when they are highly ethnocentric.

Title: Comprehensive analysis of *in vitro and in vivo* association of somatic mutations in PSMB5 gene with proteasome inhibitor resistance in Multiple myeloma

Primary Author (and presenter): Chakravarti, Sayak
Additional Authors: Kumar, Harish; Mitra, Amit, K.
Department: Drug Discovery and Development
College/School: Harrison School of Pharmacy

Description:

Multiple myeloma (MM) is the 2nd most common hematological malignancy characterized by the abnormal proliferation of clonal plasma cells. Proteasome inhibitors (PI) like Bortezomib (Bz) are widely used in the treatment of MM, alone or in combination with other anti-cancer agents. Bz specifically inhibits the ATP-independent chymotryptic activity of the 26S proteasome through reversible binding to the β5-subunit (PSMB5) of the 20S multi-catalytic protease core. This interferes with tumor progression primarily by accelerating unfolded protein response (UPR) in cancer cells and by interfering with NF-κB-enabled regulation of cell adhesion-mediated drug resistance. However, despite an increasing number of approved therapies, MM remains an incurable disease. Somatic mutations in PSMB5 gene have been proposed as a possible mechanism behind Bz resistance, although the evidences have been conflicting. Bz-resistant human myeloma cell lines (HMCLs) have been shown to harbor PSMB5 mutations that cause conformational or steric changes in the Bz-binding pocket of proteasome resulting in impaired PI binding and decrease in the chymotrypsin-like catalytic function. However, these *in vitro* findings could not be validated in Bz-resistant myeloma patients. We believe this gap in observation between *in vitro* vs *in vivo* studies is due to the small number of HMCLs and patient samples historically used to perform PSMB5 variant analysis. In this study, we sequenced the PSMB5 gene in a large HMCL panel (n>50) to discover *de novo* and reported mutations followed by genotype-phenotype association analysis with PI response (Bz IC_{50} values) generated using *in vitro* cytotoxicity assays. PSMB5 mutations significantly associated with PI-resistance were then validated in clinical samples using genotype vs Progression-free survival (PFS) data from the CoMMpass trial MM patients (>1000). Our future aim is to understand the role these mutations at sub-clonal levels using single-cell genomic analysis.

Title: Computational investigation of inhibition of Methyl-coenzyme M Reductase
Primary Author (and presenter): Channell, Kirsta G.
Additional Authors: Donnan, Patrick H.; Mansoorabadi, Steven O.
Department: Chemistry and Biochemistry
College/School: Sciences and Mathematics

Methyl-coenzyme M reductase (MCR) is the enzyme responsible for catalyzing the final reaction in methanogenesis, the biological production of methane in archaea. Methanogenesis is a large contributor to carbon emissions into the atmosphere. Inhibition of MCR is of scientific and environmental significance, and prior experimental work has determined compounds that can inhibit the enzyme. One compound, 3-nitrooxypropanol (3-NOP), was recently shown to be an inhibitor and limited both methane production and cell growth (E. Duin *et al.*, *Proc. Natl. Acad. Sci. USA* **113**, 6172 (2016)). However, the chemical process of MCR inhibition by 3-NOP has yet to be determined. In the present work, density functional theory (DFT) methods were used to predict model geometries, energies, and electron paramagnetic resonance (EPR) spectra for species that could accurately represent the inhibited state of MCR. Properties of truncated models of the active site of MCR, comprised of the F430 cofactor, a lower axial glutamine ligand, and various upper axial ligands, were calculated and compared to experimental EPR spectra of the inhibited enzyme. Preliminary results support a mode of inhibition where 3-NOP methylates the F430 cofactor and releases NO_3 from the active site.

Title: AUBIE: A novel approach for the computational de-novo design of antibody structures and alternative scaffolds
Primary Author (and presenter): Chauhan, Varun
Additional Authors: Pantazes, Robert
Department: Chemical Engineering
College/School: Samuel Ginn College of Engineering

Description:

Antibodies play a vital role in aiding the immune system to identify and subdue harmful foreign antigens. Smaller alternative binding structures, such as fibronectin domains, anticalins, ankyrin repeats etc., have been identified that retain the high affinity and specificity of antibodies but offer specific advantages. The conventional approaches of manufacturing such biomolecules in lab are laborious and inefficient for targeting a desired epitope. To overcome these shortcomings, significant work has been done on computationally designing antibodies. In the past two decades, computational algorithms have been developed to perform specific antibody related tasks In spite of this large body of work, no similar attempt has been made for alternative binding scaffolds mentioned earlier. In this work, we have developed a novel Algorithm for Ultra-rapid Binding Interaction Engineering (AUBIE) for the *de novo* design of both antibody and non-antibody scaffolds. The design approach initially identifies modular binding loops for the chosen framework and optimal interaction regions around these loops. The protein is designed by selecting loops from the previous step which have multiple strong interactions with the epitope without any clashes. We used AUBIE to design antibodies that bound the HER2 epitope. Analyzing the binding interfaces of the AUBIE solutions reveal the success of the approach to engineer several strong interactions. Moving forward, the approach can be used to design and antibodies with added functionalities such as pH-sensitivity. We believe that this work can lead to the development of new medicines and experimental reagents and advance the state of art in computational protein engineering.

Title: Disulfiram copper nanoparticles prepared with a stabilized metal ion ligand complex method for treating drug-resistant prostate cancers

Primary Author (and presenter): Chen, Wu
Additional Authors: Huang, Chunghui; Yang, Wen; Chang, Ya; Coombs, David T.; Wang, Qi; & Chen Pengyu; Li, Feng
Department: Drug Discovery and Development
College/School: Harrison School of Pharmacy

Description:

Prostate cancer is the second leading cause of cancer-associated death among males in the USA. Although multiple therapeutic strategies, such as hormone therapy and radiation, have been used successfully for early-stage prostate cancer, it inevitably progresses to an aggressive form of castration-resistant prostate cancer, which presents a significant challenge for the treatment. Disulfiram (DSF), an alcohol-aversion drug, has been repurposed for cancer treatment and overcome drug resistance. DSF and copper ions form a copper diethyldithiocarbamate (Cu-DSF) complex which has a potent anticancer activity. However, the poor aqueous solubility of Cu-DSF creates a significant formulation challenge. We developed a Stabilized Metal Ion Ligand Nanocomplex (SMILE) technology to prepare Cu-DSF nanoparticle (NP) formulations where in situ formed DSF-Cu NPs were stabilized by an optimal amount of stabilizers (e.g. PEG-PLA). After optimizing the protocol, we can prepare Cu-DSF NPs with size in the sub-100 nm range which is suitable for intravenous injection and can target tumors through EPR effects. Cu-DSF NPs prepared with SMILE method showed high drug loading efficiency and high drug concentration. The drug concentration of Cu-DSF NPs developed in our study was much higher than those prepared with the classical film-dispersion method. Because of the novel preparation process, the SMILE technology can produce Cu-DSF NPs on a large scale and thus paved the way for its commercialization. We also determined the anticancer effects of Cu-DSF NPs with multiple assays including MTT assay, colony-forming assay, calcein-AM/PI staining, and others. Cu-DSF NPs showed excellent anticancer activity against various drug-resistant prostate cancer cells. In summary, we developed a novel SMILE method to prepare Cu-DSF NP formulations which could address drug delivery challenges of DSF-based chemotherapy and facilitate the clinical translation for treating drug-resistant prostate cancers.

Title: Reception of human odorants inhibited by plant-derived chemicals in the yellow fever mosquito, *Aedes aegypti*

Primary Author (and presenter): Chen, Zhou
Additional Authors: Leal, Walter & Liu, Nannan
Department: Entomology and Plant Pathology
College/School: College of Agriculture

Description:

Electrophysiological studies revealed 39 human odorants that were detected by the yellow fever mosquito, *Aedes aegypti* through their antennal olfactory sensilla SST, SBTII, and GP. Compounds with similar chemical structure tended to elicit same response patterns by *Ae. aegypti*. In addition, examination of the effect of blood meal on the sensitivity to human odorants indicated that blood-fed mosquitoes evoked reduced responses to certain aldehydes, alcohols, ketones, aliphatics/aromatics, and amines at 24-60 hours post blood meal. This result suggests that certain chemicals are required in mosquito host-seeking activity. Eucalyptol, a plant-derived compound, was capable to inhibit the neuronal excitation evoked by three human odorants. The study reveals that eucalyptol may serve as an alternative compound to protect humans from mosquitoes.

Title: Numerical simulation of compressed energy storage in porous aquifer
Primary Author (and presenter): Chidera, Iloejesi O.
Additional Authors: Beckingham, Lauren E.
Department: Civil Engineering
College/School: Samuel Ginn College of Engineering

Description:

Compressed energy storage in porous formations is a promising means of abating the limitations of intermittent renewable energy production. In these formations, working fluids such as air, CO2, or H2, are injected into and extracted from the subsurface for energy storage or production based on energy demand. In the subsurface, complexities can arise in this system from multi-phase flow, working fluid phase change and formation alterations from geochemical reactions that may affect the security of the stored fluid and contiguous protected environment. Fortunately, the extensive study of geologic CO2 sequestration in saline aquifers provides insight to understand these complex interactions and reactions. Nonetheless, the compressed energy storage and sequestration systems differ critically with respect to the wide range of potential working fluids and the flow regimes where energy storage relies on cyclic injection and extraction. Thus, this work seeks to utilize reactive transport simulation to evaluate the geochemical influence of supercritical CO_2 on mineral facies on Kemper formation under the different flow regimes. Numerical simulations consider injection only, injection-extraction and injection-storage-extraction flow regimes at a temperature and pressure of 35^{o}C and 100 bar respectively. The results of the uni-directional flow simulation are compared with bi-directional flow simulation, which is further compared to the injection-storage-extraction regime simulation. The results help to understand the evolution of the formation mineralogy under different flow pattern which simultaneously affect the integrity and efficiency of the system.

Title: Improving self-management behaviors of patients diagnosed with chronic kidney disease
Primary Author: Chislom, Ashley L.
Additional authors: Ellison, Kathy
College/ School: School of Nursing

Description:

Poor self-management behaviors are associated with advanced progression of kidney disease and increased mortality rates. Recent research has shown that comprehensive educational programs are beneficial in improving self-management behaviors of patients with various stages of CKD to improve overall clinical outcomes and quality of life. The purpose of this project was to implement educational sessions led by a healthcare professional in the clinical setting to improve self-management behaviors of patients diagnosed with CKD. The target population included adults (18 and older) diagnosed with CKD in a nephrology clinic. Following participant agreement, participants completed the Self-Efficiency for Managing Chronic Diseases 6-item scale and the Chronic Kidney Disease Knowledge Questionnaire to assess self-management behaviors, baseline knowledge and disease awareness. Baseline blood pressure readings were also recorded. Educational sessions were offered to participants over four weeks. Participants were required to attend at least one 1-hour session each week. After four weeks of education, post-intervention questionnaires were completed, and blood pressure readings were recorded again. The project is in progress. Descriptive statistics will be used to describe the patient population. Data will include gender, age, ethnicity, years since diagnosis, and stage of disease. In addition, the pre-post mean scores for each questionnaire and blood pressure recordings will be compared with paired t-tests (alpha=0.05). Implementing educational sessions for patients diagnosed with CKD can help improve self-management behaviors, increase awareness, and expand knowledge. Early education for patients with various stages of CKD is recommended to achieve improved self-management behaviors and clinical outcomes. Further implementation of the project is warranted.

Title: Spatial epidemiology of *Toxoplasma gondii* infection risk in sentinel feral chickens (*Gallus gallus*) in Kauai, Hawaii

Primary Author (and presenter): Chalkowski, Kayleigh A.
Additional Authors: Fiedler, Kathryn; Lucey, William; & Lepczyk Christopher
Department: Wildlife Science
College/School: School of Forestry and Wildlife Sciences

Description:

Toxoplasma gondii is a globally prevalent coccidian parasite that infects a wide range of avian and mammalian hosts including wildlife, livestock, and humans. Thus, identifying environmental factors that predict and/or impact *T. gondii* infections is important for mitigating disease risks. The island of Kauai presents excellent opportunities to study spatial and environmental covariates of *T. gondii* prevalence due to a) high landscape heterogeneity spanning a small geographical area, b) the presence of an ideal sentinel species, the feral chicken (*Gallus gallus*) and c) recent evidence that *T. gondii* contributes to local declines of Hawaii's endemic bird and mammal species. Despite these compelling opportunities, very little is presently known about the prevalence or distribution of *T. gondii* in Hawaii. In this study, 294 Kauai feral chickens were tested for *T. gondii* using ELISA IG-M immunoassays. 117 chickens (39.8%) tested seropositive, indicating recently acquired infections. Prevalence varied among the 34 sampled localities and was positively correlated with proximity to coastal and unvegetated soil type. These findings reveal that *T. gondii* is both prevalent and heterogeneously distributed among Kauai's diverse habitats. This variability offers insight to the factors that might predict *T. gondii* prevalence within the landscape, and likely also impact infection risks for humans and endangered wildlife.

Title: Pain management for osteoarthritis patients
Primary Author (and presenter): Choi, Da Som
Additional Authors: Ellison, Kathy
College/School Name: School of Nursing

Description:

Osteoarthritis is prevalent worldwide, a total of 13.9% of adults between the ages of 25 years and 65 years have osteoarthritis (OA) in at least one joint and 33.6% of adults age 65 years and older have OA. Joint-related pain and decreased functioning are the two most common problems associated with OA. For Joint-related pain, the most common treatment is administering nonsteroidal anti-inflammatory drugs (NSAIDs). Exercise treatment is the single most effective treatment for improving function. Combining these two most effective treatments for OA can create a synergetic effect and produce a better health outcome by controlling joint pain while performing exercise. The small test-of-change project tested the benefit of combining two interventions for OA patients. Appropriate exercise intervention was introduced to patients depending on the location of their OA, and NSAIDs administration education was provided. Participants will perform exercise daily and will record the activity, NSAIDs administration, and daily pain level into a journal. The project manager will obtain Time Up and Go (TUG) test results of each participant at the first and last meeting. Ten participants with hip and knee OA were included in the small test of change. The project is still in progress. Descriptive statistics will be used to describe the patient population, types of osteoarthritis, pain level and TUG result before project, NSAIDs administration frequency, exercise frequency and pain level and TUG result after project. Pre and posttest pain level and TUG mean score will be compared with paired t-tests (alpha=0.05). NSAIDs and exercise combined treatment to osteoarthritis patients can improve joint mobility level and reduce joint pain level thus, it can improve OA patient's quality of life. Providing appropriate treatment for OA patient can attainable in this doctor's office setting and further implementation of the project is warranted.

Title: Pain management for osteoarthritis patients
Primary Author (and presenter): Choi, Da Som
Additional Authors: Ellison, Kathy
College/School Name: School of Nursing

Description:

Osteoarthritis is prevalent worldwide, a total of 13.9% of adults between the ages of 25 years and 65 years have osteoarthritis (OA) in at least one joint and 33.6% of adults age 65 years and older have OA. Joint-related pain and decreased functioning are the two most common problems associated with OA. For Joint-related pain, the most common treatment is administering nonsteroidal anti-inflammatory drugs (NSAIDs). Exercise treatment is the single most effective treatment for improving function. Combining these two most effective treatments for OA can create a synergetic effect and produce a better health outcome by controlling joint pain while performing exercise. The small test-of-change project tested the benefit of combining two interventions for OA patients. Appropriate exercise intervention was introduced to patients depending on the location of their OA, and NSAIDs administration education was provided. Participants will perform exercise daily and will record the activity, NSAIDs administration, and daily pain level into a journal. The project manager will obtain Time Up and Go (TUG) test results of each participant at the first and last meeting. Ten participants with hip and knee OA were included in the small test of change. The project is still in progress. Descriptive statistics will be used to describe the patient population, types of osteoarthritis, pain level and TUG result before project, NSAIDs administration frequency, exercise frequency and pain level and TUG result after project. Pre and posttest pain level and TUG mean score will be compared with paired t-tests (alpha=0.05). NSAIDs and exercise combined treatment to osteoarthritis patients can improve joint mobility level and reduce joint pain level thus, it can improve OA patient's quality of life. Providing appropriate treatment for OA patient can attainable in this doctor's office setting and further implementation of the project is warranted.

Title: Estimating operational age of an integrated circuit
Primary Author (and presenter): Chowdhury, Prattay
Additional Authors: Guin, Ujjwal; Singh, Adit; & Agrawal, Vishwani
Department: Electrical and Computer Engineering
College/School: Samuel Ginn College of Engineering

Description:

Used ICs being fraudulently recycled as new replacement parts towards maintaining older electronic systems is a serious reliability concern. This paper presents a novel approach to estimate the operational age of chips by measuring I_{DDQ}, the quiescent (steady state) current from the power supply. The measured I_{DDQ} is the total leakage current in steady state, with all conducting paths turned OFF. It decreases as the circuit ages due to the increase in the magnitude of the PMOS transistor threshold voltages caused by negative bias temperature instability NBTI. Observe that the impact of NBTI varies depending on the degree of operational stress experienced by individual transistors. We use a normalized difference, ΔI, from measurements using two different input test patterns to generate a self-referencing circuit age indicator. The first pattern is chosen such that its I_{DDQ} is dependent on a large number of minimally stressed PMOS transistors; the other is dependent on approximately an of highly stressed PMOS transistors. Clearly, the difference between these two I_{DDQ} currents will increase with circuit age. The new approach requires no hardware addition or modification to the design and can hence be applied to legacy ICs. Our simulation results show that we can reliably detect recycled used for as six months.

Title: Physical and electrochemical properties of copper deficient CuCrO2 for application in Li-ion batteries

Primary Author (and presenter): Chown, Amanda L.
Additional Authors: Chen, Hengze; Beidaghi, Majid; & Farnum, Byron
Department: Chemistry and Biochemistry
College/School: College of Sciences and Mathematics

Description:

Transition metal oxides are often used in conjunction with carbon black as the cathode material in Li-ion batteries. While these materials are extensively studied and used in commercial production, studies on defect states of these materials and how their properties are influenced is scarce. Here we report the synthesis and characterization of copper deficient CuCrO2 for application in Li-ion batteries. Through electrochemical and synthetic lithiation, adjusting synthetic parameters, and modification of paste and film development, the effects on CuCrO2 and electrochemical properties were studied. Defect states in delafossite CuCrO2 in the form of Cu vacancies during hydrothermal synthesis. The pH of the solution during synthesis as well as using acidic or basic solutions to wash the product is shown to impact the concentration of Cu vacancies in the sample. Doping CuCrO2 synthetically with lithium at varying concentrations, as well as electrochemically lithiating the sample, influences the observed physical and electrochemical properties of the material. Based on EDS and XRD data, the morphology of CuCrO2 is shown to be influenced by synthetic conditions used. TEM is being explored more extensively to determine if such results are predominately caused by a change in the size distribution of the nanoparticles, or whether synthetic conditions cause the material to be amorphous or crystalline. Through lithiation of CuCrO2, CV presents drastic changes in faradaic current which signifies increased electron transfer within the system. Lithiation of the material and synthetic conditions also influence the charge and discharge of the system via chronopotentiometry. Further studies of defects states in delafossite CuCrO2will aid in developing a firm understanding of how these states influence other properties. These findings may be used to aid researchers in developing more efficient cathodic materials for Li-ion battery development and production.

Title: Understanding pan's labyrinth: tracking the subcellular localization of viral long non-coding RNA using *in situ* fluorescence microscopy techniques
Primary Author (and presenter): Cline, Sabrina E.
Additional Authors: Sztuba-Solinska, Joanna
Department: Biological Sciences
College/School: College of Sciences and Mathematics

Description:

Kaposi sarcoma associated herpesvirus (KSHV) is an oncovirus known to cause Kaposi Sarcoma and Body Cavity B Lymphoma in immune-compromised patients. KSHV displays two stages of the life cycle, namely latent, where a small subset of genes is expressed, and lytic, where the full repertoire of genes is expressed and viral progeny are produced. During lytic phase of infection, KSHV produces an abundant long non-coding transcript designated polyadenylated nuclear (PAN) RNA, which regulates expression of viral lytic genes and modulates the cellular immune response. PAN RNA accumulates mainly in the nucleus, but recent studies have proved its presence in the cytoplasm and virions, supporting its multifunctional regulatory roles. The goal of my project is to elucidate how a recently identified PAN-specific chemotype (Compound #15) impacts the localization and metabolism of PAN RNA in BCBL-1 cell line at different stages of KSHV life cycle. Compound 15 has been shown to influence KSHV latent-to-lytic switch, and as such represents a potential therapeutic latency-reversing agent. I will use KSHV-positive primary effusion lymphoma cell line, BCBL-1, that represents an authentic tumor model and permits a controlled chemical maintenance of viral latency or lytic induction. I will develop target-specific immunofluorescent oligonucleotides to track the dynamic sub-cellular localization of PAN RNA at different stages of KSHV life cycle. Time and concentration course experiments involving the compound #15 treatment followed by PAN-specific RT qPCR analysis will assess the influence of the compound on PAN metabolism. Overall, this project has a potential to identify a novel therapeutic target against KSHV infection.

Title: The role of awareness in eyeblink classical conditioning to distinct and similar tones
Primary Author (and presenter): Coe, Taylor E.
Additional Authors: Bolaram, Anudeep & Cheng, Dominic T.
Department: Psychology
College/School: Liberal Arts

Description:

Eyeblink classical conditioning (EBCC) is a widely used experimental procedure for understanding fundamental forms of learning and memory. In EBCC, a neutral conditioned stimulus (CS) (e.g. tone) is repeatedly paired with a biologically relevant unconditioned stimulus (US) (e.g. corneal airpuff). Following repeated presentations, the CS alone begins to elicit a reflexive, anticipatory eyeblink, known as the conditioned response (CR). A better understanding of the mechanisms underlying this form of learning may ultimately contribute to the diagnoses and treatment of certain psychopathologies, such as anxiety disorders and phobias. Determining whether this type of conditioning is possible with or without conscious awareness may be useful in devising treatment strategies for these psychopathologies. It is possible that the relationship between CR and awareness depends on the physical properties of the CS. We tested this by manipulating the frequency of tones (CSs) within a differential delay EBCC procedure and probing the awareness of the contingency in three groups of participants. It was observed that when distinct CSs (1kHz tone vs. white noise) were used, the CR was unrelated to awareness i.e. both aware and unaware participants produced differential CRs. When two tones (1kHz vs 1400Hz) were used as the CSs, similar results were observed as in the previous group. However, when the CSs were perceptually similar to each other (1Khz vs 1150Hz), irrespective of reported contingency awareness, differential CRs were not observed. These data suggest that awareness is not necessary for distinct tones, but is also not sufficient for CR expression for similar tones.

Title: Solutions to bird window collisions: A meta-analysis
Primary Author (and presenter): Colbaugh, Jessica
Additional Authors: Gitzen, Robert & Lepczyk, Christopher
Department: Wildlife Sciences
College/School: School of Forestry and Wildlife Sciences

Description:

Bird window collisions happen throughout the year, taking place in rural and urban habitats with deaths documented for many groups of birds. Birds are unable to perceive glass itself as a barrier, and instead are attracted to the reflections on the surface or suitable habitat on the other side. Window treatments have been developed to reduce collisions, and some comparisons have been done within studies. However, there hasn't been a systematic review of developed solutions. This meta-analysis was designed to provide an overall effect of treatments as well as systematically compare different window treatments using rate ratios to find which solutions had the best effect for reducing collisions. Following PRISMA guidelines we found eight studies, for a total of 34 effect sizes. A random effects model comparing each solution identified a commercially available one-way glass called CollidEscape, UV absorbing and reflecting alternating pattern to completely cover the window, and vertical stripes of UV absorbing 2.5 cm wide spaced 5 cm apart as the top solutions. A mixed effects model was used to moderate and compare grouped treatments, grouped based on physical similarities. The mixed effects model accounted for a fair amount of heterogeneity and identified glossy black horizontal stripes (2 mm thick and spaced 28 mm apart) and parachute cords as the best options. The overall effect was that the treatments reduced collision rate by about 80% compared to clear glass. The solutions found to be effective are feasible for application anywhere from homes to businesses.

Title: A survey of in-service music teacher preparedness for teaching non-traditional music courses and ensembles in secondary-level schools
Primary Author: Colquhoun, Shane E.
Department: Curriculum and Teaching
College/School: College of Education

Description:

Despite efforts to diversify music curriculum in secondary schools, research indicates that music education in the United States primarily focuses on western classical music, overemphasizes performance, and fails to reach most students in secondary level schools. Research spanning 27 years indicates that over 70% of students in secondary-level schools across the United States do not participate in a traditional large ensemble.

The purpose of this quantitative study was to investigate in-service music teacher preparedness for teaching non-traditional music courses in secondary-level schools. Specifically, this research examined which non-traditional courses are offered in U.S. secondary schools and how often they are offered in different geographical areas. Results indicated three key findings: guitar, music theory, music appreciation, and piano are the most frequently offered NTMC's, music educators are underprepared to teach NTMC's based on their in-service teacher preparation, and multicultural and popular music ensembles were the least offered and participants were least interested in offering these courses. A critical link in providing music education for all is finding ways to reach students who do not participate in traditional large ensembles.If it is true that music education is for all, it is critical that music educators begin to analyze our approach to music learning and teaching. Music educators should begin to question if we are offering relevant and meaningful music opportunities in secondary schools and develop plans to reach a more diverse population of students.

Title: Lumped parameter modelling of cerebrovascular and cardiovascular blood flow
Primary Author (and presenter): Compher, Tyler, R
Additional Authors: Raghav, Vrishank
Department: Aerospace Engineering, Chemical Engineering
College/School: Engineering

Cardiovascular disease is the leading cause of death in the United States, killing approximately 610,000 people in 2015. This results in huge socio-economic burden on the US with over $500 billion spent annually. While human and animal model studies yield the best results, computer models of the cardiovascular system provide researchers with a simpler alternative to study hemodynamics in order to better understand and treat cardiovascular disease. The goal of this work was to develop a coupled cardio-and-cerebrovascular computer model that would reproduce physiologically accurate pressures and flowrates in arterial segments. The model could then be used to investigate phenomena resulting from the coupling of the cardio-and-cerebrovascular system. An analog of an electrical circuit, the Windkessel model, was used to simulate blood flow. The flowrates and pressures calculated using this model were then compared to clinical measurements to validate the model using simulations run using physiological cardiac output and heart rate. The resulting pressures and flow rates matched those that are measured clinically, validating the model. This model can be used to investigate the relationship between the cardio-and-cerebrovascular system.

Title: The interactive effect of anxiety sensitivity and cognitive fusion on anxiety symptoms
Primary Author (and presenter): Conboy, Natalie E.
Additional Authors: Bardeen, Joseph R.
Department: Psychology
College/School: College of Liberal Arts

Description:

Anxiety sensitivity (AS) and cognitive fusion (CF) are risk factors for anxiety and related disorders. AS is the fear of arousal-related sensations due to beliefs that such sensations will have adverse psychological, social, and physical outcomes. Cognitive fusion (CF) occurs when people believe the literal meaning of their thoughts instead of viewing them as transient internal experiences. Some evidence suggests that AS is only maladaptive when combined with processes related to psychological inflexibility, such as CF (Bardeen, 2015). As such, the purpose of the present study was to examine the interactive effect of AS and CF on anxiety. Specifically, we predicted that the relationship between AS and anxiety would be significantly stronger at higher, versus lower, levels of CF.

Adult participants (N = 504) completed a battery of questionnaires in exchange for payment through Amazon's Mechanical Turk. Questionnaires included self-report measures of AS, CF, and anxiety. The proposed interaction effect was examined using a hierarchical regression model. As predicted, the interaction term (AS x CF) significantly predicted anxiety (ΔR^2 = .01; β = .13, p < .001). Simple slopes analyses showed that the positive association between AS and anxiety was significantly stronger at high CF (β = .56, p < .001) compared to low CF (β = .34, p < .001).

These findings suggest that individuals with both high AS and CF may be particularly prone to experiencing anxiety. As a result, preemptive interventions to reduce CF may be beneficial among individuals prone to AS. Interventions that target both of these risk factors simultaneously may be particularly effective for treating individuals with anxiety.

Title: Decreasing pediatric stressors with vaccinations
Primary Author (and presenter): Cook, Julianna M.
Additional Authors: Howell, Eleanor
College/School: School of Nursing

Description:

The American Academy of Pediatrics recommend children receive a total of 32 vaccinations over six years. Stress and pain are common emotions children and parents feel during these vaccination processes. Studies show that using interventions, such as parent involvement and distractions, can decrease stressors during vaccinations. The purpose of this project is to implement developmental age appropriate distraction techniques before, during, and after vaccinations to decrease stressors pediatric patients and families. The target population included pediatric patients, ages infant to adolescent, receiving vaccinations in a pediatric primary care setting. Following a participant agreement, patients or parents receive educational handouts and complete a pre-vaccination survey using the Face, Legs, Activity, Cry, Consolability scale (FLACC scale), Visual analog pain scale, and satisfaction (Likert-type) scale. Distraction methods will be chosen by the patient or caregiver and used (by the caregiver or medical assistant) with the child before, during, and after vaccination. A post-vaccination survey will be given to the same participant to complete. If the intervention was helpful in decreasing stressors, the same intervention will be used during subsequent appointments. The project is in progress. Descriptive statistics will be used to summarize demographic characteristics. Pre and post-scores on child stress, family stress, and vaccination satisfaction will be analyzed using paired t-tests (alpha = .05) to determine if the project improved stress. Implementing stress-reducing interventions during vaccinations can decrease stressors and increase satisfaction in pediatric patients and families. Using distraction techniques to reduce pediatric stressors with vaccinations will continue to be tested using this project.

Title: Creep and shrinkage behavior of concrete in I-59/20 segmental bridge
Primary Author: Cooper, Grant M.
Additional Authors: Richey, Daniel; Schindler, Anton; & Barnes, Robert
Department: Civil Engineering
College: Samuel Ginn College of Engineering

Description:

This poster will cover current research of creep and shrinkage behavior of the I-59/20 segmental bridge in Birmingham, Alabama. The main goal of the research is to use collected data from the on-site casting yard to calibrate prediction models for a better understanding of how the bridge will behave over its life cycle. Creep testing occurred in the lab where the collected samples were loaded at forty percent of their compressive strength at the following ages: 7 days, 28 days, 91 days, and 182 days. Each creep specimen was loaded with a specific amount of stress depending on the strength of the cylinders. Shrinkage prisms were used to quantify temperature shrinkage over curing time. All creep and shrinkage samples collected in the field were cured alongside the bridge segments to keep consistency between the samples. Several prediction models were compared including: AASHTO LRFD 2017, ACI 209, CEB MC 2010, GL 2000, and the B3 Model. Statistical analysis was used in comparing the predicted values for creep and shrinkage. Each model was calibrated to minimize the sum of the squared error associated with each loading age. Conclusions as of January 2019 are subject to change. As of now most of the models under-predict the collected creep and shrinkage data. Further data collection will allow for better prediction of long-term total shrinkage.

Title: Planning for natural disasters: A geospatial analysis on the effects of Hurricane Ivan on Alabama and Florida

Primary Author (and presenter): Copeland, Joshua W.
Additional Authors: Wates, Garrett &Esco, Taylor
Department: Community Planning
College/School: College of Liberal Arts

Description:

As a result of the global rise in average temperatures due to climate change, natural disasters such as hurricanes have become an increasing threat to the Gulf Coast region of the United States. Despite the large degree of urban planning research assessing the effectiveness of post-disaster planning methods implemented in coastal regions, a disparity exists regarding the efforts of policymakers to improve the access to tools and information available to regional planning agencies to mitigate the impact of natural disasters on at risk groups which may otherwise go overlooked. This case study analyzes the effects of Hurricane Ivan on the four Gulf Coast counties of Escambia and Santa Rosa Florida alongside the Alabama counties of Baldwin and Mobile. A literature review showcases that the coastline of both Alabama and northwest Florida comprised the area most heavily impacted by Hurricane Ivan in the United States. Demographic data collected from the United States Census Bureau was analyzed through geospatial analysis to determine the categories and locations of residents who were most vulnerable to hurricanes in the research area. A review of the research variables of at risk groups through GIS revealed that locations of residents over the age of 65, households without the ownership of a personal vehicle, and residents of census tracts with low income per capita were not fully accounted for in the process of planning for Hurricane Ivan. The findings of this case study demonstrate the necessity of adopting a more holistic review of at risk groups to improve the effectiveness of local planning practices to better alleviate the impact of natural disasters in the region.

Title: Hip, knee, and ankle contribution are affected during sloped walking in individuals with ACLR

Primary Author (and presenter): Corona, Katherine S.
Additional Authors: Holmes, Hillary; Fawcett, Randy; & Roper, Jaimie
Department: Kinesiology
College/School: College of Education

Description:

Anterior cruciate ligament tears are one of the most common injuries sustained across all sports. While the reconstructive surgery has been thoroughly refined to an efficient and speedy procedure, the future joint complications like osteoarthritis still affect a large percentage of this population. The purpose of this study was to analyze if and to what extent individuals with anterior cruciate ligament reconstruction (ACLR) modify their gait during sloped walking. We recruited 13 individuals with ACLR, at least 4 months post operation and cleared for activity. The participants were given questionnaires investigating past medical history, and functionality of the ACLR limb. To assess gait, we placed markers on the participants lower body and recorded the trials with a 17 camera Vicon motion capture system. The participants walked on a split-belt treadmill under three different sloped conditions, 0°, +/-4°, and +/-10°, at set speeds of 1.3 m/s, +/- 1.0 m/s, and +/- 1.0 m/s, respectively. We calculated joint moment contributions for each limb. We compared the percentages from the ankle, knee, and hip in the ACLR limb to the healthy limb. We did not observe a significant difference between contribution in each limb under any condition. These results support the idea that individuals with ACLR are able to maintain gait symmetry during sloped walking. These results do not implicate an asymmetric gait is at fault for joint complications. However, it is possible that patients with ACLR demonstrate bilateral modifications. Further, it is also possible that movements associated with fatigue lead to alterations with short and long-term joint complications. Future research should investigate gait patterns in individuals with ACLR compared to a matched control group. Further work is also required to establish the role of fatigue in gait during incline/decline walking in persons with ACLR, as we were careful to limit fatigue in our study.

Title: Testing whether sex-specific senescence in the lizard, *Anolis sagrei*, translates to the cellular level

Primary Author (and presenter): Courtenay, Milica, S.
Additional Authors: Clark, Amanda; Schwartz, Tonia
Department: Biology
College/School: COSAM

With more scientific knowledge and improved health care, people are living longer than ever. A deeper understanding of aging allows for a more comprehensive insight of a process that is a precursor for many diseases. On the molecular level, senescence is the deterioration and loss of function leading to cell death. In many species, including humans, males and females age at different rates. For anole lizards, females live longer than males in the wild and are proposed to be a novel model for studying sex-specific aging. This project seeks to determine if there are gender-specific differences between rates of senescence in the cultured dermal fibroblasts of *Anolis* lizards. First, this project tests whether cell lines from the tail tissue of old brown anoles (three-years old) can be established. Second, the cell lines from these old individuals (three males and three females) are being cultured through senescence and signs of aging such as cell morphology, and vacuolization are being observed. In addition, at each passage, IGF2 expression, and p16 phosphorylation are quantified as a biomarkers of senescence. It is predicted that the male cell lines will show a higher rate of senescence in earlier passages than female lines, consistent with the pattern observed at the organismal level in the wild. It is also predicted that expression of the biomarkers will decline with senescence as this is what has been found in similar studies in other organisms. It has been determined that it is possible to establish reptile fibroblast cell lines from old lizards because of successful establishment of four male and three female cell lines from three-year-old individuals. The biomarker data is being collected and final results will be presented. Future work will compare the patterns of sex-specific cellular senescence between the cell cultures and individuals living in the wild. If the results are consistent it could provide evidence supporting tissue culture, and *Anolis* lizards, as a sound aging model. Even if that isn't the case, the relation between aging and these biomarkers could be elucidated in this new model species.

Title: Effects of lifetime exposure of dietary methylmercury in zebra finch pancreatic function
Primary Author (and presenter): Cronin, Jamie, E.
Additional Authors: Brittain, Cara; Stills, Shelby; Wada, Haruka
Department: Biological Sciences
College/School: COSAM

Mercury is an environmental pollutant with negative effects on many physiological processes in zebra finches, a model songbird. Methylmercury (MeHg) is a known endocrine disruptor, but the effect of dietary methylmercury in pancreatic function has not been explored in depth in songbirds. We examined effects of dietary MeHg on pancreatic morphology in zebra finches. Twelve birds were fed a controlled diet laced with 1.2ppm MeHg, an environmentally-relevant dose based on polluted sites, for the duration of their lives and then humanely euthanized and their pancreases harvested. Using Hematoxylin and Eosin staining of the pancreas, we analyzed the percentage of islets in a consistent area of the pancreas that are peripheralized, as well as the number of pancreatic cells showing signs of apoptosis, or cell death. We are expecting significant differences in these measures between mercury-exposed birds and control birds.

Title: The impact of pharmacist-delivered medication therapy management (MTM) on outcomes for patients with diabetes: a systematic review

Primary Author (and presenter): Crosby, Cassidi N.
Additional Authors: Qian, Jingjing; Ngorsuraches, Surachat; & Garza, Kimberly
Department: Health Outcomes Research and Policy
College/School: Harrison School of Pharmacy

Description:

To systematically assess the impact of pharmacist-delivered MTM services on diabetes related outcomes: hemoglobin A1c (HbA1c), blood glucose, hospitalizations, emergency department visits, and healthcare costs. Searches were carried out through Pubmed, IPA, CINAHL, and PsycInfo. The search was limited to those articles in English, studied in humans, and published between 01/01/07-10/10/18. Search terms for each database were established based on concepts including diabetes, clinical outcomes, pharmacist/pharmacy, and medication therapy management. References of included full-text articles were hand searched, and grey literature was searched through Clinicaltrials.gov. A total of 284 articles were identified through the initial search. After eligibility criteria were applied, 15 articles were included in the final qualitative synthesis of evidence. Study designs included observational, pilot, and randomized controlled trials. Majority (n=12) of the studies measured HbA1c as study outcome, and other outcomes included fasting plasma glucose (FPG), fasting blood glucose (FBG), postprandial glucose (PPG), hospitalizations, and cost. Overall, pharmacist-led MTM services resulted in improved diabetes-related outcomes. The reduction in HbA1c ranged from 0.19% to 3.56%. Patients with more severe diabetes (higher HbA1c) accounted for the larger reductions in HbA1c compared to patients with less severe diabetes. Blood glucose values were improved by 14 mg/dL for FPG, 6 mg/dL for FBG, and 14 mg/dL for PPG. Diabetes-related hospitalizations decreased by 52% due to MTM implementation. Additionally, annual costs were reduced due to MTM programs ($1031 per patient) and medication changes initiated by pharmacists through MTM ($166.20 for the patient and $163.08 for the health plan). Pharmacist-led MTM services have shown promising improvements in diabetes outcomes; in particular, patients with higher HbA1c benefited more from MTM services.

Title: Explicit and implicit instruction of discourse markers to Spanish heritage speakers
Primary Author (and presenter): Cuartero Marco, Marina
Department: Foreign Languages
College/School: College of Liberal Arts

Description:

One of the main debates in the field of Second Language Acquisition (SLA) is regarding the use of explicit versus implicit instruction of linguistic forms. Linguistic input is necessary for SLA; however, the way input is presented, explicitly or implicitly, to the L2 learner may have an impact on the learning process. In contrast, the amount of research on Heritage Language Instruction is scarcer. Most heritage language courses rely heavily on L2 methodologies for language instruction. Given that Heritage Speakers learn the minority language from their surrounding community and family, we can describe their knowledge of the language as being more implicitly rooted. Although Explicit Instruction seems to benefit the acquisition of certain linguistic forms by both Heritage Speakers and L2 learners, little is known about its impact on the acquisition of less salient linguistic forms such as Discourse Markers. Explicit instruction and metalinguistic awareness might be required for Heritage Speakers to acquire these elements. The purpose of this study is to determine whether Explicit or Implicit Instruction has an effect on the assimilation and retention of Discourse Markers by Heritage Speakers of Spanish. In order to test this, I expose a group of 24 Heritage Speakers to two different types of computer instruction (e.g., Explicit vs. Implicit) on Discourse Markers *(e.g., entonces,* 'then or therefore'*, así que,* 'so that'); and test participants' assimilation and retention of these forms through two different tasks: A Simulation Oral Proficiency Interview and an Acceptability Judgment Task. In order to evaluate the stability and retention of these forms, I administered a delayed post-test to the participants as in Hernandez and Rodríguez-González (2013). Although data collection is still ongoing, I hypothesize that Heritage Speakers will benefit from Explicit Instruction more than, based on previous research.

Title: Experimental throughfall reduction increases water use efficiency in longleaf pine
Primary Author (and presenter): Custodio Mendonca, Caren
Additional Authors: Samuelson, Lisa J.; Stokes, Thomas A.; & Ramirez, Michael R.
College/School: School of Forest and Wildlife Sciences

Description:

Future climate change predictions for the southeastern U.S. include increases in evaporative demand and soil water depletion. Longleaf pine (*Pinus palustris* Mill.) forests may serve as a pathway to increase the resilience of southern forests to changing climate. The objective of this research was to examine the effects of experimentally induced drought on leaf physiological and shoot phenology to better understand drought tolerance of longleaf pine. The impacts of 40% throughfall reduction (TR_{40}) imposed by diverting rainfall off plots versus ambient throughfall (TR_0) on leaf-level physiology, water use and shoot phenology of a 12-year-old longleaf pine plantation were studied over two years. Leaf physiological measurements included stomatal conductance (g_S), net photosynthesis (P_{net}), and predawn (Ψ_{PD}) and midday (Ψ_{MD}) leaf water potentials. Shoot phenology measurements included shoot and needle elongation. TR_{40} decreased g_s by 22% and P_{net} by 13%. Leaf water use efficiency (WUE, calculated as the ratio of P_{net} to g_S was increased by 12% in TR_{40}, mainly because of reductions in g_S. TR_{40} also reduced mean Ψ_{PD} by 7.6%, indicating an effect of the treatment on soil water availability. The $\Delta\Psi$ (defined as the difference between Ψ_{PD} and Ψ_{MD}) was similar between treatments ($p=0.116$) indicating that improved WUE limited leaf water stress. Trees under TR_{40} treatment decreased shoot elongation in 2017, but not in 2018. Needle elongation was similar between treatments both years. These results indicate that longleaf pine tolerates reductions in soil water availability by decreasing g_S and improving WUE.

Title: Improving education of patients with heart failure using mobile devices
Primary Author (and presenter): Dailey, April F.
Additional Author: Peterson, Mary H.
College/ School: School of Nursing

Description:

Evidence supports that patients' lack of education and understanding of heart failure has been linked with increased hospitalizations and exacerbations. The utilization of mobile devices to access educational websites can increase patients' knowledge regarding heart failure and decrease hospitalizations. Information from the websites can also increase the ability to manage heart failure in the home setting. The purpose of this project is to implement the use of mobile devices by patients with heart failure to access educational websites, improve knowledge, self-care management, and self-reported quality of life (QOL). With improved self-management and reduced exacerbation of symptoms, fewer hospital admissions can result. The target population includes adults ages 50-80 years of age with heart failure who receive intravenous medication treatments in an outpatient infusion center. After signing a participation agreement, participants completed a pre-project data collection survey regarding current heart failure self-care management regimen. Participants also completed a quality of life questionnaire, the Minnesota Living with Heart Failure Questionnaire (MLHFQ). A follow up post survey and the MLHFQ were completed to access knowledge, self-care management, and QOL. The project is in progress. Descriptive statistics will be used to describe the patient population, use of educational websites, knowledge gained regarding self-management, and changes in quality of life. Follow-up data will include pre-post data collection assessment mean scores and pre-post mean scores will be compared with paired t-tests (alpha=0.05). Mobile devices can provide easily accessible education for patients with heart failure, can improve knowledge of self-care and management (e.g. signs and symptoms of heart failure), promote lifestyle changes to decrease exacerbations, and improve QOL. Further implementation of the project is warranted.

Title: Characterization and expression of *ANKEF1A/B* in the developing and adult zebrafish (*Danio rerio*)

Primary Author (and presenter): Daniel, Jeff G.
Additional Authors: Panizzi, Jennifer (PI); Schwartz, Dean; Biancardi, Vinicia; Panizzi, Peter.
Department: Anatomy, Physiology, and Pharmacology
College/School: College of Veterinary Medicine

Description:

Recent human next-generation sequencing (NGS) and genome-wide association studies (GWAS) studies indicate an association of *ANKEF1* (ankyrin and EF-hand containing protein 1) polymorphisms or abnormal levels of *ANKEF1* transcripts with prostate cancer risk, schizophrenia, glioblastoma, thoracic aortic aneurysms and dissections, pediatric acute lymphoblastic leukemia, and nasopharyngeal carcinoma. A single study conducted in *Xenopus laevis* has indicated xANKEF1 plays a role in protocadherin-mediated cell protrusion and adhesion and is down-regulated after pharmacological FGF inhibition. Interestingly, while little is known about ANKEF1 function in other vertebrate systems, recent proteomic data from isolated human airway cilia, as well as embryonic zebrafish kidney single-cell RNA analyses, have implicated ANKEF1 as a cilium-enriched protein. Likewise, publicly available EST profile databases indicate *ANKEF1* expression in multiple human tissues, including enrichment in the testes. These previous studies suggest important role(s) for ANKEF1 in the pathogenesis of the aforementioned human diseases, with a possible function in ciliated tissues. Here, we have cloned zebrafish *ANKEF1A*, as well as its predicted paralog *ANKEF1B*, and conducted expression analyses by whole-mount in situ hybridization and qPCR during embryonic development and in adult tissues. Certainly, our experiments in the zebrafish model system with *ANKEF1A and ANKEF1B* provide a solid foundation for future studies to elucidate the molecular pathways in which ANKEF1 acts in both healthy and disease states.

Title: Improving adherence of diet, fluid, and medication in patients with end-stage renal disease with a peer mentoring program

Primary Author (and presenter): Danley, Lisa K.
Additional authors: Peterson, Mary H.
College/School: School of Nursing

Description:

Strong evidence supports nonadherence to diet, fluid and medication treatments contribute to poor outcomes with increased morbidity and mortality in patients with end-stage renal disease (ESRD) on hemodialysis. Almost 50% of patients are non-adherent to one or more aspects of treatment. Evidence-based studies suggest peer mentor programs for patients with ESRD can improve adherence, self-management and self-efficacy. The purpose of this project was to implement a peer mentor program to improve adherence to the prescribed treatments and health-related quality of life. The target population included adults over 18 years with ESRD on hemodialysis in an outpatient clinic. Peer mentor criteria included a minimum of a year on hemodialysis, knowledge and treatment adherence. Additional criteria were evidence of non-adherence in labs and fluid gains obtained in pre-implementation chart review. Following the participant agreement, surveys for self-management, knowledge, self-efficacy, dialysis and social support, and health-related quality of life were completed. The clinical manager reviewed results to guide treatment recommendations. Guidelines were prescribed and pairs were assigned. A follow up meeting at 4-6 weeks assessed knowledge and adherence to recommendations. The project is in progress. Descriptive statistics will be used to describe patient population, nonadherence such as fluid gains, phosphorus levels, and knowledge. Follow-up data will include number and percent of adherence to treatments. Baseline non-adherent fluid gains and pre-post knowledge mean scores will be compared with paired t-tests (alpha=0.05). Peer mentor education among patients on hemodialysis can identify gaps in knowledge to guide appropriate treatment recommendations and improve adherence. Identifying knowledge gaps and nonadherence to the prescription early in this setting are achievable. Further project implementation is warranted.

Title: Utilization of FEPPA as a marker for microglial activation
Primary Author (and presenter): Darakjian, Lucy
Additional Authors: Alrihani, Sweilem & Kaddoumi, Amal
Department: Drug Discovery and Development
College/School: Harrison School of Pharmacy

Description:

Neuroinflammation and abnormal immune responses are increasingly implicated in the pathophysiology of Alzheimer disease. Microglia are a key player in the immune surveillance system of the CNS where they act as resident macrophages and are the first responders to various types of brain insult. As part of the brain inflammatory response, microglia are transformed from a “sentry” state into an “active” state. Microglia are activated in response to endogenous signals such as amyloid-beta accumulation, tau protein, α-synuclein, or exogenous “danger” signals such as traumatic CNS injury. Activated microglia express elevated levels of a protein in their mitochondria known as translocator protein 18 kDa (TSPO). Because TSPO is overexpressed in response to neuroinflammation as compared with normal tissue, it represents an important imaging target for microglial activation. FEPPA is a specific ligand for the TSPO used as a positron emission tomography (PET) biomarker for glial activation and neuroinflammation. Currently, there is sufficient scientific evidence supporting that chronic exposure to the Mediterranean diet (MedD) is associated with a lower risk of AD and cognitive impairments. Among the key elements of the MedD is the daily consumption of extra-virgin olive oil (EVOO), which possesses an anti-inflammatory and antioxidant effects, in addition to other health benefit. To study the effect of EVOO consumption on brain inflammation in AD mouse model, FEPPA was injected to the 3 months EVOO- and refined olive oil-fed mice, then plasma and brain tissues were collected for FEPPA analysis by our new developed HPLC method. Findings demonstrated EVOO significantly reduced microglial activation measured by reduced brain FEPPA levels by 40% when compared to refined olive oil fed mice.

Title: Mental health first aid: Promoting integrated care through nursing education
Primary Author (and presenter): Darnell, Amy C.
Additional Author: Watts, Sarah
College/ School: School of Nursing

Description:

A statewide shortage of psychiatric specialists has shifted the responsibility for identifying and treating mental illness onto non-psychiatric healthcare professionals. These care providers are often inadequately trained in providing mental health interventions. Research suggests that hospitals can improve staff morale and promote quality patient care by providing nurses with evidence-based courses, such as the Mental Health First Aid (MHFA) program. The MHFA program was created to improve mental health literacy by equipping non-psychiatric professionals with skills needed to provide competent care to individuals suffering from mental illness. The purpose of this project was to evaluate how participation in the program affects acute care nurses' confidence in treating patients with depression. The target population included non-psychiatric nurses employed on three medical-surgical floors at a suburban hospital. Following participant agreement, the participants completed a pre-test survey measuring confidence in treating patients with depression. Participants then attended a one-hour MHFA course taught by a certified instructor. At the end of the course, participants completed a post-test survey measuring confidence in treating patients with depression. The project is currently in progress. Descriptive statistics will be utilized to describe participant characteristics, including age, level of education, and prior experience in treating mental illness. Paired sample t-tests will be used to compare pre- and post-test confidence scores and to assess for improvement (alpha=0.05). Mental Health First Aid training can effectively increase overall job satisfaction and confidence among nurses employed in hospital settings in treating patients suffering from mental illness. Multi-unit staff training on mental health literacy is achievable in an acute care setting and further implementation of the project is warranted.

Title: Stochastic gradient descent method for the control of stochastic partial differential equations

Primary Author (and presenter): Das, Somak
Additional Authors: Yanzhao, Cao & Hans, Werner van Wyk
Department: Mathematics and Statistics
College/School: College of Sciences and Mathematics

Description:

Most of our contemporary mathematical models are based on partial differential equations. However, the varied levels of randomness pose difficulties for such systems to be accurately modeled using deterministic partial differential equations. In such settings we use stochastic partial differential equations to incorporate the randomness. To determine the optimal control for the stochastic system in this project, we adopt ‘machine learning’ algorithms. With vast data-sets being customary for the training of most ‘machine learning’ algorithms, the use of stochastic gradient descent method becomes one of the efficient ways of obtaining the optimal control. We shall in this project construct an algorithm using stochastic gradient descent method. It presents a finite element solution for obtaining the optimal control for stochastic parabolic partial differential equation (unsteady state heat equation) with the use of stochastic gradient descent algorithm. The algorithm combines stochastic gradient descent method to improve the optimal control with the finite element method to solve the parabolic differential equation.

Title: Fatigue behavior of additively manufactured 17-4 PH stainless steel
Primary Author (and presenter): Dastranjy Nezhadfar, Pooriya
Additional Authors: Shamsaei, Nima
Department: Mechanical Engineering
College/School: Samuel Ginn College of Engineering

Description:

The effect of heat treatment on the crack initiation and crack growth behavior of 17-4 precipitation hardening (PH) stainless steel (SS) fabricated through laser powder bed fusion (L-PBF) process is investigated. Two types of specimens were employed in this study; dogbone round specimens with straight gage section based on ASTM E606 standard for crack initiations and compact tension (CT) specimens based on ASTM E647 standard for crack growth. In order to characterize the effects of surface roughness on crack initiation mechanism, some dogbone specimens were kept in their as-built surface condition, while some other were machined and polished. CT specimens were designed with the notch parallel and perpendicular to the build direction to investigate the effect of layer orientation on the crack growth behavior of L-PBF 17-4 PH SS. Two different heat treatment conditions, CA-H900 giving high strength and low ductility, and H1025 giving low strength and high ductility, were applied to these specimens. Cracks were observed to initiate from micro-notches on the surface of the as-built specimens due to the surface roughness, while internal pores were found on the crack initiation sites of machined specimens, irrespective of the heat treatment procedure utilized. No layer orientation dependency was noticed in the crack growth behavior of CA-H900 L-PBF 17-4 PH SS and the crack growth rate was found to be similar to the one for the wrought counterpart. This behavior was explained based on microstructural observations.

Title: What is the effectiveness of including pharmacists in collaborative care programs for mental health treatment? A systematic review

Primary Author: Davis, Brandy R.
Additional Authors: Qian, Jingjing; Garza, Kimberly; & Ngorsuraches, Surachat
Department: Health Outcomes Research and Policy
College/School: Harrison School of Pharmacy

Description:

Pharmacists have been shown to be the most accessible primary healthcare provider and using them in collaborative teams has been widely accepted. This study synthesized existing literature to determine the effects of pharmacists on collaborative teams in mental health care. Articles were compiled by searching published articles at Pubmed (n=152), PsychInfo (n=221), IPA (n=5), and clinicaltrials.gov (n=4) through November 2018. Search terms included “pharmacist”, “mental health”, “collaboration”, “interprofessional”, “patient care team”, and “cooperative behavior”. Inclusion criteria were the inclusion of pharmacists on collaboration teams, mental health outcomes measured, and written in English. Articles were excluded if outcomes were not assessed or collaborative teams were not included. A total of 360 records were screened after initial search and eleven articles meeting the inclusion and exclusion criteria were included in the review. Settings of the included studies were primary care (n=4), specialty care (n=3) clinics, hospital (n=3), and miscellaneous (n=2). Composition of collaborating teams also varied. Teams primarily consisted of Primary Care Practitioners (n=5), nurse managers (n=5), and mental health professionals (n=8). Pharmacists mainly reviewed medications and performed medication therapy management services. Mental health conditions assessed were depression (n=9) and Post Traumatic Stress Disorder (PTSD) (n=2). Studies that looked at PTSD severity (n=2), depression remission (n=3) and depression response (n=5) had significant improvement in outcomes. Overall, this study found that pharmacists have an important and effective role in mental health collaborative teams. Future research should look further into collaborative effects on PTSD and depression as well as expanding to include other mental health conditions like anxiety and schizophrenia.

Title: Optimization of a 3D tumor spheroid model for the evaluation of schedule dependent mechanistic differences of chemotherapeutics for the treatment of aggressive castration resistant prostate cancer

Primary Author (and presenter): Davis, Joshua T.
Additional Authors: Mitra Ghosh, Taraswi; Jasper, Lani; Eggert, Matthew; Arnold, Robert
Department: Drug Discovery and Development
College/School: Harrison School of Pharmacy

Description:

Alternative treatment schedules, such as low-dose, high-frequency (metronomic; METRO) of some chemotherapeutics enhance efficacy and reduce toxicity in some cancers when compared to chemotherapy given conventionally (CONV). Previously, we demonstrated that low-dose, prolonged exposure to topotecan (30-day infusion 0.1 mg/kg/day *via* Alzet pump) improved survival and reduced tumor volume ~120%, compared to topotecan given CONV (4 mg/kg, every 4 days) in xenograft model of aggressive prostate cancer in athymic mice. Yet, detailed examination of the mechanisms underlying this enhanced activity and optimization of treatment schedules is limited due to limitations with existing 2-dimension (2D) cell culture models that do not adequately reflect *in vivo* reality and do not allow for sufficient culturing time to adequately evaluate potential schedule dependent differences with chemotherapy. Therefore, we developed and applied a 3D spheroid model that allows for the evaluation of longer drug exposures. Cell cultures that are two-dimensional grow out about 72 to 96 hours before confluency is reached. While we previously demonstrated enhanced activity *in vivo*, the 2D model showed no benefit (improved potency) over this time frame, *ie*, METRO *vs* CONV dosing (logIC50 2.278 (177nM), 95% CI [1.781-2.776] *vs* logIC50 2.248 (189 nM) 95% CI [1.723-2.773]. Attempts to reduce seeding density to increase study duration resulted in poor and inconsistent cell growth and greater variability. 3D spheroids yielded reproducible round spheroids of similar size (~800 μm) that grew for up to 28 days, thus permitting evaluation of long treatment exposures. Overall, we developed a high-throughput, Matrix-based 3D co-culture spheroid that is much more effective at differentiating between schedule dependent differences of the same therapeutic than 2D cell culture.

Title: Development of a moving window molecular dynamics framework to model shock wave interactions at microstructural features in materials

Primary Author: Davis, Alexander S.
Additional Authors: Agrawal, Vinamra
Department: Aerospace Engineering
College: Samuel Ginn College of Engineering

Description:

In this work, we develop a long-time, large-domain moving window Molecular Dynamics (MD) framework to model shock wave interactions at microstructural features in materials. Research on shock wave propagation from an atomic perspective has been minimal because of the transient effects due to small domain sizes. To circumvent these problems, we implement ideas of control volume on a MD framework where a moving window follows a propagating shock. As a first step, we create a 1D version of this MD framework. We model wave development in a 1D chain of atoms for various FCC materials as well as compare the behavior of these atoms subject to the EAM potential. We validate the framework by computing the elastic modulus of the system, and we compare this with literature values. Then, we perform shock simulations and build the moving window structure using the 1D framework. We achieve this by splitting the chain into three sections composed of copper atoms. The two outer regions represent the continuum states in front of and behind the shock wave front and incorporate a Langevin thermostat. The inner region, containing the shock wave, consists of atoms where the classic MD equations are solved using the velocity Verlet algorithm. We implement the moving window by adding or removing atoms from the boundaries to the window after the shock has traveled a distance of one lattice constant. Then, we modify the parameters of the atomic chain until the shock front maintains its position at the center of the middle section throughout the simulation. To validate the moving window formulation, we compute the coefficients of the linear shock equation and compare these with literature values. Our next step will be to use this framework to study shock scattering and microstructural changes upon a shock's interaction with an interface. Understanding such microstructural interactions will lead to improved energy dissipation mechanisms for application in ballistics and detonations.

Title: *Ay, cómo me duele* . . . The effects of language barriers in accessing quality health care for Latina women in rural areas

Primary Author (and presenter): Day, Katelyn S.
Additional Authors: Gutiérrez Kerns, Jana
Department: Foreign Languages & Literatures
College/School: Liberal Arts

Description:

This study analyzes the factors associated with access to health care, quality of care, and health outcomes for female Spanish-speaking patients in the rural southeast. With Spanish becoming more prominent in this region, physicians and patients confront communication obstacles related to language and cultural barriers; failure to adopt effective communication strategies adversely affects the care of the patient both physically and emotionally. Similarly, there is a negative outcome for the health care provider, who is unable to provide the best care necessary for Latina patients. Qualitative observation of gynecological and obstetrical health professionals demonstrates that effective communication strategies can lead to an improved community outcome. Assessing physician levels of Spanish-as-a-second-language (L2) oral proficiency according to the American Council in the Teaching of Foreign Languages (ACTFL) provides insight into the importance of establishing a positive physician-patient dynamic. Bilingual interviews conducted with health care providers and Latina women suggest that increasing medical professionals' linguistic and cultural fluency could result in an improved intercultural exchange benefiting both the physician and the patient. *Ay, cómo me duele* (translated as, "Ah, that hurts me") is an expression of pain or loss. The bilingual title simulates a common exchange between Latina women and rural women's health providers. Patients experience alienation which could lead to emotional and physical stress. For the monolingual physician, this disrupted communication similarly could create feelings of frustration and stress; whereas, capable bilingual physicians find themselves with an opportunity to break down those language barriers and provide the best care possible for the patient. When it comes to healthcare, regardless of language, effective communication is necessary to alleviate and avoid both emotional and physical pain.

Title: Cloning, expression and purification of human mitochondrial molecular chaperone Tid1
Primary Author (and presenter): De Bovi Pontes, Carolina
Additional Authors: Buckhannon, LaQuandra; Morgan, Emily; Truong, Thinh Q.; & Ciesielski, Grzegorz L.
Department: Chemistry
College/School: Auburn University at Montgomery – Science

Description:

Molecular chaperones play an important role in the folding and maintenance of the cellular proteome. Tid1 is a mitochondrial Hsp40 chaperone involved in mitochondrial import and folding of proteins within the mitochondrial matrix. Additionally, Tid1 has been found to co-localize with mitochondrial nucleoids and to interact directly with the catalytic subunit of mitochondrial DNA polymerase gamma (Pol γ), which facilitates the mitochondrial DNA replication process. Homologous Hsp40 chaperones have been found relevant for DNA replication processes in prokaryotes and viruses. The goal of our research is to investigate the putative role of Tid1 in the human mitochondrial DNA replication process. Here we present results of cloning, expression and purification of Tid1. We amplified two splice variants of Tid1, $Tid1_S$ and $Tid1_L$, using PCR. Next, we inserted the target sequences into the pETite N-His SUMO vector applying the Expresso® T7 SUMO cloning and expression system. Target proteins were produced in *Escherichia coli* Hi-Control BL21 (DE3) cells and purified using nickel (NiNTA) affinity chromatography. In the future, we will evaluate the direct interaction of Tid1 isoforms with the subunits of the Pol γ holoenzyme, as well as test whether the presence of Tid1 isoforms affects the catalytic properties of Pol γ.

Title: Hydrocode simulations of formation of Wetumpka impact crater, Alabama
Primary Author (and presenter): De Marchi, Leticia
Additional Authors: Agrawal, Vinamra & King Jr, David T.
Department: Geosciences; Aerospace Engineering
College/School: College of Sciences and Mathematics; Samuel Ginn College of Engineering

Description:

The process of impact cratering in marine target materials has been a topic of significant interest because of its connections with geological and biotic evolution of Earth, and to ancient oceans on other planetary bodies such as Mars and Europa. By studying craters on Earth, we can have a better understanding about impact processes on our solar system.
The Wetumpka impact crater, located in central Alabama, is a good candidate for this since it was formed in a shallow sea environment, ~85 m.y. ago. This study aims to provide, from a numerical perspective, insights into the Continuum Damage Mechanics in order to understand fragmentation process of brittle materials under hypervelocity impacts. Simulations, performed by iSALE, focus on how water depth, layering and porosity in the target can affect the cratering process. For the model, the impactor was considered as a granitic sphere of 400m in diameter and velocity of 20km/sec, and the target was made of three layers, granite as bedrock, ~ 110 m wet tuff, and uppermost sea water layer of different thickness (66 m; 88 m; 110 m; and 132 m). Results seem to confirm geological observations in that the central crystalline unit of the crater center's subsurface conforms to the early central area rebound, and the collapse of the rims by slide of crystalline and sedimentary materials. Crater formation specific intervals can also be linked to different processes such as the infilling sediments of the crater's moat. As water depth is increased, from 66 m to 132m, the crater rim and internal crater-filling processes appear to be substantially the same. The differences in the water depth are seen mainly in the depth of the outgoing wave and its origins. In progressively deeper water scenarios, the wave has larger amplitudes and appears to be enhanced and amplified by the fall of the ejecta curtain. This study, combined with previous geologic observations, aims to fill the gaps in our knowledge of marine impact craters.

Title: Characterization of phosphorus (P) in poultry litter and determination of P extraction efficiency of extractants

Primary author (and Presenter): Dey, Poulomi[1]
Additional Authors: Prasad, Rishi[1]; Chakraborty, Debolina[1]; Higgins, Brendan[2]; Gamble, Audrey[1] & Feng, Yucheng[1]
Department: Crop, Soil, and Environmental Sciences[1]; Department of Biosystems Engineering[2]
College/ School: College of Agriculture

Description:

The Alabama poultry industry is the second largest agricultural industry with a $15 billion impact on Alabama's economy. However, the poultry industry generates 1.5 million tons of litter containing 19,665 tons of Phosphorus(P). As poultry litter is bulky, its long-distance transportation is uneconomical. Poultry litter (PL) when applied repeatedly over time causes the soil P levels to rise beyond environmental threshold levels and increase the risk of P loss to waterways via runoff during storm events. Development of methods to extract phosphorus from litter could be an important step towards reducing the P transport into environment and extracted P can be safely reused for agricultural purposes. The objectives of our experiments are 1) to quantify the P dissolution efficacy of extractants 2) quantify proportions of organic verses inorganic P forms in labile phase during extraction process. Poultry litter was collected from several poultry houses across Alabama. The extractants that were selected for the first phase of the experiments were: deionized water (H_2O), 0.5 M $NaHCO_3$, 0.1 M NaOH and 1 N HCl. Poultry litter to solution ratio of 1:100 and 1 hour shaking time was used. The extracted solution was analyzed for molybdate reactive P, organic P and total P after each extraction cycle, for each extractant. Extraction cycle was repeated 4 more times to observe the decrease in P levels with successive washes. Based on the preliminary results P dissolution efficacy can be ranked as follows: 1 N HCl > 0.5 M $NaHCO_3$ > Deionized water > 0.1 M NaOH. 1N HCl extracted on an average of 95% of Total P from P from P from PL followed by 0.5M $NaHCO_3$ (40% of total P) and Deionized water (30% of total P). Additional extractants will be explored for their P dissolution efficacy. This research will aid to find the most suitable method for P extraction from PL towards the broader goal of developing a concentrated fertilizer product from the extracted P.

Title: Technology innovative and integration in career and technical education classrooms
Primary Author (and presenter): Diamond, Elizabeth A.
Department: Curriculum and Teaching
College/School: College of Education

Description:

Students need to be tech savvy, both digitally literate and fluent, to be successful in a growing global society. To this end, besides being content experts, educators must embrace the importance of technology use, have skills and intention to *use* technology, and have the knowledge to *teach* students how to use technology and digital resources. While all educators are exposed to various types of technology training, most is a one-size-fits all approach. By understanding educators' Innovativeness, their attitudes towards the importance of classroom technology use, and how frequently they implement technology standards, improved professional development can be developed to help educators in such a way that ensures that they have the skills to use and integrate technology, creating a classroom culture that champions technology use, creativity, critical thinking and problem-solving. Using Rogers (2003) diffusion of innovation theory, this research study was designed to determine Innovativeness, or *willingness to change*, and technology integration by Career and Technical Education (CTE) educators. Relationships between educators' characteristics, such as teaching field, years of experience, age and gender, and technology integration was also investigated. The International Society for Technology in Education Standards for Educators was used as a framework for technology integration. Data analysis found that most educators fell within the Early Adopter (45.2%) and Early Majority (41.4%) categories of Innovativeness. Analysis of variance indicated that there were statistically significant differences found between CTE programs, years of experience, and gender and technology integration. Using this information and understanding the needs of different program areas, more focused technology training can be developed to help teachers fully integrate technology in their pedagogy, thus helping students to be prepared for the future.

Title: *In-situ* analysis of the fundamental transport of single- and multi-component systems through polymeric membranes

Primary Author (and presenter): Dobyns, Breanna M.
Additional Authors: Beckingham, Bryan S.
Department: Chemical Engineering
College/School: Samuel Ginn College of Engineering

Description:

Polymeric membranes are widely used in society today, from biomedical applications, to fuel production, to water purification. An important property of these membranes is their ability to transport (permeate) different solutes at different rates. This transport is typically characterized through membrane permeability (P_i) which describes the productivity of the membrane for transporting that solute. The solution-diffusion model describes this transport through dense, hydrated polymeric membranes and is utilized to determine whether the changes in permeability are due to thermodynamic or kinetic variations ($P_i = K_i \times D_i$) where K_i is the solute solubility within the membrane and D_i is the diffusivity of the solute through the membrane. The solubility is a thermodynamic quantity that describes the equilibrium concentration of a solute within a membrane and the diffusivity is a kinetic quantity that describes how easily the solute will move through the free volume between polymer chains in the membranes. In this work, single- and multi-component permeability experiments were performed via *in-situ* ATR FTIR spectrophotometry to monitor permeability (P_i) through a commercial cation exchange membrane, Nafion® 117. The ATR FTIR spectrometer was calibrated and tested for proof of concept as it is a new technique for determining the transport properties of multiple solutes through a membrane without the need for aliquotic sampling (and changing downstream volume). Single- and multi-component solubility adsorption/desorption experiments were performed with solute concentrations determined using high-field ^{1}H NMR spectroscopy to extract the solute solubility (K_i) of the membrane for each solute. Once determined, the permeability and solubility are used to calculate the solute diffusivity in order to fully describe the solution-diffusion behavior and investigate whether the changes in permeability from single- to multi-component transport experiments are thermodynamically or kinetically driven.

Title: Significant physical and mental health burdens in rural, low-income, 10th grade students
Primary Author (and presenter): Dolinger, Sarah B.
Additional Authors: Feiss, Robyn & Pangelinan, Melissa
Department: Kinesiology
College/School: College of Education

Description:

Throughout childhood and adolescence, obesity and mental health problems increase. Many studies have investigated the relationships between physical and mental health in adolescence. However, few studies have investigated these relationships in populations that may be prone to the greatest health disparities (i.e., deep-south, rural, low-income, minorities). The purpose of this study was to conduct wellness fairs with 10th grades students at four rural Alabama high schools to identify physical and mental health disparities among students; to educate students about physical and mental health; and to encourage help-seeking behaviors among students. Of the participating schools, three are Title I schools, in which at least 40% of the students are from low-income families and receive free or reduced meals. A total of 146 (62 males, 84 females) 10th grade students from four rural Alabama high schools participated. Students completed the PROMIS Psychological Stress Experiences, PROMIS Pediatric Depressive Symptoms, PROMIS Pediatric Anxiety, and PROMIS Physical Activity questionnaires. During the wellness fair, body composition and BMI were measured. Of the 146 participants, 39.7% were either overweight or obese (16.4% overweight, 23.3% obese), which is higher than the most recently reported obesity rate of adolescents in the state of Alabama (18.2%). Of the 146 participants, 37.5% reported moderate or severe anxiety symptoms, 31.25% reported moderate or severe depressive symptoms, and 39% reported moderate or severe psychological stress symptoms. Significant correlations were observed between BMI and mental health measures, including stress, depression, and anxiety ($p < 0.05$ for all). These data may indicate that low-income, rural, minority populations are at an increased risk for physical and mental health burdens. To lessen the physical and mental health burdens in this population, targeted interventions and longitudinal tracking are necessary.

Title: Computational studies of a novel organometallic intermediate in radical SAM enzymes
Primary Author (and presenter): Donnan, Patrick H.
Additional Authors: Mansoorabadi, Steven O.
Department: Chemistry and Biochemistry
College/School: College of Sciences and Mathematics

Description:

The radical *S*-adenosyl-L-methionine (SAM) enzyme superfamily catalyzes a wide variety of chemical reactions across all kingdoms of life. Identifying similarities between the catalytic mechanisms present in the superfamily is of fundamental importance for understanding the radical chemistry accomplished by these enzymes. Recent experimental results by Byer *et al.* (*J. Am. Chem. Soc.* **140**, 8634 (2018)) have used electron paramagnetic resonance (EPR) and electron nuclear double resonance (ENDOR) spectroscopy to identify and characterize a novel organometallic intermediate common to the catalytic mechanisms of several representative enzymes in the superfamily. The proposed organometallic intermediate has resulted in a significant revision of the understanding of catalysis in radical SAM enzymes. In the present work, broken symmetry density functional theory (BS-DFT) methodology was employed to computationally verify if the proposed organometallic intermediate or another species is able to account for the observed EPR and ENDOR spectra. Characteristic g-values and hyperfine couplings were calculated and compared to values obtained experimentally.

Title: Don't blow out the candles – preventing transmission of bacteria to birthday cakes
Primary Author (and presenter): Donohoe, Natalie; James, Caitlyn
Additional Authors: Jones, Autumn; Brito-Estrada, Omar; O'Neill, Ann Marie.
Department: Department of Biology and Environmental Science.
College/School: Auburn University at Montgomery - Sciences

A previous study demonstrated that blowing out candles on a birthday cake can transfer bacteria to the surface of the cake. An engineer developed a child-friendly device that included a filter and would allow a child to blow through it onto a birthday cake, but prevent the transfer of bacteria. We were approached to develop a series of experiments to evaluate the performance of the device.

Using tryptic soy agar plates, we observed the amount of bacteria that was transferred from the mouth by mimicking blowing out birthday candles directly onto an agar plate, through a device without a filter and through a device fitted with a filter. For all 3 conditions, plates were held approximately 10 – 15 cm away from the mouth. We then further tested the stringency of the device by using an aerosol of *E coli* suspension, which was blown through the device and then air blown through for 3-4 seconds with the air source approximately 12 -15 cm from the tryptic soy agar plates. To determine if the device would perform with repeated uses, they were washed in hot, soapy water and the tests repeated.

The results of these tests confirmed that bacteria are transferred from the mouth to a surface when it is blown on. However, using the filtered device almost eliminated this transfer, while use of the unfiltered device substantially reduced and in some cases eliminated the transfer. When using an aerosol of *E coli*, the transfer of bacteria through the filtered device was also reduced to approximately 8% of that transferred through an unfiltered device. These results suggest that the filtered device substantially blocked the transfer of *E coli*, and when used to mimic blowing out birthday candles by mouth both the filter and the design of the device contribute to the reduction of transferred bacteria.

Title: Water-resistant, transparent, conductive cellulose nanopaper with tunable ultraviolet blocking ability for flexible electronics
Primary Author (and presenter): Du, Haishun
Additional Authors: Parit, Mahesh, Jiang, Zhihua; & Zhang, Xinyu
Department: Chemical Engineering
College/School: Samuel Ginn College of Engineering

Description:

With an increasing demand for portable and wearable electronic devices, flexible cellulose nanopaper (CNP) has received increasing attention due to its low thermal expansion and excellent mechanical property. However, the hydrophilic nature of cellulose made the CNP very sensitive to moisture, which limited the usability of CNP under high-moisture environments. In this work, we developed a novel method for the fabrication of water-resistant, transparent and conductive CNP with tunable ultraviolet (UV) blocking performance. Firstly, cellulose nanofibrils (CNF) was successfully extracted from bleached softwood pulp by a sustainable formic acid (FA) hydrolysis process combined with microfluidization. Then, flexible CNP was fabricated from CNF and polyaniline mixture suspension by a simple casting method. Finally, a thin layer of silver nanowires (Ag NWs) was coated on the surface of CNP to make it conductive. It was found that the fabricated CNP showed excellent stability in water (over 100 days) due to the introduction of hydrophobic ester groups during FA treatment. By introducing a little amount of polyaniline (0.1-0.5 wt.%) into the CNP, UV blocking ability could be tuned, high transmittance (over 80% at 550 nm) could retain as well. Moreover, the thin layer of Ag NWs endowed the final CNP with good conductivity (13.2 Ω/sq). Overall, the resultant CNP shows great promise for the development of flexible and multi-functional electronics (e.g. touch screen).

Title: Investigating effect of soil moisture initialization on runoff predictability in national water model

Primary Author (and presenter): Duan, Yanan
Additional Authors: Kumar, Sanjiv
Department: Forest and Wildlife Sciences
College/ School: College of Agriculture

Description:

As with the impact of initial soil moisture states on the drainage, soil moisture influences on the streamflow is a source of predictability. Runoff and soil moisture predictability due to random and realistic land surface initialization is examined using NCAR Weather Research and Forecasting Hydrological model (WRF-Hydro) driven by reanalysis forcing data and random forcing. Streamflow predictability is defined as the statistically significant difference triggered by realistic and random initial land surface field. Realistic land surface conditions are generated from the last 7 days. Random land surface conditions were selected from a different year but in the same season. Predictability depends on soil moisture memory, dryness degree, and precipitation intensity. To attribute the possible cause of changing predictability, experiments are carried out with these assumptions. The results show the effect of soil moisture initial states to provide long-term streamflow predictability which is greater than soil moisture. Both of the predictability is influenced by climate forcing. Noah-MP soil moisture and streamflow lag effect is another contributor.

Title: Pulmonary function of the competitive swimmer: Implications for treatment of PVFM
Primary Author (and presenter): Dunn, Lauren A.
Additional Authors: Sandage, Mary J.
Department: Communication Disorders
College/School: College of Liberal Arts
Description:

Swimmers have been observed to have larger than predicted pulmonary function when compared to typical force vital capacity (FVC) algorithms that account for age, height, weight, sex, and ethnicity. Differences in FVC values of swimmers versus non-swimmers and spirometer-predicted values have not been well described in the literature. As a result, the FVC of competitive swimmers may not be appropriately interpreted when these individuals undergo routine pulmonary function testing, resulting in a potential underdiagnoses for various respiratory disorders such as paradoxical vocal fold motion (PVFM). Understanding differences in FVC secondary to swimsuit construction is important for treatment of the competitive swimmer with PVFM. The purpose of this study was to quantify the extent of disparity between predicted and actual volumes of competitive swimmers and to measure how a compression race suit may influence pulmonary function. Using a within-participant repeated measures design with ten female competitive swimmers, forced vital capacity (FVC) was measured using a medical grade spirometer during various conditions to quantify and compare differences in effect on breathing of a practice swimsuit and a compression racing suit. Descriptive analysis of results support the initial hypotheses that swimmers' pulmonary volumes are measurably higher (by an average of 1 liter) than spirometer-predicted values; lower pulmonary volumes occur in the horizontal position; and compression race suits yield lower FVC when compared to practice suit trials. Each of these three findings from the data may directly influence the way therapy techniques are initiated for swimmers with pulmonary conditions. Swimmers are very different from land-based athletes and findings from this study provide vital physiological evidence to consider when speech language pathologists design therapy interventions for competitive swimmers who have been diagnosed with PVFM.

Title: Use of game cameras to survey small mammals in Auburn, Alabama
Primary Author (and presenter): Durboraw, Tara D.
Additional Authors: Lepczyk, Christopher
Department: Wildlife Sciences
College/School: Forestry and Wildlife Sciences

Game cameras are a common tool for evaluating biodiversity. This technique is favored due to its cost-efficiency, passive nature, and the large amounts of data collected. However, while game camera surveys are typically effective in capturing a lot of data on meso-mammals and large mammals, they can often be inadequate at capturing the biodiversity of small mammals, such as rodents and shrews. While a motion-triggered camera can be set off by small mammals, they often go undetected in photographs or are difficult to identify to species level. Given this information, our goal was to effectively survey small mammal diversity in Auburn, Alabama using motion-triggered game cameras using scent lures. To address this goal we assembled five camera trap units, based on a modified design of the camera trap described in McCleery et al. (2014), and installed these units at deliberately distinct locations within the Kreher Preserve and Nature Center in the fall of 2018. The traps were baited with rolled oats and peanut butter to attract target species and checked every two weeks. To date, we have been able identify mammals not typically detectable by classic game camera installation, such as *Sigmodon hispidus* and *Blarina carolinensis*. However, this method has several flaws, including an inability to adjust focal length of the cameras and hence lack of clear pictures. Upon competition, this data will provide us with a better understanding of the small mammals found in Auburn, Alabama as well as the effectiveness of this camera trap surveying method.

Title: The socioeconomic viability of wastewater recycling and reuse in India: Household study
Primary Author (and presenter): Dutta, Debaleena
Additional Author: Alley, Kelly D.
Departments: Earth System Science; Sociology, Anthropology & Social Work
College/School: College of Liberal Arts

Description

Reclaiming wastewater has tremendous potential to provide usable water to people across the world. However, investigation is needed to know the extent of a user's interest and perception about using treated wastewater. Studies have been done on the users' interest in the areas of industries, agriculture and municipalities and to a lesser extent in communities in India. This study seeks to contribute to the understanding of users' perspectives at the household level by employing three data collection methods: qualitative interviews, focused groups and a survey. The survey employs a Contingent Valuation Method to link perception with the values users assign to treated wastewater usages. The Contingent Valuation Method is an economic technique used for valuing goods and services which do not have an established market. We focused specifically on householders in residential complexes and communities with available and or operational wastewater treatment facilities in their premises or in close proximity. These type of households are 'hard-to-reach' due to dearth of preliminary information. Eventually a wide array of techniques were recruited to identify and reach out to communities having access to wastewater treatment facilities and having provision for reuse. 300 respondents, 184 householders in Delhi and 116 householders in Bangalore were surveyed. The survey data show that householders' responses vary across four parameters. The parameters are 1) fresh water availability in their housing communities, 2) awareness about usability of treated wastewater, 3) extent of participation in water governance, and 4) legal requirements and enforcements. The variations give us a holistic understanding of the challenges and potential of treated wastewater reuse. The analysis reframes the theories of hydrosocial cycle, informality and environmental externalities.

Title: A new lineage of turtle blood fluke (Digenea: Schistosomatoidea) from the six-tubercled Amazon River turtle (Podocnemididae) in South America (Peru, Amazon River Basin)
Primary Author (and presenter): Dutton, Haley R.
Additional Authors: Bullard, Stephen A.
Department: School of Fisheries, Aquaculture and Aquatic Sciences
College/School: College of Agriculture

Description:

Turtles comprise two primary lineages, Cryptodira (hidden-necked turtles, 263 species) and Pleurodira (side-necked turtles, 93 species) and host blood flukes comprising 103 named species assigned to 22 accepted genera. Most of the named turtle blood flukes infect cryptodires, and only 5% of pleurodire species are known as hosts. During a research expedition to the Amazon River (Peru) in 2016, we discovered infections in the heart of six-tubercled Amazon River turtles (*Podocnemis sextuberculata* [Pleurodira: Podocnemididae]) that represented a new species and a new genus (= new lineage) of turtle blood fluke. This record, combined with two other new species from another turtle in the region, collectively represent the first records of blood fluke infections in South American freshwater turtles. The new species resembles the other new sympatric species by having a dorsoventrally flattened, ovoid body, an oral sucker with anteroventral spines, two inter-cecal testes arranged in a column, inter-gonadal terminal genitalia, an inter-cecal post-ovarian Laurer's canal pore, Y-shaped excretory bladder, as well as having an anterior to posterior sequence of ventral sucker, anterior testis, cirrus sac, ovary, and posterior testis. This newly discovered lineage is unique by having M-shaped ceca, an aspinose body that lacks mammillae, a ventral sucker, U-shaped posterior ceca, a deeply-lobed (dendritic) ovary, a uterus that is transverse (having both ascending and descending portions), a vitellarium that is dispersed, and a posterior body end that is tapered. As predicted by morphology, a phylogenetic analysis of the nuclear large subunit ribosomal DNA (28S) revealed that these South American freshwater turtle blood flukes are monophyletic and sister to the marine turtle blood flukes. The present study comprises the 8th blood fluke known from a pleurodire, the 3rd from a pleurodire in South America, and 1st first blood fluke infection from *Podocnemis sextuberculata*.

Title: Premature infant post-discharge: Preparing caregivers for the transition
Primary Author: Dutton, Asia C.
Additional Author: Watts, Sarah O.
College/ School: School of Nursing

Description:

Considering the high birth rates and survival of premature infants in the United States, comprehensive follow-up post-discharge becomes vital for improved outcomes. Preparation of caregivers for infants post-discharge is instrumental to address the growing need of support during this critical time. Evidence-based guidelines recommend use of educational-based transitional programs for infants post-discharge from the Neonatal Intensive Care Unit (NICU). The objective of this project was to provide a transitional educational intervention for caregivers of premature infants post-discharge from the NICU. The target population included premature infants discharged from the NICU and their caregivers in a pediatric clinic. Following participant agreement, caregivers completed the Parenting Sense of Competence Scale (PSOC) questionnaire. Caregivers were then provided with an individualized Transitioning Newborns from NICU to Home Family Informational Packet followed by a phone contact with a nurse 24 to 48 hours after the first clinic visit to include supplemental education, referral, and support. At the 2-week follow-up visit, caregivers completed the post- PSOC. The project is in progress. Descriptive statistics will be used to describe the infant age, gender, diagnoses, and length of time admitted to the NICU. Follow-up data will include number of sick visits following implementation and pre- and post- scores on the PSOC. The pre-and post- PSOC scores will be compared with paired t-tests (alpha=0.05). Transitional educational strategies recommended for care of the premature infant post-discharge from the NICU have the potential to positively impact neonatal outcomes. Further implementation of the project is warranted with a focus on infant growth parameters, developmental milestones, and caregiver emotional stability.

Title: Fate of soil microbial communities in a loblolly pine stand inoculated with *Leptographium terebrantis*

Primary Author (and presenter): Duwadi, Shrijana
Additional Authors: Nadel, Ryan; Feng, Yucheng & Eckhardt, Lori
College/School: School of Forestry and Wildlife Sciences

Description:

Leptographium terebrantis is one of the causal agents associated with declining loblolly pine trees. Although it has already been revealed that the introduction of this fungus in the host species can inhibit water transportation and utilize host resources, it is still unknown about commercial loblolly pine stand, particularly regarding what happens to the soil microbes following artificial stem inoculation with *L. terebrantis*. Loblolly pine trees in Eufaula, Alabama were inoculated in March 2017. The microbial biomass was determined by chloroform fumigation extraction method and the ectomycorrhizal colonization of fine roots was determined by gridline intercept method. Though the treatment effect was insignificant, in 2 years of the study period, seasonal variation in microbial biomass was evident. Acidic soil was found to induce ectomycorrhizal colonization. Based on the study, it appears that microbial biomass responds positively to soil moisture and organic matters, which calls for the strategies to increase soil organic matter levels in the forest floor and to protect commercial stands from drought events.

Title: Investigating the role of insulin resistant adipocytes in the proliferation of cancer cells.
Primary Author (and presenter): Eastwold, Martin.
Additional Authors: Ahmed, Bulbul; O'Neill, Ann Marie.
Department: Biology and Environmental Science.
College/School: Auburn University at Montgomery - Sciences

While convincing epidemiological evidence links obesity to increased cancer growth, the underlying molecular mechanisms remain elusive. Metabolic dysfunction, characterized by insulin resistance, frequently accompanies obesity. In adipocytes, this causes altered cell secretions and increased inflammation. Changes in the secretions from such adipocytes may push cancer cells to a more aggressive phenotype. Recent studies have investigated the role of adipocyte secretions as potential mediators of accelerated growth. The goal of this project is to investigate if secretions from insulin resistant adipocytes leads to increased proliferation of cancer cells, and if this proliferation is, in part, attributable to changes in fatty acid oxidation (FAO) pathways.

The cell line 3T3-L1 was differentiated and rendered insulin resistant by the addition of TNF-α and subjecting the cells to hypoxic conditions for 24 hours, and media collected. Canine melanoma (CML10) and mammary tumor (CMT28) cell lines were incubated in the presence of conditioned media obtained from normal adipocyte cultures or insulin resistant adipocyte cultures. After 24 hours, cell viability was assessed and quantitative PCR performed to determine expression of Ki67 and PCNA as markers of proliferation, and the genes CPT1, ACOX, ASCL1, SLC27A4 and CD36 to investigate potential differences in FAO.

The mammary tumor cell line CMT28 showed increased proliferation in response to insulin resistant media by both cell count and increased expression of Ki67 and PCNA. Also, expression of CPT1, ACOX, ASCL and CD36 was increased in these cells in response to media obtained from insulin resistant adipocytes.

These results indicated that secretion from insulin resistant adipocytes increased tumor cell proliferation, and resulted in upregulation of genes in the FAO pathway. This suggests the cells are using fatty acids as source of fuel, and this may contribute to increased proliferation.

Title: Forced vital capacity in swimmers
Primary Author (and presenters): Edwards, Ryleigh; Pope, Sara Ann
Additional Authors: Sandage, Mary J.
Department: Communication Disorders
College/School: Liberal Arts

The purpose of this study was to compare the differences in lung capacity of competitive swimmers compared to a) predicted pulmonary volumes and b) age-matched peers. Given that swimmers differ from land-based athletes due to horizontal body position and breathing against water pressure, it is important to identify if differences in pulmonary function exist in the healthy competitive swimmer as compared to age-matched non-swimmer peers. In this study, non-swimmers and swimmers, between the ages 19-40 with no history of asthma or allergic symptoms were recruited to participate. Participant's forced vital capacity (FVC), or maximum voluntary expiration, was measured using a medical grade spirometer which is the device typically used for assessing respiratory function and diagnosing pulmonary disease. It was hypothesized that FVC would be greater in swimmers than in non-swimmers due the unique pulmonary abilities of swimmers.

Twenty-three women were recruited for this study. Participant demographics include age, height, weight, sex, and ethnicity. The findings from this study reveal swimmers' pulmonary volumes to be approximately one liter more than spirometer-predicted values. Because swimmers train in water, these athletes experience resistance in the area of the ribs and lungs which may result in their higher lung capacity when measures on land, exceeding the volume predicted by the typical medical grade spirometer algorithm. Should a competitive swimmer produce a FVC volume within the predicted range, the swimmer may actually be under-functioning for what is required for the sport. Underestimation of swimmer's FVC values on the spirometer may result in under-diagnosis of pulmonary disorders in this population. Health professionals such as pulmonologists and speech-language pathologists to be aware of these differences when diagnosing respiratory disorders in general and for behavioral breathing disorders in competitive swimmers.

Title: Linking observed seismicity to crustal structure in the New Madrid seismic zone using LiDAR, gravity, and magnetic modeling
Primary Author (and presenter): Eldridge, Caleb M.
Additional Authors: Wolf, Lorraine W.
Department: Geosciences
College/School: College of Sciences and Mathematics

Description:

This study incorporates geophysical and geologic data to create crustal models of the New Madrid Seismic Zone (NMSZ) for understanding the relationship of regional geologic structure to sources of prehistoric earthquakes that produced widespread soil liquefaction. The NMSZ, located in parts of Tennessee, Missouri, and Arkansas, is the most seismically active zone in the U.S. east of the Rocky Mountains. Most of the earthquakes in this region are small (M<3) and not felt by humans. However, the NMSZ has hosted large magnitude earthquakes (M >7) in the past. The most recent events were in 1811-1812, when a series of three large earthquakes caused massive damage and widespread soil liquefaction. Previous studies suggest that large earthquakes such as these happen on a period of approximately 500 years. For this study, a comprehensive database consisting of LiDAR data, geologic data, well-log information, and locations of liquefaction deposits was assembled in ESRI ArcGIS™ to provide a framework for interpreting regional gravity and magnetic data and gaining insight into potential earthquake sources. Analysis of LiDAR data shows prominent earthquake-induced soil liquefaction deposits and subtle topographic lineations that may be related to subsurface faults. These are sub-parallel to northeast-trending bands of seismicity that align with the Reelfoot Rift, a geologic structure that is now deeply buried beneath the Mississippi Embayment. A model derived from analysis of gravity and magnetic data suggests that much of the seismicity may be associated with igneous plutons in the upper crust that can concentrate far-field stresses originating from distant plate margins. However, not all plutons are spatially related to seismicity, so we postulate there are multiple sources for past earthquakes. Future work will be aimed at understanding the mechanics responsible for regional seismic activity because of its close proximity to major cities, such as St. Louis and Memphis.

Title: Discovering a specific targeting protein to be used for the detection of Matrix Metalloproteinase-2 activity in tumor models
Primary Author (and Presenter): Kareem, El-Kattan; Tareq, Anani; Allan David
Department: Chemical Engineering
School/College: Engineering

In their lifetime, around one in every seven men will get prostate cancer. This disease can be very serious, however if diagnosed can be treated. The goal of this project was to develop bioprocess-sensitive “smart” magnetic nanoparticles (MNP) which respond to overexpressed protease activity in the tumor microenvironment – and thus to tumor aggressiveness – and which can be monitored and quantified non-invasively over the entire tumor volume. This has been previously done by using a conjugated fluorescent marker that’s rate of release correlated with the activity of an enzyme linked to cancer aggressiveness. This projects aim was to increase the specificity of the biomarker by discovering a targeting peptide specific to the abundant prostate cancer strains. The uptake of the cells by the HT-1080 fibrosarcoma cell line was initially used to test the uptake of those superparamagnetic iron oxide nanoparticles(SPIONS), that had been characterized with the RGD peptide. This uptake was measured by incubating them with the cells overnight with the two different types of particles, the next day the cells were all washed then stained with Prussian Blue dye. This allows the obersvation of how many SPIONs got taken up by the cell. This was used many times in addition again with the phage study peptides with PC3 cancer cells, a line preveelant in prostate cancer. These reaffirmed the phage study uptakes and worked well on the iron oxide nanoparticles as well. This seems to affirm the observation that the peptides were attached and could be used in such a way to make the cells target only the prostate tumor cells A conjugated near-infrared fluorescent marker via an MMP-2 cleavable peptide linker displayed sensitivity to MMP-2 activity; and it has been given peptides on its surface to make it more targeted towards the prostate cell lines.

Title: Impact of irrigation and nitrogen fertilization on yield and quality of 'Tifton-85' bermudagrass in the Gulf Coast Region

Primary Author (and presenter): El-Nagar, Sahar H.
Additional Author: Dillard, Leanne
Department: Animal Sciences
College/ School: College of Agriculture

Description:

Bermudagrass (*Cynodon dactylon* (L.) Pers.) represents a major source for animal fed in southeastern United States. Forage quality and quantity are the two largest factors that affect livestock performance and ultimately producer profit. The objectives of this study were to determine the effects of nitrogen fertilization (112 or 168 kg N/ha) and dryland or irrigated production on forage yield, crude protein (CP), neutral detergent fiber (NDF), acid detergent fiber (ADF), acid detergent lignin (ADL), and ash in 'Tifton-85' bermudagrass. The study was designed as a completely randomized split-plot (n = 3) and conducted from April – October, 2018. Statistical analyses were conducted using the Glimmix procedure of SAS 9.4 (Cary, NC) with $\alpha = 0.05$. Irrigation and fertilizer treatments had no effect ($P > 0.05$) on forage yield or quality parameters. However, Harvest 3 had superior CP, ADL, and ash ($P < .0001$) than Harvest 1 and 2. On the other hand, Harvest 1 exceeded Harvest 2 and 3 in yield production (1,100, 799, and 423 kg/ha, respectively), while NDF and ADF were the greatest ($P \leq 0.0015$) in Harvest 2 (33.8% and 34.2%, respectively). Although the irrigation only affected ($P = 0.0034$) ADL content, the irrigation × harvest interaction significantly affected ($P < 0.0001$) ADF and ADL. Dryland-Harvest 2 had a 17.4% greater ($P < 0.0001$) ADF concentration than Harvest 1 or 3. Furthermore, Harvest 3 had a 29% greater ($P < 0.0001$) ADL concentration than Harvest 1 or 2. During year 1, irrigation had little effect on forage yield and quality, likely due to the above average rainfall during the experimental period. More research is needed to determine the interactive effects of N-fertilization and irrigation on forage yield and quality under a variety of climatic conditions.

Title: Impact of nano-chromium chloride on animal performance, carcass characteristics, and histopathology of rabbits exposed to chronic heat stress

Primary author: El-Nagar, Sahar H.[1, 3]
Additional authors: Abdelrahman, Hisham[2]; Helal, Mohamed[3]; Mahmoud, Shawky[4]; & Dillard, Leanne[1]
Department: [1]Animal Sciences; [2]School of Fisheries, Aquaculture and Aquatic Sciences
College/ School: [1]Agriculture; [3]Animal Wealth Development, Kafrelsheikh University, Kafr El-Shaikh, Egypt**;** [4]Department of Physiology, Kafrelsheikh University, Kafr El-Shaikh, Egypt

Description:

Heat stress adversely affects the growth of animals by altering feed intake and other physiological parameters resulting in reduced performance and possible mortality. The intention of this study was to evaluate the effects of nano-chromuim chloride (nano-$CrCl_3$) on body weight (BW), body weight gain (BWG), feed intake (FI), feed conversion ratio (FCR), carcass weight (CW), dressing percentage (D%), and carcass percentage, as well as liver (L%), kidney (K%), and thymus (T%) percentage relative to the carcass weight. Histopathological changes of the liver, kidney, and appendix were also determined. For this experiment, 108 weaned rabbits of two breeds [Rex (RX) and New Zealand white (NZW)] were allocated randomly in 2 × 2 × 3 factorial design by breed, temperature [comfortable (24.5 ± 1.3°C), heat stress (32.8 ± 1.5°C)], and nano-$CrCl_3$ supplementation (0, 1, or 2 mg/L). Breed affected ($P <$ .0001) BWG and FCR. Although temperature adversely affected most measurable traits, it was had no effect ($P > 0.05$) on FCR. The addition of nano-$CrCl_3$ did not alter ($P > 0.05$) FCR, CW, L%, K%, and T%, but affected BW, BWG, and FI when 2mg/L nano-$CrCl_3$ was supplemented (1303 g, 548 g/wk., and 2232 g/wk., respectively). Histopathological slides of the liver indicated that heat stress had a greater effect on NZW than RX. Supplementation of 2 mg/L nano-$CrCl_3$ improved the degenerative changes caused by heat stress on liver, kidney, and appendix. It was be concluded that the nano-$CrCl_3$ supplementation with 2mg/L can improve the growth of NZW under heat stress as well as ameliorate the degenerative changes resulting from heat stress of both breeds.

Title: A novel laser-based approach for synthesis of two-dimensional quantum dots
Primary Author (and presenter): Elafandi, Salah G.
Additional Authors: Yakupoglu, Baha; Ahmadi, Zabihollah; Azam, Nurul; Mahjouri-Samani, Masoud
Department: Electrical and Computer Engineering
College/School: Samuel Ginn College of Engineering

Description:

Following the discovery of two-dimensional (2D) carbon known as graphene in 2004, many other 2D materials have been under intensive investigation including transition metal dichalcogenides (TMDCs). When these 2D materials are additionally confined in the lateral length dimension, 2D quantum dots (2D-QDs) could be realized. These 2D-QDs prevail improved or new properties in addition to the inherent properties of their parent 2D materials. Although some progress in syntheses of 2D-QDs has been achieved in the past few years, the ability to precisely control their size, edge configurations, and heterogeneities are still great synthesis challenges. Here, we report a universal laser-based approach for the synthesis of 2D-QDs in the gas phase. A stoichiometric 2D target is used as the source material. We show that the laser ablation of this target in an argon background gas highly condenses the laser-generated plume resulting in the formation of aggregates and nanoparticles in the gas phase. The effect of different background gas pressures is
systematically studied, and emissions are compared. The produced nanoparticles are then collected on the substrates and dispersed in different solutions for surface passivation and capping of the 2D-QDs surfaces resulting in an enhanced emission. Our method has the advantage of producing 2D-QDs in a fast, clean, and dry fashion.

Title: Improving the quality of life for patients with chronic kidney disease (CKD) through renal rehabilitation education

Primary author (and presenter): Ellis, Elizabeth Alison
Additional authors: Hall, Ashley, & Watts, Sarah
College/School: School of Nursing

Description:

Substantial documented evidence suggests the lack of chronic kidney disease (CKD) knowledge by patients and providers correlates to increased hospital admissions. Preventive programs such as renal rehabilitation have demonstrated to be beneficial to patients' quality of life, but the programs continue to remain underutilized. In order to alleviate CKD knowledge deficits, this project aims to introduce a RR program to increase patients' knowledge and awareness of their individual risk factors and needed lifestyle changes. The patient population includes men and women at last 19 years of age with CKD or risk factors in the primary care setting. The outcomes measured CKD stage, knowledge of CKD, CKD diet, and medication awareness and compliance, and activity level will be obtained through a pre- assessment. Participants were given verbal and written education about RR. During the 2nd follow up phone call at 21 days a post-questionnaire will be administered to re-evaluate participants progress, patient adherence, and program effectiveness. Descriptive statistics will be used for the project in progress for comparison of pre and post data analysis using SPSS software for outcome evaluation. Responses will be compared at 7 and 21 days with paired t-tests ($p=<0.05$) and mean scores for day/week daily activity, diet and medication compliance from pre to post intervention (mean SDs). The analysis showed that there is a great need for improvement in patient education and referral to RR. The project showed how vital patient education through RR improves quality of life and the overall well being of patients diagnosed with CKD. A STOC was implemented to evaluate the overall project and find ways to increase CKD knowledge through RR. Encouraging and educating hospitals as well as healthcare providers to initiate referral and follow-up may be accomplished by initiating a core measure for CKD patients in CPOE that would track referral.

Title: Transparent heart valves for improved hemodynamic testing
Primary Author (and presenter): Elmore, Danielle W.
Additional Authors: Tiwari, Bipin & Raghav, Vrishank
Department: Aerospace Engineering; Biological Sciences
College/School: Samuel Ginn College of Engineering; College of Sciences and Mathematics

Description:

The objective is to develop a technique that can be used to make porcine aortic valves transparent while not altering the size, biological structure, or durability of the valve and to test the transparent valve in a benchtop flow loop. When using a naturally opaque porcine aortic valve in a benchtop flow loop, the optical instruments used for the advanced fluid dynamic tests cannot collect data on the pressure and flowrate through the valve; they can only collect data going into and out of the valve. Making the valve transparent allows for optical measurements of the flow through the valve. Once the pressure and flowrate data is collected for a healthy valve, the bench top model with the clear valve can be altered to mimic different heart valve disease conditions. The protocol developed is applicable for excised porcine aortic valve. First the valve is made clear by removing the red blood cells and matching the tissue's refractive index; the results of the clearing process were assessed using qualitative measures. The transparent aortic valve will be implanted into a bench top model for advanced fluid dynamic tests to obtain quantitative data. The data collected can be used to help physicians determine the effectiveness of different valve repair and replacement techniques, and it can be used to help determine the optimal time to replace valves.

Title: Near and thermal infrared (NIR-TIR) spectral investigations of Siloe Patera, Mars
Primary Author (and presenter): Emran, Al
Additional Authors: King, David & Marzen, Luke
Department: Geosciences
College/School: College of Sciences and Mathematics

Description:

Siloe Patera, formed around ~3.5 billion years ago of Late Noachian to Early Hesperian period of the martian history, is a collapsed volcanic feature on Mars. This paper addresses surficial geology, including possible geologic history, of the patera by combining spectral investigation of orbital spacecraft data from thermal infrared (TIR) and near infrared (NIR) sensors. TIR images of the Thermal Emission Imaging System (THEMIS) sensor were used to characterize spectral units, bulk-silica [e.g., $(SiO_2)^{n-}$] content, and thermophysical (thermal inertia) characteristics. Mineralogy of olivine [$(Mg,Fe)_2SiO_4$], phyllosilicate [e.g., $Al_2Si_2O_5(OH)_4$)], and hydrated silicates [e.g., $(Na,Ca)_{0.33}(Al, Mg)_2Si_4O_{10}(OH)_2$ nH_2O] phases were investigated from NIR data of the Compact Reconnaissance Imaging Spectrometer for Mars (CRISM) sensor. Geologic features were interpreted from spacecraft data of the Context Camera (CTX) and the High Resolution Imaging Science Experiment (HiRISE) instruments. We identified four spectral units: the purple (P), fuchsia (F), yellow (Y), and typical terrain (TT). P unit is consistent to lower silica content, higher thermal inertia (indicating bedrock materials), and olivine mineralogy. F unit confirms the presence of rich olivine phase like P unit. Y unit is home to elevated silica content, a transverse dune field of coarse-grain sands, and weak phyllosilicate abundance. TT unit is the most dispersed unit and has elevated silica content- consists mostly of fine-grain dust showing positive abortion to phyllosilicate phase. In some areas hydrated phyllosilicate phase is spatially adjacent to the network of channels and gullies. The presence of faulting consistent with collapsed features and related lava-flow features support the feature to be a collapsed caldera. We assert that Siloe Patera is a large volcanic edifice that has experienced at least two major caldera collapse events and has a history of water having filled the southern caldera basin.

Title: Neuromuscular development in neonates & post-natal infants: implications for nmes therapy for dysphagia

Primary Author (and presenter): Epperson, Hannah E.
Additional authors: Sandage, Mary J.
Department: Communication Disorders
College/School: College of Liberal Arts

The aim of the current study was to review neuromuscular development, summarize the current body of evidence describing the use of neuromuscular electrical stimulation therapy (NMES) in infants, and identify possible contraindications for the use of NMES in the neonate and young infant. After a review of the literature describing neuromuscular development, we created a timeline of the developmental processes. Key milestones were determined and a literature search was conducted to identify potential effects of electrical stimulation on this process. Possible contraindications of use of NMES in the neonate and young infant were identified including: a) inhibited expression of the neural cell adhesion molecule that is vital for neuromuscular development; b) alteration of muscle fiber type metabolic profile away from intended muscle fiber type morphology; and c) interruption of post-synaptic acetylcholine receptor synthesis during neuromuscular junction development. Results from our investigation suggest that the use of NMES for the treatment of dysphagia in the neonate and young infant may influence early neuromuscular development in a manner that is not currently well understood. Future research is needed to further understand the effects of NMES on the developing neuromuscular system.

Title: Vibratory system identification of 3D printed cantilever
Primary Author (and presenter): Ergle, Matthew W.
Additional Authors: Crifasi, Daniel; Özdeş, Hüseyin; & Perkins, Edmon
Department: Mechanical Engineering
College/School: Samuel Ginn College of Engineering

Description:

Although 3D printing has become a widespread method of fabrication, the vibratory properties of thermoplastic composites are poorly understood. This is, in part, due to the anisotropies introduced by the 3D printing process, the composite materials used, and the geometry, but vibratory properties are crucial in order to predict and control the dynamics of mechanical systems. In this study, an attempt has been made to characterize the vibratory response of a 3D printed thermoplastic cantilever, in order to determine the damping ratio and natural frequency. The cantilevered beams were 3D printed, with a range of varied parameters. These parameters include the inclusion and exclusion of continuous carbon fiber reinforcement, as well as the three orthogonal build directions. Impact tests and frequency sweeps were used to gain information about the vibratory response of these cantilevers. This information was used to model the effects of the carbon fiber and anisotropy introduced by the different build parameters. During the experiments, a highspeed camera was used to record the response of the cantilevers. These videos were then post-processed with image analysis tools to quantify the response. Then, a point near the tip of the cantilever was used as the time-dependent variable for a reduced order model. By proceeding in this described method, the damping ratio and natural frequency of the system may be written as a function of the build parameters. From this, it was found that the orientation of continuous filament carbon fiber and the in-fill geometry drastically affect both the damping and the natural frequency of a printed cantilever. By implementing this knowledge, it should be possible to tune both the damping ratio and natural frequency of 3D printed parts. In addition to complex static structures, this could allow 3D printing to fabricate complex dynamic structures and could have implications for 3D printing acoustic waveguides and metamaterials.

Title: Heart of the wiregrass: Dothan, AL
Primary Author (and presenter): Esco, Taylor V.
Department: Political Science
College/School: College of Liberal Arts

Description:

This project examined how the current economic situation of Dothan, AL can be improved by leveraging existing resources for future economic development because economic growth has been restricted due to the city's lack of access to interstates and major rivers. After determining that the medical industry drives the economy, data was collected from the U.S. Census, U.S. Geological Survey, and the Center for Economic Studies to create spatial analysis for the demographics and medical industry in Dothan, AL. By increasing specialty healthcare services to women and children living in the area, Dothan has an opportunity to bring outside money into its economy and become the "Heart of the Wiregrass." My findings suggest that the residents of the Wiregrass region (approximately 400,000 people), particularly women and children, have to drive over 100 miles to seek specialty medical care such as pediatric ER along with regional neonatal and pediatric transport services. If specialized medical care in Dothan is expanded, then the economy will experience new growth, and the residents of the Wiregrass will not have to travel up to 100 miles to seek the specialized medical services they need.

Title: Processing, characterization, and valorization of soy hull
Primary Author (and presenter): Etebari Alamdari, Navid
Additional Authors: Aksoy, Burak; Jiang, Zhihua
Department: Chemical Engineering
College/School: Samuel Ginn College of Engineering

Description:

Soybean hull is one of the major by-products of soy industry with global annual production of 18-20 million tons. However, current applications and products of this inexpensive feedstock are of low value. Our objective is valorization of this unique biomass to produce high value products and we have developed series of processing technologies towards production of new products. These patent-pending products are paper-based gas sensor to detect meat spoilage, aquafeed/animal feed binder, and paper-based conductive surfaces with potential application as antistatic packaging. Gas sensors were composed of three coating ingredients, i.e. bentonite, soyhull product, and pH-sensitive dye. Three different bentonites used and three resultant gas sensor samples were tested for sensitivity and durability. The highest sensitivity and durability were 10 µL (upon exposure to 1mM ammonium hydroxide solution) and 5 days (upon exposure to 100 µL of 5mM ammonium hydroxide solution), respectively.
For aquafeed/animal feed binder
application, five pellets, using four different soyhull products and CMC as
binders, were prepared and evaluated for wet and dry strengths. Pellets
having soyhull products as binder were much superior in strength properties comparing to CMC-containing pellets. Two samples of paper-based conductive surfaces were prepared with one using commercial binder only and the other using this binder along with soyhull product. The resistance value for these two samples were measured using four-probe resistance measurement device and the results were 900 and 500 Ω, respectively, which indicate that both samples are in conductive range suitable for antistatic packaging application. Characterization of soyhull after each processing stage can help us optimize the developed processes with the purpose of improving properties of soyhull for the aforementioned products or utilizing this biomass in new novel applications.

Title: Neurofunctional specialization of the human hippocampus

Primary Author (and presenter): Etherton, Sarah, E.
Additional Authors: Robinson, Jennifer L., Ph.D., Yanes, Julio A, M.S., Bird, Ryan T., M. S., Zhao, Xinyu, Ph.D., & Deshpande, Gopikrishna, Ph.D.
Department: Psychology
College/School: College of Liberal Arts

Description:

The hippocampus is one of the most phylogenetically preserved structures of the brain. The foundation for memory, it serves pivotal roles in emotional and cognitive processing. Two of the most prevalent theories of hippocampal functioning are seemingly diametrically opposed. One theory posits that the hippocampi have a long-axis functional topography, such that the anterior and posterior portions are associated with different functions. The second theory suggests that the hippocampus favors a dorsal-ventral organization, in-line with the neuroanatomical organization. To our knowledge, no theory has emerged that may address this discrepancy in the literature. Leveraging ultra-high field, high resolution functional magnetic resonance imaging (fMRI), coupled with advanced analytic techniques, we identified data-driven neurofunctional clusters within the hippocampus from submillimeter fMRI data during encoding, recognition, and paired association tasks. We then extracted timeseries data from each cluster for associative analyses to probe which clusters were preferentially engaged in each of the processes, and whether stimulus type (i.e., words, pictures, or faces) had any effect. Our data reveals that different sections of the hippocampus preferentially respond to certain types of stimuli, and that the dynamic interaction of portions of the hippocampus with the rest of the brain change dependent on context (i.e., during a 'resting state' versus during active engagement as with encoding and recognition tasks). Together, these data provide support for a comprehensive model of hippocampal engagement whereby both models of hippocampal functioning can be accommodated

Title: Investigating multi-valued LUT architectures for improved FPGA Performance
Primary Author (and presenter): Fadamiro, Ayokunle O.
Additional Authors: Rezaie, Pouyan; Millican, Spencer; & Harris, Christopher
Department: Electrical and Computer Engineering
College/School: Samuel Ginn College of Engineering

Description:

Although the binary transistors have benefits consumers for many decades, modern design challenges necessitate the exploration of multi-valued logic (MVL), i.e., logic which has more than two possible values. Many previous researches have focused on quaternary logic: a multi-valued logic using four distinct voltage levels (e.g., 0, 1, 2, 3) as opposed to conventional binary logic (e.g., 0 and 1). A notable use of MVL is in field programmable gate arrays (FPGA), which are digital designs which can be configured post-manufacturing. MVL cells in FPGAs can transfer more information with less circuitry compared to traditional binary logic cells and allow for more complex circuits to be implemented with less power consumption and increased circuit performance. While MVL in FPGAs have numerous potential benefits, the performance and manufacturability as a viable alternative to the binary FPGAs have yet to be explored. Various implementation of MVL on FPGAs have been proposed, but their manufacturability and performance are questionable due to their requirement of complex silicon structures. This research studies the performances of various MVL FPGA architectures by designing and simulating circuits with bulk silicon FinFET models; this verifies the performance of MVL implementations compared to binary in terms of speed, power consumption, and area of implementation. Further research will explore improvements to MVL FPGA architectures and will explore methods of utilizing such an architecture in novel applications, e.g., the encryption of binary hardware designs.

Title: Impact of antidiabetic medication use on breast cancer diagnostic characteristics
Primary Author (and presenter): Fahim, Shahariar Mohammed
Additional Authors: Hsu, Chiu-Hsieh; Qian, Jingjing; & Chou, Chiahung
Department: Health Outcomes Research and Policy
College/School: Harrison School of Pharmacy

Description:

Knowledge regarding different antidiabetic medication use patterns at baseline and their impact on breast cancer diagnosis remains limited. To identify and compare different antidiabetic medication use patterns among female patients prior to their breast cancer diagnosis and evaluate if different antidiabetic medication use was associated with the breast cancer stage at diagnosis. Longitudinal, retrospective cohort study. Linked Surveillance, Epidemiology and End Results (SEER)-Medicare database from 2007 to 2013. Patients were included if they had newly diagnosed breast cancer in between 2008 and 2013, and continuously enrolled in Medicare Parts A, B, and D for 12 months before cancer diagnosis, excluding those enrolled in Medicare Advantage. Use of antidiabetic medications during one year prior to breast cancer diagnosis. Stage at diagnosis (categorized as early and advanced). Chi-square tests were used to compare characteristics between breast cancer patients with and without antidiabetic medication use. Multiple logistic regression models were used to examine the effects of different antidiabetic medication use on stage at diagnosis. A total of 1,719 female breast cancer patients used antidiabetic medications during one-year period prior to their cancer diagnosis while 6,084 patients were identified as non-antidiabetic users. Although more antidiabetic users (20.36%) had advanced stage compared to the non-user group (14.46%), antidiabetic medication users had similar likelihood (odds ratio [OR] 0.97, 95% CI 0.83 – 1.14) in getting advanced stage compared to the non-user group. Insulin users were more likely to be in the advanced group (OR 1.62, 95% CI 1.10 – 2.40) when compared to the metformin-users. Considering the diabetes severity, exposure to different antidiabetic medications may pose different risks in breast cancer stage at diagnosis.

Title: Differential effects of high-fat diet and niacin on nonalcoholic fatty liver disease in C57BL/6J and B6129SF2/J mice: A metabolomic analysis

Primary Author (and presenter): Fang, Han
Additional Authors: Graff, Emily; Li, Zhuoyue; McCafferty, Kayleen; & Judd, Robert
Department: Anatomy, Physiology and Pharmacology
College/School: College of Veterinary Medicine

Description:

Recent studies have demonstrated significant metabolic changes in different strains of mice fed a high-fat diet (HFD). Pharmacological doses of niacin can improve non-alcoholic fatty liver disease (NAFLD) in HFD-fed rodents. However, previous study from our lab demonstrated that niacin increases the hepatic triglyceride content and histological score in HFD-fed B6129SF2/J (B6129) mice but has no effect in C57BL/6J (B6) mice. Therefore, the aim of this study was to identify the mechanism responsible for niacin-induced fatty liver in B6129 mice using targeted liver metabolomic analysis. Livers were collected from B6 and B6129 mice, which were fed either a chow (10% fat) or HFD (60% fat) for 20 weeks with niacin (360 mg/kg/day) or vehicle supplementation from week 5 to week 20. Two hundred polar metabolites were identified in these livers. A total of 21 and 26 metabolites identified as different between chow and HFD group in B6 and B6129 mice, respectively. In B6 mice, only 6 metabolites were identified as different with niacin treatment and no specific pathways appeared to be impacted. In contrast to B6 mice, 16 metabolites and 5 pathways were impacted by niacin in HFD-fed B6129 mice. Of the metabolites that were changed in these pathways, only hydroxyphenylpyruvate (also known as 4-Hydroxyphenylpyruvate, 4-HPP) did not change with HFD feeding but significantly decreased with niacin treatment. 4-HPP is an intermediate in the metabolism of phenylalanine/tyrosine and improves mitochondrial oxidation in rats subjected to hemorrhagic shock. Therefore, decreased 4-HPP by niacin may lead to decreased beta-oxidation in the liver and subsequent lipid accumulation and liver damage in B6129 mice. Further lipidomic analysis suggested different hepatic lipid profiles with HFD and niacin treatment in B6129 mice, which may explain the increased NAFLD development in these mice with niacin treatment.

Title: In-pond raceway production of stocker and foodsize hybrid catfish
Primary author (and presenter): Fantini, Leticia E.
Additional authors: Chappell, Jesse and Hanson, Terry
Department: School of Fisheries, Aquaculture and Aquatic Science
College/ School: College of Agriculture

Description:

In-pond raceways systems (IPRS) can produce greater fish yields at lower feed conversion ratios (FCR) compared to conventionally managed catfish ponds. The goal of this study was to determine if a doubling of hybrid catfish (channel catfish, *Ictalurus punctatus*, ♀ x blue catfish, *I. furcatus*, ♂) biomass at a lower FCR could be raised in IPRS units compared to traditional pond production (8,000 kg/ha; 2.0-2.5 FCR). Foodsize and stocker production was evaluated in this study. Foodsize production used a larger raceway (64 m^3 unit) placed into each of two 0.4 ha ponds (B1 and B2) and a smaller raceway (45 m^3) placed into each of two 0.4 ha ponds (B3 and B4). For fingerling-to-stocker production a smaller (14 m^3) floating IPRS unit was placed into each of the four 0.4 ha ponds along with the foodsize raceways. Fingerlings for the foodsize units were stocked (8,641 ± 56 per IPRS) with hybrid catfish averaging 31 g in April 2018; and the fingerling-to-stocker generator units were stocked (13,750 ± 289 per IPRS) with hybrid catfish averaging 13 g in July 2018. Fish were fed a 35% and 32% CP floating commercial catfish pellet twice a day. For foodsize production (228 days), final average fish weight and FCR were 612.98 ± 41.05 g and 1.7 ± 0.17, respectively; and for stocker production (137 days), final average weight and FCR was 147.9 ± 0.10 g and 1.3 ± 0.21, respectively. Total foodsize plus stocker production was 14,821 kg/ha (11,281 kg/ha foodsize + 3,540 kg/ha stocker) for B1, 17,117 kg/ha (12,841 + 4,276) for B2, 16,964 kg/ha (12,626 + 4,338) for B3 and 15,392 kg/ha (10,963 + 4,429) for B4. Total IPRS production was 64,343 kg/4 ha or 15,818 kg/ha. This was 1.97 times the production and 0.7 to 1.2 FCR improvement over pond production.

Title: Impacts of wild pigs on acorn availability as a food source for native wildlife
Primary Author (and presenter): Fay, Arielle S.
Additional Authors: Zenas, Stephen J.; Smith, Mark D.; Ditchkoff, Stephen S.
Department: Wildlife Sciences
College/School: School of Forestry and Wildlife Sciences

Wild pigs (*Sus scrofa)* are a non-native invasive species that cause $1.7 billion/year in damage to agriculture in the United States, destroy native plant communities, and compete with native wildlife for seasonally available resources (e.g., acorns). Our objective was to estimate the consumption of acorns by wild pigs relative to that of other native wildlife species. We established 40 monitoring stations beneath acorn producing trees at a study site in eastern Alabama. At each monitoring station, we placed 5 acorns on a 1m x 1m sand pad and positioned a game camera to record acorn fate (species-specific consumption) during 2-week intervals once a month from November-February, 2018-19. Additionally, we constructed acorn traps from 18.9 L plastic buckets to estimate the total number of acorns that were potentially available for consumption at each monitoring station. We are currently analyzing approximately 3.2 million camera images to estimate acorn consumption by species. The most frequently observed animals thus far include deer, squirrels, birds, raccoons, and wild pigs. Although data collection is still in progress, our current observations indicate that wild pigs likely consume a significant amount of acorns and may possibly reduce availability of this pulse resource for other native wildlife species, and potentially influence oak regeneration.

Title: Rural studio breathing wall mass timber research
Primary Author (and presenter): Rains, Preston
Additional Authors: Ferguson, Katherine; Halepaska, Anna; Elbrecht, Jacob
Department: Architecture
College/School: College of Architecture, Design, and Construction
Description:

Rural Studio's Breathing Wall Mass Timber Research, in partnership with McGill University, explores how an envelope can best be designed as a heat exchanger so that incoming fresh air can be efficiently tempered with low-grade heat while conduction losses, energy expenditures, and ecologically damaging materials are kept to a minimum. The project will conduct building scale experiments to continue developing the Breathing Wall concept, integrate the Breathing Wall concept with Mass Timber construction, investigate the thermal, structural and ecological properties of the Breathing Wall Mass Timber system on the built environment, and promote the use of wood as and for a local, sustainable construction ecology. Modern enclosures are designed as insulators and made from layers of different materials, but designing them as heat exchangers could have significant potential by using one base material that performs several functions. While research has been conducted designing building materials as heat exchangers - or 'Breathing Walls' - the concept and material choice has yet to be explored at construction/industry scale. As an ongoing project, this research has the potential to further our understanding of alternative ventilation systems, redefine expectations for thermal comfort, and reinvigorate the use of a local, west Alabama resource.

Title: Effect of morphology on the selective CO adsorption process using CuCl on a copper substrate

Primary Author (and presenter): Feyzbar K. Nejad, Farshad
Additional Author: Oh, Tae-Sik
Department: Chemical Engineering
College/School: Samuel Ginn College of Engineering

Description:

Cuprous chloride is a widely used material for CO adsorption. Many attempts have been made to synthesize CuCl-decorated adsorbent to achieve a high selectivity of CO in gaseous mixtures. Different crystal planes of copper (I) chloride (CuCl) affects selectivity and reactivity of CuCl crystals. Accordingly, we are investigating a possible facile approach to decorate copper substrate with different morphologies of CuCl using copper (II) chloride as a precursor. Characterized by X-ray diffraction, initial results of this method show the formation of CuCl along the {111} and {220} crystal planes indicating the presence of tetrahedra and tripod dendrites. The future plans are to synthesize the four morphologies on a copper substrate in order to investigate their capability in CO adsorption using techniques such as Electrochemical Impedance Spectroscopy (EIS).

Title: Aarhus midttrafik: I am black velvet
Primary Author (and presenter): Finnegan, Eilís, T
Department: Architecture and Interior Architecture
College/School: College of Architecture, Design, and Construction

Description:

Throughout the scope of the built environment, there are several archetypal programs that embody mundane connotations. These archetypes include gas stations, convenience stores, public restrooms, and bus stations. *Aarhus Midttrafik: I Am Black Velvet* is an architectural urban infill project in Aarhus, Denmark which investigates how to combat the standard understanding of the commonplace program of a bus station, and office center by designing a space of more outward opulence and grandeur. The main focus of the architectural research is to explore how Scandinavian Functionalism, and architectural principle in Scandinavia from the 1930s-40s, can be reevaluated to convey the same motifs of commodity and utility, but with an emphasis on elevating the architecture to convey sociological importance. Upon travelling to Iceland, Denmark, Norway, Sweden, and Finland, and documenting prosaic spaces, I began to theorize about how to elevate them to the same degree as other public programs: city halls, public libraries, and banks. It became increasingly apparent that throughout Scandinavia, there is much importance on the quality of life for civic and government employees, often represented in design. *Aarhus Midttrafik* is designed and articulated, through the construction methods and spatial arrangements, to highlight this importance in addition to the experience of a person purchasing a ticket to ride a bus or experience the city. Elevating the experience of such a banal task creates a conversation between the people of Aarhus and the means by which they engage with their city. It is a kind of opulent dance or exchange – one that cloaks the two in velvet. This velvet, sophisticated, and flattering, brings the ordinary to a level of extraordinary. Purchasing a ticket, going to work, or riding the bus is no longer a humdrum undertaking – it is a sensational experience, one on par with visiting a museum or attending an opera, but accessible for everyone, all walks of life.

Title: Field-scale bioremediation of arsenic-contaminated groundwater with sulfate-reducing bacteria and arsenian pyrite at an industrial site in Florida
Primary Authors (and presenters): Fischer, Alicia, B. & Orndorff, Tristan, L.
Additional Authors: Lee, Ming-Kuo
Department: Geosciences
College/School: College of Sciences and Mathematics

Description:

Although arsenic (As) is a toxic metalloid, it is usually not a health concern as it is found in naturally reducing environments in undisturbed lakes, oceans, and aquifers. Yet, anthropogenic pumping for groundwater has exposed millions of people around the world to the contaminant. Moreover, developing countries lack the funds to remove this As. Previous studies have investigated techniques to affordably remove the arsenic by stimulating sulfate-reducing bacteria (SRB) to form As-sequestering pyrite. This study intends to improve upon these past methods to demonstrate the effectiveness of SRB As remediation at an As-contaminated, field-scale site in Florida. The study has revised the injection scheme to sequester As for nine months at the site: First, a ferrous sulfate and molasses mixture that will stimulate the bacteria has been injected into groundwater wells, and, second, the wells are located hydrologically upgradient so that the injectate travels downgradient for full-scale remediation. Groundwater samples have been and will be collected weekly for the first four weeks, monthly for the first three months, and quarterly for the remaining months until the completion of the experiment. X-ray diffraction (XRD) and X-ray fluorescence (XRF) analyses as well as Geochemist's Workbench Eh-pH diagrams will determine whether As has been sequestered in the biogenic pyrite. Excel scatterplots and GIS maps will confirm whether As concentrations are decreasing throughout the experiment. From these analyses, the study expects to reduce As concentrations throughout the site to below the regulatory standard of 0.05 mg/L, as the SRB-stimulating injection should engender the formation of arsenian pyrite. If the results are promising, then the study is within reach to optimize an affordable As-remediating procedure for developing communities to reduce As to safe standards.

Title: Identification of canine mast cell progenitors in blood
Primary Author (and presenter): Flaat, Taylor D.
Additional Authors: Smith, Bruce F.
Department: Scott Ritchey Research Center
College/School: Veterinary Medicine

Description:

Mast cells are widely considered a multi-functional master cell, with involvement in histamine allergic reactions, wound healing, tissue remodeling and innate immunity. They are strongly associated with the tumor micro environment as well as pathologies such as anaphylaxis, allergic rhinitis and infantile asthma as well as a myriad of other pathologies. Mast cells are found in nearly every tissue of the body, with the exception of the central nervous system and the retina of the eye, but originate in the bone marrow as hematopoietic stem cells. These early mast cells leave the marrow and circulate in the blood as uncommitted mast cell progenitors (MCp) which are $CD117^{+}$, $CD34^{+}$, $Fc\varepsilon RI^{+}$ and $CD90^{-}$ before being recruited to the peripheral tissues where they mature. When canine mast cells become neoplastic they, most commonly, form tumors in the skin, but may also cause tumors in the liver, intestines, spleen and elsewhere. Our long-term goal is to sequence mast cell tumors in a patient-specific, precision medicine approach designed to identify therapeutic targets in individual patients. Normal mast cells from canine mast cell tumor patients are needed to compare transcriptomes to patient mast cell tumors using deep sequencing/single cell sequencing to aid in the identification of therapeutic targets. The current project seeks to identify and obtain appropriate normal mast cell precursors from patient animals with minimal additional morbidity. Circulating MCp's represent a population of approximately 0.1-0.5% nucleated cells in the blood, making them a difficult target to isolate. We have developed a method of Flow cytometric analysis and sorting of $CD117^{+}$, $CD34^{+}$, $Fc\varepsilon RI^{+}$ and $CD90^{-}$ MCp's from canine blood using antibody labeling. Once isolated by cell sorting, these cells will be harvested, their RNA sequenced and then the RNA sequencing data compared to that of tumor cells from the same patient.

Title: Effect of different basal culture media and sera combinations on primary broiler chicken muscle satellite cell proliferation and heterogeneity

Primary Author: Flees, Joshua J.
Additional Authors: McGuire Sams, Cierla V. & Starkey, Jessica D.
Department: Poultry Science
College/ School: College of Agriculture

Description:

Satellite cells (SC) isolated from the *pectoralis major* muscle provide a useful *in vitro* model to study muscle development and growth in broilers. There is little consistency in the literature regarding optimal basal culture media (BCM) and sera combinations for SC proliferation. The effect of 3 BCM: 1) McCoy's 5A (MCCOY), 2) High Glucose Dulbecco's Modified Eagle's medium (HGDMEM), and 3) Low Glucose DMEM (LGDMEM) and 2 sera: 1) 15% chicken serum (CS) and 2) a combination of 5% horse serum (HS) + 10% CS (HSCS) were assessed. The SC from 22-d-old, male broilers were plated at 1.66 x 10^6 cells per well on gelatin-coated, 24-well plates. Three parallel plates were cultured at 40°C in a 5% CO_2 incubator and fixed at 48, 72, and 96 h post-plating 3 different times. Fixed cultures were immunofluorescence (IF) stained to detect cells expressing myogenic regulatory factors (MRF): MYF5, MYOD, and PAX7, and DAPI nuclear counterstained. NIS-Elements imaging software was used to capture and analyze 2 images per well. Densities of single, double, and triple positive MRF+ cells are reported on a mm^2 basis. Cells expressing one or more MRF were considered myogenic (MYO). Cells expressing no MRF were considered non-myogenic (NONMYO). Doubling time (DT) of all densities was calculated using 48 and 96 h cell densities. Data were analyzed using the GLIMMIX procedure of SAS (V9.4) with well as the experimental unit. Means were considered different when $P < 0.05$. At 48, 72, and 96 h post-plating, SC cultured in MCCOY+HSCS had the highest NONMYO cell density of all treatments ($P \leq 0.0001$), while the SC cultured in LGDMEM and HGDMEM had the fewest NONMYO cells at 96 h. The SC cultured in HGDMEM+HSCS tended to have the most MYO cells at 96 h ($P = 0.066$). The DT of MYO cells was shortest in those cultured in HSCS compared with CS ($P = 0.019$). In conclusion, HGDMEM+HSCS appears to best support broiler SC proliferation.

Title: The effects of phosphoprotein enriched in astrocytes-15 (PEA15) on cerebral endothelial and neuronal cell density in domestic cats

Primary Author (and presenter): Florus, Kacie L.
Additional Authors: Towns, T. Jordan; Brinker, Emily; Wilson, Dylan; Watanabe, Rie; & Graff, Emily
Department: Pathobiology
College/School: Veterinary Medicine

Description:

A loss-of-function mutation in phosphoprotein enriched in astrocytes-15 (PEA15) results in severe neurodevelopmental abnormalities in cats. Our lab examines brains in normal cats (unaffected) and those with the mutation (affected) to help determine how PEA15 contributes to the observed phenotype. We utilized RNAseq cell-type deconvolution analysis which suggests that affected cats have increased endothelial cell number or activity with little change in neuron cell number. Additionally, differential gene expression analysis suggests that affected cats have upregulation of transcripts associated with collagen. Therefore, our study aimed to (1) validate the cell-type deconvolution data through immunohistochemical (IHC) staining and morphometric analysis, and (2) determine if there are changes in collagen thickness of cerebral vessels. To address aim one, sections of cerebrum from affected (N=5) and unaffected (N=5) cats were stained for endothelial and neuronal cell detection, digitized, and analyzed using VisioPharm software to quantify the density of each cell type. We successfully created two algorithms for endothelial cell detection and one for neuronal cell detection but found no significant difference ($p>0.99$, $p=0.31$, and $p=0.47$ respectively) between the two groups for either cell type. To address aim two, sections of cerebrum from affected (N=4) and unaffected (N=5) cats were stained to highlight collagen. Subjectively, there is an increase in collagen surrounding vessels of affected cats, but future efforts will include a statistical comparison. In summary, cell-type deconvolution data was able to accurately evaluate neuronal density but did not correlate with IHC staining for endothelial cells. This may reflect a change in endothelial cell activity rather than cell number. Because endothelial cells can drive changes in collagen within vessel walls, this may reflect the subjective changes we observed in affected cats. However, further study is needed.

Title: Evaluating the feeding ecology of endemic freshwater mussels (Unionidae) in Central Texas using stable isotope and fatty acid analysis
Primary Author: Fogelman, Kaelyn J.
Additional Authors: Stoeckel, Jim; Abdelrahman, Hisham; Higgins, Brendan; Peng, Haixin; & Helms, Brian
Department: School of Fisheries, Aquaculture and Aquatic Science
College: College of Agriculture

Description:

Unionid mussel populations are declining as a result of various anthropogenic stressors. The increased awareness of their ecological function and their imperiled status has driven greater concern for mussel conservation. Although it is widely assumed that mussels are filter-feeders, much remains unknown regarding their feeding relationships. Understanding their feeding ecology is necessary to fully understand their role in ecosystem processes, the causes of their decline and to aid in propagation and relocation programs. In this study, we assessed feeding relationships of four Texas species (*Cyclonaias petrina*, *Cyclonaias neckii*, *Cyclonaias pustulosa* and *Lampsilis bracteata*), using stable isotope analysis ($\delta^{13}C$, $\delta^{15}N$) to assess the contribution of multiple food resources including fine particulate organic matter (FPOM) associated with benthic sediments, suspended particulate organic matter (SPOM), and coarse particulate organic matter (CPOM). Additionally, fatty acid profiles were identified to further elucidate microbial contributions to their diets. Seasonal samples were collected from all four species and potential food sources across four basins. Mussel $\delta^{13}C$ and $\delta^{15}N$ values suggested that all mussel species were feeding similarly. All species exhibited elevated $\delta^{15}N$ signatures, while the majority of assimilated carbon appeared to be derived from detrital CPOM. SPOM and FPOM played relatively minor roles in the contribution to dietary carbon. Fatty acids show seasonal variation within mussel species, indicating that different food resources are utilized seasonally.

Title: Optimizing patient expectations related to cardiac surgery
Primary author (and presenter): Forehand, Marilyn C.
Additional authors: Peterson, Mary
College/ School: School of Nursing

Description:

Cardiac surgery preoperative education focuses on procedure and potential adverse effects. Research has shown that optimizing patient expectations can decrease anxiety and improve outcomes. Educational programs used to improve patients' illness perceptions alter risk factors and cardiac misconceptions, improve knowledge, and increase physical activity. Preoperative education is designed to reduce risk factors leading to complications by enhancing patients' ability to recover from cardiac surgery. Emphasizing risk factors and complications may motivate patients to modify behavior in order to reduce risk factors. Education related to illness perceptions will reduce anxiety and improve postoperative outcomes. The target population is adults requiring cardiac surgery. Following participant agreement, participants completed the State Trait Anxiety Inventory (STAI), and the Illness Perceptions Questionnaire (IPQ). The nurse practitioner reviewed the results to guide teaching for improving patient expectations. After completion of the preoperative appointment, a telephone appointment provided by the project leader provided teaching, discussed anxiety and illness perceptions, and reviewed expectations. The STAI and IPQ are to be completed at the postoperative clinic appointment. The project is in progress. Descriptive statistics will be used to describe the patient population, prevalence of postoperative complications, knowledge improvement, anxiety, and illness perception scores. Follow-up data will include percentage adhered to treatment. The pre-post Anxiety and illness perception mean scores and pre-post knowledge scores will be compared with paired t-tests (alpha=0.05). Pre-surgical education reduces negative patient expectations, decreases anxiety, and improves the patient experience**.** Improving the informed consent process by addressing patient expectations is achievable and further implementation of this project is warranted.

Title: Exploring the use of digital asthma action plans on adolescent asthma management
Primary Author (and presenter): Fortner, Molly E.
Additional author: Peterson, Mary H.
College/ School: School of Nursing

Description:

An asthma action plan (AAP) is the evidence-based tool available to guide self-management in asthma patients. Only 50% of asthma patients across the U.S. receive an AAP, with a 40% compliance rate of the patients prescribed traditional paper AAPs. There is strong evidence that digitally stored AAPs result in increased adolescent compliance rates. The purpose of this project is to implement and evaluate the effectiveness of an AAP app in adolescent self-management of asthma. The target population included adolescents (12-17 years) with a diagnosis of asthma in an asthma clinic. Following participant agreement, participants completed an Asthma Control Test (ACT) indicating short-term control of asthma and a long-term management questionnaire. Outcomes measured were ACT scores, school days missed, clinic visits, hospitalizations, and steroid use related to asthma. The MD, NP, or PA provided an AAP to each patient that was entered into the patient's smartphone app, AsthmaMD. Participants received six weekly phone calls to report ACT responses. At the end of the implementation, participants answered the long-term management questionnaire. The project is in progress. Descriptive statistics will be used to describe the patient population, and short-term and long-term control of asthma symptoms. Participants will be classified as improved or not improved based on pre/post self-reported questionnaires. The interval/ratio variables will be tested using a paired sample t-Test (alpha = 0.05). The ordinal variables will be examined using the Wilcoxon Signed Rank Test. Participants experienced increased asthma control supported by improvements across all short-term and long-term evaluation variables. Further implementation of the project is warranted. By increasing accessibility to patient's treatment plans, AAP apps can decrease school days missed, prevent unnecessary clinic visits, and improve overall control of adolescent asthma.

Title: Effects of powder recycling on powder characteristics for inconel 718
Primary Author: Fox, Matthew
Additional Authors: Tehrani, Arash S,; Shamsaei, Nima
Department: Mechanical Engineering
College/School: Engineering

Additive manufacturing (AM) offers a means to create complex geometries through layer-by-layer fabrication that otherwise would be difficult or impossible with subtractive manufacturing methods. One of the most popular AM technologies is laser-powder bed fusion (L-PBF) which uses fine metallic powder as the feedstock. A significant amount of powder is used to fill the build envelope in the L-PBF process. Since the majority of this powder is unused for a single build process, most of the powder is sieved and reintroduced into the feedstock. The effects of sieving process on powder characteristics, and ultimately the mechanical properties are not well understood. This study investigates the change in rheological powder properties through a systematic fabrication and sieving process for L-PBF Inconel 718 powder feedstock. A total of 21 builds were performed using 100 kg of Inconel 718 powder which was sieved and remixed into the feedstock after each fabrication. Powder samples were collected from the mixed feedstock before every build and were characterized using a Freeman Technology FT4 rheometer. Powder characteristics include particle size distribution and shape morphology, flowability, tap density, and compressibility. Results indicate that particle size distribution becomes narrower and flowability increases with recycling.

Title: Comparison of region-specific neurotoxicity of prenatal alcohol and nicotine exposure
Primary Author (and presenter): Fujihashi, Ayaka
Additional Authors: Bhattacharya, Dwipan; Dunaway, Elizabeth; Bloemer, Jenna; Bhattacharya, Subhrajit; Majrashi, Mohammed; Almaghrabi, Mohammed; Ramesh, Sindhu; Escobar, Martha; Suppiramaniam, Vishnu; Dhanasekaran, Muralikrishnan
Department: Drug Discovery and Development
College/School: Pharmacy

Despite the well-known negative effects, smoking and alcohol consumption during pregnancy remains to be a global health issue. In 2016, 7.2% of American women reported smoking during pregnancy, and 10% reported drinking during pregnancy. Women who tend to smoke during pregnancy also tend to drink during pregnancy, and vice-versa. Therefore, this study was conducted to investigate the neurotoxic effects of prenatal alcohol and nicotine use in the cerebellum, cortex, and hippocampus using a rat model. We evaluated behavioral differences, electrophysiological changes, biochemical markers of oxidative stress, mitochondrial functions, and neural apoptosis. Experimental data was analyzed using one-way analysis of variance (ANOVA) followed by Dunnet's multiple comparisons test, and results are presented as means ± SEM. Statistics were performed using the Prism-V software (La Jolla, CA, USA). Prenatal alcohol exposure increased levels of oxidative stress, decreased mitochondrial functioning, increased caspase activities, had no effect on cholinergic neurotransmitter activities, increased expression of PSD-95, decreased LTP, and decreased performances on spatial memory tasks. However, nicotine exposure, in addition to alcohol exposure, was found to mitigate the negative effects of alcohol alone on ROS generation and spatial memory task performances. Thus, our current study may lead to better insights in the molecular mechanisms of fetal alcohol and nicotine exposure on the developing offspring.

Title: Continuous state of charge and power fade (SOH_P) estimation using a variable state Adaptive Extended Kalman Filter for lithium ion cells

Primary Author (and presenter): Gairola, Saurabh
Additional Authors: Choe, Song-Yul
Department: Mechanical Engineering
College/School: Samuel Ginn College of Engineering

Description:

Lithium ion batteries are widely implemented as energy storage devices in smart grids and electric vehicles due to their high energy and power densities. Accurate estimation of state of charge (SOC), capacity fade (SOH_Q) and power fade (SOH_P) is critical for ensuring safe and reliable operations of these battery systems. Traditional methods, using either complex electrochemical models or large look-up tables to estimate these states, do not meet either the required accuracy or low computational time necessary for online applications. This work focuses on developing a low complexity – high accuracy method for online estimation of SOC and SOH_P using an improved Adaptive Extended Kalman Filter (AEKF) based on a 2^{nd} order equivalent circuit model (ECM). The adaptive filter is used to estimates the SOC and the parameters of ECM. The estimated parameters are then used to calculate the instantaneous available power, using detailed equations considering all the power limits, and the power fade using multiple methods. The model adaptive noise update is developed using a moving-window based covariance matching method to update the noise error covariance which helps in state estimation error reduction. Stability of AEKF is improved by employing a novel "variable state estimation" approach that controls the number of states being estimated depending on the persistency of excitation of the input profiles. This method improves the stability and accuracy of state estimation even with low excitation inputs and incorrect initial parameters. The proposed algorithm is designed for a large format NMC/Carbon pouch power cell with a nominal capacity of 58.4 Ah and validated using single and multiple charge-discharge cycles until End-Of-Life (EOL) at different ambient temperatures ranging from 10^0 C to 45^0 C. The proposed method is able to accurately estimate all the states with output estimation errors of less than 10 mV for all types of input profiles.

Title: Efficacy of alternative salt mixture to grow Pacific White Shrimps (*Litopenaeus vannamei*)

Primary Author: Galkanda Arachchige, Harsha S. C.
Additional authors: Roy, Luke A. & Davis, D. Allen
Department: School of Fisheries, Aquaculture and Aquatic Sciences
College: College of Agriculture

Description:

Though Pacific white shrimp, *Litopenaeus vannamei* exhibit a remarkable ability of tolerating a wide range of salinities, proper acclimation to an appropriate environment is critical. In the case of low salinity culture, post larvae are often transferred into systems for which the salinity has been adjusted with reconstituted sea salt (RSS), which are formulated for salt-water aquariums. However, the price is not within a sustainable range considering the volume of salt necessary for the acclimation process or to operate an indoor recirculating aquaculture system which operates at considerably higher salinities (>10 g/L). Therefore, the current study was carried out with the objective of testing the efficacy of lower cost salt mixture (LCSM) to replace RSS. LCSM was formulated with sodium chloride (NaCl), magnesium chloride ($MgCl_2$), magnesium sulfate ($MgSO_4$), potassium oxide (K_2O), calcium chloride ($CaCl_2$) and sodium bicarbonate ($NaHCO_3$) to mimic sodium, calcium, potassium, and magnesium levels in diluted sea water. RSS was incrementally replaced (2.5, 25, 50, 75 and 100 %) with LCSM at four replicates per treatment to conduct two nursery trials (21 days) and growth trials (42 days) at 15g/L and 6g/L salinities. Experiments were carried out in 150L tanks equipped with miniature fluidized bed bio-filter and shrimp were fed standard ration over experimental period four time/day. No significant differences were observed in survival or growth performances of shrimp reared in 15g/L nursery trial, 6g/L nursery trial and 6g/L growth trial while treatment 6 (100% LCSM) showed significantly higher growth performances over treatment 1 and 2 (100 and 97.5% RSS) at 15g/L growth trial. Results reflect the potential use of LCSM to replace RSS which could be an excellent solution to bring down the cost of production for indoor shrimp aquaculture and acclimation process in low salinity inland ponds, thereby helping to stimulate the growth of the industry.

Title: Petrography, geochronology, and geochemistry of the epithermal DeLamar Au-Ag deposit in the Silver City District, Idaho
Primary Author (and presenter): Garcia, Raeann D.
Additional Authors: Bilenker, Laura D.; Hames, Willis E.
Department: Geosciences
College/School: College of Sciences and Mathematics

Description:

DeLamar is a low-sulfidation (LS) epithermal deposit located in the Northern Great Basin in western Idaho. LS epithermal deposits are a type of hydrothermal ore deposit that supplies much of the world's gold and silver. They form at relatively low temperatures (below 250°C) and within 500 meters of the surface. As one of three LS epithermal sites within the Silver City District, DeLamar is an active prospect that provides a unique research opportunity. Although mined sporadically for over 150 years, little research has focused on these Northern Great Basin epithermal ores during the past four decades. This study will elucidate the formation of DeLamar and help improve the current understanding of the genesis of LS epithermal deposits by developing the first three-dimensional geochemical perspective of a deposit within the Silver City District. Complementary petrographic and geochemical approaches will help construct a refined genetic model for DeLamar by constraining the timing and source of mineralization. Argon-argon dating on adularia present in the waste material will allow for a comparison of ages between the surrounding mine sites and within the broader geologic context of the initiation of the Yellowstone Hotspot. Additionally, analyses of the sulfur isotope composition of sulfides associated with the ore will fingerprint the source of the fluids that transported the gold and silver. An analysis of the concentration of titanium in quartz will also be performed in order to identify the environment of quartz formation, providing information on potential high-temperature contributions to the system and further unravel observed mineralogical relationships. The methods employed in this study will contribute significantly to the current understanding of the ore-forming mechanisms responsible for LS epithermal deposits worldwide.

Title: A systemic response stimulated by *Bacillus* sp. can manage *Meloidogyne incognita* population density in *Gossypium hirsutum*
Primary Author (and presenter): Gattoni, Kaitlin M.
Additional Authors: Xiang, Ni; Lawaju, Bisho; Lawrence, Kathy; & Kloepper, Joseph. **Department:** Entomology and Plant Pathology
College/School: College of Agriculture

Description:

Meloidogyne incognita is a plant parasitic nematode that causes economic losses in upland cotton. Management of the nematode includes nematicides, cultural control and biological control. Due to the inexpensive cost and low environmental impact, biological control agents are becoming more popular as a control method for *M. incognita*. Biological control agents can work by direct or indirect antagonism of their target pathogen. Indirect antagonism includes the upregulation of plant defense pathways. This includes the induced systemic resistance pathway, which utilizes jasmonic acid and is stimulated by plant-growth promoting rhizobacteria, and the systemic acquired resistance pathway, which utilizes salicylic acid. Determining which pathway a biological control agent, with an indirect method of antagonism, stimulates is essential to the integration of the biological control agent into a successful pest management program. This research will examine five *Bacillus* species and their ability to stimulate a systemic response to *M. incognita* within cotton. Experiments will include a split root assay to determine systemic capabilities, a RT-qPCR assay to determine the activity of genes correlated to jasmonic acid and salicylic acid levels, and qPCR to determine how well the bacteria were able to colonize the roots. The split root test indicated that two species, *B. amyloliquefaciens* QST713 and *B. firmus* I-1582, were able to produce a systemic response. This was confirmed by RT-qPCR that saw an initial increase in systemic acquired resistance followed by a late induced systemic response. The findings of this research will help implement these biological control agents in an integrated pest management program for nematodes, specifically *M. incognita*.

Title: Study of *cutC* gene involved in copper resistance in plant pathogen *Xylella fastidiosa*
Primary Author: Ge, Qing
Additional Authors: Cobine, Paul & De La Fuente, Leonardo
Department: Entomology and Plant Pathology
College/School: College of Agriculture

Description:

Copper (Cu) is a crucial element for many bacteria to survive, however it can also be toxic. Plant pathogenic bacteria have been exposed to Cu stress for years, due to wide application of Cu-containing antimicrobials. This has led to the acquisition of Cu resistance mechanisms by the pathogens to allow for better survival. One protein related to Cu tolerance of *E. coli* and humans is CutC, this is a "TIM-barrel protein" that has a single copper binding site and is thought to protect cells against accumulation of free Cu. The mechanisms of Cu tolerance/resistance in *Xylella fastidiosa* (Xf), which is a Gram-negative, xylem-limited plant pathogenic bacterium that causes disease in many economically important crops worldwide, is barely studied. Here we focused on analyzing the *cutC* gene, a homolog of *cutC* from *E. coli*, in Xf by site-directed mutagenesis. The *cutC* mutant when compared wild type Xf strain, shows increased sensitivity to Cu. The mutant showed decrease in colony forming units under short time exposure to high concentrations of Cu, less accumulation of Cu in biofilm, delay of biofilm formation, and increase of biofilm attachment. Thus, we hypothesize that in Xf the *cutC* gene is involved with Cu resistance by binding Cu in cells, leading to Cu detoxification. Future studies will address the copper binding capacity of CutC and more detailed analysis of damaged caused by Cu in the mutant. This will help to develop disease management strategies against this plant pathogen.

Title: Development of a functional ex-vivo porcine heart system to test and improve heart valve repairing techniques

Primary Author (and presenter): George, Caroline, C
Additional Authors: Heyat, Ali; Raghav, Vrishank
Department: Chemical Engineering, Aerospace Engineering
College/School: Engineering

Fully functional heart valves are integral to a healthy heart. Defective valves cause decreased overall heart performance and ultimately heart failure. Developing improved methods of heart valve repair typically involves performing the procedure on a pig, as pigs' hearts are anatomically and physiologically very similar to humans'. However, an excised porcine (pig) heart model can provide a reliable intermediate step before porcine procedures to save resources on initial testing. In this study, the porcine left heart model is designed and developed to test its ability to emulate a beating heart for surgical testing. Water was pumped through the porcine heart with a pulsing pump to mimic blood flow and heartbeat. In future study, damage will be induced on the heart valves. Flow through the valves and pressure in the chambers of the heart before damage, after damage, and after surgical repair will be detected with sensors to assess the model's accuracy and the repair's effectiveness. When such intermediate models become more commonplace, they can drastically decrease the time and resources necessary to develop heart repair techniques.

Title: Intensive weight loss program
Primary Author (and presenter): George, Rachel C.
Additional Authors: Howell, Eleanor
College/ School: School of Nursing

Description:

There is strong evidence that obesity increases the risk for hypertension, diabetes, infertility, cardiac disease, depression, joint pain, and other conditions. Achieving a healthy weight and body mass index (BMI) decreases the risk for disease, and improves existing comorbidities. Evidence indicated that weight loss programs using behavioral therapy techniques and nutritional counseling can facilitate a patient's weight loss journey and promote maintenance of weight loss after program completion. This project evaluated an intensive educational weight loss program tailored to participants' preferred learning style on achieving weight loss goals. The target population is adults aged 19 and older, with a BMI of 30 or greater, in an outpatient weight loss program. Following participant agreement, participants completed a baseline assessment of weight, BMI, and waist circumference. Participants met with a provider to discuss a healthy weight, establish weight loss goals, and develop a diet and exercise regimen. Participants also completed a questionnaire to determine learning style and the results were used to tailor educational programming. Participants attended weekly appointments to discuss progress and weigh-in, and monthly appointments to assess progress and treatment regimen. Weigh-in at 6 weeks was compared to baseline. Satisfaction with the program was measured at 6 weeks. Adherence was measured by self-report. The project is in progress. Descriptive statistics will be used to describe patient weight, BMI, waist circumference, treatment recommendations, and patient adherence. Outcomes measured will include the percentage of patients able to achieve weight loss goals and patient satisfaction with the program. Participating in an intensive weight loss program can improve weight loss outcomes. Further implementation of the project is warranted.

Title: Gallium (III) catalyzed formation of Cu_2O nanocrystals as a potential pathway for controlled growth and morphology via a hot injection synthesis.
Primary Author (and presenter): Gibson, Noah, J.
Additional Authors: Bredar, Alexandria; Farnum, Byron.
Department: Chemistry & Biochemistry
College/School: COSAM

Nanocrystalline metal oxides are a diverse class of functionalized materials, with use in solar cell architectures, fuel cells, and as catalysts. Given that properties in metal oxide nanocrystals are typically related to the synthetic methodology by which they are made, a need for effective and controllable synthetic methods is necessary for new classes of functionalized materials. A green, non-aqueous hot injection method has been previously developed for the synthesis of binary metal oxides, utilizing acetate precursors in alcohol to induce metal-oxygen bond formation via a condensation reaction. This synthesis method allows for tunability of size and composition of metal oxide nanocrystals due to its high temperature and control of reactivity through injection rate. Cuprous Oxide (Cu_2O), which is of particular interest to us given its p-type character and material properties, has not been successfully synthesized using this method due to the difficulty of copper-oxygen bond formation, which makes controlled particle morphology challenging. Here, we show that the use of a catalytic amount of gallium(III) can catalyze the formation of nanocrystalline Cu_2O solids while still offering the tunability to size and morphology. The reactivity of the reaction was monitored using FT-IR and UV-vis spectroscopic techniques while size, morphology, and composition was analyzed using SEM, EDS, powder XRD.

Title: Action plans to improve health-related quality of life for patients with COPD
Primary Author (and presenter): Glass, Stacy H.
Additional Authors: Peterson, Mary H.
College/School: School of Nursing

Description:

There is strong evidence that chronic obstructive pulmonary disease (COPD) decreases health related quality of life (HRQoL). Studies have demonstrated that improving self-efficacy leads to decreased health care usage and increased health-related quality of life. Evidence-based recommendations for practice in an outpatient setting suggest providing patients with COPD written action plans and measuring HRQoL with St. George's Respiratory Questionnaire (SGRQ). The goal of providing written action plans is to increase self-management and HRQoL, and decrease health care utilization. The purpose of this project was to implement use of written action plans in a pulmonary clinic, improve self-efficacy and health-related quality of life, and decrease health care usage. The target patient population included adults (age 18 or older) with diagnosis of COPD seen in a pulmonary clinic. Following participant agreement, participants were provided written action plans and completed a validated tool (SGRQ) for assessing health related quality of life. Outcomes measured on initial visit were SGRQ scores and self-management. A follow up telephone call at four to six weeks was made to evaluate SGRQ scores post implementation. Also, an assessment of symptoms (e.g., number dyspnea episodes) and evaluation of adherence with written action plans was completed. The project is in progress. Descriptive statistics will be used to describe the patient population (age, gender, ethnicity, smoking status), prevalence of dyspnea episodes, patient adherence with action plans, and pre-post-implementation SGRQ scores. The pre-post mean scores will be compared with paired t-tests (alpha=0.05). The provision of written action plans for patients with COPD can improve health-related quality of life and self-efficacy. Early assessment of HRQoL is achievable in this pulmonary clinic setting using the SGRQ. Further implementation of the project is warranted.

Title: Saving our heritage: World heritage sites threatened by rising sea levels
Primary Author and Presenter: Glenn, Kaitlyn J.
Department: Environmental Design
College/School: College of Architecture, Design, and Construction

Description:

The United Nations Educational, Scientific, and Cultural Organization (UNESCO) designates certain places around the world as World Heritage sites. Unfortunately, many of these sites are threatened by the effects of climate change such as rising sea levels. The area that is most endangered by rising sea levels, which this project focuses on, is the Mediterranean region. A loss of these World Heritage sites would be devastating. Cities would lose part of their culture and heritage, economic resources, and some people would even lose their homes. Most of the information was accumulated from one research study done on threatened sites around the Mediterranean Sea with other information coming from articles on general sea level rise and World Heritage sites. My research demonstrates present and future conditions with and without intervention and how loss of these areas could be prevented. I found that many sites are in eminent danger of being flooded, but that many countries do not consider sea rise in their conservation plans. Many of these sights could be protected by implementing a flood barrier system. This research demonstrates the need for protection for these sites so that they and their contributions to society will not be lost to the sea.

Title: Experimental investigation of geometrically modified wicked heat pipes
Primary Author (and presenter): Gomes, Chris
Department: Mechanical Engineering
College/School: Samuel Ginn College of Engineering

Description:

Wicked heat pipes are passive heat transport devices composed of a sturdy outer shell, a porous wick material, and a hermetically sealed inner chamber filled with a working fluid. A heat pipe transfers heat energy from a heat source to a heat sink through a passive, cyclic phase change of the internal working fluid and can have an effective thermal conductance orders of magnitude greater than some of the best known thermally conductive materials in the universe. Typically, wicked heat pipes are designed, tested, and produced in a standard straight-round geometry, but in the application of electronics thermal management, complicated geometrical constraints can interfere with the compatibility of straight-round heat pipes. Thermal management solutions requiring geometrically modified heat pipes are very common and the alterations of these heat pipes can drastically affect their overall behavior and performance. For this reason, an experimental investigation is being performed to model the effects that geometric modifications, such as bending and flattening, have on the thermal conductance of wicked heat pipes. This study will provide a model backed by empirical data that will be used to characterize geometrically modified heat pipes in terms of their limits and capabilities. With these results, companies in the defense and aerospace industry will be better equipped to provide efficient thermal management solutions for terrestrial vehicle computers and space-systems avionics.

Title: Modulation of twitching movement in *Xylella fastidiosa* mediated by the PD0913 gene under different calcium concentrations

Primary Author (and presenter): Gomez Arias, Laura Melissa
Additional Authors: De La Fuente, Leonardo
Department: Entomology and Plant Pathology
College/School: College of Agriculture

Description:

Xylella fastidiosa (Xf) is a Gram-negative, insect-transmitted, xylem-limited bacterium that causes disease in many economic and ecological important host plants. Key features involved in the virulence mechanisms of Xf is the formation of biofilm and twitching motility. Mineral nutrients such as calcium (Ca) are transported through the xylem vessels. In Xf, Ca was reported to have an important role modulating biofilm formation and twitching motility. Through the study of whole transcriptome analysis and comparative genomics in Xf, a set of genes regulated by Ca was identified. Some of these genes were clustered in genomic islands and 42 genes were predicted to have a Ca-binding motif. From these, 7 genes were significantly expressed in Xf Temecula1 strain. In this study, PD0913 was chosen to be analyzed because it was found in all the categories mentioned above. Interestingly PD0913 is absent in EB92-1 (non-virulent) strain. This gene was functionally studied by performing site-directed mutagenesis. Compared to the wild type, the mutant had lower total and planktonic growth under different concentrations of Ca (2 mM and 4 mM). However, biofilm growth was significantly higher for both mutant and WT under 4 mM of Ca. The main difference between WT and mutant is found in their ability to move via twitching motility. High concentrations of Ca (2 mM) significantly increased the twitching motility of mutant cells in which the fringe width was 120 mm while it was 40 mm for the WT. 4 mM Ca concentration prevented movement in both WT and mutant. Overall, results suggest that the PD0913 gene indeed is involved in the regulation of virulent traits such as twitching motility, which is modulated by Ca *in vitro*. Virulence *in planta* of WT and PD0913 mutant is under evaluation.

Title: Nanocellulose/ β-cyclodextrin polymer design for adsorption of microcystin-LR
Primary Author (and presenter): Gomez-Maldonado, Diego
Additional Authors: Lombardo, Salvatore; Vega,
Beatriz; Filpponen, Ilari; Thielemans, Wim; & Peresin, Maria Soledad
Department: Forestry
College/School: School of Forestry and Wildlife Science

Description:

With the increase in water temperatures observed in the recent decades, blooming seasons of algae last longer, resulting in toxins concentrations in waterways that exceed safe limits for human consumption and recreational use. Microcystin-LR is reported as the main cyanotoxin related to liver cancer, therefore its abundance in water is constantly monitored. The World Health Organization stipulates a maximum concentration of 1 μg/L, but the Environmental Protection Agency reported concentrations up to110 μg/L in the blooming at Lucie River, Florida in 2018. Traditional treatments like chlorination, filtration and ozonating are not effective during blooming seasons due to the short retention times used and the higher concentrations; thus, a need to develop new methods to remove this type of toxin is imperative. Utilizing cellulose-based products as alternative materials for water treatment hold an exciting potential for generating value-added, environmentally friendly products, which production and use could help to regenerate an important portion of the forestry economy and pulp and timber industries. In this project, we used a cellulose-based material modified with a cyclic polysaccharide (β-cyclodextrin) under different structural conformations. Characterization of the modified nanocellulose was performed with Fourier Transform Infrared Spectroscopy (FT-IR), Thermogravimetric Analysis (TGA) and Atomic Force Microscopy (AFM). The obtained materials were tested for recovery of microcystin from formulated water with a novel surface sensitive method, Quartz Crystal Microbalance with Dissipation monitoring (QCM-D), which allows the following in real time of the adsorption behavior. Our cyclodextrin-nanocellulose co-polymer showed a maximum recovery of 195 mg/g, which doubles the adsorption capability of other natural derived systems. Additionally, interactions between the co-polymer and the toxins will be investigated using Isothermal Titration Calorimetry (ITC).

Title: Oriented β-cyclodextrin/Chitosan polymer adsorption on nanocellulose surfaces and its use on capture of microcystin-LR

Primary Author (and presenter): Gomez-Maldonado, Diego
Additional Authors: Vega, Beatriz; Filpponen, Ilari; Waters, Matthew; Peresin, Maria Soledad
Department: Forestry
College/School: School of Forestry and Wildlife Science

Description:

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Title: Improving antiretroviral therapy adherence in HIV+ men with mobile phone technology
Primary Author (and presenter): Gravel, Timothy J.
Additional Authors: Peterson, Mary
College/ School: School of Nursing

Description:

Antiretroviral therapy (ART) adherence is crucial to reaching UNAIDS 90-90-90 goal of 90% viral suppression by 2020. Human Immunodeficiency Virus (HIV) positive men who have sex with men (HIVMSM) are disproportionately affected by HIV making up 70% of all newly diagnosed HIV cases in the United States. The most common reasons for non-adherence include simply forgetting and difficult dosing schedules. Past studies have shown that patients using short message service (SMS) reminders significantly increased ART adherence ($p=0.04$). The purpose of this project is to use SMS medication reminders to improve ART adherence in the HIVMSM population. The target population included adult men who have sex with men whom are HIV+ in a local HIV clinic. A smartphone application, Life4Me+, was used for this project as it provides a free service of SMS reminders for medications. Following participation agreement, Life4Me+ was introduced to the HIVMSM population at a county health department clinic setting and used to remind patients when medications were to be administered. Measurements for adherence were assessed at baseline and 4-week follow-up via the Morisky Medication Adherence Scale-8 (MMAS-8). At this time the project is ongoing. The pre- and post-test mean scores of the MMAS-8 will be compared with paired t-tests ($alpha=0.05$) to evaluate improvement in ART adherence. Descriptive statistics will be used to describe the population's age, ethnicity, education level, and insurance status. The descriptive data will include number and percent of patients in each category.The use of SMS reminders, such as Life4Me+, can improve ART adherence in the HIVMSM population. Improvement in ART adherence is directly correlated to improved health outcomes for this population. Early assessment and intervention can improve medication adherence among patients in this clinic setting and justifies further implementation of the project.

Title: Preventing tobacco and nicotine delivery device use among adolescents
Primary author (and presenter): Griffin, Kerri
Additional authors: Peterson, Mary
College/ School: School of Nursing

Description:

There is strong evidence that interventions led by primary healthcare providers (PCP) are successful in helping reduce and prevent adolescent tobacco use. The United States Preventive Services Task Force suggestions for practice recommend that PCPs provide interventions, (i.e., education and counseling), to prevent the initiation of tobacco use in school-aged children and adolescents. The purpose of this project was to implement educational sessions in collaboration with primary healthcare providers to educate adolescent patients on the effects of tobacco and nicotine delivery device use. The focus is prevention and/or reduction of use among adolescents. The target population included adolescents between 14-18 years of age seen in a family practice clinic. Following participant agreement, participants completed a pre-intervention knowledge test and a survey to identify current understanding, onset, and trajectory of tobacco and nicotine delivery device use. The participants then attended an educational session on the health-related effects of tobacco and nicotine delivery devices. After the session, participants were allowed to discuss questions and concerns about the educational material with the project leader and health care providers. A post-intervention knowledge assessment was completed for the project leader to review. The project is in progress. Descriptive statistics will be used to describe the patient population (age, gender, prevalence of tobacco and nicotine delivery device use). Follow up data will include number and percent who use tobacco and/or nicotine delivery devices. The pre-post-knowledge mean scores will be compared with paired t-tests (alpha=0.05). Preventing tobacco and nicotine delivery device use among adolescents may be achieved with education, advice, and counseling from PCPs in this family practice office setting. Further implementation of the project is warranted.

Title: Intravenous delivery of AAV gene therapy in GM1 gangliosidosis
Primary Author (and presenter): Gross, Amanda L.
Additional Authors: Gray-Edwards, Heather; Bebout, Cassie; Neilson, Kayly: Brunson, Brandon; Batista, Ana Rita; Maitland, Stacy; Sena-Esteves, Miguel; Martin, Douglas
Department: Anatomy, Physiology, & Pharmacology
College/School: College of Veterinary Medicine

Description:

GM1 gangliosidosis is a fatal neurodegenerative disease caused by a deficiency of lysosomal β-galactosidase (β-gal). Adeno-associated viral (AAV) vector, serotype 9 was delivered at 1.5e13 vector genomes/kg body weight via the cephalic vein into six GM1 cats at one month of age. The six animals in the study were divided into two cohorts for short term and long term evaluation. Untreated GM1 animals survived 8.0±0.6 months while IV treatment increased survival to approximately 3.5 years. Clinical assessments included neurological exams, cerebrospinal fluid (CSF) and urine biomarkers, and 7T magnetic resonance imaging (MRI) and spectroscopy (MRS). Postmortem analysis included β-gal and vector distribution as well as histological analysis. Neurological abnormalities, which in untreated GM1 animals progress to the inability to stand and debilitating neurological disease by 8 months of age, were mild in treated animals. Treated cats had only mild hind limb muscle atrophy and fine ear tremors, symptoms that occur early in the disease process of untreated cats. CSF biomarkers such as aspartate aminotransferase (AST) and lactate dehydrogenase (LDH) were normalized, indicating decreased central nervous system (CNS) cell damage in the treated animals. MRI revealed the preservation of brain architecture in AAV-treated cats, and MRS revealed correction of glycerophosphocholine and phosphocholine, markers of demyelination. β-gal activity was increased throughout the CNS, reaching normal levels in the CSF, cerebellum and spinal cord (cervical, thoracic and lumbar regions). Peripheral tissues such as heart, skeletal muscle and sciatic nerve also had normal β-gal activity in treated GM1 cats. GM1 histopathology in the CNS was largely corrected with treatment, with little to no evidence of storage lesions. There was no evidence of tumorigenesis or toxicity. This data supports the clinical application of IV gene therapy as a safe, effective treatment for GM1 gangliosidosis.

Title: Hands up, don't shoot: Decision factors underlying the use of deadly force
Primary Author: Grove, Julia W.
Additional Authors: Franco-Watkins, Ana; Shaw, Melissa; Glaser, Kerstin
Department: Psychology
College/School: Liberal Arts

Description:

Making good decisions at work is an important facet of job performance. Understanding the cognitive processes underlying an individual's decision making habits may improve the general comprehension of decision outcomes. It is also important to investigate environmental and individual factors which may impact decision making, such as workplace stress and how individuals cope with stress, biases, or individual propensity for risk taking. This study addressed the cognitive processes underlying decision making under stress that is common in many workplaces, such as how a police officer might consciously or unconsciously identify threats and decide to utilize lethal force differently depending on perpetrator race. Individuals who took part in this study demonstrated higher shooting rates for Black than White figures and higher shooting rates for threatening figures than non-threatening figures. To examine the impact of stress on decision making, we used a time pressure manipulation, and time pressure did not demonstrate significant impact on shoot rates, regardless of race of figure presented. Additionally, individual differences such as risk taking behaviors and racial bias did not significantly impact shooting rates. As such, future training programs should seek to help officers mitigate unconscious biases and correctly identify threats under stress, such as time pressure.

Title: Synthesis and characterization of transition metal complexes for antimicrobial application
Primary Author and Presenter: Grundhoefer, John P.
Additional Authors: Emily E. Hardy; Maya M. West; Anne E. V. Gorden; & Ashley B. Curtiss
Department: Chemistry
College/School: College of Sciences and Mathematics

Description:

As the population increases, so does the need for advanced medical techniques. Metal complexes of Schiff base ligands, which have nitrogen and oxygen donor atoms, have been known to show antimicrobial properties with inhibition concentrations comparable to standard antibiotics such as ampicillin. The biologically relevant metals Cu, Ni, Fe, Mn, and Zn are of particular interest in this area. The purpose of this experiment was to synthesize and characterize the copper and nickel complexes of the newly synthesized 1-[(1E)-({2-hydroxy-3[(E)-[(2-dhydroxy napthalen1yl)methylidene]amino]propyl}imino)methyl] napthalen-2ol ligand. The metal-ligand complexes were characterized using IR, NMR, UV-vis, and MS spectroscopy. The crystals were grown using standard lab technique over the course of several months in various solvent systems and were solved using x-ray crystallography. The complexes were found to share several structural similarities to ligands of published literature of which the antimicrobial properties of these transition metal compounds were further confirmed. Notably, the metal and ligand were found to associate in a 1:1 complex in the solid state, however the binding ratio was much closer to 3:1 upon examination in solution via UV-vis spectroscopy. The metal-ligand complexes were also found to have formed hydrogen-bond dimers after crystallization. Future work is planned to characterize similar transition metal-ligand complexes with nitrogen and oxygen-based coordination spheres.

Title: The Effect of Child Body Image on Perceptions of Life
Primary Author: Gunning, Anna F
Additional Authors: Margaret E. Young, MS, Megan R. Schaefer, & Wendy N. Gray, PhD
Department: Psychology
College/School: Auburn University

Description:

During adolescence, children can become attuned to the perceptions of body image due to changes in emotional, social, physical, and psychosocial functioning. The present study contributes to the knowledge behind how child body image affects children and guardians' perception of quality of life.

We examined the effects of child body image on guardians' and children's perceived overall quality of life, dietary habits, and symptoms of depression. Participants included 68 children between the ages of 7-18 *(M* =11.8, *SD* = 3.20*)* along with their guardians at Phoenix City Children's and Family Clinic. Child body image was calculated by subtracting the body image the participant wants from the body image that the participant has on the Child Body Image Scale (CBIS).

Results showed there were statistically significant differences on the guardians' PedsQL emotional subscale (χ^2 (4)=11.2, p = .004), suggesting that the guardians whose children had perceived themselves as overweight were more likely to give low scores for their child's emotional quality of life. However, the child's PedsQL emotional subscale showed no statistically significant differences between the CBIS groups (χ^2 (4) = 3.241, p = .518), suggesting CBIS doesn't affect their emotional quality of life. Guardian's results may be biased by social norms causing assumptions that heavier weight children have a poorer emotional quality of life. A broader understanding of these factors that contribute to perceptions of body image can increase early detection of children at risk for developing dietary issues, emotional issues and physical issues among adolescents.

Title: Use of plant-based protein concentrates as replacement for fishmeal in practical diets for the Pacific white shrimp (*Litopenaeus vannamei*) reared under high stocking density and low salinity conditions

Primary Author (and presenter): Guo, Jingping
Additional Authors: Ying, Huang; Guillaume, Salze; Luke, A. Roy; & Allen, Davis
Department: School of Aquaculture and Aquatic Science
College/School: College of Agriculture

Description:

Two feeding trials were conducted to investigate the effect of replacing fishmeal with a combination of soy and corn protein concentrate (1:1 ratio) on growth performance of the Pacific white shrimp (*Litopenaeus vannamei*) under high stocking density and low salinity conditions. A basal diet containing 200 g/kg fishmeal was systematically reduced (200, 150, 100, 50, 0 g/kg) with protein concentrate on an isonitrogenous basis (D1, D2, D3, D4 and D5, respectively). Additionally, two diets containing 0 or 50 g/kg fishmeal (D6 and D7, respectively) were supplemented with lysine and methionine to evaluate possible limitations in essential amino acids. Each diet was randomly fed to five replicate tanks (15 shrimp per 75 L aquaria) reared in an indoor clear water system (Trial 1), or four replicate circular tanks (100 shrimp per 800 L) reared in outdoor green water system (Trial 2). In trial 1, results indicated a slight decrease in shrimp performance as fishmeal was replaced at the highest levels. At the highest levels of replacement, the supplementation of lysine and methionine to the diet did not result in shifts in survival, growth or FCR albeit it did improve the protein retention efficiency. In trial 2, there were no significant differences in final biomass, survival, final mean weight, weight gain, and protein retention across the tested diets. Results of this study demonstrate that plant-based protein concentrates can be used to replace fishmeal in practical shrimp diet in clear and green water under high stocking density.

Title: Rotating volumetric velocimetry for rotor flows
Primary Author (and presenter): Gururaj, Abbishek
Additional Authors: Moaven, Mahyar; Tan, Puayen, Zu; Thurow, Brian; & Raghav, Vrishank
Department: Aerospace Engineering
College/School: Samuel Ginn College of Engineering

Description:

The aerodynamics over rotors is important in understanding the performance of wind turbines, helicopters, compressor blades and most recently of small unmanned aerial vehicles. The flow over rotors strongly control the performance of rotors and therefore the study of flow over the rotors is of primary importance. However, measurement of the flow over a rotor blade is very challenging especially using state-of-the-art optical laser-based flow diagnostic techniques such as Particle Image Velocimetry (PIV). Conventional PIV techniques are severely limited by their inability to measure the flow in the rotating frame of reference that is needed to comprehensively diagnose the flow over a rotor. Hence, the present work explores a novel rotating frame of reference flow measurement method to study the flow structures over a rotor. By employing a rotating mirror system on the rotor hub and imaging through a plenoptic camera, the challenges experienced by conventional PIV methods are overcome. The poster presents a concept of the feasibility of the novel methodology and some initial calibration results to enable such rotating frame of reference velocimetry measurements.

Title: Determining the nexus between upland and riverine processes in a forested ecosystem
Primary Author (and presenter): Haas, Henrique
Additional Authors: Kalin, Latif; Srivastava, Puneet
Department: School of Forestry and Wildlife Sciences
College/School: College of Agriculture; Samuel Ginn College of Engineering

Description:

The widely used watershed-scale, hydrologic and water quality model, the Soil and Water Assessment Tool (SWAT), has not been extensively tested in forested ecosystems. Forests can cover significant portions of mixed land use/land cover watersheds and can affect water and nutrients cycling. The main goal of this study is to parameterize the SWAT model by improving its plant database using the species-specific-physiologic understanding of pine trees that are dominant in the southeastern US. The improved model's performance is being tested against the default parameterization to assess the effect of improved forest model representation on hydrology and water quality in the Fish River watershed located in coastal Alabama. To understand the impact of forested ecosystems on water resources, we will analyze model outputs of net primary productivity (NPP), evapotranspiration (ET), leaf area index (LAI), and biomass. Observed data will be derived from remote sensing observations and those available from the U.S. Department of Agriculture and U.S. Geological Survey. We anticipate that the improved model parameterization will positively affect process representation of plant canopy, evapotranspiration and biomass production, which will enhance simulation of upland and riverine processes, thus increasing prediction accuracy and decreasing uncertainty of simulated NPP, LAI, ET, stream flows, and water quality variables.

Title: Prostate tumor-on-a-chip model for *in vitro* recapitulation of the native tumor microenvironment and implementation in pre-clinical drug testing
Primary Author (and presenter): Habbit, Nicole L.
Additional Authors: Anbiah, Benjamin; Suresh, Joshita; Anderson, Luke; Hassani, Iman; Eggert, Matthew; Jasper, Shanese; Prabhakarpandian, Balabhaskar; Arnold, Robert; & Lipke, Elizabeth
Department: Chemical Engineering
College/School: Samuel Ginn College of Engineering

Description:

The current likelihood of approval for oncology drugs entering clinical trials is estimated to be only 3.4%. This poor performance can be attributed to the lack of a physiologically relevant drug testing platform that can accurately predict drug efficacy during pre-clinical research. This study reports the development of a microfluidic tumor-on-a-chip model that employs three-dimensional (3D) bioengineered tumor tissue (BioTT) within the primary tumor chamber, surrounded by a microvascular network held under dynamic flow conditions, derived from computerized tomography (CT) images of tumors *in vivo*. Ancillary tumor chambers provide the ability to monitor cancer cell metastasis on-chip either through direct invasion or intravasation and extravasation mechanisms. The *in vitro* BioTT was fabricated utilizing metastatic PC-3 prostate cancer cells and BJ-5ta fibroblasts encapsulated within a poly(ethylene glycol)-fibrinogen (PF) matrix, modulated with varying amounts of excess poly(ethylene glycol)-diacrylate (PEGDA) to stiffen the polymer matrix. BioTT characterization was performed off-chip in macrotissues to ensure the encapsulated cells remained viable and demonstrated characteristic morphology over 29 days in 3D co-culture. Mechanical stiffness quantification was performed on BioTTs, as well as *in vivo* PC-3 tumor samples generated in immunocompromised mice. It was verified that the full range of stiffnesses found in prostate tumors *in vivo* was recapitulated by modulating the polymer matrix composition and culture duration. On-chip perfusion of a fluorescent probe molecule through the endothelialized microvascular network at physiological flow rates demonstrated the ability to achieve differential drug distribution within the BioTT, such as is observed in native tumors. Future studies will investigate the ability of the tumor-on-a-chip model to accurately predict anti-cancer drug efficacy *in vivo* using the known oncolytic agents, doxorubicin and paclitaxel.

Title: Elements of incremental architecture and their applications in a broader context
Primary Author: Hadley, Carter T.
Additional Authors: N/A
Department: Architecture, Planning, and Landscape Architecture
College/School: Architecture, Design, and Construction.

Description:

Incremental Housing describes any housing methodology that is intended to grow over time. Arising from informal squatter settlements, it eventually developed into a wide-spread method of providing low-income housing. Residents buy subsidized plots of land with varying levels of supporting infrastructure, ranging from simple plumbing to an entire structural core. From there, they themselves construct homes, often expanding and improving spaces as their needs change. Often houses that are built in this way become generational assets that gain equity over time. Neighborhoods constructed with this method grow into dense patchworks, with active streets and close communities. While there have been many close studies of the economic success of incremental housing, there have been few studies that examined the architectural elements created with this method. Through a research study conducted across different types of incremental housing sites, the author examined the architectural elements created by incremental housing methodology. As a result of the study, it became clear that these elements may be adopted outside the context of low-income housing. Although, Incremental housing as a design methodology has been relegated to low-income housing thus far, the author contends that it may have significant architectural possibilities even in a wider economic context. In her *Death and Life of Great American Cities*, Jane Jacobs states that the key to a successful city is diversity. More precisely, this diversity is the result of a myriad of contributions by the "unaverage" people in the society. Incremental housing is a methodology that thrives on the "unaverage," regardless of class, functioning as an amalgamation of the occupants' needs, fluidly adapting and constantly changing.

Title: Understanding how to best track staphylococcus aureus (s. Aureus) infections in a murine model by use of fluorescence or photo-acoustic imaging
Primary Author (and presenter): Hall, Ivy M.
Additional Authors: Panizzi, Peter
Department: Drug Discovery and Development
College/School: Harrison School of Pharmacy; College of Science and Mathematics

Based on preliminary studies, *B. amyloiquefaciens* AP183 has the potential to compete with *S. aureus* in a wound for nutrients via competitive exclusion and to protect a highly potent, but short lived anti-microbial compound that has been previously identified as bacillusin A. Preliminary *in vivo* studies have also shown that co-administration of the secondary metabolites and spores of AP183 results in the protection against the dermal MRSA infection in a wound model. The overarching goal of this particular research study is to assess the preclinical benefit of *B. amyloiquefaciens* AP183 therapy for the prevention of murine MRSA endocarditis from an initial dermal infection site by confirming the pathogenesis of the disease. Although studies have shown that the colonization does vary greatly on age, underlying disease, and occupation, the murine model relieves the study of all previously mention factors. To provide significant results, we infected a murine model with MRSA, specifically USA-300R and USA-300F, and then used these models to determine the pathogenesis of the disease through fluorescence imaging and histology. Overall, our studies have found that the USA-300 strain tends to colonize in the following organs: spleen and gallbladder, and lung.

Title: Dispersion microstructure effects on the electrochemical properties of graphene/manganese oxide cryogels

Primary Author (and presenter): Hamade, Fatima A.
Additional Authors: Radich, Emmy J. & Davis, Virginia A.
Department: Chemical Engineering
College/School: Samuel Ginn College of Engineering

Description:

The order of magnitude larger length to diameter ratio of ultra-large graphene oxide (GO) sheets compared to the smaller GO sheets being studied by most researchers (~40,000 compared to ~2,000) enables new opportunities for understanding their self-assembly in dispersions and the potential fabrication of bulk materials with fewer inter-sheet contacts. In addition, the inclusion of 1D transition metal oxides as guest materials to form a sandwich structure with 2D ultra-large reduced graphene oxide (RGO) sheets may provide electrochemical properties that cannot be achieved with either material alone. Therefore, the combination of manganese oxide (MnO_2) nanowires and ultra-large RGO sheets was explored by two methods: a) mixing both dispersions that have been synthesized separately to form a mixture and b) growing the nanowires along the ultra-large GO sheets to form a hybrid material. The pure and multicomponent dispersions were characterized by spectroscopy and microscopy techniques to characterize the materials and gain insight into their dispersion microstructures. The dispersions were then freeze-dried into cyrogels, which are lightweight, 3D solid and porous structures. Comparison of the dispersion morphology, cryogel morphology and electrochemical properties provided insights into the relationships between material type, initial dispersion microstructure and electrode properties.

Title: Molecular mechanisms involved in the chemotherapy-induced cognitive impairment: Designing effective neuroprotective strategies

Primary Author: Hamby, Allis
Additional Authors: Majrashi, Mohammed; Almaghrabi, Mohammed; Ramesh, Sindhu; Desai, Darshini; Moore, Timothy; Pondugula, Satyanarayana; Dhanasekaran, Muralikrishnan
Department: Drug Discovery and Development
College/School: Harrison School of Pharmacy

Description:

Administration of Chemotherapeutics causes severe adverse effects affecting both the central and peripheral nervous system. CNS toxicities such as seizures, drowsiness, tremors, ataxia, disorders, or even comas are commonly observed. Recently, there have been numerous reports of chemotherapy-induced cognitive impairment. Consequently, these adverse effects should always be taken into consideration when starting chemotherapy. The proper assessment of central and peripheral neuropathy and its impact on quality of life should be carefully included in the chemotherapy regimens. Neuroprotective agents should ideally reduce the chemotherapy-induced neurotoxicity without reducing the antitumor effect. Unfortunately, data on neuroprotection in chemotherapy-related peripheral neurotoxicity are still controversial at this time. In this study, we will elucidate the neurotoxic mechanisms associated with chemotherapy-induced cognitive impairment and also the possible neuroprotective agent that can be recommended for standard use in daily clinical practice.

Title: Speaking fundamental frequency differences with familiar versus unfamiliar listeners
Primary Authors (and presenters): Hamby, Hailey & Barnett, Laurin
Additional Authors: Sandage, Mary
Department: Communication Disorders
College/School: College of Liberal Arts

Description:

Voice acoustic measures are used in speech language pathology practices to quantify vocal function in health and disease. The extent to which speaking fundamental frequency (Sf_0) varies by communication partner is not well described in the literature, despite the reliance on Sf_0 as a standard vocal function measure. For this investigation, women were consented for participation during sorority recruitment and were asked to engage in conversation with familiar and unfamiliar communication partners. Vocal dose, based on fundamental frequency and voice sound level, was determined via the Ambulatory Phonation Monitor (PENTAX Medical, Tokyo, Japan). The acoustic signal was captured with use of a vibrotactile microphone. Vocal dose was measured during two trials per participant; one trial for speaking with an unfamiliar listener and the other with a familiar listener. It was hypothesized that Sf_0 will be higher when talking to an unfamiliar communication partner. The information gathered in this study could be beneficial for voice assessments in speech language pathology. When determining a voice disorder, it would be beneficial for the speech pathologist to consider that the fundamental frequency of the client's voice could vary based on the fact that the speech pathologist is at first an unfamiliar listener. Descriptive analyses of the data indicated that fundamental frequency was higher when speaking to an unfamiliar listener, which supported the hypothesis. In this study, the average Sf_0 when talking to familiar listeners was 250.93 Hz, and when speaking to unfamiliar listeners the Sf_0 was 310.07 Hz, resulting in an average difference of 59.13 Hz. This study will be expanded to include additional participants, allowing for a larger sample size enabling statistical analyses. The broader impact of this study may result in a more thorough understanding of the influence of familiar versus unfamiliar listener when quantifying speaking fundamental frequency.

Title: High performance liquid chromatography-UV detection and validation of primaquine phosphate in penguin plasma

Primary Author (and presenter): Hargis, Christina L.
Additional Authors: Cruz-Espindola, Crisanta & Boothe, Dawn
Department: Anatomy, Physiology, and Pharmacology
College/ School: College of Veterinary Medicine

Description:

Primaquine diphosphate (PQ) is an antimalarial drug commonly used to treat and prevent malarial infections in penguin zoo populations. Proper use of antimicrobials should be based on pharmacokinetic studies that support proper dosages for that species. However, no published validated method exists for the quantitation of PQ in penguin plasma. In this study a high performance liquid chromatography method with ultraviolet detection (HPLC-UV) was developed and validated for PQ in penguin plasma. The purpose was to get a method with the best precision and accuracy. Several stationary and mobile phases were tested to determine optimal conditions for analyzing PQ with reverse phase HPLC-UV. Different methods of extraction for PQ in penguin plasma were also tested (solid phase extraction (SP), liquid-liquid (LL), protein precipitation (PP), PP followed by drying with nitrogen (N_2), and PPE followed by incubation then drying with N_2). The PQ extraction in penguin plasma was accomplished with: PP, with a 60 min incubation at 60°C, then dried with N_2. Samples were analyzed by HPLC using a reversed phase C18 column (150mm x 4.6 i.d. x 5 µm), 40°C, and UV absorbance at 264 nm. The mobile phase was 0.1% phosphoric acid in water and methanol, flow rate 0.8 ml/min. The linear coefficient for was 0.99, limit of detection (LOD) 15 ng/ml, and lower limit of quantification (LLOQ) 20 ng/ml. The Precision (CV %) for PQ at 25, 60, 125 and 350 ng/mL was 3.25%, 7.69%, 4.79%, and 8.07% respectively. The Accuracy (% Recovery) for PQ at 25, 60, 125 and 350 ng/mL was 112.66%, 102.86%, 92.64%, and 92.16% respectively. The new validated method is suitable for detection and quantification of PQ in penguin plasma concentrations to help veterinarians accurately dose penguins for the treatment and prevention of malaria in zoo populations, and ultimately establish therapeutic ranges.

Title: Lending a hand to caregivers in need
Primary Author: Harrell, Whitney E.
Additional authors: Howell, Eleanor
College/School: School of Nursing

Description:

There is strong evidence that caregivers (CG) of persons with Alzheimer's disease (AD) experience negative health effects and are at higher risk for CG burden and depression. Evidence-based guidelines recommend all CGs should be screened for CG depression and burden and considered for an intervention program. The purpose of the project is to determine if a structured support program, using education and telephone support, will decrease the rate of burden and depression in CG's of family members with AD. The population of focus includes adults (21 years and older) who are blood or non-blood family CGs of individuals diagnosed with AD at a family practice clinic. Following participant agreement, participants will complete a socio-demographic questionnaire, the Center for Epidemiologic Studies Depression Scale (CES-D) questionnaire, and the Zarit Burden Interview (ZBI) questionnaire to measure CG burden and depression. Participants will receive an education binder (Called to Care), one telephone-based support call at three weeks, and complete both the CES-D and ZBI at six weeks. The project is in progress. Descriptive data will be summarized using frequency statistics. Inferential statistical analyses will be conducted on variables of age, gender, education, and ethnicity. The pre-post mean scores of the CES-D and ZBI will be compared with t-tests (alpha = 0.05). Studies have demonstrated CG interventions may improve rates of CG burden and depression. Early screening can direct program interventions among CGs at this clinic and further implementation of the project is warranted.

Title: Analyzing the effects of tissue geometry on engineered cardiac tissue functionality.
Primary Author (and presenter): Harris, Bryana Nycole
Additional Authors: Ellis, Morgan; Lipke, Elizabeth
Department: Chemical Engineering
College/School: Engineering

Cardiac disease remains one of the major causes of mortality worldwide and can cause myocardial infraction. Research has shown that engineered cardiac tissues can be grafted onto the infracted heart to decrease infraction size and increase cardiac function. Our research group has previously shown the ability to use biomaterials to produce functional engineered cardiac tissues using human induced pluripotent stem cells (hiPSCs) in a microisland geometry. Although this study was successful, the contraction of these tissues often propagated in a circular direction, which is not very indicative of contracting human myocardium. In my research, I investigate whether tissue geometry of the 3D developing engineered cardiac tissues (3D-dECTs) impacts the functionality of the resulting tissue. To do this, I compared three different geometries: a rectangular tissue, a square tissue, and the established microisland geometry. After hiPSC encapsulation and differentiation, a variety of assays where performed to characterize the resulting 3D-dECTs. To track tissue growth post encapsulation, phase contrast images were taken and analyzed using ImageJ. In preliminary encapsulations, comparison of phase contrast images showed tissues with high cell densities and even cell distribution prior to differentiation. After the onset of tissue contraction, videos were taken at various timepoints and analyzed using a motion tracking software to calculate frequency and contraction and relaxation velocities. While this data showed that statistically there was no difference between frequency and velocities, we did see a difference in the directionality of contraction. Rectangular tissues contracted along their longitudinal axis while microislands and squares contracted around the perimeter of the tissue. The ability of engineered cardiac tissues to function at a variety of geometries is promising for studying action potential propagation and future bioprinting applications.

Title: Vocal function in college women during sorority recruitment
Primary Author(s) (and presenter(s)): Harris, M. L., Parker, C. R., Sessions, E. J., Hamby, H., Barnett, L.
Additional authors: Sandage, Mary J.
Department: Communication Disorders
College/School: Liberal Arts

There is limited evidence available that describes the vocal impact of participation in sorority recruitment, an endeavor that culturally requires extensive voice use over a period of about one week. The aim of the current study was to quantify the voice function changes of women before and after participating in sorority recruitment at Auburn University. Measures of vocal function included: perceived phonatory effort (PPE), and changes in the fundamental frequency of speech. Higher PPE, decline in voice quality, and lower fundamental frequency following recruitment were hypothesized.

Eleven sorority recruitment participants, aged 19-21 (avg age 20) with no history of voice disorders, were recruited for this study. Nine completed both the pre and post stages of data collection. Study hypotheses were evidence-supported. Descriptively, speaking fundamental frequency was lower after sorority recruitment. However, statistical analyses of the speaking fundamental frequency data indicated no significant difference between pre and post acoustic measures. Significance was identified for the perceived phonatory effort between pre and post analysis. Since our study is preliminary in nature, further exploration would be beneficial to expand our understanding of voice quality in sorority women.

Title: Exploring adherence to medications using weekly telehealth calls to patients with congestive heart failure

Primary Author (and presenter): Harsha, Mallory B.
Additional Authors: Gibson-Young, Linda
College/School: School of Nursing

Description:

A leading cause of death is congestive heart failure (CHF). Evidence identifying leading cause of CHF complications is medication adherence. Weekly follow-up visits, via telehealth, with a healthcare provider compared to routine yearly visits for CHF patients have been shown to be beneficial to help patients adhere to medication regimens (Ruppar et al., 2016). The purpose of this project is to determine if weekly telehealth follow-ups will improve CHF patient's adherence to medications and improve symptom management. Physicians Pointe primary care clinic was selected, assessed and approved as site to implement a small test of change project. 20 patients will be selected and consented to participate in the STOC. Ten patients will receive standard care and ten will receive standard care in addition to weekly follow-up phone calls where the Moriskey adherence scale and the CHF zone management assessment tools will be utilized during each call to determine adherence and risk of complication. After four weeks of weekly follow-up calls, the data collected by the assessments will be computed and transferred to an Excel spreadsheet for analyzation through SPSS software. Project is currently in progress. Nominal data, resulted by t-results, in the spreadsheet will include the number of CHF meds, number of hospitalizations in the last year, pre- and post- Moriskey scale, pre- and post- CHF zone management score, and pre- and post- weight. Weekly follow-up telehealth for CHF patients in this primary care clinic can potentially improve adherence to medication regimens and increase knowledge of symptom management. Better adherence and symptom management can increase quality of life, decrease hospitalizations from exacerbations, decrease healthcare cost, and decrease the risk of an early death.

Title: Therapeutic effect of non-toxic designer drugs
Primary Author: Harshan, Aisha
Additional Authors: Majrashi, Mohammed; Almaghrabi, Mohammed; Fujihashi, Ayaka; Suppiramaniam, Vishnu; Deruiter, Jack**;** Clark, Randall; & Dhanasekaran, Muralikrishnan
Department: Drug Discovery and Development
College/School: Harrison School of Pharmacy

Description:

Designer drugs are synthetically formulated to mimic the psychostimulatory effects of an original controlled/illegal drug of abuse. Designer drugs have similar chemical structure or functional analog as compared to existing controlled psychostimulatory drugs. Based on the current literature, there are several designer drugs and some of them (TFMPP derivatives) have minimal adverse effects. The non-toxic designer drugs can have therapeutic potential in the future. These drugs have pharmacodynamic effects similar to stimulants allowing their usage in diseases such as fatigue. Therefore, non-toxic designer drugs have significant potential for the treatment of various diseases. Stimulant usage has limitations such as anxiety, Insomnia and addiction. We will explore the therapeutic effects of the non-toxic designer drugs in order to find safe alternative for currently used stimulants.

Title: Regenerative ternary oxide sorbents for long-term CO2 capture at high temperature
Primary Author (and presenter): Hassani, Ehsan
Additional Authors: Oh, Tae-Sik
Department: Chemical Engineering
College/School: Samuel Ginn College of Engineering

Description:

Global climate change presents a constant challenge to humankind. The release of CO_2 to the environment, the main cause of climate change, is greatly exacerbated by industrial activity. Given the damage done by high concentrations of carbon in the atmosphere, it is essential to slow or stop the harmful effects. One way to mitigate this problem is post-combustion CO_2 capture using solid sorbents. Calcium oxide-based materials are economically favorable option due to their abundance and high adsorption capacity. One of the challenges for CaO-based sorbents is the decay that takes place through the carbonation and regeneration cycles. The regeneration of these sorbents can be improved by selecting a good metal as a support to synthesize CaO-based sorbents. In this research, different kind of metals, such as Cu, Mn, and Co will be used to synthesize ternary oxide sorbents in form of $Ca_xM_yO_z$. The effectiveness of the sorbents considering their ability to capture CO_2 and regenerability will be investigated using *in situ* XRD method.

Title: Regenerative ternary oxide sorbents for long-term CO2 capture at high temperature
Primary Author (and presenter): Hassani, Ehsan
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Description:

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Title: Immunization registry implementation in community pharmacy: A qualitative study using the Consolidated Framework for Implementation Research (CFIR)

Primary author (and presenter): Hastings, Tessa J.
Additional authors: Zhao, Yi; Ha, David; Fox, Brent; Qian, Jingjing; Lakin, Joni; Westrick, Salisa
Department: Health Outcomes Research and Policy
College/School: Harrison School of Pharmacy

Description:

Immunization registries, also known as immunization information systems (IIS), facilitate consolidated vaccination data within each state. However many states have limited pharmacy participation, especially Alabama. The purpose of this study is to 1) identify contextual barriers from the Alabama IIS (ImmPRINT) and pharmacist perspectives and 2) identify best practices of IIS representatives and pharmacists in states with high participation rates. Qualitative interviews with pharmacy personnel and IIS representatives were conducted in 2018. 30-60 minute interviews were conducted using open-ended questions informed by the CFIR. All interviews were audio-recorded and transcribed verbatim. Data collection and analysis were conducted simultaneously to identify the saturation point. Deductive coding using the 39 CFIR constructs was used with additional codes created as new, unexpected concepts were revealed. 25 participants (16 pharmacy personnel; 9 IIS representatives) were interviewed. 32 of 39 CFIR constructs were mentioned during interviews and experiences of pharmacy personnel in implementing IIS align well with CFIR domains. Frequently identified constructs among pharmacy personnel include “access to knowledge and information”, “complexity”, “needs and resources of those served by the organization”, “compatibility”, “available resources”, and “peer pressure.” Two constructs that seem to distinguish between Alabama pharmacy personnel and those in other states are “knowledge and beliefs about the innovation” and “external policy and initiatives.” Engagement of “Key Stakeholders” and “External Change Agents” were discussed more frequently among IIS representatives from high participation states. Implementation strategies incorporating an educational component to address pharmacy personnel knowledge and beliefs, as well as support from influential entities such as state boards of pharmacy may help improve IIS participation.

Title: Depth-averaged soil moisture dynamics modeling and assessment
Primary Author (and presenter): He, Junhao
Additional Authors: Latif Kalin; Mohamed
M. Hantush; Sabahattin Isik; & Mehdi Rezaeianzadeh
College/ School: School of Forestry and Wildlife Sciences

Description:

Modeling water movement in variably saturated porous medium is fundamental to environmental research and management. The Richards Equation (RE) has been widely studied and applied in soil physics and hydrologic studies due to its clear physical basis and applicability. However, solving Richard's equation is a challenging process because it is highly nonlinear and computationally demanding. In this study, the depth-averaged approximation of Richards equation (DARE) was obtained for one-dimensional vertical unsaturated flow in the root zone and the vadose soil below. Essentially, the partial differential equation was replaced by two, coupled ordinary differential equations describing depth-averaged soil moisture dynamics in the two soil zones subject to a deep or shallow water table and variable soil moisture flux and pressure conditions at the surface. DARE was assessed for three uniform soil textures and contrasting sand/clay soil texture combinations for two-layer soil profile subject to different fluxes and prescribed pressure conditions at the soil surface combined with water-table and free-drainage bottom boundary conditions. The numerical results were compared with HYDRUS-1D model as a benchmark. Results showed that, in general, DARE predicted average soil moisture contents under these different bottom and top boundary conditions matched well with HYDRUS-1D predicted results. DARE showed higher stability than HYDRUS-1D in sand/clay combination simulations. The overarching goal of this study is to develop a numerically stable and efficient module for field and watershed-scale soil moisture simulations.

Title: Edge computing: Moving cloud computing to IoT devices
Primary Author (and presenter): Heckwolf, Thomas
Additional Authors: Kauten, Christina & Zhang, Chaowei
Department: Computer Science and Software Engineering
College/School: Samuel Ginn College of Engineering

Description:

Cloud computing is one of the most common technology terms mentioned with modern computing. We send our request into the cloud, have it process the request, and retrieve our desired results. The cloud is typically a collection of servers that ingests our data using a pool of resources to perform computations, reassembly, and delivery of the computed data back to our original machine. The cloud has converted calculation of large data into a simple request. However, a drawback of cloud computing is the price of the resources, be it the price per computing time, the actual cost of the equipment, or the amount of energy that these servers in modern datacenters use to perform computing. The IoT device emergence has created the advent of a new computing technology known as edge computing. Edge computing attacks the computing problem in a distinctive aspect by bringing the computational power to the IoT devices (a.k.a., the edge). While IoT devices are usually limited resource devices, we are able to combat these limitations by the sheer number of devices. An added benefit of edge computing is the smaller price per unit of the devices along with other benefits of reducing size and energy consumption. Our approach to edge computing is a simple yet effective solution. Cloud and Edge computing both have to pool resources and segment the data for computation and reassembly which is like a decentralized network. Our approach to creating an edge computing platform is comprised of three steps. First, utilizing the power behind one of today's hottest cryptocurrencies Ethereum, we utilize their decentralized network approach and create a custom hybrid blockchain based off of the platform that can run on IoT devices. Second, utilizing our custom blockchain application, we send segments of data to devices for computation. Our initial approach will be simple calculations to cross validate, correct, disassemble, and reassemble the data packets. Third, we add more devices to increase the computational aspect of the network. Once validation of computational power is verified, we introduce tougher known computational problems into the network. Finally, we cross validate our edge computing platform against a simple cloud computing platform to investigate pliability of the edge computing platform.

Title: First principles study of magnetoresistance in CrI3-graphene tunneling junctions
Primary Author (and presenter): Heath, Jonathan J.
Additional Author: Kuroda, Marcelo A.
Department: Physics
College/School: College of Sciences and Mathematics

Description:

Recently, spin transport was demonstrated in heterostructures based on two-dimensional (2D) materials. Here we characterize electronic transport through multilayer CrI3 systems (monolayer, bilayer, and trilayer) using the density functional theory (DFT) and the Landauer formalism for ballistic transport. These ballistic transport calculations are able to yield magnetoresistance values in graphene/CrI3/graphene in agreement with experiments [Klein et al., Science 360, 1218 (2018)]. The electronic band structures, both real and complex, of these tunneling junctions reveal that the interplay between quantum confinement and metamagnetic configurations defines the different tunneling rates. Hence, atomistic calculations capturing weak interlayer interactions are vital to these descriptions, effects simple spin filter models forego. The atomistic details provided by this work may prove valuable towards the use of these 2D material-based spintronic devices.

Title: Immunolocalization of gonadotropin-releasing hormone in pituitary gonadotrope cells
Primary Author (and presenter): Heath, Margaret A.
Additional Authors: Cochran, Ann, Mackay, Laci, Faradori, Chad, Samoylova, Tatiana
Department: Pathobiology; Anatomy, Physiology and Pharmacology
College/ School: Veterinary Medicine

Gonadotropin-releasing hormone (GnRH) is a hypothalamic decapeptide that specifically binds to the GnRH receptor on gonadotrope cells in the pituitary gland. Through binding to this receptor, GnRH regulates synthesis and secretion of pituitary gonadotropins that are essential for gametogenesis and synthesis of gonadal steroids crucial for animal reproduction. Although the role of GnRH in non-hypothalamic tissues remains largely unknown, its mRNA and/or protein expression in these tissues has been reported previously. One study (*Krsmanovic et al., Endocrinology 2000, 141, 1187-1195*) demonstrated the presence of GnRH mRNA and protein in cells of the pituitary gland using RT PCR or quantitative radioimmunoassay, respectfully. The goal of this study was to use immunocytochemistry to prove GnRH protein expression in alphaT3-1 cells, which are immortalized pituitary gonadotropes. First, the immunostaining protocol was optimized with respect to primary antibody used for GnRH detection. At equal dilutions, Abcam GnRH antibody (cat #16216) demonstrated significantly stronger staining compared to other GnRH antibodies (Abcam cat #24563 and QED Bioscience cat #19304). Second, the protocol was optimized with respect to two positive controls: (1) cultured GT1-7 neurons available commercially from Sigma-Aldrich, and (2) cat brain sections that included hypothalamus. While we obtained strong and consistent staining of GnRH neurons in cat brain tissue, staining of cultured GT1-7 neurons varied, depending on cell passage and cell lot. This precluded the further use of GT1-7 cells as positive control for GnRH immunolocalization. The optimized protocol was used to detect GnRH in alphaT3-1 gonadotrope cells. These cells were found to express low level of GnRH protein in their cytoplasm. This study was a part of an ongoing project focusing on GnRH gene delivery to cat pituitaries for contraception of feral cats.

Title: Snake news!: road-based survey effectiveness in Everglades National Park
Primary Author: Heptinstall, Tucker C.
Additional Authors: Miller, Melissa; Romagosa, Christina; Gitzen, Robert
Department: Forestry and Wildlife Sciences
College/School: School of Forestry and Wildlife Sciences

In ecosystems of the southeastern US, snakes are a highly diverse and ecologically important wildlife group. While many snake species in the region are of high conservation interest, snakes are difficult to monitor due to their cryptic habits. Road-cruising surveys are a valuable method for detecting snakes in natural history studies, but researchers have raised concerns about the effectiveness of road surveys for rigorous monitoring due to the low rate of detecting snakes present in a study area. We are examining survey effectiveness using a data set from Everglades National Park. Over a 17-month period, we conducted 90 nocturnal road-cruising surveys over a 14 km paved-road route in Everglades National Park. We recorded 528 total detections of 17 native snake species and one non-native snake species (Burmese Python). The most commonly detected species included the Florida water snake (147 detections), cottonmouth (124 detections), and Eastern ribbon Snake (54 detections). Six species were represented by 5 or fewer detections each, including the Eastern diamondback rattlesnake (5 detections), ringneck snake (4 detections), rat snake (5 detections), striped crayfish snake (4 detections), Florida kingsnake (3 detections), and rough green snake (1 detection). We did not detect 7 species previously confirmed in the park. Such species may not have been present in the limited portion of the park covered by our survey route. However, survey effectiveness for many of the 18 observed species was low. Therefore, other survey methods may be needed along with, or in place of, road-cruising surveys to effectively monitor this community.

Title: Assessing contractility of engineered cardiac tissue with optical flow software

Primary Author (and presenter): Hicks, Emma E.
Additional Authors: Ellis, Morgan; Finklea, Ferdous; Lipke, Elizabeth
Department: Department of Chemical Engineering
College/School: Samuel Ginn College of Engineering

Cardiovascular disease (CVD) is responsible for 1 out of every 4 deaths in the United States. Current methods of studying CVD are restricted due to the inability to culture adult cardiomyocytes *in vitro*. Advancements in regenerative medicine and tissue engineering have enabled the reprogramming of somatic cells to form human induced pluripotent stem cells (hiPSCs) which can be differentiated into all three germ layers. Currently in our lab, we encapsulate hiPSCs in a biomaterial for direct differentiation to form engineered cardiac tissue (ECT). ECT functionality is assessed using a variety of assays including video-based contraction analysis. This project focuses on evaluating the contraction magnitude, frequency, and directionality of different ECT geometries including microislands, squares, rectangles, and microspheres. In order to measure how well these models work, a software was developed that analyzes the contraction of *in vitro* ECT. Using a MATLAB Graphical User Interface (GUI), the software detects the pattern of motion in 2X or 10X contraction videos using optical flow methods specialized for stem-cell derived cardiomyocytes. These videos are converted into .tiff files and the code assigns macroblocks to the pixels in order to track movement. Regions of interest are chosen in tissue videos to find local measurements that are compiled to find a global frequency and velocity. Amplitude-based, vector-based, and frequency-domain cleaning of the contraction traces can also be used to reduce noise for the tissues that are free-floating or extraneously moving. I have improved this software and developed a protocol for collecting and organizing contraction analysis data that benefits a variety of ECT project types. With this protocol, I have analyzed over 1,000 tissue regions for local and global contraction analysis of ECTs and have succinctly tagged them for straightforward data identification and presentation.

Title: Improving knowledge of and attitudes towards safe-sleep practices
Primary author (and presenter): Hill, Hannah L.
Additional author: Watts, Sarah O.
College/ School: School of Nursing

Description:

There is strong evidence to suggest that non-adherence to evidence-based guidelines established by the AAP, contributes to the sudden and unexpected death of more than 3,500 infants per year who are less than one year of age. Risk-related practices and lack of education for vulnerable populations are essential focal points for preventing sleep-related infant injuries. Current studies have shown that despite implementation of national and statewide safe-sleep campaigns, caregivers continue to lack the necessary knowledge to implement safe-sleep measures for newborns. The purpose of this project is to improve caregiver knowledge concerning safe-sleep practice recommendations and decrease risk for sleep-related infant injuries. The target population included adults (18 years or older) who are caring for a newborn. Following participant agreement, participants completed a safe-sleep assessment. Participants also received an educational tool. A follow-up phone call at 4-6 weeks was made to assess safe-sleep knowledge and behaviors as well as caregiver adherence to safe-sleep practice recommendations. The project is in progress. Descriptive statistics will be used to describe age, ethnicity, gender, level of education, relation to newborn, number of children in the home (including newborn child), and whether or not federal assistance is collected. Follow-up data will include number and percent who adhered to recommendations. Pre- and post-test results will reflect a score of knowledge and behaviors concerning safe-sleep. These scores will be compared with paired t-tests (alpha=0.05). Refining communicative and educational techniques with caregivers in the primary care setting, can assist in identifying behavioral risks and gaps in knowledge to further guide sleep-safety education to prevent risk of sleep-related infant injury. Strengthening understanding and modifying behavioral risk among caregivers to prevent sleep-related infant injury is not only possible, but pertinent in this clinical setting and further implementation of the project is warranted.

Title: Improved management of atrial fibrillation in the prevention of stroke
Primary Author (and presenter): Hill, Nancy C.
Additional Authors: Ellison, Kathy
College/School Name: School of Nursing

Description:

A review of evidence reveals that uncontrolled atrial fibrillation is a significant risk factor for stroke. Evidence-based guidelines recommend follow-up telephone calls and patient education to increase compliance with medications, decrease the risks for stroke, and decrease readmissions. The purpose of this project is to improve the management of atrial fibrillation and decrease the risks for stroke. The participants are adult patients (20-90 years) in a rural area who are discharged from the hospital with atrial fibrillation. The patient's medication list is reviewed at discharge for atrial fibrillation medications, and the physician is consulted if needed for consideration of an atrial fibrillation medication. A telephone call is made to the patient after discharge to ensure that prescriptions were filled, assess medication compliance utilizing the Morisky Medication Adherence Scale, ensure that a follow-up appointment has been scheduled, and provide education on atrial fibrillation and prescribed medications. A second telephone call is made to the patient after the follow-up appointment. The project is currently in progress. The results will be reported using descriptive and inferential statistics. The evaluation of the project will include a description of the population, a comparison of the scores from the Morisky Medication Adherence Scale using paired t-tests (alpha=0.05), a comparison of the percentage of patients that follow-up with the physician prior to and post implementation of the project, and the number of patient readmissions related to atrial fibrillation and stroke. Follow-up telephone calls and patient education improves the management of atrial fibrillation, decreases the risks for stroke, and decreases readmissions. The interventions of the project are achievable in rural primary care clinics and do improve the management of atrial fibrillation in the prevention of stroke.

Title: Renewable nanosized carbon fiber production
Primary Author (and presenter): Hinkle, John A.
Additional Authors: Bansode, Archana; Kanungo, Rohit; Tcherbi-Narteh, Alfred; Elder, Thomas; Auad, Maria
Department: Chemical Engineering
College/School: Samuel Ginn College of Engineering

Description:

Most carbon fiber is produced using polyacrylonitrile, which is a byproduct of oil refinery. Due to the increased use of carbon fiber in multiple industries, a renewable method of carbon fiber production is needed. Lignin is a potential alternative to polyacrylonitrile for carbon fiber production. It is a byproduct from the pulp and paper industry that is typically burnt for fuel. However, due to the abundance of aromatic groups, lignin can be used to produce valuable products, such as vanillin or carbon fiber.During our research, we produced carbon nanofiber from Indulin AT, a softwood kraft lignin. The Indulin AT was first processed into lignin fibers with thermoplastic polyurethane and dimethylformaldehyde. These lignin fibers were produced through different methods, such as electrospinning and centrifugal spinning. The fibers that were then carbonized to produce the nanosized carbon fiber. Different characterization methods were used to analyse the carbon fiber, such as the scanning electron microscope and Raman spectroscopy.

Title: Relationship of glove arm elbow flexion with pitch velocity in youth baseball pitchers
Primary Author (and presenter): Hoesley, Adam J.
Additional Authors: Barfield, Jeff & Oliver, Gretchen
Department: Kinesiology
College/School: College of Education

Description:

Previous research analyzing glove arm (GA) kinematics and pitch velocity only focused on the GA shoulder. However, a common GA motion highlighted by baseball coaches is GA elbow flexion. The purpose of this study was to investigate the relationship of GA elbow flexion with pitch velocity in youth baseball pitching. Twenty-eight right-handed youth male baseball pitchers (13.5 ± 2.0 years; 167.7 ± 15.3 cm; 62.8 ± 13.0 kg; experience, 7.3 ± 2.7 years) each threw three fastballs to a catcher while an electromagnetic tracking system collected kinematic data at 100 Hz. Data from the fastest of the three pitches were used for analysis. Normality was analyzed using a Shapiro-Wilk test of normality. Since data did not meet the assumption of normality, a Spearman rank order test was used to determine if a relationship exist between GA elbow flexion at the events of foot contact (FC), shoulder maximum external rotation (MER), ball release (BR), and shoulder maximum internal rotation (MIR) with pitch velocity. The spearman rank-order test showed no significant relationship between glove arm elbow flexion and pitch velocity, FC ($r_s[28]=0.36$, $P=0.060$), MER ($r_s[28]=0.29$, $P=0.139$), BR ($r_s[28]=0.15$, $P=0.452$), and MIR ($r_s[28]=0.11$, $P=0.595$). These findings suggest that GA elbow flexion does not have a relationship with pitch velocity. While focusing on GA elbow flexion may be a coaching cue that helps pitchers with ball control, this variable alone should not be considered for performance enhancement. Limitations on this study include that only elbow flexion was analyzed to determine a relationship of a GA kinematics with pitch velocity. Another limitation includes all data being collected in a laboratory setting, which does not fully simulate game conditions. Future studies should consider more GA variables, such as shoulder horizontal abduction and shoulder flexion, to further investigate the relationship between GA kinematics and pitch velocity.

Title: Extra virgin olive oil as a medical food enhances donepezil effect against Alzheimer's disease

Primary Author (and presenter): Hoffman, Grace E.
Additional Authors: Batarseh, Yazan; Brannen, Andrew; & Kaddoumi, Amal
Department: Drug Discovery and Development
College/School: Harrison School of Pharmacy

Description:

Alzheimer's disease (AD) is a progressive disease of neurodegeneration resulting in memory loss and eventually, the inability to perform daily tasks. A person's genetic makeup combined with lifestyle and environmental factors may contribute to an increased risk for developing toxic changes in the brain, which occur over the course of decades, and ultimately lead to AD. Although the U.S. Food and Drug Administration (FDA) has approved medications indicated for symptom relief, this debilitating disease does not have a cure. Multiple studies have shown the benefits of selecting Mediterranean diet foods, including staple, extra virgin olive oil (EVOO) consumption on the cognitive function in humans. EVOO contains neuroprotective polyphenolic molecules such as oleocanthal (OC) which has been shown to improve cognition by reducing amyloid-beta and enhancing blood-brain barrier tightness, two of the hallmark pathologies of AD. In our lab, in-vivo studies dosing OC-rich EVOO vs placebo in transgenic mouse models of AD were performed to evaluate the therapeutic effectiveness of OC-rich EVOO. Through recent grant funding, our lab plans to transition
OC drug development into future human clinical trials. Of the limited medications currently in use for AD symptom relief, donepezil is an acetylcholinesterase inhibitor that while temporarily improving alertness and memory, will eventually lose effectiveness and lacks the ability to slow disease progression. Donepezil alone has limited capacity to reduce Aβ plaques, however when used in combination with OC-rich EVOO consumption, responses in 5xFAD-AD model mice showed reduced Aβ through increased clearance, shifting of amyloid precursor protein towards non-amyloidogenic pathway and increased blood-brain barrier tightness resulting in decreased AD pathology. Practitioners can utilize the neuroprotective benefits of the OC-rich EVOO containing Mediterranean diet to treat patients adjunctively to prescribed medications against AD.

Title: Empowering community pharmacists to prevent opioid overdose deaths: a qualitative study exploring pharmacists' needs, attitudes, barriers, and implementation strategies regarding pharmacy-based naloxone services

Primary Author (and presenter): Hohmann, Lindsey A.
Additional Authors: Diggs, Kavon; Fox, Brent; Garza, Kimberly; Wang, Chih-Hsuan; Curran, Geoffrey; & Westrick, Salisa
Department: Health Outcomes Research and Policy
College/School: Harrison School of Pharmacy

Description:

Given that opioid misuse is a major public health issue in the United States, this study aimed to explore community pharmacists' attitudes, training needs, barriers, current practices, and experts' best strategies regarding implementation of pharmacy-based naloxone services. Semi-structured telephone interviews with community pharmacists from eight Alabama counties with highest opioid death rates were conducted to explore attitudes, training needs, barriers, and current implementation strategies. Opioid/naloxone experts were interviewed to compare current practices to recommended strategies. Participants were purposively recruited and interviews continued until saturation. Interviews were audio-recorded and transcribed verbatim, and transcripts were analyzed by two independent researchers using open coding and thematic analysis. Peer debriefing ensured credibility, with inter-coder reliability assessed using Krippendorff's alpha ($\geq$0.70). Saturation was reached at 16 interviews (10 pharmacists, 6 experts). The majority of pharmacists were white (80.0%) and worked in independently-owned pharmacies (80.0%). Regarding pharmacists' attitudes and educational needs, most frequently cited themes included support for pharmacy-based naloxone services but misinformation regarding naloxone basics. Common barriers included perceived patient resistance and uncertainty in how to communicate with patients about receiving naloxone. Successful naloxone service strategies currently implemented by pharmacists included using safety-centered language and marketing the service via in-store advertisements like bag-stuffers and flyers. These strategies aligned with experts' recommendations. However, practicing community pharmacists more often employed individualized approaches to identify eligible patients, while experts recommended a universal approach. Findings will be used to inform the development of a practical naloxone training program for community pharmacists in Alabama.

Title: Patient preferences for features of community-based fall prevention programs: a systematic literature review and qualitative meta-synthesis

Primary Author (and presenter): Hohmann, Natalie S.
Additional Authors: Qian, Jingjing; Westrick, Salisa; Hunt, Caralise; Hincapie, Ana; & Garza, Kimberly B.
Department: Health Outcomes Research and Policy
College/School: Harrison School of Pharmacy

Description:

Evidence-based fall prevention programs for older adults exist in community settings, but remain under-utilized. Incorporating patient values into the design and evaluation of Community-based Fall Prevention (CFP) programs may increase patient engagement and program utilization. The purpose of this study was to explore older adults' preferences for design elements of CFP programs. A systematic literature review and qualitative meta-synthesis was conducted from July to September 2018. PubMed, CINAHL, PsycINFO, ERIC, and ClinicalTrials.gov were searched to find peer-reviewed, English-language articles published between 2008-2018 that met these criteria: 1) qualitative, quantitative, or mixed-method design; 2) patients at least 65 years of age; 3) focus on fall prevention programs; 4) program takes place in a community setting; 5) includes patient preferences for design elements of CFP programs; 6) ability to extract results. An inductive coding approach with open and in-vivo coding of article Results sections was used to identify preferred CFP program features. A total of 56 out of 1,086 articles were retained, representing 17,361 older adults. Features that influenced older adults' decision to participate in CFP programs included cost, perceived program efficacy, session frequency, setting, extra features such as consultations with a home safety expert, session length, program duration, and level of exercise difficulty. Social interaction, need for transportation, and referral from providers were also important aspects. Older adults' preferences for a specific number of program sessions and out-of-pocket program cost were unclear. Older adults prefer CFP programs that incorporate social interaction and fit into their daily routines. However, the optimal combination of CFP program features needed to improve older adults' willingness to participate, and how this varies among specific types of older adults, is unclear.

Title: Modeling of photosynthetic aeration for energy efficient wastewater treatment
Primary Author (and presenter): Holmes, Bryan L.
Additional Authors: Higgins, Brendan
Department: Biosystems Engineering
College/School: Samuel Ginn College of Engineering
Description:

Wastewater treatment is an energy-demanding process with one of the main contributors to energy usage being the intensive aeration that aerobic bacteria require in order to break down organic materials. Little research has been done to assess the effectiveness of utilizing photosynthetic aeration sourced from algal microorganisms. Because algae are known to produce large amounts of dissolved oxygen in water, our hypothesis was that their implementation would reduce the need for mechanical aeration. The objectives of this project were to quantify the effects that algae have on wastewater oxygenation and the productivity of wastewater bacteria. In order to accomplish these goals, a simplified model of a wastewater treatment process was developed that consisted of a model bacterial organism (E.coli) and a single carbon source (succinate) that was consumable by bacteria only. This system was then tested both with and without the presence of algae while monitoring the dissolved oxygen, dissolved carbon dioxide, and organic content over time. The collected experimental data was then analyzed using a model that quantifies microbial gas production and organic carbon consumption. The results indicated that algae stimulated faster consumption of succinate by bacteria. This was likely driven in part by oxygen provision from algal photosynthesis. Dissolved oxygen levels initially depleted in all cultures but recovered 33% faster when algae were present compared to bacteria alone. Analysis of organic acids also indicated that more acetic acid, an anaerobic bi-product, was produced in cultures with bacteria than those with algae. This work confirms that photosynthetic oxygen facilitates breakdown of organics by bacteria. Further study could lead to a more energy efficient approach to wastewater treatment.

Title: Curing kinetics for copolymer using DSC
Primary Author (and presenter): Hou, Xinyu
Additional Authors: Beckingham, Bryan S.; Minkler, Michael J.
Department: Chemical Engineering
College/School: Engineering

In the petroleum industry, new and unconventional ways to extracts hydrocarbons (e.g. hydraulic fracturing, enhanced oil recovery, geologic CO_2 sequestration, compressed air energy storage) have greatly increased the number of subsurface well systems. The integrity of these wellbores is a serious problem for both operating and abandoned wells. Hydrocarbon, brine, and other injected components can leak from these wells posing a significant risk to overlying resources, including drinking water, and the health of humans and surface environments. Here, we're investing the properties of a polymer system aimed at healing these leakage pathways. In particular, we examine a four component system consisting of two monomers, a cross-linker and a catalyst. Of interest is understanding the curing processes as it provides thermodynamic information about the reaction kinetics of the polymerization. In this research, the curing kinetics is examined by monitored the change in enthalpy over time by differential scanning calorimetry (DSC). The curing is examined both isothermal and non-isothermal curing. Then the reaction kinetic parameters and the cure behavior of the polymer are determined from the data collected. The relationship between the degree of cure and time is determined. From the data analysis, the curing processes is faster at higher temperature as the higher temperature accelerates the reaction rate. At the lower temperature, the curing process is not completely completed. Thus, the residual heat of reaction would be detected. The lower the temperature is, the more residual heat of reaction. For different isothermal trials, the heat of reaction is similar. During the non-isothermal process, the peak temperature increases as the heating rate increases.

Title: Development of a small-scale flume reactor for benthic filamentous algae colonization studies

Primary Author (and presenter): Howell, Rachel, P.
Additional Authors: Blersch, David
Department: Biosystems Engineering
College/School: Engineering

Benthic filamentous algae, when attached to a substrate under running water, are capable of removing excess nutrients and other pollutants from the water. Different combinations of substrate characteristics may select for certain species of algae over others. However, algal growth is also dependent on environmental factors like water temperature and flow velocity. Therefore, successful attachment experiments require control over not only the substrate, but the surrounding water. This study explores the use of small hydrodynamic flume reactors to conduct controlled and replicable surface attachment experiments on the algae *Oedogonium*. Each reactor is an enclosed system that repeatedly cycles water over a test section, maintaining consistent flow characteristics to ensure that *Oedogonium* attachment depends on the characteristics of the substrate alone. Substrate tiles of various surface characteristics were inserted into the test sections and exposed to a culture of *Oedogonium* for 48 hours. The tiles were then analyzed microscopically to determine algal cell attachment rates and colonization patterns in relation to surface topographic features. The results show that *Oedogonium* prefer to attach to a small range of surface substrate topographic features. These findings demonstrate that engineered substrates can be used to select for desirable species of algae, a promising sign for phytoremediation and wastewater treatment applications.

Title: Using post polymerization click-chemistry approaches to incorporate magnetic properties within polymer structures towards MRI contrast agents
Primary Author (and presenter): Hu, Mengyang (Claudia)
Additional Authors: Beckingham, Bryan S. & Minkler, Michael J.
Department: Chemical Engineering
College/School: Samuel Ginn College of Engineering

Description:

Magnetic resonance imaging (MRI) is one of the most commonly used modalities in clinical diagnostics. To achieve the evolution of MRI as a high-resolution and noninvasive clinically important imaging modality, development on new and better MRI contrast agents has been an active area of research. The overall goal of this research is to determine if post-polymerization click-chemistry approaches can be applied to incorporate magnetic properties within polymer structures to prepare polymeric T1/T2 MRI contrast agents. Currently, Gd(III) complexes are the dominant contrast agent used in clinical settings because of gadolinium's ability to alter or manipulate T_1 relaxation times. Unfortunately, despite the favorable magnetic behavior, Gd(III) complexes are highly toxic for human bodies. This research could potentially provide alternative contrast agents with reduced costs and toxicity. The synthesis of these polymeric systems through a series of click chemistry reactions, NMR spectra analyses, and magnetic susceptibility data obtained via SQUID analysis produced in this work will provide less toxic and tunable T1/T2 contrast agents. We synthesize a histamine thiol (N-(2-(1H-imidizol-4-yl)ethyl)-4-mercaptobutanamide, through the reaction of histamine and thiobutyrolactone. This histamine-thiol is then isolated and product purity confirmed using 1H NMR spectroscopy. Once isolated a histamine-functionalized polyisoprene was synthesized through thiol-ene click chemistry between the histamine-thiol and pendant allyl groups on polyisoprene. 1H NMR spectra of the reactants and products were obtained and compared for analysis of successful polymer modification. The products will also be characterized using differential scanning calorimetry (DSC) to examine changes to thermal behavior, and NMR spectroscopy and SQUID (superconducting quantum interference device) analysis to investigate the magnetic-response properties.

Title: Improving polymer-modified asphalt by changing the characteristic of SBS using click chemistry.
Primary Author (and presenter): Huang, Tina
Additional Authors: Dobyns, Breanna M.; Beckingham; Bryan S.
Department: Chemical Engineering
College/School: Engineering

The increase of vehicles on the road has shortened the lifespan of roads. The permanent strain in asphalt, including rutting and cracking, can make driving rough and dangerous. In addition, the cost of maintaining roads increases with the increasing traffic load and distressed asphalt. The need for polymer-modified asphalt is now at the forefront because it is more durable, has higher stiffness, and stronger cracking resistance. The poor solubility of polymers and separation of asphalt-polymer mixtures are some of the current difficulties of polymer-modified asphalt. Polystyrene-*block*-polybutadiene-*block*-polystyrene (SBS) triblock copolymer is an ideal polymer because it is a thermoplastic elastomer with both glass-like and rubber-like properties. SBS has already been used to modify asphalt and as a result, there is improved heat resistance, elasticity, and higher strength. However, it has several negative characteristics. The polarity difference between SBS and asphalt make storage stability unsatisfactory such that it must be produced on-demand for immediate use. Production costs can increase drastically if construction was delayed and the polymer-asphalt mixture becomes unusable. In addition, bulk production of the polymer-asphalt mixture is currently unavailable due to its lack of storage stability.

My research plan is to modify SBS with different functional groups to improve the miscibility and stability of polymer-asphalt mixtures. This will be achieved using a thiol-ene radical addition reaction (i.e. using ‘click chemistry’). Click chemistries are highly selective reactions that have high yield with very little to no by-products. The product from this reaction will be isolated and fully characterized with nuclear magnetic resonance (NMR), gel permeation chromatography (GPC) and differential scanning calorimetry (DSC). Its stability and mechanical properties will be tested in collaboration with the National Center of Asphalt Technology.

Title: Characterization of tetradentate Schiff-base ligands and their uranyl complexes
Primary Author (Presenter): Hunter, Katherine M.
Additional Authors: Niklas, Julie; Gorden, Anne.
Department: Department of Chemistry and Biochemistry
College/School: College of Sciences and Mathematics

The fundamental chemical behaviors of the actinides, in particular that of uranium, are relevant to improving methods for nuclear waste remediation and storage, but unfortunately, this chemistry is still relatively poorly described. Redox-active ligands have been used widely in transition metal chemistry and catalysis, and can provide a useful framework to examine the electronic and bonding properties of metal centers; however, uranium and uranyl (UO_2^{2+}) complexes such as these are rare. Schiff base ligands, which contain the redox-active diimine fragment (R—N=C—C=N—R) have been commonly used in coordination chemistry and catalysis with transition metals like iron, copper, and manganese. The redox-active Schiff base ligands "phen-BIAN" (N,N'-bis(iminophenol)acenaphthene), along with a binding pocket analog "gbha" (glyoxal bis(2-hydroxyanil)), have been synthesized to compare the behaviors of these new ligand types when complexed with uranium as the uranyl cation (UO_2^{2+}). Here, these new coordination complexes are compared both structurally and by means of detailed analysis of their electrochemical profile.

Title: Trends and factors associated with asthma among U.S. prostate cancer patients in 2007-2014

Primary Author (and presenter): Huo, Nan[1]
Additional Authors: Chou, Chiahung[1]; Garza, Kimberly B.[1]; Zeng, Peng[2]; & Qian, Jingjing[1]
Department: Health Outcomes Research and Policy; [2]Mathematics and Statistics
College/ School: [1]Harrison School of Pharmacy; [2]College of Sciences and Mathematics

Description:

To examine trends in asthma among prostate cancer patients and their treatment patterns, and to identify factors associated with asthma among prostate cancer patients. A retrospective, cohort analysis was used to identify newly diagnosed prostate cancer patients (n=107,285) from the 2007-2014 Surveillance, Epidemiology, and End Results (SEER)-Medicare database. Prostate cancer patients were identified as primary site cancer by using ICD-9 Code (185) and ICD-O site code (619). Asthma was identified using ICD-9 codes (493) and the 'Asthma First Ever Occurrence Date' flag. Prostate cancer and asthma treatments were examined in 12 months post-index period. Simple linear regression models were applied to test annual prevalence trends in asthma among control and comparison group. Multivariable logistic regression model was used to identify factors associated with asthma among prostate cancer patients. Statistical significance was set at $P<0.05$. Annually, about 17% of prostate cancer patients had asthma comparing with 15% in non-cancer patients from 2007 to 2014. The annual trend in prevalence of asthma was stable (trend $P=0.61$). The top three prostate cancer management in the 1st year after cancer diagnosis were Active Surveillance (14.01% VS. 17.15%), ADT only (29.74% vs. 24.01%), and ADT plus surgery (8.91% vs. 11.74%) in asthma and non-asthma group, respectively. The most frequently used asthma treatment was inhaled corticosteroids (65.58% vs. 79.23%) both in cancer and non-cancer group, respectively. Prostate cancer patients with asthma were more likely to be older, non-Hispanic black, not married, in stage IV prostate cancer, and with two and more comorbidities. This study identified stable trend in comorbid asthma among U.S. prostate cancer patients. Understanding burden of and factors associated with asthma helps practitioners better identify patient's needs and improve clinical decision making in treatment.

Title: Improving medication adherence in older adults with low health literacy
Primary Author (and presenter): Hurst, Erin C.
Additional Authors: Howell, Eleanor
College/School: School of Nursing
Description:

Medication nonadherence is prevalent in all age groups, and is most predominate in older adults. Low health literacy (HL) is a known contributing factor to medication nonadherence and 50% of older adults have basic or below basic HL levels. Evidence-based recommendations for improving adherence include customized education and formal HL assessments. The purpose of this project is to assess medication adherence rates in older adults who receive customized medication lists. The target population is adults, 65 years or older, who are prescribed at least two cardiac medications. After a participation agreement was obtained, a formal HL assessment was conducted. Participants completed the Morisky Medication Adherence Scale (MMAS-4_ and a self-assessment of medication adherence. Participants received a customized medication list using patient-preferred terminology for drug names and dosages. Additional data on adherence and HL will be collected during the follow-up phone calls at three- and six-weeks. This project is in progress. The target population will be described in terms of age, gender, educational level, number of chronic conditions, and number of medications. Ordinal data include MMAS-4 scores and self-assessment of adherence at baseline, 3-weeks, and 6-weeks, and HL levels at baseline and 6-weeks. Adherence and HL scores will be compared using dependent T-tests. Medication nonadherence and low HL are both significant issues in the elderly, and can lead to detrimental health outcomes. This project will assess if formal HL evaluations and customized medication lists affect the medication adherence of older adults. The results may indicate if wider implementation of this small test of change is warranted.

Title: Group treatment outcomes in trauma exposed youth
Primary Author (and presenter): Hurston, Sarah, R.
Additional Authors: Thompson, Kelli, Dr. Copeland, Lucas
Department: Psychology
College/School: Liberal arts

An overwhelming majority of detained youth report experiencing some form of lifetime trauma (Abram et al. 2007). Adolescents who have been adjudicated for illegal sexual behavior have shown significantly more trauma exposure when compared to adolescents adjudicated for general delinquent behavior (Seto & Lalumiere, 2010). Thus, effective treatment programs for these youth should address developing skills to deal with the negative emotions associated with trauma. Core-4 is a trauma-focused cognitive behavioral therapy group that helps educate and build resiliency in emotion regulation skills for adolescents. The current study sought to test the effectiveness of this 9-week group intervention in a sample of detained adolescents at a residential treatment facility. Data collection is ongoing, but data from two treatment groups were collected and analyzed for the current preliminary analysis. Data was collected at two points, once at pre-treatment and once again at post-treatment. The Difficulties in Emotion Regulation Scale (DERS; Gratz & Roemer, 2004) was administered to assess multiple aspects of emotion dysregulation. The 36-item self-report questionnaire yields six scales including nonacceptance of emotional responses, difficulties in engaging in goal-directed behavior, impulse control difficulties, lack of emotional awareness, limited access to emotion regulation strategies, and lack of emotional clarity. Results demonstrated significant treatment gains for the goal-directed behaviors scale and approached significance on the lack of emotional clarity scale. Results suggest that short-term group interventions aimed at improving emotional regulation can be an effective tool for dealing with the emotional consequences of trauma exposure. Future research, with larger sample sizes, directed at broader treatment gains, such as larger behavioral or mental health gains, are needed to determine the full scope of treatment benefits from emotion-focused group therapy.

Title: Targeting DNA-damage inducible homolog 2 (Ddi2) for the treatment of cancer

Primary Author (and presenter): Ibtisam, Ibtisam[1]
Additional Authors: Ann, Jennifer[3]; Lipke, Elizabeth[2]; Mitra, Amit K.[1]; Fiering, Steven N.[3]; & Kisselev, Alexei F.[1]
Department: Drug Discovery and Development[1]; Chemical Engineering[2]; Norris Cotton Cancer Center[3]
College/School: Harrison School of Pharmacy[1]; Samuel Ginn College of Engineering[2]; Dartmouth - Hitchcock Medical Center, Lebanon – NH[3]

Description:

Proteasome is essential protein-quality control proteolytic complex in mammalian cells. It also controls the level of transcription factors and cell cycle regulatory proteins. Rapid growth and increased production of the damaged protein in cancer cells makes them highly proteasome-dependent. Unlike non-malignant cells, tumor cells undergo apoptosis upon partial proteasome inhibition. Proteasome inhibitors Bortezomib and Carfilzomib are approved for the treatment of multiple myeloma; novel proteasome inhibitors are in trials for the treatment of solid tumors. Clinical effectiveness of these drugs is limited by the rapid recovery of proteasome activity, and lack of therapeutic approaches to block this recovery. DNA-damage inducible 1 homolog 2 (Ddi2) is a novel aspartic protease, which activates the transcription factor Nrf1 responsible for the restoration of proteasome activity. We found that knockout of Ddi2 sensitizes cells to Bortezomib and Carfilzomib. Although Ddi2 knockout did not affect the growth in a 2D culture, it dramatically reduced the growth of xenograft tumors in mice. RNA sequencing of tumors revealed that knockout of Ddi2 leads to down-regulation of several pathways that have been associated with tumorigenesis such as GLI1 and STAT3. Our data suggest that Ddi2 is an oncoprotein and potential target for the treatment of cancer.

Title: Effect of biomass chemical composition on the rheological behaviour of cellulose nanofibrils (CNF) suspensions obtained from different natural sources

Primary Author (and presenter): Iglesias, Maria C.
Additional Authors: Aksoy, Burak[1]; Hamade, Fatima[2]; Davis, Virginia[2]; Jiang, Zhihua[1,2]; Elder, Thomas[3]; & Peresin, Maria S.
Department: Forestry
College/School: [1]Alabama Center for Paper and Bioresource Engineering; [2]Department of Chemical Engineering, Samuel Ginn College of Engineering; [3]Southern Research Station, U.S. Forest Service, U.S. Department of Agriculture, Auburn, AL

Description:

Based on renewable, biodegradable and biocompatible properties, lignocellulosic materials with nano-scale dimensions are well known as nanocellulose. This nanomaterial has emerged as a promising alternative for high-performance applications. To this end, many efforts have been made to extract fibrous materials not only from wood, but also from agro-industrial side streams as an alternative to increase their value. In 2016, United States was described as the country with the highest soybean production according to the Food and Agricultural Organization of the United Nations (FAO). After oil extraction, soybean hulls have little commercial value, mainly being use as a fiber source for cattle. On the other hand, invasive species such as *Triadica sebifera*, commonly known as Popcorn tree, is a woody tree with low commercial value usually mixed with other hardwood species and utilized as boiler fuel in pulping plants. Nanocellulose isolation from these sources have the potential of valorizing these resources by incorporating them in advanced bio-based products. In this work, we investigate the potential of locally abundant biomass alternatives -such as residues from soy oil production and non-commercial, invasive wood species- to be utilized for nanocellulose production. A thorough characterization of nanocelluloses properties is essential for understanding the stability of these colloidal suspensions, the interactions between the different components, and the performance of these materials when combined with others. Specifically, rheological properties provide insights into dispersion stability and the interactions between components. They are also relevant importance as they affect handling and processing. We focused on the study of the effect of starting material and nanocellulose chemical composition on rheological behavior (using steady shear and oscillatory rheology) for cellulose nanofibrils (CNFs) obtained from popcorn tree, and soybean hulls and how they compare to commercial wood sources. Atomic force microscopy (AFM), Fourier-Transform Infrared Spectroscopy (FTIR), surface charge analysis, thermal gravimetrical analysis (TGA), and zeta-potential were used to study the morphology, chemical composition, and charge density, as well as thermal and colloidal stability of the obtained CNFs.

Title: Investigation of the interactions between cellulose nanofibrils (CNF) and wood adhesive (pMDI) for its application in wood composites

Primary Author (and presenter): Iglesias, Maria C.
Additional Authors: Hornus, M.; Via, B.; & Peresin, Maria S.
Department: Forest Products Development Center
College/School: School of Forestry and Wildlife Science

Description:

Historically, the wood composite industry has utilized adhesives derived from non-renewable sources, due to its strong dependence on petroleum. Although formaldehyde-based resins used to dominate the market, in recent years the concerns about toxicity of formaldehyde emissions have increased, reducing its utilization. Thus, the necessity for a more environmentally friendly formulation of wood binders has grown. As an alternative to these formaldehyde-free adhesives, poly methylene diphenyl diisocyanate (pMDI) has been introduced and well-positioned into the market, mainly for the production of Oriented Strand Boards (OSB). The advantages of pMDI include high reactivity, good tolerance for moisture, and good bonding strength.

Cellulose is a well-known renewable and abundant natural source that can be mechanically treated and converted into the nanoscale to produce the so-called nanofibrillated cellulose (CNF). Because of its low density, high aspect ratio, and high capacity to be modified, CNF has been used in many applications, such as an additive and reinforcement agent. Additionally, its utilization in adhesive formulations has demonstrated to improve the mechanical performance of pMDI resins.

In this work, we investigated the fundamental interactions between pMDI and cellulose nanofibers through Quartz Crystal Microbalance with Dissipation monitoring (QCM-D). Model surfaces were prepared with a spin coating technique, which allows for a uniform and thin layer of material on the surface to be obtained. Interactions were measured by flowing the nanocellulose suspension through the equipment while measuring in real time. Additionally, Atomic Force Microscopy (AFM) was utilized to study the morphology of the samples before and after the nanocellulose deposition. To gain a better understanding on the interactions between CNF and pMDI, CNF was fully characterized. Atomic force microscopy (AFM), Fourier-Transform Infrared Spectroscopy (FTIR), surface charge analysis, thermal gravimetrical analysis (TGA), and zeta-potential were used to study the morphology, chemical composition, charge density, as well as thermal and colloidal stability of the CNF.

Title: Evidence-based design approach to Icelandic Hospital
Primary Author: Ingros, Gabrielle M.
Additional Authors: Samaras, Rachel
Department: Consumer and Design Sciences
College/School: Human Sciences

Iceland is known for its universal healthcare system, which is largely paid for by citizen taxes and is administrated by the Ministry of Welfare. On top of that, there is almost no private health insurance and no private hospitals in Iceland. To that end, our project deals with Landspitali University in Reykjavik, which is opening a new wing that is partnering with several major U.S. medical institutions to provide medical training and healthcare business courses based on the Icelandic universal healthcare system. This evidence-based healthcare design project identifies and utilizes best practices for the interior design of the Landspitali Women's Hospital through a multiple-step multidisciplinary design process. Through (1) assessment of current approaches to LDRP and Caesarean Section rooms, (2) identification of the spaces necessary for facilitating active learning environments for medical training and healthcare business courses, and (3) utilization of evidence-based design practices to create an environment that fosters and increases each patient's mental and physical well-being. Evidence-based design solutions will be presented through the Women's Hospital that aim to enhance the overall quality of life for all Icelandic citizens through efficient space planning, circulation patterns, and material selections.

Title: Identifying individuals' comprehensive epitope repertoire
Primary Author (and presenter): Islam, Sumaiya
Additional Authors: Pantazes, Robert
Department: Chemical Engineering
College/School: Samuel Ginn College of Engineering

Description:

Antibodies are proteins in our immune system that recognize epitopes on antigens and bind specifically and strongly at these locations. The high specificity of their binding to antigens has led them to be extensively used both experimentally and in therapeutic purposes. Although there are many diagnostic tests to evaluate immune health and function, there is not yet a test that can identify all epitopes bound by an individual's antibodies. Such a test involves developing an experimental assay using an antibody epitope repertoire as a source of biomarkers of infectious and autoimmune diseases. The first step towards building the repertoire would be screening a designed peptide library. The library must be generated from a large collection of variants undergoing multiple rounds of enrichment displaying binding properties to antibodies. The designed library must have a high diversity to increase the probability for rare sequences, with better functional properties, to be selected and amplified. Such a library can be generated using an mRNA display technique and next-generation sequencing (NGS) technologies can read and deliver sequence information of the large number of peptides separated from the library. Analysis of the sequence reads necessitate a similarity matrix to identify and cluster patterns to generate motifs. Existing similarity matrices, created based on the evolutionary selection of amino acid mutations, are not appropriate for this purpose. The desired matrix must facilitate scoring the binding efficiency of the peptides as antigenic sequences. The poster will show how the similarity matrix was developed as a tool towards building the repertoire. The matrix was constructed using numerical data from analysis of the effects of point mutations on the binding interactions of proteins. Clustering the patterns based on their scores from the matrix can be used to identify binding motifs that are statistically enriched in the disease- specific individuals.

Title: Investigation of a slope failure using seismic full waveform inversion
Primary Author (and presenter): Jackson, Dan T.
Additional Authors: Kiernan, Michael; Montgomery, Jack; & Anderson, J. Brian
Department: Civil Engineering
College/School: Samuel Ginn College of Engineering

Description:

Highly plastic, calcareous clays are prevalent throughout Alabama. Slope failures occur fairly frequently in these clays, and experience shows that these clays have very low mobilized shear strengths when they fail. The exact mechanism of these failures is currently unknown, but it is suspected that the clay could potentially be a strain-softening material. These materials exhibit a decrease in strength and stiffness with increasing deformation. This reduction in stiffness may be visible in a subsurface profile of seismic velocities as a low velocity zone in an otherwise stiff clay deposit. To develop a profile of the seismic velocities, seismic full waveform inversion, a non-destructive imaging technique, can be employed. This method provides an alternative to traditional seismic imaging techniques that may not be able to detect localized, low velocity zones. This study evaluates a recent slope failure along County Road 37 in Wilcox County, Alabama. This failure destroyed a section of the roadway and damaged buried utility lines. The slope was located in the Porters Creek Formation which is known to consist primarily of highly plastic clay. As part of the investigation of this slide, two lines of seismic data were acquired, one in the slide area and one outside of the slide area. Electrical resistivity data was also acquired parallel to the seismic lines. Data was also available from four borings performed at the site by the Alabama Department of Transportation (ALDOT). The seismic data was processed using full waveform inversion (FWI). This presentation will offer an interpretation of the FWI results and comparisons to the resistivity and borehole data. The feasibility of using FWI for slope failure investigations in highly plastic clay will also be discussed based on the results of this case study.

Title: Staff perceptions of animal assisted therapy in children with intellectual disabilities
Primary author (and presenter): Jackson, Kayla W.
Additional authors: Gibson-Young, Linda
College/School: School of Nursing

Description:

Recent students have identified nurse practitioner perceptions with animal assistance therapy as a form of counseling. Yet, while focusing on animal assisted therapy in primary care, studies often lack perceptions of staff when prescribing animal assisted therapy. The purpose of this project was to assess perspectives on the opinions of animal assisted therapy in children with intellectual disabilities in office staff of a primary care setting. This small test of change is a cross sectional design, and targets office staff working in a primary care setting. After obtaining agreement, a pre-questionnaire was completed by them to form baseline data. The intervention includes education on animal assisted therapy in children with intellectual disabilities. Positive aspects identified in the review of literature was provided to all staff. After the educational session was completed, a post-questionnaire was given to assess if the educational session had an impact on staff opinions. The project is in progress. Descriptive statistics will be used to describe the patient population, such as age and gender. Follow up data will include the number and percent of staff that finished the study. The pre and post questionnaire data will be compared to see the impact made by the study. Additionally, their positions will be compared and joined with their opinions such as nurse, physician, nurse practitioner, medical assistant, and receptionist. Performing studies to assess the outlook of office staff on animal assisted therapy is essential in helping broaden the evidence base for this particular subject. In order for animal assisted therapy to implement into primary care more often, more education must be done to get health care providers on board with prescribing the therapy. Further implementation of this project is warranted to see how long term education would affect staff perception

Title: Thermal conductivity evaluation of medium/high-temperature phase change materials for thermal energy storage by molecular dynamics
Primary Author: Jamshideasli, Dourna
Additional Author: Khodadadi, Jay M.
Department: Mechanical Engineering
College/school: Samuel Ginn College of Engineering

Description:

The greater utilization of the concentrated solar power to compete with conventional power generation systems is strongly linked to updated and more accurate thermophysical property data for molten salts. In this study, the thermal conductivity of potassium nitrate in a certain range of temperature was determined by applying the nonequilibrium Molecular Dynamics (NEMD) and using the molecular dynamics code in LAMMPS. The Buckingham potential energy function that describes the interaction potential and is comprised of both bonded and non-bonded interactions was employed. Particle-particle particle-mesh approach was used for the Coulombic interactions. The crystal structures for melting and solidification and instantaneous movements of the constituents of the system were captureed by OVITO. Presence of a graphene nanoplatelet was also modeled and the optimized Tersoff potential was employed for the force field. The current code can be extended to simulate salts with graphene nanoplatelets additives to realize the effect of the alignment factor and the interfacial thermal conductance between the nanofiller and the salt matrix. The relevant MD predictions of the properties can be compared with simultaneous in-house experimental data under development and literature values.

Title: Optimizing a 3D culture system to study the roles of epithelial breast cancer cells and tumor microenvironment in mediating drug uptake from enzyme-responsive liposomes
Primary Author (and presenter): Jasper, Shanese L.
Additional Authors: Skarupa, Elena, B. & Arnold, Robert D.
Department: Drug Discovery and Development
College/School: Harrison School of Pharmacy

Description:

Triple negative breast cancer describes a subgroup of breast cancers which are negative for the estrogen and progesterone receptors as well as the HER2 protein. As such, triple negative breast cancers have seen little benefit from the targeted therapies developed for the treatment of breast cancer. To address this challenge, we must look at alternative targets within the tumor as well as the tumor microenvironment. To this end, it is necessary to develop high-throughput models for the accurate and reliable testing of possible drug agents as well as biologically relevant *in vitro* models which can better depict the complexity of the tumor environment. In this model, we endeavor to explore the utility of sPLA-2 responsive liposomes in 3-dimensional co-cultures to include macrophages and fibroblasts. Herein, we evaluated the therapeutic activity of secretory phospholipase a2 responsive liposomes (SPRL) compared to the clinically used, sterically stabilized liposomes (SSL) for *in vitro* response in a triple-negative breast cancer (TNBC) model. Secretory phospholipase a2 (sPLA2), enzymes which cleave phospholipids at sn-2 ester bonds, releasing lysophospholipids and fatty acids, are over expressed in several pathologies including breast cancer. In these studies, SSL and SPRL formulations were made according to previous studies and resulting in three formulations SSL, SPRL- E and SPRL-G. SPRL were made by the addition of either DSPE (SPRL-E) or DSPG (SPRL-G). Doxorubicin was used as the drug of choice and Dox-loaded liposomes were prepared by remote-loading using an ammonium sulfate gradient. Toxicity studies were performed by the use of resazurin while uptake studies were performed by fluorescence microscopy and flow cytometry. By using this model, we hope to assess the complex interactions between tumor and microenvironment and their implications in drug uptake and efficacy.

Title: Exploring the relationship between adherence and number of prescribed medications with patients' preference for incentives

Primary Author (and presenter): Jeminiwa, Ruth N.
Additional Authors: Hohmann, Natalie; Hastings, Tessa; Qian, Jingjing; Hansen, Richard; Garza, Kimberly
Department: Health Outcomes Research and Policy
College/School: Harrison School of Pharmacy

Description:

Incentive-based interventions are effective in increasing adherence to medication. However, patient preferences vary widely. The role of number of prescribed medications and adherence on this variability is unclear. To explore the association between adherence and number of prescribed medications with preferences for financial or social incentives. A cross-sectional survey of a nationally representative sample of patients across the United States was conducted via Qualtrics (n=1009). Adults who reported taking at least one prescription medication for a chronic condition were included. Survey items elicited participants' demographic information, preference for financial or social incentives, self-reported adherence, and number of prescribed medications. Adherence was categorized as adherent, low adherence, very low adherence, and overdose. Chi-square test was performed to examine associations between adherence and incentive preference. Logistic regression was performed to determine whether number of medications is associated with preferences for financial or social incentives, controlling for demographics. Individuals with low adherence were more likely to prefer social incentives ($p < 0.001$). Logistic regression results indicated that for each additional prescription, odds of preferring financial incentives increased by 12% (OR = 1.12 [95% CI, 1.00 – 1.26]). Other characteristics that were significantly associated with preferences for financial incentives were being female (OR = 1.92 [95% CI, 1.17 – 3.15]), earning $100000 per year or above (OR = 2.29 [95% CI, 1.39 – 3.77]), and not being Hispanic (OR = 2.00 [95% CI, 1.21 – 3.31]). Patients taking multiple medications may prefer financial incentives. Those who are non-adherent may prefer social incentives. Findings have potential implications on how incentives to improve medication adherence can be structured.

Title: The biomechanical effect of body-borne loads on airborne soldiers
Primary Author (and presenter): Jenkins, Katelyn, A
Additional Authors: Zabala, Michael, E
Department: Mechanical Engineering
College/School: Engineering

Non-contact injuries in military personnel costs the United States millions of dollars each year. The heavy loads that soldiers carry can significantly increase joint reaction forces and moments and alter other parameters compared to their unloaded gait, leading to an increased risk of injury. Airborne soldiers are often required to carry nearly 180 pounds of gear for long periods of time, thus creating greater joint reaction forces and moments than is experienced by other types of soldiers. For this study, motion capture data was collected from both ROTC and non-military Auburn students to characterize the kinematics and kinetics of their gait under various loading conditions emulating the conditions of airborne soldiers. Visual3D software was used to analyze the overall demand of the muscles across the joints in the knee and ankle. Data analysis has shown the ground reaction force to increase approximately 50% from unloaded walking to walking with 60 lbs, half the normal weight an airborne soldier carries. The ankle and knee moments also increased by approximately 50% for this loaded condition. This study provides an understanding of mechanisms associated with musculoskeletal injury during heavy load carriage so that they may ultimately be prevented.

Title: Speaking of Auburn: exploring dialect discrimination on and off Auburn University's campus
Primary Author (and presenter): Johnson, Shelley Caitlin
Additional Authors: Marlow, Dave
Department: English
College/School: Liberal Arts

There is a drastic difference in culture between Auburn University's campus and the surrounding rural areas. A hallmark dimension of any culture is language and dialect.
Our research delves into the effects of discrimination on the basis of dialect within the greater Auburn community. Everyone has a story to share of a time when they experienced discrimination of some sort due to the way they speak. Perhaps their "southern accent" was a cause of laughter among acquaintances in the Northeast, or maybe it caused colleagues to assume a lack of education. Perhaps they were teased as a child by others who spoke differently. Dialect discrimination is defined as follows: "penalizing speakers of vernacular varieties on the basis of dialect differences; for example, in language-acquisition testing, treating the use of a dialect form as evidence that the standard form has not been acquired" (Wolfram & Schilling, 2016). In this research, we analyze people's perception of dialect discrimination, including respondents who self-identify as dialect-speakers and those who do not. This research complements a linguistics course (ENGL 4140) project designed to create a new oral history archive, My Journey, in the Auburn University Special Collections. We hope that exploring peoples' stories, together with targeted, survey-based research will provide a rounder, more balanced picture of dialect diversity in our area than either approach alone. In this portion of the research, participants from the greater Auburn community and from within Auburn's campus are asked to fill out a short survey. The purpose of this survey is to gauge 1) the extent to which participants have been affected by dialect discrimination, 2) the situations in which they have experienced this effect, and 3) the way(s) in which they feel dialect discrimination has affected their self-perception and/or opportunities.

Title: Exploring the removal of excess nutrients and heavy metals from polluted water bodies through the use of macrophytes and microorganisms
Primary Author (and presenter): Johnston, LeeAnn, M
Department: School of Fisheries, Aquaculture, and Aquatic Sciences
College/School: Samuel Ginn College of Engineering

The primary intended purposes of this research project were to (1) study the effects that the exposure of heavy metals and excess nutrients have on algae and terrestrial macrophytes and (2) determine if different species could be strategically placed together in a floating treatment wetland (FTW) to combat the effects of pollution due to agricultural runoff. This project was inspired by a common issue experienced in water bodies: excess phosphorous from agricultural runoff creates conditions ideal for algal blooms that subsequently deplete the water of oxygen necessary to sustain aquatic life. In order to combat the issue of excess phosphorous in water, 2 types of grass and 2 types of flower were tested for their ability to absorb different concentrations of phosphorous. The same plants were also tested for their tolerance of different levels of copper on account of the commonly used technique of applying cupric sulfate to water bodies as an algicide. Algae collected from five ponds were also exposed to different levels of copper.

All algae samples exposed to copper were tested for phycocyanin and chlorophyll production. These samples were tested through filtration methods in addition to the use of a Turner Tool. Each sample was exposed to copper for a total of 5 days and tested for its phycocyanin and chlorophyll production periodically. Plants exposed to copper were tested for chlorophyll production and copper absorption for a period of 4 days. Plant matter samples consisted mainly of leaves and stems which were collected each day during the time period. The same species of plants were also exposed to varying levels of phosphorous for the same time period and tested for chlorophyll production as well as phosphorous absorption. Plant matter samples consisted of leaves and stems as in the plants exposed to copper. Flower and grass species were planted in a constructed FTW and tested periodically for chlorophyll production and copper and phosphorous uptake.

Title: Synthesis and characterization of photopolymerizable hydrogels based on poly (ethylene glycol) for biomedical applications

Primary Author (and presenter): Joshi, Prutha
Additional Authors: Auad, Maria L.
Department: Chemical Engineering
College/School: Samuel Ginn College of Engineering

Description:

Hydrogels are polymeric materials widely used in medicine due to their similarity with the biological components of the body. Hydrogels are biocompatible materials that have potential to promote cell proliferation and tissue support because of their hydrophilic nature, porous structure and elastic properties. Research question here is whether our synthesized poly (ethylene glycol) diacrylate (PEGDA) hydrogel can be used as 3-D printable scaffolds for tissue engineering applications? We synthesized three different varieties of PEGDA and rapid photopolymerization of them using UV radiation (365 nm). 1-Hydroxy-cyclohexyl-phenyl-ketone (Irgacure 184) was used as a photoinitiator. The effects of PEGDA molecular weight and degree of acrylation on swelling, mechanical and rheological properties of hydrogels were investigated. The mechanical properties of these hydrogels were tuned for various biomedical applications by modifying the degree of acrylation and the gel chemical composition. The biodegradability of the PEGDA hydrogels was investigated for its viability as a scaffold in tissue engineering. Altogether, the biomaterial hydrogel properties open the way for applications in the field of medicine.

Title: Effects of cold plate mini-channel design on the effective thermal management of the non-uniform heat generation from an electric vehicle lithium-ion battery
Primary Author (and presenter): Kambhampati, Akhil T.
Additional Author: Thompson, Scott M.
Department: Mechanical Engineering
College/School: Samuel Ginn College of Engineering

Description:
As the demand for full electric cars increases, battery capacity requirements are becoming more and more important. Vehicular battery packs are increasing in size and power capacity, yet their effective and efficient thermal management is still a major engineering design challenge. In this study, different configurations of mini-channel liquid cold plates are investigated for the purpose of effectively cooling, and maintaining uniform temperature, among cells in a lithium-ion battery. In order to maintain uniform temperature, a cold plate is designed at the cell level as configured between two cells of a lithium-ion battery. A thermal resistance model is developed and used to estimate the thermal/hydraulic performance of a cold plate under realistic heating conditions representative of the nonuniform heat generation found from lithium-ion batteries. A parametric study is conducted to determine the effect of cold-plate channel configurations on battery-to-cold-plate heat transfer and temperature uniformity. Heat transfer and pressure drops within various cold plate prototypes are solved numerically/computationally and the trends are compared with the existing experimental data to provide proof of concept.

Title: Physicochemical and nutritional properties of selected banana (*Musa* spp.) cultivars in the Southeastern U.S.

Primary Author (and presenter): Kargar, Mahnaz
Additional Authors: Woods, Floyd; Wall, Marisa; Fonsah, Greg; Kessler, Raymond; Vinson, Edgar; & Jeganathan, Ramesh.
Department: Horticulture
College/School: Agriculture

Description:

Banana (*Musa* spp.) is the fourth most important food crop after rice, wheat, and maize consumed across the world. This tropical fruit is a rich source of antioxidant compounds which have role in prevention of cardiovascular diseases, cancer, diabetes, and other chronic diseases. United States is the number one banana importer in the world. 'Williams', the commercial banana cultivar, is the only cultivar that most of the consumers are familiar with. However, there are hundreds of banana cultivars all around the world with potential health benefits which are not identified yet. In the current study, physicochemical properties (soluble solid content (SSC), titratable acidity (TA), and sweetness index (SSC/TA)) and nutritional value (total carotenoid, total phenolics, and total flavonoids) of fruit pulp tissue were compared in six banana cultivars different in genome, including 'FHIA 1' (AAAB), 'Hua Moa' (AAB), 'Kandarian' (ABB), 'Pisang Raja' (AAB), 'Saba' (ABB), and 'Williams' (AAA) at ripe stage. 'Pisang Raja' was identified as the cultivar with the highest content of total carotenoids, total phenolics and total flavonoids among all cultivars. Fully ripe fruits of 'Williams' were reported as the sweetest fruits with the highest value of SSC/TA. 'Pisang Raja', however, had the medium sweetness index compare to the other cultivars. As a conclusion, 'Pisang Raja' has the potential to be commercialized because of its high nutritional value and the optimum sweetness. Results of this study indicate that nutritional value and physicochemical properties of banana fruit varies significantly depending on cultivar. It is important to identify banana cultivars with high nutritional value and health aspects and encourage the growth and consumption of these cultivars.

Title: Effect of chitosan coating on tomato fruit softening
Primary Author (and presenter): Kargar, Mahnaz
Additional Authors: Woods, Floyd & Brown, James
Department: Horticulture
College/School: Agriculture

Description:

Tomato as the most consumed vegetable crop in the world, has a short shelf life and postharvest losses about 50% of production. The common method of postharvest preservation, storage at low temperature, induces chilling injury in tomato. An alternative method is the use of edible and biodegradable coatings as modified atmospheres packaging. In this context, chitosan, an environmentally friendly polysaccharide which is found in the outer skeleton of crustacean specious has excellent film-forming ability and antimicrobial properties and has received considerable attention in recent years. Therefore, the current study was designed to determine the effect of chitosan coating on softening of tomato fruit during the shelf life. Mature red fruits were harvested and disinfected by sodium hypochlorite 10% for 3 min. The coating treatment was then applied to the fruits by immersing them in 0.5% chitosan. Fruits were stored at 20oC and 95% RH for 20 days and were analyzed for polygalacturonase activity, pectin solubility, electrolyte leakage, and proline accumulation every 5 days. The activity of total polygalacturonase as an enzyme which has the role in cell membrane degradation during ripening and senescence, was significantly lower in chitosan coated fruits. During ripening, insoluble pectin is converted to soluble pectin which cause membrane deterioration. Chitosan coating significantly suppressed pectin solubility in the treated fruits. Electrolyte leakage as a factor showing cell membrane permeability was also measured significantly lower in the coated fruits. Therefore, membrane deterioration and senescence occurred less. In addition, chitosan coated fruits significantly remained turgid longer and osmotically active as a consequence of higher proline accumulation. Chitosan coating not only could be a great idea to preserve the environment, it also could be a cheap, non- chemical treatment in postharvest physiology and technology of fruits and vegetables industry.

Title: Investigating the effect of surface energy of the substrate on attached algal growth
Primary Author (and presenter): Karimi, Zahra
Additional Authors: Rodriguez, Marisa G.; Blersch, David M; & Davis, Virginia A.
Department: Chemical Engineering
College/School: Samuel Ginn College of Engineering

Description:

The goal of this research is to investigate the effect of surface energy of the substrate on attached algal growth, mainly focusing on studying filamentous algal species with specialized attachment mechanisms. Algal cultivation on substrates has a promising potential as an effective strategy for boosting the efficiency of algal growth systems. However, limited fundamental scientific understanding of algal attachment and growth is one of the major barriers in designing high yield cultivation substrates that are species-selective. In addition, to date, most studies in the field have focused on growth of suspended algae. Very little is known about substrate preferences of filamentous algae with specialized attachment mechanisms. In this research, substrates with different surface energies were cultivated with algae in a flow reactor and the amount of attached biomass was evaluated. The surface energy of the substrates was evaluated by determination of the surface energies *via* sessile drop contact angle measurements. The results demonstrate the correlation of the surface energy of the substrates and the amount of attached algal growth.

Title: Multi-variable sensitivity analysis, calibration, and validation of a field-scale SWAT model: A case study in south central Georgia
Primary Author (and presenter): Karki, Ritesh
Additional Authors: Srivastava, Puneet; Guzman, Sandra M.; Lamba, Jasmeet
Department: Biosystems Engineering
College/School: College of Engineering

Description:

The Soil and Water Assessment Tool (SWAT) is a widely used watershed-scale model that can simulate runoff, water quality, crop yield, and agricultural chemical for evaluating the effects of land use change, climate, and management practices, among others. The model's performance at the field scale, which can be a critical piece of information for regional-scale scenario analysis, has, however, not been studied thoroughly. This study evaluated the ability of SWAT to simulate runoff, soil moisture, crop yield, and nutrient loss at a field scale by simulating cotton-peanut rotation in conventionally-tilled and strip-tilled fields in south-central Georgia. Runoff and crop yield simulations were evaluated utilizing observed data set from 1999-2006 (8 years), while soil moisture and water quality were evaluated from 2001-2006 (6 years) and 2004-2006 (3 years), respectively. Parameter sensitivity analysis using SWAT-CUP SUFI-2 algorithm was also performed for hydrological, water-quality, and crop-yield parameters to determine the important parameters for field-scale modeling using SWAT. The calibrated model was then used to evaluate water use, nutrient loss, and crop yield for high, UGA recommended, low, and no fertilizer and irrigation application scenarios. Preliminary model performance evaluation shows that SWAT is able to adequately simulate daily runoff, crop yield, and water quality, but only moderately simulated soil moisture at a field scale for both conventionally- and strip-tilled plots. It was also observed that SWAT over-estimated the baseflow portion of the total streamflow at the field scale. Evaluation of the fertilizer and irrigation application scenarios showed no statistical difference in crop yields between high fertilizer and irrigation application and UGA recommended application.

Title: Understanding the use of deep learning–based perception augmentation systems for autonomous vehicles

Primary Author (and presenter): Kauten, Christian
Additional Authors: Zhang, Chaowei; Heckwolf, Thomas
Department: Computer Science and Software Engineering
College/School: Samuel Ginn College of Engineering

Description:

Contemporary advancements in computational science, function approximation, and automotive engineering have introduced highly autonomous features to consumer automobile markets. Indeed, such features provide a means of reducing the inherent risk of operating a personal vehicle; however, recent news events reveal that artificial intelligence technologies powering autonomous vehicles often perform non-optimally. Such news coverage decreases public trust in the technology. To fill this deficit of trust, this work proposes an alert system based on deep learning that allows passengers to monitor the artificial intelligence performance in real-time. The system presents the driving scene to the passenger through two mechanisms: (1) a heads up display (HUD) which renders the semantic segmentation output from the neural network as a color-coded image to the passenger, and (2) a light strip around the windshield that highlights areas of the windshield that have pedestrians and cars in the nearby field of view. Using an autonomous vehicle with a series of cameras, we collect data and build a simulation experiment for human participants. We evaluate the alert system through a clinical trial ($N \approx 300$) to measure the impact of the system on trust, scene parsing, and decision making.

Title: Effect of dietary protein source and litter condition on immune response and mitotic cell activity in the duodenum of broiler chickens at 21 days of age
Primary Author (and presenter): Keel, Andrew, J.
Additional Author: Calderon, Allan; Tejeda, Oscar; Starkey, Jessica; Starkey, Charles
Department: Poultry Science
College/School: Agriculture

Proper absorptive and protective functions of the gut are important for efficient utilization of feed, and these functions depend on the self-renewal of intestinal epithelial cells and the presence and activity of immune cells necessary to defend against pathogens. A randomized complete block design experiment with a 3 x 2 factorial treatment arrangement was used to explore the impact of dietary protein source and litter condition on the density of mitotically active (proliferative) enteric cells and macrophages present in the duodenum of broiler chickens. The 3 different protein sources were soybean meal (**SBM**), 50% poultry by-product meal and 50% feather meal (**PFM**), and porcine meat and bone meal (**MBM**). Birds consuming each protein source were reared on new (**NL**, fresh pine shavings) and used litter (**UL**, litter after 3 previous flocks). On d 0, Yield Plus x Ross 708, female broiler chicks (Aviagen, Huntsville, AL) were randomly allotted to 1 of 6 treatments and placed in an environmentally-controlled raised floor pen facility with 5 chicks per pen. On d 21, birds and feed were weighed in order to calculate body weight gain (**BWG**), feed intake (**FI**), and feed conversion ratio (**FCR**) on the birds sampled. On d 21, 6 birds per treatment from different pens (total n = 36) were injected intraperitoneally with 5'-bromo-2'-deoxyuridine (**BrdU**) 1 h prior to duodenal sample collection to label mitotically active cells. The duodenal samples were analyzed using cryohistology, immunofluorescence staining, and digital fluorescence microscopy to determine the density of mitotically active cells and macrophages. Neither protein source or litter condition significantly altered BWG ($P \geq 0.3427$) or FI ($P \geq 0.4994$). However, birds fed PFM had improved FCR compared with those fed MBM or SBM ($P = 0.0002$). Litter condition did not impact FCR ($P = 0.3659$). Neither protein source ($P = 0.5946$) or litter condition ($P = 0.9155$) altered duodenal macrophage or mitotically active cell densities.

Title: Public art project
Primary Author (and presenter): Kelley, Samantha
Co-Authors: Emily Forrester, Marquesa Cope, Katilyn McCurdy, Bethany Johnson
Department: Consumer and Design Sciences
College/School: Human Sciences

Samford lawn is currently a well-loved destination for families and students to enjoy nice weather and gather with friends. Providing more organic places to sit around the lawn will attract larger numbers of students and give them a more defined outdoor study area that supports interaction and collaboration. Not only will Auburn students benefit from the additional seating, but faculty, staff, Auburn fans, and local families will as well. The promotion of wellbeing in the places that we live, play, work and relax is accomplished in part by access to nature and frequent time outdoors. By providing organic environments for members of the Auburn family to use in the natural environment of Samford lawn, wellbeing is being inherently supported. Our proposal to accomplish this, is the integration of seating into the existing landscape of Samford lawn that will act as a natural extension of the beauty of campus and will not distract from the view of Samford hall. Inspired by the Auburn Oaks, this seating will mimic the organic shapes found in nature and will interact with the surrounding trees.

Title: A plenoptic multi-spectral pyrometer for high temperature applications
Primary Author (and presenter): Kelly, Dustin L.
Additional Authors: Thurow, Brian
Department: Aerospace Engineering
College/School: Samuel Ginn College of Engineering

Description:

In many industrial applications, it is critical to get accurate surface temperatures for different processes. However, the use of an optical instrument for non-contact temperature measurements can be problematic due to unknown emissivity, surface finish, and ambient radiation. Traditional 2-D optical pyrometers use 2 to 3 wavelength filters to try to mitigate these issues, but these wavelengths are specific to the application. Therefore, a more flexible, multi-spectral technique is desired. In this work, a new 2-D optical pyrometry technique has been developed using the plenoptic camera and a continuous variable bandpass filter to acquire instantaneous 2-D multi-spectral measurements. The images are acquired using a CCD. The filter allowing wavelengths ranging between 400nm to 850nm is placed at the aperture plane to mitigate image artifacts. To determine where each wavelength falls behind each microlens, a wavelength calibration was performed. Temperature calibration was performed by imaging graphite at temperatures between 873 K and 1323 K to determine the brightness levels of each wavelength. Once acquired, Plank's blackbody radiation equation is used to calculate a ratio between true and measured spectral radiance. The ratio is then used to convert measured to true spectral radiance so temperature can determined by a least-squares fit of Plank's equation. Initial results show that the measuring technique can produce accuracy and precision of 4 Kelvin in that temperature range. This system has a magnitude more wavelengths than traditional pyrometers, which allows the system to have flexibility in the wavelengths that are used. This design allows it to be attached quickly and easily to low and high speed plenoptic cameras. In future work, we will explore the possibility of characterizing hypersonic vehicles' surface heating, determine cooling effects on additive manufacturing, measure temperature gradients in hybrid rockets, and more.

Title: High frequency shape memory alloy actuators
Primary Author (and presenter): Kennedy, Scott M.
Additional Authors: Price, Morgan; Zabala, Michael; & Perkins, Edmon
Department: Mechanical Engineering
College/School: Samuel Ginn College of Engineering

Description:

Advancements in artificial muscle actuators are needed in order to design robots with the capability of replicating complex biological joints. Shape memory alloys (SMA) are metals that can be "trained" to change their length based on their temperature, which mimics the motion of human skeletal muscles. The most common SMA is a nickel-titanium alloy. It is 500 times stronger than human skeletal muscles, but current applications limit the operating frequency of the material to less than 3 Hz (compared to ~20 Hz in human muscles) due to its dependence on temperature change. Using a bimorph actuator configuration with active SMA layers on both sides of a passive elastic substrate, the linear motion of the SMA can be converted into a bending motion by alternating voltage between the two active layers. The hypothesis is that operating this actuator design at its natural frequency leads to an increase in actuator stroke length along with an increase in operational frequency compared to traditional SMA actuators thereby expanding the application of SMA technology. The actuator design consisted of thermoplastic polyurethane for the passive layer coated in room-temperature-vulcanizing silicone to adhere the active and passive layers. These high frequency bimorph actuators were manufactured at lengths of 50-20 mm in 5 mm increments. The natural frequency of the actuator was experimentally determined by actuating it at varying frequencies while motion capture cameras tracked the displacement. The results show that the actuator achieves peak displacement at 15 Hz, well above the average operational frequency of current SMA technology (< 3 Hz). The use of high frequency SMA actuators has implications in the field of biomimetic robots, such as fish-like robots, allowing SMA robots to actuate at similar speeds to their biological counterparts.

Title: Theoretical study of a complete catalytic cycle for methane to methanol transformation facilitated by metal methoxides

Primary Author (and presenter): Khan, Noor Md Shahriar
Additional Author: Miliordos, Evangelos
Department: Chemistry and Biochemistry
College/School: College of Sciences and Mathematics

Description:

The future of this planet will be defined by, how we are going to manage our present energy sources. Though the search for a compatible renewable energy source is rampant, we still rely heavily on fossil fuels to satisfy our energy demand. In company with investigating for 'Green Energy', extensive research is going on for a better utilization of fossil fuels. Petroleum (mixture of long-chain hydrocarbons) and natural gas (primarily methane) is the driving force of world economy. Besides its industrial/commercial importance as a source of energy, methane and other hydrocarbons have a high demand as a feedstock to produce other valuable chemicals. Because of the high abundance of hydrocarbon in fossil fuel, research on C-H bond activation is popular among different research communities. For example, active research is ongoing to find out industrially viable transformation of methane to methanol. Despite of a search for about half a century, that 'Holy Grail' is still elusive. In this study, we have developed a complete catalytic cycle for Methane to Methanol (MTM) transformation by using quantum mechanical tools. Our proposed catalytic cycle comprises of three stages, namely C-H bond activation, oxidation and isomerization. Metal methoxide cation (CH_3OFe^+) has been used as a catalyst to activate C-H bond transforming methane to methanol. Then an oxidant (N_2O) has been used to oxidize the metal to form metal oxide followed by an isomerization reaction that reproduces CH_3OFe^+ to complete the catalytic cycle. Moreover, this catalytic pathway suppresses other side reactions. We have employed Multi Reference Configuration Interaction, Coupled Cluster and Density Functional Theorem calculations to construct the energy landscape. It has been found that multi-reference calculations are necessary to capture the complicated nature of the system. And in the future, this research will be expanded further by studying the effect of different ligands in this system.

Title: Investigation of jet issuing from a cyclone vortex combustion chamber
Primary Author (and presenter): Khan, Omer
Additional Authors: Ahmed, Anwar
Department: Aerospace Engineering
College/School: Samuel Ginn College of Engineering

Description:

An innovative characteristic of the cyclone vortex combustion chamber is the tangential injection of oxidizer near the nozzle that gives rise to a distinct vortical-helical motion over the entire length of the chamber, which reverses its direction at the head wall and forms a core vortex traveling down the chamber before exiting through the nozzle. The primary advantages of the vortex combustion chamber are prolonged fuel residence time, increased fuel/oxidizer mixing length and thermal shielding of chamber walls by the oxidizer. Preliminary flow visualization show flow bifurcation in the vortex chamber and unique swirling jet at the exit. This swirling jet exiting the cyclone chamber possesses significantly higher net momentum, however all of it is not in the axial direction. Therefore, as the benefits of cyclone combustion chamber are achieved, the cost is in terms of reduction in net trust. It has been found in our study that the axial and vortical components of jet momentum are strongly dependent on geometric as well as injection constraints of the cyclone chamber design and operating conditions. Thus, there is a need to determine the jet characteristics as a function of these parameters. In this paper, the swirling jet issuing from a cyclone combustion chamber has been characterized in terms of its axial and vortical/tangential momentum, turbulent kinetic energy and jet instabilities.

Title: Anticancer effects of cannabinoid in human prostate cancer cell line
Primary author and presenter: Khan, Saba O.
Additional authors: Boothe Dawn, Mansour Mahmoud
Department: Biomedical Sciences
College/ School: College of Veterinary Medicine

Description:

One in nine men will develop prostate cancer (PCa) over the course of their lifetime. It is the second most commonly diagnosed cancer in American men and the second leading cause of cancer death, despite recent advances in radiotherapy and chemotherapy. Cannabinoids, the active components of Cannabis sativa Linnaeus (marijuana) and their derivatives have received renewed interest in recent years due to their diverse pharmacologic activities such as cell growth inhibition, anti-inflammatory effects and tumor regression. Objective of our study was to evaluate cannabinoid receptors (CB1 and CB2) expression and anti-proliferative effect of cannabinoid in human prostate cancer cells. We used two androgen independent human PCa cell lines (PC3 and D145) and normal prostate cancer cell line RWPE to characterize the expression of cannabinoid receptors using conventional and quantitative PCR. We found positive expression of cannabinoid receptor CB1 in both PCa cell lines and normal prostate cell line, however CB2 receptor was not found in any of the cell line. To find the anti-proliferative effect of cannabinoid we used two endocannabinoids (2AG and AE), two synthetic cannabinoid agonists (2MAF and WIN55-212-2) and a synthetic cannabinoid antagonist (AM125). PC3 cells were incubated for 48 hrs with the drugs in five different concentrations, (10, 20, 40, 80 and 160 µmol). We used media as a control and looked at the anti-proliferative effect of cannabinoids using MTT assay. We did not find significant anti-proliferative effect with WIN55-212-22, However we found significant dose dependent inhibition of cell proliferation with both endocannabinoids 2AG and AE, synthetic cannabinoid 2MAF and cannabinoid antagonist AM125. Our results suggest that cannabinoids could be developed as a novel therapeutic agents for the treatment of prostate cancer.

Title: Liver fat quantification with magnetic resonance spectroscopy at 3T
Primary Author (and presenter): Khan, Salaar
Additional Authors: Bashir, Adil
Department: Electrical and Computer Engineering
College/School: Samuel Ginn College of Engineering

Description:
Excessive accumulation of intra-hepatocellular lipid (IHCL) can lead to one of the most common forms of chronic liver diseases in adults, the non-alcoholic fatty liver disease (NAFLD) that comprises of a range of liver disorders including hepatic steatosis, an advanced stage of which can result in liver cirrhosis. Many diseases are known to be associated with the retention of IHCL including, but not limited to, obesity and type II diabetes. It is, thus, essential to quantify IHCL for early diagnosis and monitoring for an effective treatment. This study presents a non-invasive, robust and reproducible approach to quantify IHCL content using the single-voxel ^{1}H magnetic resonance spectroscopy (MRS) at 3 Tesla (3T). For validation, peanut oil phantoms of known fat fractions (8%, 14%, 18%, 25%, 30%, 40%, 45%, 55%) were constructed and tested. For in vivo scans, the study included fifteen obese volunteers. To confirm the relative uniformity of IHCL content within the liver, spectroscopy was performed at three different voxel locations. Fat fractions were evaluated after T2 correction was done using five echo times (24, 30, 35, 40, 50 ms). The results with the peanut oil phantoms were in close agreement with the known fat fraction values (<10% error on the fat fraction value). The in-vivo study confirmed the obese volunteers with fatty liver, registering IHCL content beyond the 5-10% clinically considered normal range.

This study demonstrated a reliable and accurate way to quantify liver fat content through spectroscopy at 3T.

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Primary Author (and presenter): Khan, Salaar
Additional Authors: Bashir, Adil
Department: Electrical and Computer Engineering
College/School: Samuel Ginn College of Engineering

Description:
Excessive accumulation of intra-hepatocellular lipid (IHCL) can lead to one of the most common forms of chronic liver diseases in adults, the non-alcoholic fatty liver disease (NAFLD) that comprises of a range of liver disorders including hepatic steatosis, an advanced stage of which can result in liver cirrhosis. Many diseases are known to be associated with the retention of IHCL including, but not limited to, obesity and type II diabetes. It is, thus, essential to quantify IHCL for early diagnosis and monitoring for an effective treatment. This study presents a non-invasive, robust and reproducible approach to quantify IHCL content using the single-voxel ^{1}H magnetic resonance spectroscopy (MRS) at 3 Tesla (3T). For validation, peanut oil phantoms of known fat fractions (8%, 14%, 18%, 25%, 30%, 40%, 45%, 55%) were constructed and tested. For in vivo scans, the study included fifteen obese volunteers. To confirm the relative uniformity of IHCL content within the liver, spectroscopy was performed at three different voxel locations. Fat fractions were evaluated after T2 correction was done using five echo times (24, 30, 35, 40, 50 ms). The results with the peanut oil phantoms were in close agreement with the known fat fraction values (<10% error on the fat fraction value). The in-vivo study confirmed the obese volunteers with fatty liver, registering IHCL content beyond the 5-10% clinically considered normal range.

This study demonstrated a reliable and accurate way to quantify liver fat content through spectroscopy at 3T.

Title: Proposed art installation on Auburn University campus
Primary Author: Kile, Kensie, J. and Farrimond, Mollie, D.
Additional Authors: Nichols, Temple., Overbee, Emily., Haley, Bethany, L., Prisoc, Nate
Department: Interior Design
College: Human Sciences

Description:

Our group is proposing an art installation at the newly constructed Jay and Susie Gouge Performing Arts Center. This art installation will provide a meaningful experience to the community and beyond while the new center will support the university's vision to provide culturally enriching experiences for university, the community and the region. Our group created a survey to see what students would prefer to see. The options included an abstract sculpture, wall mural, statue, or geometric piece of art. The results concluded that people want a geometric piece of art. Our vision is to install a sign to grab people's attention through its unique shape and form while representing some Auburn values. The line from the Auburn Creed, "I believe in human touch, which cultivates sympathy with my fellow men and mutual helpfulness and bring happiness for all" is what is inspiring us. Auburn's Campus does not have many art installations and we believe that having an art installation on campus could be inspiring to students, faculty, alumni, community members and visitors.

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Title: Poly(3-methoxythiophene) a novel polyalkoxythiophene synthesized using Grignard Metathesis polymerization

Primary Author (and presenter): Kim, Jihyuk
Additional Authors: Minkler, Michael J. & Beckingham, Bryan S.
Department: Chemical Engineering
College/School: Samuel Ginn College of Engineering

Description:

Growing energy demand has elicited the need for more efficient means of energy generation and utilization. Researchers have been investigating semiconducting polymers for applications in many electronic fields to replace the more expensive less flexible materials traditionally used. Within the class of conjugated polymers, polythiophene has attracted wide interest in organic-based electronics due to its high stability of (un)doped states, ease of structural modification, and solution processability. Therefore, to better understand the effect of microstructure of polythiophene on its optoelectronic properties and solid-state properties, we synthesized a polythiophene derivative, poly(3-methoxythiophene) (POMeT), using Grignard Metathesis polymerization in place of the more traditional electropolymerization of alkoxy thiophenes. Grignard Metathesis polymerization yields polymers with more uniform regiochemistry than other polymerization techniques such as the Rieke method or electropolymerization. Briefly, we synthesize methoxythiophene through the reaction of 3-bromothiophene with sodium methoxide in the presence of a copper catalyst. The product is purified by successive extractions before dibromination to yield 2,5-dibromo(3-methoxy) thiophene. This substituted thiophene is then susceptible to polymerization using GRIM polymerization. Molecular characterization via ^{1}H NMR spectroscopy was used throughout the synthesis of POMeT to verify the intermediate compounds and to confirm the final product composition. Relative molecular weight and dispersity will be determined via gel-permeation chromatography, differential scanning calorimetry will be used to determine melting transition and equilibrium melting enthalpy, and UV/Vis spectroscopy will be used to estimate optical band gaps. The knowledge gained through this research will help understand the structure-property relationships of the different microstructure of polythiophene on the resulting material properties.

Title: Solute sorption and transport behavior of methanol and acetate in Selemion® AMV-N
Primary Author (and presenter): Kim, Jung Min (Luca)
Additional Authors: Beckingham, Bryan S.
Department: Chemical Engineering
College/School: Samuel Ginn College of Engineering

Description:

Permselective ion-containing membranes are an integral component of many energy generations and storage devices, including fuel cells, electrolyzers, and solar fuel devices. Anion exchange membranes are one type of ion-containing membrane where the mobile ions are negatively charged anions. These ion-containing membranes are promising membranes for desalination and other photoelectrochemical cells due to their capability to selectively permit the transport of ions (salts) and solutes (such as water). Anion exchange membranes have been applied to photoelectrochemical cells for the production of liquid product from the reduction of CO2. In these systems, understanding the transport of the CO2 reduction products such as acetate, formate, methanol, ethanol, and propanol is paramount. Here, we investigate the diffusive transport behavior of these solutes (namely methanol and acetate) through the anion exchange membrane Selemion® AMV-N. In previous research, multicomponent transport of alcohol mixtures through, Selemion® AMV, a related membrane material has been investigated based on diffusion cell experiments with in-situ ATR-FTIR spectroscopy and found that the transport behavior differed, in some cases significantly, between single component transport scenarios and multi-component transport scenarios. In this work, we probe how the co-transport of solutes impacts transport behavior through Selemion® AMV-N by conducting single and multicomponent diffusion cell permeability experiments monitored by in-situ ATR-FTIR spectroscopy coupled with adsorption-desorption experiments to extract solute solubilities and through the solution-diffusion model solute diffusivities.

Title: Assessment of resurfacing process on (99942) Apophis during the 2029 Earth flyby
Primary Author (and presenter): Kim, Yaeji
Additional Authors: Masatoshi, Hirabayashi
Department: Aerospace Engineering
College/School: Samuel Ginn College of Engineering

Description:

Although compositional materials of S- and Q-type asteroids are identical, the spectral slopes of them are different. While S-type asteroids have redder and darker surfaces, Q-type asteroids have bluer and brighter ones. This spectral discrepancy between them have been considered to result from interactions between space weathering and resurfacing. However, the detailed mechanism of the resurfacing on the surface of an asteroid was not well constrained, especially given that asteroids are not ideally spherical, for relatively well-known space weathering. It has been proposed that a tidal effect from the terrestrial planets may contribute to resurfacing on an asteroid, resulting in shape modification and/or landslides, which may expose fresh surface materials. Expected to have the closest Earth flyby on April 13, 2029, (99942) Apophis is considered to be key to observe resurfacing due to tidal effect. Here, we develop a numerical simulation package with the use of ground-radar-driven polyhedron shape model to evaluate the surface condition of Apophis during the 2029 flyby, which will provide critical information to characterize the resurfacing process. In this simulation, by taking into account the translational and rotational motion of Apophis, we compute its surface slope evolution. First, the translational motion is computed by using the position data starting on March 13, 2029 (from JPL Horizon). Second, the angular acceleration of Apophis' attitude is computed by using the Euler equation with the tidally induced torque. Then, the surface slope of Apophis is computed based on the direction of the gravity force, the tidal force from the Earth, and the rotation-driven force on each facet. Through the simulation, the results show that some regions of Apophis may become unstable area, where is susceptible to experience landslides. Finally, a better understanding of the surface evolution of Apophis will give a clue to the resurfacing process on asteroids.

Title: Do study abroad programs change food neophobia among students?
Primary Author: Kim, Yoonah
Additional Authors: Lee, Yee Ming
Department: Nutrition, Dietetics, and Hospitality Management
College/School: College of Human Sciences
Description:

The department of Nutrition, Dietetics and Hospitality Management (NDHM) at Auburn University offers several study abroad programs that provide students with educational an socio-cultural experience that relate to food, cultures, and tourism. There is no formal assessment on how cultural exposure influences student learning, as well as student's horizon about trying different kinds of food. There is a need for an innovative research that investigates the change of students' perspectives on food before and after the exposure to the foreign culture. In order to gain a better understanding about this issue, the concept of food neophobia will be applied in this study. Generally, food neophobia is defined as "rejection of novel or unfamiliar foods" (Dovey et al., 2008). In addition, there is an increasing demand and interest of locally grown food (Bianchi & Mortimer, 2015; Menapace, 2016; Penney & Prior, 2014). To evaluate study abroad program students' locally grown food consuming intention, the framework of Theory of Planned Behavior (TPB) will be used in this study. The objectives for this research are to 1) Evaluate overall study abroad program students' changes in food neophobia before and after their exposure to foreign cultures using the food neophobia scale; 2) Compare how different study abroad programs affect food neophobia; and 3) Assess study abroad program students' perceptions on locally grown food and their intention to consume local food using the TPB.A convenience sampling method will be used to recruit students participating in the study abroad programs offered by the Department of Nutrition, Dietetics, and Hospitality Management. Data collection will be in the form of pre-and post-paper-based questionnaires. Data analysis will include descriptive statistics and inferential statistics. The research findings will provide valuable information to the department to enhance its study abroad programs.

Title: Graphical user interface for protein engineering software.
Primary Author (and presenter): Kirkpatrick, Evan, H
Department: Chemical Engineering
College/School: College of Engineering
Description:

Nature only utilizes a small portion of the possible amino acid sequences which combine to form proteins. The field of protein engineering seeks to combine amino acids in ways to find novel proteins with novel functions. The computational tools necessary to run the largely combinatorial design algorithms are young, meaning that the potential for developing novel proteins has been largely untapped. This research seeks to provide a graphical user interface (GUI) for software that designs novel binding proteins. The purpose of this being to facilitate the use of the software and to provide real-time feedback. Development of this interface presents challenges in that it is unclear what the best way to extract information from the user is, and additionally what information the user needs in return most optimally. These challenges exist largely because software like this often runs on supercomputers, but in our case the design algorithms simply require a desktop computer. These challenges were addressed by working with those that have used the console software, and deciding what could be improved by using a GUI. Once fully complete, this software and other like it can be used to make the tools of protein engineering easier to utilize for making meaningful discoveries.

Title: Evidence-based design patient room typicals across hospital specialties
Primary Author (and presenter): Kirksey, Britney
Additional Authors: Killen, Maggie & Burchill, Stephanie
Department: Consumer and Design Sciences
College/School: Human Sciences

Description:

Healthcare design is a challenging and demanding specialization for architects, interior designers, and general contractors. When designing a healthcare facility, some obstacles practitioners face is following strict building codes, creating complex building programs, and addressing building users' varied needs. Evidence-based design (EBD) presents a promising practice in that it asks these practitioners and their peers to work together from a project's inception through completion as a multidisciplinary design team. This team-based approach may improve communication, help solve problems faster and more efficiently, and produce better design outcomes. Unlike other healthcare design models, where the decision-making process is influenced by personal experiences and technological advances, key EBD decisions are based on research gathered from credible sources. Research-based decisions produce informed and measurable design outcomes. Our project is the development of a prototype patient room that is specialized to different needs within a single hospital case. A literature review of EBD will be conducted comprising of scholarly articles and case studies. The project team will be constructed of individuals with backgrounds in architecture, interior design, and construction. The prototype is expected to address typical design for different specialties; such as geriatric, neurology, orthopedic, and intensive care unit (ICU). Though the EBD framework provides a model for how the development of specialized patient rooms may improve patient care. Our group feels that our EBD prototype will improve employee performance, and system interaction through decreased lifecycle costs, improved employee performance, and increased systems efficiencies. The potential future influence of our work is continuation of research into EBD's impacts and benefits to healthcare and increased use of EBD implementation in healthcare.

Title: Movement of *Salmonella* in a veterinary teaching hospital
Primary Author (and presenter): Kitchens, Steven Ray
Additional Authors: Michaels, Mackenzie & Price, Stuart
Department: Pathobiology
College/School: College of Veterinary Medicine

Description:

Salmonella is the most commonly associated agent responsible for nosocomial outbreaks in veterinary teaching hospitals. Previous studies conducted at the Auburn University College of Veterinary Medicine (AUCVM) found *Salmonella* contamination in the environment. The current study was conducted to determine if dairy calves on the AUCVM campus were carrying *Salmonella*, and if so, to define the frequency and duration of fecal *Salmonella* shedding. Because these dairy calves are located proximally to the AUCVM Equine Reproduction Center (ERC), we performed a parallel study focused on sampling the ERC environment, hypothesizing that we would find the same *Salmonella* strains in the ERC that were isolated from the calves. Samples were processed for *Salmonella* isolation as described in the USDA FSIS *Microbiology Laboratory Guidebook*. *Salmonella* serogrouping was performed onsite and *Salmonella* isolates were submitted to the Biovet, Inc., for serotyping. Calves sampled from 2017 through 2018 had intermittent and sporadic shedding of *Salmonella*, primarily of serotypes Muenster and Cerro (serogroups E and K, respectively). In the summer of 2018, environmental samples from the ERC contained serotypes Muenster and Cerro, along with serotype Muenchen, (*Salmonella* serogroup C_2). After closure of the ERC due to environmental *Salmonella* contamination, calves at the AUCVM started shedding *Salmonella* serotype Muenchen. The isolation of identical *Salmonella* serotypes from the dairy calves and the adjacent ERC environment strongly suggest proximal movement of these strains. These findings support the need for implementation of intervention strategies that increase biosecurity at the AUCVM.

Title: Ore mineralogy, geochemistry, and genesis of the Hog Mountain orogenic gold deposit, southwestern Appalachians, USA

Primary Author (and presenter): Kline, Anabelle K.[1]
Additional Authors: Bilenker, Laura D.[1]; Brueckner, Stefanie M.[2]
Department: [1]Department of Geosciences, [2]Harquail School of Earth Sciences
College/School: [1]College of Sciences and Mathematics; [2]MERC Laurentian University

Description:

Orogenic gold (Au) deposits are economic concentrations of Au formed from hot fluids mobilized during collisional events. They occur throughout geologic time and are a significant global source of Au. The formation of orogenic Au deposits is structurally controlled. The fluid conditions responsible for the transport and deposition of metals in these deposits and the origin of those metals is highly debated. Hog Mountain is an orogenic Au deposit within the southern-most Appalachians of Alabama. The region has a long history of Au prospecting and mining, although many operations ceased in the mid-1850s. An in-depth understanding of the genesis of Au mineralization at Hog Mountain can be applied to other orogenic Au occurrences within the Appalachians and collisional orogens worldwide. Hog Mountain contains Au concentrations of up to 2.5 oz/t. Mineralized quartz veins that cross-cut an intrusive rock body (tonalite) with an assumed age of 384 ± 32 million years host the Au. To study the genesis of Au at Hog Mountain in more detail, over 4,000 ft of core were examined and the sampled to be analyzed in detail with mineralogical and geochemical analyses. Key findings include: 1) Au mineralization occurs within quartz-sulfide veins with variable thickness of alteration envelopes; 2) Au is observed as free grains within quartz and with iron-sulfides; 3) in addition to quartz veins, thin sulfide veinlets free of Au cross-cut the tonalite; and 4) the sulfides are homogenous.Textural, mineralogical and geochemical results indicate that Hog Mountain was formed by one continuous hot fluid event. Low salinity and reduced fluid conditions were responsible for metal transport, and Au transport was dominated by sulfur complexes; however, colloidal Au transport cannot be excluded. Metal and Au deposition was controlled by wall rock-fluid reactions that resulted in changes in the chemical conditions of the fluid.

Title: Reduced AMY1 gene copy number is associated with increased BMI in children

Primary Author (and presenter): Koenigs, Taylor, N
Additional Authors: Venkatapoorna, Chandra M. K.; Ayine, Priscilla; Parra, Emily P.; Sandey, Maninder; Jeganathan, Ramesh B.; Thangiah, Geetha
Department: [1]Department of Nutrition, Dietetics, and Hospitality Management, Auburn University, Auburn, AL, USA; [2]Department of Pathobiology, College of Veterinary Medicine, Auburn University, Auburn, AL, USA
College/School: College of Human Sciences

Description:

***Background*:** Salivary amylase (*AMY1*) is the most abundant enzyme in human saliva, responsible for the hydrolysis of α-1,4 glycosidic linkages that aids in the digestion of dietary starch. Recently few studies have shown that copy number of *AMY1* is associated with obesity, however, the data varies with different location. One-third of children are overweight/obese in Alabama. In this study, we specifically aim to determine the relationship between the copy number of *AMY1* gene and obesity measurements in elementary school children from Alabama.
***Methods*:** Sixty elementary school children (30 normal weight and 30 overweight/ obese) aged between 6 to 10 years participated in this study. Anthropometric measurements were measured using WHO recommendations. Saliva was collected, genomic DNA was extracted and the copy number of the *AMY1* gene was estimated by digital PCR. Linear regression analysis was used to investigate the association between *AMY1* copy number and obesity measurements.
***Results*:** The mean *AMY1* copy number significantly decreased in obese (5.91 ± 1.43) compared to normal weight (8.02 ± 2.37) children. The results showed a significant inverse association between obesity measurements and *AMY1* copy number. Gender specific analysis showed boys had a stronger association between low *AMY1* copy number and obesity compared to girls.
Conclusions: Our findings suggest that low *AMY1* copy number plays a major role in childhood obesity in Alabama elementary school children and the effect is more prominent in boys compared to girls.

Title: On frequency synchronization in the Kuramoto networks
Primary Author (and presenter): Korchevskaia, Evgeniia
Department: Mathematics and Computer Science
College/School: Auburn University at Montgomery - Sciences

Description:

Spontaneous synchronization is the ubiquitous phenomenon that appears in a wide range of scientific disciplines including physics, biology, and engineering. It has thus been the topic of intense research in the recent decades. The Kuramoto model is a classical mathematical model in the study of synchronization in the systems of interconnected oscillators. In particular, a system is said to be in frequency synchronization when all the oscillators move in unison. A network of N oscillators can be mathematically described by a weighted graph G = (V, E, A) on the vertex set V representing the oscillators, with edges E representing the connections among the oscillators, and weights A representing the coupling strength along the edges. In this research, we focus on networks whose underlying graphs are trees and cycles since they are the building blocks of graphs in general. Using the tools from tropical geometry, we study the number of possible synchronization configurations. In particular, we show that the maximum number of possibilities is less than previously conjectured.

Title: Computational fluid dynamics study of expiratory flow in the human trachea
Primary Author: Kore, Tarun, E
Additional Authors: Tiwari, Bipin; Bodduluri, Sandeep; Bhatt, Surya; Raghav, Vrishank;
Department: Chemical Engineering, Aerospace Engineering
College/School: Engineering

Chronic Obstructive Pulmonary Disease (COPD) is a respiratory disease which is the third leading cause of death in the United States, affecting an estimate of more than 11 million people. It is a chronic inflammatory lung disease that obstructs airflow in the lower airways and is caused due to the long-term exposure to irritating gases, particulate matter, most often experienced due to smoking. A recently discovered phenomenon linked with COPD is Expiratory Central Airway Collapse (ECAC) which is the flattening and collapse (of more than 50% of the surface area) of the trachea during expiration. This occurrence leads to abnormal air flow rates due to shortness of breath, cough and mucus production that worsens respiratory quality of life. Currently, the mechanisms for initiation and progression of ECAC is not well understood and is the primary motivation of this study. In collaboration with the Department of Medicine at the University of Alabama at Birmingham (UAB), we have hypothesized that pathophysiological wall shear stress due to abnormal air flow rates could lead to heterogeneous progression of ECAC. Through the use of Computational Fluid Dynamics (CFD) simulations, we aim to observe and compare the wall shear stress (WSS) responses of ten patient specific tracheal geometries, five with ECAC and five normal tracheas, under nominal and coughing breathing conditions. Through a previous experiment, the heterogeneous progression of ECAC was found to show 13.8% higher WSS values for geometries with ECAC when under a steady state air flow simulation. Following this logic, we predict that the ECAC geometries will show larger WSS values under coughing conditions than under nominal breathing conditions. For a more vigorous and realistic inspection of the progression of ECAC, a pulsatile transient inlet flow rate had been administered under varying time intervals.

Title: Investigation of the performance and energy consumption of superconducting adiabatic computing circuits

Primary Author (and presenter): Krause, Keith, M
Additional Authors: Hamilton, Michael; Goteti, Uday
Department: Electrical and Computer Engineering
College/School: Engineering

Superconducting circuits using adiabatic quantum-flux-parametron (AQFP) logic have been shown to have ultra-low power consumption. The energy dissipation of adiabatic processes are orders of magnitude lower than non-adiabatic processes, which can lead to a high number of logic gates with little power consumption. We have studied the bit-energy dissipation of various superconducting computing circuits that use AQFP logic gates including NOT gates, MAJ gates, and Full Adders. Since AQFP logic gates use Josephson Junctions (JJs), we have analyzed numerous AQFP logic circuits using the JJ simulator JSIM. By adjusting the rise/fall times of the excitation currents, we can slow down the clock speed of these circuits to produce even greater energy efficiency. With the bit-energy dissipation data we've gotten from JSIM, we can see how the design, clock speed, and complexity of the AQFP circuits affects the power consumed during computation.

Title: Analysis of on-site irrigation management data in five Alabama container nurseries
Primary Author (and presenter): Krofft, Claire E.
Additional Authors: Newby, Adam; Pickens, Jeremy; & Fain, Glenn
Department: Horticulture
College/School: College of Agriculture

Description:

During the summer of 2018, five ornamental container nurseries located in central and southern Alabama were visited to collect data about management practices of overhead irrigation systems. Distribution uniformity (DU), leaching fraction (LF), and average irrigation application were measured on blocks of dwarf Yaupon hollies (*Ilex vomitoria* 'Nana') growing in #3 containers. Substrate pH and electrical conductivity (EC) of the leachate and size index of the plants was measured. Although application varied due to seasonal changes and weather patterns, most nurseries applied an average of 0.3–0.5 inches of irrigation. Application depth ranged greatly within each nursery visit, and indication of low DU. All nurseries visited had DU below recommendation of 80%. Average LF ranged from 4% to 36%, with some nurseries obtaining the recommendation of ≤15%. LF ranged greatly, again likely due to low DU. No conclusions could be drawn from size index, pH and EC data. In the summer of 2019 this study will be repeated with one visit to each nursery and an increased LF sample size to obtain a more accurate representation of LF values. The biggest limitation to system efficiency appears to be DU, therefore monitoring and improving DU is the first step to improving overhead irrigation management. The results from this study will be used to educate nursery growers about how to improve the efficiency of their systems through the implementation of best management practices to reduce resource use and production costs while improving crop quality.

Title: Cryptic species of *Myxobolus* (Myxozoa: Myxobolidae): an intercellular cnidarian that parasitizes the central nervous system of native brook trout (*Salvelinus fontinalis*) in western North Carolina

Primary Author (and presenter): Ksepka, Steven P.
Additional Authors: Ruiz, Carlos; Rash, Jacob; Bullard, Stephen
Department: School of Fisheries, Aquaculture, and Aquatic Sciences
College/School: College of Agriculture

Description:

We used microscopy, molecular sequence data, and histopathology to characterize a cryptic *Myxobolus* sp. infecting the central nervous system (CNS) of brook trout (*Salvelinus fontinalis*). This parasite was discovered while performing the standard pepsin-trypsin digest and microscopic examination for the detection of the exotic, invasive trout pathogen *Myxobolus cerebralis* (causative agent of whirling disease). We morphologically characterized these specimens as: myxospore pyriform, 12.0–16.0 μm (mean ± SD = 13.9 ± 0.9; N = 83) long, 8.0–12.0 (9.6 ± 0.8; 74) wide, 7.0–10.0 (8.1 ± 0.7; 17) thick; valve having 0–4 (2.8 ± 0.8; 69) sutural markings; polar capsules 2 in number, 6.0–10.0 (7.8 ± 0.8; 153) long, 3.0–5.0 (3.5 ± 0.5; 159) wide, having 7–10 polar filament coils; intracapsular process 1.0–3.0 (2.3 ± 0.5; 124) long, 1.0–2.0 (1.5 ± 0.5; 124) wide; sporoplasm containing iodinophilic vacuole and 2 nuclei; mucous envelope prominent on rounded posterior margin, 2.0 μm (2.0 ± 0.0; 3) thick. This species resembles *Myxobolus arcticus*, another CNS-infecting myxozoan of salmonids (*Oncorhynchus* spp. and *Salvelinus* spp.) in Russia and the Pacific Northwest (US) but differs by having sutural markings and a mucous envelope. Sequences of the small subunit ribosomal DNA (18S) of *Myxobolus* sp. differed from *M. arcticus* by 2.7%, supporting the morphology-based assertion of a cryptic species of *Myxobolus*, and extracted DNA failed to amplify using the primers and nested PCR reaction for *M. cerebralis*. The parasite exhibits host specificity and tissue tropism: only the medulla oblongata and nerve cord of 22 of 29 (76%) brook trout were infected, and 13 rainbow trout (*Oncorhynchus mykiss*) and 20 brown trout (*Salmo trutta*) were not infected. Morphologically differentiating this new species from *M. cerebralis* is critically important in the context of hatchery checks and biosecurity because it superficially could be misdiagnosed as the causative agent of whirling disease.

Title: Validation of an *in vitro* non-alcoholic steatohepatitis Cas9 model.
Primary Author: Kuhlers, Peyton, C
Additional Authors: Woodie, Lauren; Ahmed, Bulbul; Greene, Michael
Department: Nutrition, Dietetics, and Hospitality Management
College: Human Sciences

Non-alcoholic steatohepatitis (NASH) is a condition characterized by accumulation of fat in the liver accompanied by inflammation. The goal of this project was to validate a CRISPR-Cas9 model to examine genes modulating NASH. AML12 mouse liver cells were maintained in DMEM Advanced growth medium at 37°C and 5% CO_2. To obtain Cas9 expressing clones, cells were infected with lentiCas9-Blast (a plasmid containing FLAG tagged Cas9). Blasticidin resistant single cell colonies were obtained. To model NASH in vitro, cells were treated with 0.4mM palmitic acid (PA) or 25ng/mL TNFα in DMEM with 1g/L glucose for 24 hours to induce collagen I expression, a marker of NASH development. Collagen I expression was assessed by Western blot using anti-Collagen I antibodies. GAPDH expression was assessed by Western blotting and used to normalize collagen I expression. Additionally, fatty acid induced insulin resistance was examined. Cells were treated with 0.9mM PA in DMEM with 4.5g/L glucose for 24 hours, then stimulated with 100nM insulin for 15 minutes. Western blot analysis for pAkt(ser473) expression was used assess insulin signaling. Both AML12 and Cas9 expressing AML12 cells showed significant elevations in collagen I expression normalized to GAPDH when treated with PA (mean ± SE 4.6 ± 1.5-fold and 7.9 ± 2.6-fold, respectively), but not when treated with TNFα (1.3 ± 1.1-fold and 1.1 ± 0.2-fold, respectively). A 36% reduction in fold change expression of pAkt was observed in Cas9 cells treated with 0.9mM PA and stimulated with insulin compared to untreated controls stimulated with insulin, indicating an insulin resistant state. No significant differences were observed between the two cell types. These experiments demonstrate that the Cas9 does not disrupt PA-induced Collagen I expression or insulin resistance in AML12 cells. Thus, Cas9 AML12 cells can be used with gene specific guide RNAs to mutate putative genes playing a role in NASH in a cost and time efficient manner.

Title: Protein yield from filamentous algae culture from aquaculture wastewater as a function of nutrient condition

Primary Author: Land, Hudson, R
Department: Biosystems Engineering
School: Samuel Ginn College of Engineering

The objective of this research was to assess the protein yield from filamentous algae, specifically *Oedogonium*, as a function of nutrient concentration and nutrient ratios. This information was used to determine the effectiveness of algal turf scrubbers in the aquaponics industry as a means to close the nutrient loop and extract any nutrients not absorbed by the plants or ingested by the fish. This was achieved by growing and harvesting a monoculture of *Oedogonium* in laboratory microcosms using nutrient ratios (N:P ratio) and nutrient concentration as independent variables and analyzing the protein content of the algae to find the most productive conditions. It was expected that the protein yield would be significantly affected by nutrient concentrations and nutrient ratios.

As a common species in Alabama , *Oedogonium* was isolated in the lab and cultured in monoculture for inoculation of the indoor, benchtop microcosm system. Repeated water samples from the aquaponics greenhouses were taken and analyzed in pooled samples to determine the chemical makeup of the water that would typically be found in an aquaponics setup. This allowed for a benchtop model of algal turf scrubbers to have the same nutrient profile as the outdoor system. Finally, preliminary growth experiments using trials of nutrient concentration were performed.

Measurements were taken on biomass productivity, using sacrificial harvest and gravimetric analysis of dry biomass, and protein content, using standard spectrophotometric assays for protein. This information was analyzed to find the optimal nutrient concentration and ratio of nitrogen to phosphorous to produce protein rich algae to help close the nutrient loop in aquaponics.

Title: Identifying a novel population in the adrenal gland cortex
Primary Author (and presenter): Laprocina, Karly A.
Additional Authors: Junghans, Kristina; Reid, Olivia; Cleary, Courtney; Kang, Yuag; Huang, Chen-Che Jeff
Department: Anatomy, Physiology and Pharmacology
College/School: Veterinary Medicine

It is known that the growth and the development of the X-zone of the mouse adrenal gland is sexually dysmorphic. The X-zone regresses in males at the onset of puberty and regresses in females during the first pregnancy. It has been shown that treatment with thyroid hormone will delay X-zone regression. However, the mechanisms influencing the development and regression of the X-zone and thyroid hormone's involvement in this process are not fully understood. Understanding the mechanisms behind cell proliferation/apoptosis in the X-zone is very important as this could allow us to control the development of the adrenal glands.

Dhcr24 was first discovered linked with Alzheimer's Disease (AD). In AD patients, Dhcr24 is down-regulated in the affected regions of the brain, whereas the over-expression of Dhcr24 in neurons prevents apoptosis. Our lab recently found that Dhcr24 is also expressed in the adrenal gland, specifically in the X-zone. Our preliminary data showed that Dhcr24 is upregulated after thyroid hormone treatment, which prevents X-zone regression. This suggests a link between thyroid hormone, Dhcr24, and the apoptosis-mediated cell regression of the X-zone. Our aim in researching Dchr24 is to further understand this link as well as the other pathways that Dhcr24 plays a role in.

In this study, we are using RNA-seq to further discover the role of thyroid hormone and Dhcr24 on the cell fate in the adrenal cortex. The genome-wide transcriptome analysis identifies genes and pathways that are upregulated and downregulated with Dhcr24 under the thyroid hormone treatment. A future study aim is to use Dhcr24 conditional knock out mice to specifically remove Dhcr24 in the adrenal cortex to see the role of Dhcr24 in adrenal cortex development and regression.

Title: Maximum lyapunov exponent analysis of a repetitive vertical jump task in female athletes
Primary Author (and presenter): Larson, Jacob S.
Additional Authors: Zabala, Michael; Oldfather, Taylor; & Perkins, Edmon
Department: Mechanical Engineering
College/School: Samuel Ginn College of Engineering

Description:

Anterior Cruciate Ligament (ACL) rupture is among the most common and debilitating injuries in women's soccer, effecting up to 20% of athletes per season. What often follows is surgery and extensive rehabilitation for up to a year following the injury as well as a reduction in the athlete's quality of life thereafter. Previous studies have used the Maximum Lyapunov Exponent (MLE) to analyze trunk stability during a repetitive task, but no studies have tried to analyze stability of the knee during a high impact test. This could give insight into how athletes respond to sudden impacts on the field, and potentially create a more effective injury prevention metric to reduce risk of ACL injury. Studies have shown that risk of noncontact injury largely depends on knee abduction at the time of injury, with ACL injuries occurring at significantly greater knee abduction than the knee abduction at initial contact with the ground. The goal of this study was to assess whether the MLE is correlated to this known injury risk-related metric. This study collected the kinematics of repeated vertical jumps from thirteen uninjured female D1 soccer, D1 basketball, and club soccer athletes from Auburn University. knee abduction was measured at max knee flexion (MKF) and compared to the MLE over the duration of the study. Analysis excluded data points when the subject was airborne, which allows for the evaluation of knee kinematics during eccentric and concentric loading only. The analysis in this paper follows Rosenstein's method for calculating the MLE. The MLE evaluates a phase space reconstruction of a signal using a calculated time delay, after which the divergence of the reconstruction is calculated. After performing a bivariate correlation, a significant correlation was found between knee abduction of both legs at MKF with the MLE of knee abduction. This finding suggests that the MLE should be explored as a potential metric for assessing risk of ACL injury in future studies.

Title: Word emotionality: changing perception and performance
Primary Author (and Presenter): Laughlin, Barbara
Additional Author: Lazarte, Alejandro
Department: Psychology
College/School: Liberal Arts

There is little research about the impact of word's emotionality in feedback has on individual's ability to perform tasks. Word's emotionality generates a perceptual response associated with potential anxiety that may help or hinder an individual's performance on a task. The purpose of this study is to prove the relationship between feedback word emotionality and task performance, in an anxiety-inducing environment.
Participants were randomly assigned to an anxiety-induced condition (preforming in front of webcam) and a control condition. Both groups performed modified Emotionality Stroop tasks, one before and one after receiving different types of feedback. Feedback was framed with combinations of positive, neutral or negative numerical and emotional worded comments.

Preliminary analysis of 37 participants showed no significant response time (RT) change across Stroop tasks between the anxiety-induced (M=-274, SD=155) and the control group (M=-296, SD= 201), $F(1,27)=0.121$, $p=.730$, $\eta^2=.004$ Similarly, there was no significant difference in RT change across type of feedback, $F(4, 27)=1.298$, $p=.296$, $\eta^2=.161$. However, there was a significant interaction between groups and type of feedback, $F(4, 27)=3.053$, $p=.034$, $\eta^2=.311$. Neutral feedback (M=-315, SD=137) or positive numerical-negative worded feedback (M=-342, SD=190) had a larger reduction in RT change in the anxiety-inducing group than the control. The anxiety-induced condition motivated a better performance when the feedback was verbal none threatening and numerically average or when numerical feedback was positive but worded feedback was more demanding. These results suggest anxiety-inducing condition trigger better performance on the second time but as a function of the type of feedback.

Title: Peroxyacetic acid applied following broiler chicken feather removal minimizes pathogen levels during processing

Primary Author (and presenter): Lawley, Ella O.
Additional Authors: Bourassa, Dianna
Department: Poultry Science
College/ School: College of Agriculture

Description:

During broiler chicken processing, defeathering is known to lead to increases in microbial levels on carcasses due to squeezing of the carcass and expulsion of fecal material. The immediate application of an antimicrobial processing aid following defeathering may help to minimize the impact of carcass contamination that occurs during the defeathering process. In a commercial processing plant on three consecutive weeks, broiler chicken carcasses were dip treated with 250, 500, or 650 ppm peroxyacetic acid (PAA) for 5 seconds immediately following defeathering. Each week on three consecutive sampling days, 10 carcasses were sampled after defeathering prior to PAA treatment (controls) and 10 carcasses sampled following PAA treatment. After treatment carcasses were removed from the processing line and allowed to drip for 1 min prior to bagging and sampling by rinsing the whole carcass in 400 mL buffered peptone water with 1 g/L sodium thiosulfate added to neutralize potential PAA carryover. Rinsates were collected and sampled for Enterobacteriaceae (EB) and *Campylobacter* counts. Rinsates were then enriched for *Salmonella* prevalence. Post-defeathering PAA treatments of 500 and 650 ppm significantly decreased *Campylobacter* levels by 0.55 and 0.63 $\log_{10}$ CFU/mL ($P<0.0001$) and PAA at 650 ppm significantly decreased EB levels by 0.58 $\log_{10}$ CFU/mL ($P=0.0069$). PAA treatment at 650 ppm decreased enriched *Salmonella* prevalence from 73% to 50% ($P=0.0245$) and non-enriched *Campylobacter* prevalence from 98% to 83% ($P=0.0105$). These results indicate that the use of PAA at 650 ppm as a dip treatment following defeathering could be used as an intervention to minimize the levels and prevalence of foodborne pathogens on broiler chicken carcasses.

Title: The effects of incubation temperatures on beak coloration in zebra finches
Primary Author (and presenter): Lazenby, Madeline P.
Additional Authors: Rubin, Alex & Wada, Haruka
Department: Biological Sciences
College/School: College of Sciences and Mathematics

Description:

Developmental environment can have a strong influence on phenotype of offspring. In birds, embryonic development is a crucial life history stage with incubation temperature playing a large role in determining individual phenotype. Incubating parents will modify their incubation behavior depending on their body condition and ambient temperature by exposing eggs to suboptimal temperatures. Many studies have assessed the effects of constant suboptimal incubation temperatures on phenotype, but little is known about how fluctuating incubation temperatures alter offspring phenotype. Similarly, only few studies have investigated long-term effect of incubation temperature on fitness-related measures. One fitness related trait in birds is beak coloration, a secondary sex characteristic that indicates health condition and influences successful mating for both males and females, which varies with age and sex. Here, we assessed how periodic cooling during embryonic development influences the development of beak coloration as zebra finches (*Taeniopygia guttata*) reach sexual maturity. Embryos were incubated at one of the three temperature regimes; constantly low (36.4°C), periodic temperature (average 36.4°C), and control (37.4°C) temperatures. The hue, intensity, and saturation of the beak color was then recorded every 15 days from post hatch day 45 to 90. In *T. guttata*, juveniles have dark black beaks which become bright red in males or bright orange in females. Differences in the rate of development of this coloration between treatments, and between sexes within a treatment may indicate sex specific responses to suboptimal incubation temperatures.

Title: Heart rate reduction for coronary computed tomography angiography (CTA): Efficacy, safety, and quality
Primary author: Ledbetter, Monty D.
Additional authors: Howell, Eleanor
College/ School: School of Nursing

Description:

There is strong evidence that heart rates less than 65 beats per minute improve image and diagnostic quality in coronary computed tomography angiography (CTA) exams. Studies have demonstrated that oral ivabradine and intravenous metoprolol can provide improved efficacy with heart rate adherence. This project compared heart rate control and image quality under the current protocol using oral metoprolol and a medication protocol using oral ivabradine and intravenous metoprolol. The target population is adults (21-80 years) with cardiac history warranting contrasted imaging of the heart. Following participant agreement, participants completed a cardiac history questionnaire and provided a heart rhythm recording. A radiologist prescribed the appropriate medication protocol to lower the patient's heart rate for imaging. Data collected included adverse side effects, heart rate adherence, and image quality. The project is in progress. Descriptive statistics will be used to describe the patient population, reason for exam, and medication(s) delivered. Follow-up data include number and percent of participants achieving heart rate control and experiencing adverse side effects, and images meeting quality standards. Among those undergoing coronary CTA imaging, the pre and post heart rates following medication will be compared using paired t-tests (alpha=0.05). Achieving a heart rate reduction of less than 65 bpm prior to coronary CTA imaging can provide the highest diagnostic quality in coronary segments. Medication protocols including oral ivabradine and intravenous metoprolol can effectively lower heart rates with minimal adverse side effects. Further implementation of this project is warranted.

Title: Influence of part location and direction on surface roughness and the resulting crack initiation behavior in additive manufacturing
Primary Author: Lee, Seungjong
Additional Author: Pegues, Jonathan & Shamsaei, Nima
Department: Mechanical Engineering
College/School: Samuel Ginn College of Engineering

Description:

The Laser Powder Bed Fusion (LPBF) method is one of the most popular metal Additive Manufacturing (AM) techniques. The concept of LPBF is layer by layer fabrication using fine metallic powder as the media which is selectively melted by laser forming a 3-Dimensional part. Therefore, the parts manufactured by LPBF method have certain surface direction (e.g. from feed bin to overflowing bin). The AM components should have competitive mechanical properties compared to the component made by existing methods. Notably, AM parts have adverse fatigue behavior because of defects which cause localized stress concentration. Surface roughness which is one of the most detrimental defects can be a crack initiation point and it is critical to fatigue life. In this study, surface roughness of north, south, east, and west directions and crack initiation were examined for 304L Stainless Steel Alloy to demonstrate the effects of surface direction. All of the specimens were fabricated on the same plate, designed with circular and rectangular geometry, and located parallel with the recoating blade. Strain controlled fatigue testing was conducted with three strain levels.
The fatigue results were compared to smooth machined and polished specimens of the same material fabricated by same process. Surface roughness of specimens were analyzed and a thorough fractographical analysis was conducted using digital microscopy. This study will attempt to prove relationships between location and direction of surface and fatigue behavior.

Title: Development of interpenetrating polymer network (IPN) materials for road repair
Primary Author (and presenter): LeGrand, Craige B.J.
Additional Authors: Thorne, David & Celestine, Asha-Dee
Department: Aerospace Engineering
College/School: Samuel Ginn College of Engineering

Description:

Interpenetrating Polymer Network (IPN) materials comprise of two or more polymer networks laced together on the molecular scale. These IPNs merge the properties of two or more polymers, producing a highly specialized material that has better mechanical and/or optical properties than the individual polymers. The focus of this research is to determine whether it is possible to increase the strength of asphalt concrete by reinforcing it with an IPN composite. A majority of roads in the USA are made of asphalt which is naturally brittle and cracks easily under extreme weather conditions. As such asphalt requires extensive amounts of repairs and maintenance. Currently, US state transportation agencies spend 80% of their annual budget toward road maintenance. Increasing the overall flexural strength of asphalt will greatly reduce these maintenance costs. Our preliminary work examined the behavior of IPN-based composites. Carbon fiber composites with two types of matrices were fabricated using a hand layup method. Flexural, and tensile tests were done on composite specimens of brittle commercial Vinyl Ester (VE), and an IPN of VE and ductile polyurethane (PU). The strength, and flexural/tensile modulus were measured and recorded. Our results showed that the flexural behavior of the IPN composites were similar to that of the VE composites. However, the VE composites performed much better than the IPN composites in tensile tests. The next steps for the IPN research include conducting impact tests to determine the effect of the PU on the impact properties of vinyl ester. The main objective is to understand IPN behavior and then compose an IPN that is greater in strength compared to other commercial polymers. These IPNs will then be integrated into asphalt to strengthen its overall flexural, and impact strength.

Title: How will climate change influence storage conditions for major agricultural commodities in the United States?

Primary Author (and presenter): Lesinger, Kyle D.
Additional Authors: Tian, Di; Leisner, Courtney
Department: Crop, Soil, Environmental Science
College/School: College of Agriculture

Description:

In this study, we assessed how changing climate conditions in the 21st century can have an impact on the storage conditions of key commodity crops in 9 different U.S. climate regions. An ensemble of 24 global circulation models (GCM) were utilized to quantify the uncertainties associated with the projected storage conditions, including length of winter storage subperiod and storage degree days (SDDs). The objectives of the this study were to utilize historical and projected climate data to (*i*) analyze winter storage conditions for each climate region; (*ii*) measure the changes of number of degree days for each climate region; (*iii*) provide informed strategies to farmers regarding conditions predicted under future climate scenarios. The daily weather data for both historical and projected periods were obtained from the Multivariate Adaptive Constructed Analogs (MACA) downscaled Coupled Model Intercomparison Project Phase 5 (CMIP5) datasets. Final results will include: calculated reduction in length of winter storage subperiod and increase in number of storage degree days by region by crop (interval of storage days lost), and range of uncertainty in aforementioned changes in storage conditions. We expect the impact of changing temperature caused by elevated atmospheric CO_2 on agricultural commodity storage will lead to an increase in storage degree days. Additionally, the number of degree days will differ based upon geographical location within the contiguous United States and type of crop analyzed.

Title: Healthcare proposal
Primary Author: Leslie, Kendall, A.
Additional Authors: Angelo, Sabrina; Walker, Caroline; Hamilton, Sarah
Department: Consumer and Design Sciences
College/School: Human Sciences

Description:

To date, according to Community and Public Health, one in six New Zealand adults have been diagnosed with a generalized mental health disorder. A 2016 report in Best Practice Journal found that 53% of teenage girls have experienced depression and of those 23% reported that they had seriously considered suicide. In addition, with the rise in self harm, it has been found that 29.1% of teenage females have inflicted self-harm in the last five years. Furthermore, women have found to be more susceptible to mental health disorders than men, which is why the study of focus has been shifted to women's and children's treatment. Through evidence based design within New Zealand hospitals and a partnership with staff and patients, our project presents a design intervention for an inpatient and outpatient facility with a newly donated downtown building. Projected services to be offered range from therapy, educational areas, and psychiatric treatment to obstetrics and general women's health services. Located along Hobson Bay in Auckland, New Zealand the addition of a women's and children mental health clinic is crucial to respond to the soar in depression, anxiety, trauma, and substance abuse seen in the last three decades. Auburn University's senior interior design students are partnering with Auckland City Hospital to expand its mental health services and better address the rise in mental health disorders plaguing its population.

Title: Barriers sex trafficking survivors face while exiting the commercial sex industry
Primary Author (and presenter): Lett, Caroline L.
Additional Authors: Ruhlmann, Lauren; Schiferl, Michael
Department: Human Development and Family Studies
College/School: Human Sciences

Survivors of sex trafficking commonly report adverse biopsychosocial outcomes as a result of their exploitation. Providing adequate services to survivors requires an understanding of these barriers. Despite the growing literature on sex trafficking, little research has been conducted to understand obstacles to survivors' recovery. The purpose of this study was to identify common barriers survivors encounter during their transition out of the commercial sex industry. RESTORE, a community-based participatory research program, partnered with a residential recovery program for survivors of sex trafficking called The Homestead. Participants were made aware of the study by flyer distribution throughout the residence; interviews were completely voluntary and participants were compensated for their time. Six (N = 6) women participated in this study. A team of advanced undergraduate students from multiple disciplines conducted interviews at The Homestead which were transcribed, analyzed, and coded. Analyses revealed two themes: 1.) intrapersonal barriers, and 2.) interpersonal barriers. Intrapersonal barriers included codes such as mental health, addiction, and self-perception, while interpersonal barriers included unhelpful relationships, developmental trauma, and ineffective services. This poster will provide an overview of themes and codes, as well as implications for service providers.

Title: Risk factors of fluoropyrimidine-induced cardiotoxicity among cancer survivors: a systematic review

Primary Author (and presenter): Li, Chao
Additional Authors: Garza, Kimberly; Ngorsuraches, Surachat; & Qian, Jingjing
Department: Health Outcomes Research and Policy
College/School: Harrison School of Pharmacy

Description:

To systematically review the risk factors for fluoropyrimidine-induced cardiotoxicity in cancer patients.We searched PubMed, PsycINFO, IPA, CINAHL, Web of Science for studies published between January 1, 1990 and October 31, 2018, including ≥20 cancer patients and examining risk factors for fluoropyrimidine-induced cardiotoxicity. Cardiotoxicity was defined as electrocardiography abnormalities, increasing cardiac biomarker levels, cardiac adverse events and cardiac-related mortality. Study quality assessments were performed using NIH quality assessment tools for observational cohort and cross-sectional studies. Seventeen cohort studies (10 prospective and 7 retrospective) were included in final review. Risk factors were categorized as patient-related and treatment-related factors. Patient-related factors identified from the review included pre-existing cardiac diseases (29% of included studies), hypertension (12%), hyperglycemia (6%), hypercholesterolemia (6%), age (12%), smoking (12%), female gender (6%). Treatment-related factors included continuous infusion (24%), concomitant leucovorin or cisplatin (18%), capecitabine-based chemotherapy (12%), 5-fluorouracil with high dose (12%), concurrent radiotherapy (6%). Quality assessments revealed 35% of included studies with good quality, 47% with fair quality, and 18% with poor quality. Majority (67%) of studies with good quality identified pre-existing cardiac diseases as significant risk factors. This study suggests that cardiac comorbidities are common risk factors for fluoropyrimidine-induced cardiotoxicity in cancer patients. However, most published studies assessing these risk factors are of fair or poor quality. Further research is needed to develop risk assessment models to predict risk of fluoropyrimidine-induced cardiotoxicity among heterogeneous populations, which could serve as a tool for risk stratification and prevention of cardiotoxicity among cancer patients.

Title: Usefulness of a research-based parenting newsletter: A comparison of child-rearing information sources

Primary Author (and presenter): Littleton, Casey, A
Additional Authors: Bubb, Robert; Vilches, Silvia
Department: Human Development and Family Studies
College/School: Human Sciences

"Just in Time Parenting" (JITP) is a newsletter that provides research-based information specific to the ages and needs of children. JITP is delivered via email and includes developmental guides, tips for solving common problems, and strategies to cope with the challenges of rearing children. Given that parents may seek such information from various sources, we wanted to compare the usefulness of JITP to other sources. Observations were taken from a sample of 514 emailed survey responses (M_{age} = 35; 87% mothers; 88% college educated; 89% married, 83% White). To answer the research question, we considered several sources: JITP, other parenting websites, books/magazines, brochures/newsletters, parenting classes, TV shows/videos, doctors/other health professionals, childcare providers, and family/friends. We conducted a factor analysis and identified four sources of parenting information: JITP, other news sources, print materials, and people. We found that that the sources of information differed in usefulness, $F(2.78, 527.93) = 97.55$, $p < 001$, $R^2 = 0.33$. Participants reported significantly more usefulness for JITP than each of the other sources of parenting information. Given that parents who received the newsletter report more usefulness for JITP as compared to other sources, it is important to ensure that the information provided in the newsletter is accurate, timely, and developmentally appropriate. Additionally, the resource of people was consistently the second most useful source for parenting advice. From this finding, we conclude that the newsletter should ideally be written by professionals with children. It is possible that people were reported as the second most useful source of parenting information for parents receiving the JITP newsletter because of the trust gained from a face-to-face interaction. It may be beneficial to develop the JITP newsletter to mimic a parent-to-parent delivery of parenting tips.

Title: Effects of toxicity and structural alterations caused by Perfluorinated Alkyl Acids (PFAAs) on the microalgae *Scenedesmus obliquus* UTEX 393
Primary Author: Liu, Meizhu
Additional Authors: Itokazu, Ana Gabriela & Blersch, David M
Department: Biosystems Engineering
College/School: Samuel Ginn College of Engineering

Description:

Widely used in industry applications, Perfluorinated Alkyl Acids (PFAA) are as desirable in industry as they are a risk to the environment. Those characteristics, which include thermal inertness, chemical stability, light transparency and amphiphilic nature, make those compounds not only globally distributed, but also environmentally persistent and potentially harmful. Perfluorooctane Sulfonate (PFOS) and Perfluorooctanoic Acid (PFOA), two representative chemicals of the PFAA class, were reported recently in surface waters, raising concern for regulations and possible effects. The proposed research aims to evaluate the toxicity of PFOS and PFOA to the green microalgae *Scenedesmus obliquus,* through standard tests. The toxicity level will be determined using growth curves as a general parameter for population behavior and pigment concentrations as a parameter for overall cellular health. This test will provide important data that will serve as basis to extended studies using other perfluorooctane compounds, isolated and in mixtures, mimicking the contaminated environment to which indigenous aquatic organisms are being exposed. By the end of the experiment, the biomass and the water will be analyzed and the mass balance for PFOS and PFOA in the system will be calculated. In addition to the ecological factor involving the toxicity of PFOS and PFOA, this study intends to resolve the type and level of structural effects and to investigate the alterations caused by the different concentrations of PFOS and PFOA, during the time of the toxicological test. The expected results are to establish *Scenedesmus obliquus* Half Maximal Effect Concentration (EC50) for PFOS and PFOA, provide information on the fate of PFOS and PFOA as to the water and the algal biomass, and to provide visual and quantitative results on how PFOS and PFOA toxicities are expressed at a structural cell level. The results will form the fundamental basis for more complex ecological studies to be done.

Title: Janus liposomes: Preparation and functionalization
Primary Author (and presenter): Liu, Zening
Department: Chemistry and Biochemistry
College/School: College of Sciences and Mathematics

Description:

Patchy particles, especially Janus particles which is named after the Roman god and consisted with two patches, have drawn more and more attention in recent years due to their heterogeneous surfaces, providing an ideal platform for developing multifunctional materials. A tremendous amount of efforts has been put in studying Janus particles, and among the various chemicals have been tested for fabricating Janus particles. As a major component of all cell membranes, phospholipids are rarely reported for preparing Janus vesicles (so-called liposomes), which can be expected to own special chemical-biological properties. Herein, we prepared microsized (giant) Janus liposomes via poly (vinyl alcohol) gel-assisted lipid swelling process. Confocal fluorescence microscopy reveals the prepared liposomes display broken symmetry with liquid-ordered and liquid-disordered surfaces mainly due to hydrophobic mismatch and cholesterol-induced liquid-liquid immiscibility with the help of phase-specific dyes, and it further proves this hydration procedure is a reproducible and highly-yield method. Biotin-conjugated lipid is introduced into Janus liposomes, which shows phase preference distribution, rendering these functionalized colloidal Janus particles asymmetrical binding capacity toward avidin. Additionally, geometry dependence aggregating behaviors are observed. This work offers a reliable method for preparing and modifying biocompatible Janus particles, which offers a good chance to understand membrane biophysics as well as casts potentials in bioanalytical/biomedical applications.

Title: Role of type VI secretion system in latent infection of plant pathogens
Primary Author (and presenter): Liyanapathiranage, Prabha D.
Additional Authors: Potnis, Neha
Department: Entomology and Plant Pathology
College/School: College of Agriculture

Description:

Type VI secretion systems (T6SSs) are versatile macromolecular machines in about 25% of the Gram-negative bacteria. The genome of *Xathomonas perforans* (*Xp*), a pathogen causing bacterial leaf spot disease on tomato and pepper, carries two gene clusters (~40kb), T6SS-I and T6SS-III, whose predicted products have homology with T6SS-associated gene products from other bacteria. Despite evolutionary conservation of large T6SS clusters, nothing is known regarding the role of these clusters with regards to their contribution towards the infection strategies of *X. perforans*. Here, we present evidence that T6SS-III plays an important role in the pathogenesis of *Xathomonas perforans* on tomato plants. We constructed a knockout mutant of *X. perforans* carrying an in-frame deletion in the core T6SS-III gene, *icmF3*. In planta growth assays using *Xp*Δ*icmF3* mutant and the wild type strain, individually and in competition, indicated that the mutant had a significant advantage in terms of growth in tomato plants as well as degree of disease severity. *Xp*Δ*icmF3* mutant also exhibited higher disease index in seedlings, indicating possible role of T6SS-III in seed to seedling disease transmission. Delay in overall disease symptom development along with slower growth might provide a significant fitness advantage to a hemi-biotrophic pathogen. Our results demonstrate possible role of T6SS in contributing towards latent infection period of a pathogen.

Title: Investigation of self-folding origami structures
Primary Author (and presenter): Long, Ryan, M
Additional Authors:
Department: Aerospace Engineering
College/School: College of Engineering

Description: We explored the self-folding capacity of pre-strained shape memory polymer (SMP) sheets to produce functional devices and structures via self-folding origami. Self-folding samples are prepared by printing an ink pattern on the SMP sheet using a desktop, inkjet printer, and trimming the sample to the desired size. Upon exposure to infrared (IR) light, the patterned regions heat above the glass transition temperature of the material. This results in localized relaxation of the material pre-strain, and the sample folds. The folding speed and final angle can be controlled by line darkness and line width, respectively. Previously, we developed the Functional Origami Light Deformer Initiated by Transition (FOLDIT) to study further the self-folding behavior of SMP sheets. This device incorporates a heated surface for preheating the sample and an IR lamp to initiate folding. Since the initial design, we upgraded to an induction coil heating system, which enables the FOLDIT to reach and maintain higher temperatures. Additionally, we incorporated a second IR light to create a more uniform light field. The device can be easily modified to evaluate alternate heat sources and test fixtures. We demonstrated the device using representative self-folding origami patterns. This investigation develops a link between the ancient art of folding paper and space exploration. Eventually, by getting a better understanding of the self-folding behavior of various SMPs, we can determine how to most effectively use these materials to fabricate shapes capable of bearing loads or functioning as tools, actuators, or even spacecraft components.

Title: Starvation reduces mitochondrial function in the monarch butterfly
Presenter: Lubor, Samuel C.
Authors: Niitepold, Kristjan; Parry, Hailey A.; Kavazis, Andreas N.; Hood, Wendy R.
Department: Biological Sciences
College/School: COSAM

Food shortage resulting from any natural or human-generated changes in the environment may affect the health and fitness of individuals, which is reflected in population dynamics. In this study, we examine the effects of food restriction on the metabolic flight capacity and mitochondrial function in the monarch butterfly (*Danaus plexippus*), a species whose life-history is dependent on flight. At the outset of the study, 100 butterflies each were assigned to two treatments: control and food restriction. Control butterflies had unlimited access to 10% honey-water solution, while food restriction butterflies were fed once every other day. We measured whole-animal resting metabolic rate and flight metabolic rate through flow-through respirometry at ages 3, 9, and 15 days post-emergence. After live measurement, respiration of isolated mitochondria during maximum respiration and resting respiration was done to calculate the respiratory control ratio, a measure of mitochondrial performance. Our data shows that starvation is associated with reduced resting and flight metabolic rates, as well as a strong negative effect on mitochondrial function. This compromised mitochondrial function may act as the link between nectar availability and decreasing insect populations. These results further exemplify the connection between environmental variation and physiological processes, as well as how these are tied to reproduction and population dynamics.

Title: Honokiol ameliorates MPP+ induced neurotoxicity in an *in vitro* Parkinson's model
Primary Author: Lynd, Tyler, O
Additional Authors: Ramesh, Sindhu; Majrashi, Mohammed; Moore, Timothy; Dhanasekaran, Muralikrishnan
Department: Drug Discovery and Development
College: Pharmacy

Description:

Parkinson's disease is a neurodegenerative disease associated with cognitive and motor debilitation. The disease specifically targets the dopaminergic neurons within substantia nigra *pars compacta* largely due to the defective complex I enzyme of the ETC. Current therapeutics involve dopamine replacement therapy which is incapable of inhibiting disease manifestation. Peroxisome proliferator activated receptor gamma (PPARγ) stimulation has exhibited potential as a protectant in PD animal and cell culture models. This is due to the receptor's propagation of the anti-inflammatory response and induction of antioxidant enzyme gene expression. In addition, PPARγ interacts with PPARγ coactivator-1α (PGC1α), the master regulator of mitochondrial biogenesis. Preceding studies show that PGC1a expression is downregulated in PD and that TZD treatment ameliorates these effects in chemically and genetically induced PD models. Clinical efficacy for TZDs in PD is limited, as they generally have poor permeability through the blood-brain barrier.

Sirtuin 3 (Sirt3) is a NAD+ dependent deacetylase enzyme localized predominantly to mitochondria. Recent papers suggest that Sirt3 regulates antioxidant enzyme expression through the deacetylation of lysine residues on transcription factor FOXO3a. Sirt3 also reserves a role in overall mitochondria respiration by actuating acetyl-CoA synthetase 2 (AceCS2) promoting bioavailability of acetyl groups to the citric acid cycle.

Honokiol, a compound isolated from the bark of the genus *Magnolia*, is considered a dual Sirt3-partial PPARγ agonist with high permeability to the blood brain barrier. This study has investigated Honokiol's protective capacity on an *in vitro*, MPP+-induced model of PD. Markers of oxidative stress, mitochondrial function, and apoptosis were explored. Our data indicates that Honokiol diminishes MPP+-induced oxidative and inflammatory damage and partially restores oxidative phosphorylation essential for dopaminergic neurons.

Title: L2 Spanish learners' auditory perception of gender and number and its role in relative clause attachment resolution

Primary Author (and presenter): Mackowski, Taylor L.
Additional Authors: Vergara, Daniel
Department: Spanish
College/School: Liberal Arts

Description:

Spanish and English speakers employ two different attachment strategies to resolve ambiguous RCs. Take, for instance, an ambiguous RC like 'I dislike the ingredients of the soups that are spicy', while English speakers have the tendency to attach the adjective spicy to the lowest noun soups; in the equivalent Spanish sentence, Spanish speakers attach it to the highest noun ingredients. Unlike English, Spanish adjectives agree in gender with the nouns they describe, and these gender markers help Spanish speakers determine the right attachment in the RC. In addition, research shows that L2 learners of Spanish often resort to these gender markers to resolve the attachment of RCs when presented on a written form (references here). However, no research has focused on whether L2 learners of Spanish are able to perceive these gender markers and resolve potential attachment of RCs when presented aurally. To this end, we examine the role of auditory perception of grammatical gender in resolving ambiguities in the interpretation of Relative Clauses (RCs) by L2 learners of Spanish. While data collection is still ongoing, we hypothesize that the degree of auditory perception by L2 learners of Spanish will be highly impacted by both linguistic and extra-linguistic factors, such as, level of proficiency and motivation.

Title: Optimization of a novel phage filter for pathogens testing from large volumes of water
Primary Author (and presenter): MacLachlan, Alana M.
Additional Authors: He, Jiacheng; Du, Songtao; Horikawa, Shin; Chen, I-Hsuan; Liu, Yuzhe; Chin, Bryan Allen; & Chen, Pengyu
Department: Materials Engineering
College/School: Samuel Ginn College of Engineering

Description:

Each year in the United States, foodborne pathogens, including bacteria, viruses, and parasites, cause an estimated 179 million illnesses, 486,777 hospitalizations, and 6,186 deaths. Forty-six percent of those illnesses are attributed to fresh produce, with pathogens on leafy greens causing the most illnesses. Pathogen contamination in fresh foods is a threat to public health. Unfortunately, the microbiological testing of a few samples of whole fruits or even hundreds of spinach leaves is inadequate to ensure the safety of a batch of specialty crop produce. Similarly, microbiological testing of only a few milliliters from thousands of liters of irrigation water and wash water used to grow and process a batch of specialty crop produce is woefully inadequate. A revolutionary, non-clogging phage filter system has been developed to capture, concentrate and isolate small numbers of multiple pathogens (100 CFU) from large volumes of irrigation and wash water (1,000 liters <10 minutes), so that foodborne illnesses can be rapidly identified before food is distributed to consumers. To optimize the performance of the filter system, we investigated a broad-spectrum of parameters inclusive of sensor elements, filter configuration, flow velocity, fluid pressure and operation temperature that would contribute to the development of a better system. This project will benefit growers, processors and distributors by rapidly identifying contaminated irrigation water, contaminated lots of produce, and improving production efficiency; while reducing recalls and litigation.

Title: Therapeutic effects of mushrooms
Primary Author (and presenter): MacLeod, Spencer, B.
Additional Authors: Ramesh,
Sindhu; Majrashi, Mohammed; Almaghrabi, Mohammed; Govindarajulu, Manoj; Deruiter, Jack; Clark, Randall; Mulabagal, Vanisree; Agrawal, Dinesh, C.; Moore, Timothy; Dhanasekaran, Mur alikrishnan
Department: Drug Discovery and Development
College/School: Pharmacy

Mushrooms have been used globally for various nutritional and medicinal values. "Medicinal mushrooms" are now gaining worldwide recognition because of their bioactive remedial compounds, which have demonstrated potent and unique clinical properties. There are several evidences of their efficacy in a wide range of diseases. Extracts obtained from different mushrooms have been used medicinally as an immunomodulator, antitumor, anticancer, antibacterial, antiviral, anti-inflammatory, anti-atherosclerotic, neuroprotectant, antioxidant and anti-hypoglycemic agents. Edible mushrooms have significant beneficial importance in the treatment of neurodegenerative (Alzheimer's & Parkinson's), neurological (epilepsy), cardiovascular (hypertension, diabetes mellitus), hepatological, and infectious diseases. Nevertheless, with the evolving and emerging new evidence of health benefits, further detailed mechanisms of various benefits of mushrooms in humans still require intensive investigation. There seems to be a need to express further current knowledge about the health benefiting properties, which have engrossed prevalent interest. The assessment of fresh, cultivated mushrooms and segregation of their various ingredients with mechanism-based potential therapeutic value remains a challenge, and hence, mushrooms will continue to be the notable limelight of research in upcoming prospects as well.

Title: Current image analysis techniques to quantify adipocyte area
Primary Author (and presenter): Maguire, Anne S.
Additional Authors: Woodie, Lauren; Martin, Douglas; Judd, Robert; Graff, Emily; & Greene, Michael
Department: Anatomy, Physiology & Pharmacology
College/School: College of Veterinary Medicine

Description:

Obesity is a prevalent pathologic condition in which adipose tissue plasticity plays a significant role. Accurate quantification of adipocyte area is crucial to the investigation of novel therapeutic interventions. Current methods primarily consist of image acquisition through digital cameras fitted to microscopes followed by manual outlining of cells in software that calculates individual adipocyte areas. Disadvantages of these methods include small sample size, bias in obtaining images, and high time and labor costs. The recent advent of digital slide scanners, whole slide image analysis, and open-source software shows promise for resolving these issues. We compared a traditional method of adipocyte area quantification (microscope camera with ImageJ software), with two modern whole-slide analysis methods: a new open source software (QuPath), and a proprietary software (Visiopharm). Epididymal adipose tissue was collected from 2 groups of mice fed standard chow or high fat diet. Slides were stained with hematoxylin and eosin, then the area of individual adipocytes was calculated using: 1) microscope camera + public ImageJ plugin, 2) slide scanner + novel QuPath algorithm, and 3) slide scanner + Visiopharm. All methods successfully identified individual adipocytes and quantified their areas. Method 1 counted significantly fewer cells than the whole-slide analysis methods 2 and 3, which led to high variability in areas measured by method 1 (R^2 for 1 vs 2: 0.71, R^2 for 1 vs 3: 0.66). Though method 2 counted 36.3% fewer cells than method 3, this decrease in power did not negatively affect the variance of measured areas (R^2 for 2 vs 3: 0.94). Newer methods of whole slide analysis provide a significant sample-size advantage over more traditional methods. The open-source program QuPath provides an adequate sample size and ease of use that reduces the necessity for the high-cost proprietary software Visiopharm.

Title: *The Effects of 'Green Exercise' on Cognitive Functioning in Healthy Young Adults*
Primary Author: Maheu, Arlene R
Additional Authors: Dyke, Ford B
Department: School of Kinesiology
College/School: Auburn University

Description:

In today's society, there is a rapidly growing presence of Attention Deficit Hyperactivity Disorder (ADHD). The primary treatment for such conditions is pharmaceuticals, which often have detrimental side effects to the patients' long-term health and well-being. That said, the primary purpose of this research is focused on investigating an alternative treatment method. A sample of 54 healthy young adults with symptoms or diagnoses of ADD/ADHD were recruited and participated in the study. A computerized baseline cognitive test was administered to measure participants' baseline cognitive impulsivity. Following baseline testing, participants experienced one of three different treatment conditions: GREEN (nature/greenspace stimuli), URBAN (cities/urbanspace stimuli), and BLUE (water/bluespace stimuli). In each treatment condition, participants walked on a treadmill at a comfortable pace (i.e., 3 mph) for 10 min. GREEN, URBAN, or BLUE visual and auditory stimuli were presented during the treatment condition; participant brain activity was collected via Electroencephalography. Participants performed a cognitive test identical to baseline following each treatment condition. Each participant completed all three treatment conditions in counterbalanced order on three different days. Combining the results for all participants in terms of variations between final and baseline Flanker testing along with EEG readings, researchers are investigating relationships between the simulated environments, EEG and cognitive impulsivity. Cognitive and EEG data are currently being processed; preliminary results show decreased alpha brain activity among BLUE and GREEN groups, most significantly in blue, indicating heightened attentiveness in such conditions. Alpha activity gathered from URBAN groups indicates a decrease in focus. Also notable, BLUE groups experienced the most significant drop in response time among baseline and post-treatment cognitive testing, followed by GREEN then URBAN.

Title: Remote authentication of low-cost devices using unclonable IDs
Primary Author (and presenter): Mahmod, Jubayer & Guin, Ujjwal
Department: Electrical and Computer Engineering
College/School: Samuel Ginn College of Engineering

Description:

Ensuring authenticity of low-cost devices for the Internet of Things (IoT) is of great concern, since these devices can easily be cloned. An adversary can create a backdoor either to bypass the security and/or to leak secret information using these clones over an unsecured communication channel. It is of our prime importance to design and develop solutions for authenticating such low-cost devices. We present a hardware implementation of a novel low-cost solution for authenticating an edge device over an unsecured channel. We show how we can exploit an on-chip SRAM to generate a unique digital fingerprint or a device ID that can be used during the device authentication. The code overhead for implementing this proposed scheme in an ATMEGA2560 microcontroller is only 3.65%.

Title: Combined measurement of perfusion and T2 star in calf muscle at 7 Tesla MRI with dynamic exercise using projection based image reconstruction method
Primary Author (and presenter): Mahmud, Sultan Zaman
Additional Authors: Denney, Thomas & Bashir, Adil
Department: Electrical and Computer Engineering
College/School: Samuel Ginn College of Engineering
Description:

Impairments in oxygen delivery and consumption can lead to muscle weakness and physical disability. Reduced blood flow, O_2 delivery and consumption to the working muscle are likely to cause decline in muscle ability to sustain workloads. Perfusion is a measure of microvascular blood flow and provides information on nutrients delivery. T2* provides information about relative tissue oxygenation. Changes in these parameters following stress, such as exercise, can yield important information about imbalance between delivery and consumption. In this study, we implemented a novel projection based MR image reconstruction technique to simultaneously quantify muscle perfusion and T2* at high magnetic field, 7T, and demonstrate assessment of spatial and temporal changes in these parameters within calf muscles both during and recovery from dynamic exercise. The high magnetic field offers significant improvement in signal to noise ratio and the projection based reconstruction, which uses golden angle radial acquisition, offers very low sensitivity to human movement inside the MRI scanner compared to the conventional method, thus preventing artifacts in reconstructed MR images.

Title: Gender and rural vitality: Empowerment through women community groups
Primary Author (and presenter): Majokweni, Pilela
Additional Authors: Molnar, Joseph J.
Department: Agricultural Economics and Rural Sociology
College/School: College of Agriculture

Description:

Rural women are often the main supporters of their families and have been involved in improving the quality of life for households and communities. The attainability of sustainable rural development and poverty reduction is linked to empowering women. Community groups are one mechanism for empowering women and fostering economic development. For the poor, the ability to organize and mobilize to solve problems is crucial because collective capability assists in overcoming challenges arising from marginalization and limited resources. Even though considerable work has been done on the impact of institutional support on community groups, it is not well documented how the efforts of women community groups actually lead to improved socioeconomic wellbeing. The qualitative data collected through focus group interviews is used to analyze women community groups as interventions for advancement, empowerment and socioeconomic wellbeing. The findings are intended to help institutions that work with women groups improve the impact and sustainability of these key mechanisms for development intervention**.**

Title: *Centella asiatica* extract exhibit anti-oxidative stress effect in neuronal cells and improves synaptic plasticity

Primary author (and presenter): Majrashi, Mohammed
Additional authors: Ahuja, Manuj; Almaghrabi, Mohammed; Clark, Randall; Deruiter, Jack; Dhanasekaran, Muralikrishnan
Department: Drug Discovery and Development
College/School: Harrison School of Pharmacy

Description:

Centella asiatica (CA) is a well-known herbal drug used for centuries in traditional Indian Ayurvedic medicine to treat various diseases. Multiple studies have reported antioxidant and neuroprotective actions of Centella but the exact mechanism of action is still unknown. Furthermore, cognition improvement is one of the valuable medical effects of Centella that was reported by recent studies as well as earlier texts. In the current study, we obtained a concentrated extract of *Centella asiatica* and used it to investigate the neuroprotective and antioxidant action as compared to pro-oxidants and neurotoxin in two neuronal cell lines. In addition, we also investigated the molecular mechanisms related to neuroprotection as well as mnemonic activities in the hippocampal neuronal cell line H19-7. In addition to preliminary characterization of the current extract, the neuroprotective action of *Centella* against the endogenous toxin hydrogen peroxide was also studied in H19-7 and PC12 cell lines. Reactive oxygen species were found to be effectively reduced in in-situ as well as homogenized samples of H19-7 cells. Caspase activity was also found to be greatly reduced in presence of Centella extract. We also found Centella to increase the phosphorylation of ERK1/2 and CREB by itself at different doses and affect the NMDA receptors in differentiated and un-differentiated hippocampal neuronal cells. Similar observations were found when cells were treated with hydrogen peroxide in presence or absence of two concentrations of Centella. Thus, the current study describes anti-caspase, antioxidant actions of Centella explicitly related to asiaticoside concentration. Modulation of glutamatergic receptors and stimulation of ERK1/2-CREB-BDNF pathway was found to be one of the putative mechanisms involved in synaptic strengthening shown by the Centella.

Title: A power-aware management strategy using DVFS and virtual machines live migration
Primary Author (and presenter): Mao, Jianzhou
Additional Authors: Bhattacharya, Tathagata; Wang, Ye
Department: Computer Science and Software Engineering
College/School: Samuel Ginn College of Engineering

Description:

For decades, high-performance computing data centers performance have been significantly growing. With the increased speed and size of computing capacity, the power consumption of data centers has been doubled. To address this problem, we propose a power-aware management strategy for virtual machines running in the modern data centers. We aim to improve energy efficiency of data centers by investigating a hybrid energy-saving method that seamlessly integrates the dynamic voltage/frequency scaling and virtual machine consolidation techniques. The dynamic frequency and voltage scaling or DVFS conserves energy of computing systems by adjusting CPU frequency and voltages. Our holistic strategy advocates for DVFS if virtual-machine migration overhead can't be offset by the energy savings. In case that DVFS is unable to improve energy efficiency, our scheme relies on virtual machine (VM) consolidation to further conserve energy. Our scheme dynamically activates VM consolidation if reducing the number of active servers outperform DVFS in terms of energy efficiency. Our preliminary findings confirm that DVFS is suit for the datacenter with high migration overhead or high utilization of active servers; VM live migration provides a significant benefit for virtual serer mobility without disturbing service. We demonstrate through extensive experiments that combining DVFS and VM consolidation offers high energy efficiency for a wide range of workload conditions in cluster computing systems housed in data centers.

Title: Role of mountaintop removal mining in the opioid crisis
Primary Author (and presenter): Marberry, Morgan K.
Additional Authors: Werner, Danilea
Department: Department of Sociology, Anthropology, and Social Work
College/School: College of Liberal Arts

Description:

This study examines the relationship between mining practices in Central Appalachia and opioid use. Central Appalachia, known for coal mining, has one of the highest rates of opioid use in the U.S. (CDC, 2017). Of particular interest is Mountaintop Removal Mining (MTR). MTR is a form of surface mining that requires clearcutting the mountain's forest before detonating explosives to reveal a coal vein. The vein reveals coal that would not have been accessible using traditional underground mining methods (Holzman, 2011). This study revealed that mining practices in Central Appalachian counties significantly influenced opioid related hospital discharge rates and perception rates.

Title: Water contamination and infant health in west Alabama
Primary Author (and presenter): Marcus, Stevan, T.
Department: Economics
College/School: Liberal Arts

I analyze two relationships in my research: 1) The effect that water contamination, and violations of the 1996 amendments to the Safe Drinking Water Act (SDWA), have on infant health in west Alabama, measured in birth weight. 2) The effectiveness of contamination reporting requirements that aim to decrease violations of the Clean Water Act. Existing literature confirms that individuals who were heavier at birth are taller as adults, have greater IQ scores, attain higher levels of education (Currie 2011 and Almond and Currie 2011), and have lower lifetime earnings (Black et al. 2007). I add to this research by creating a database in which the contamination statistics found on annual Consumer Confidence Reports (CCRs), can be found, and determining the effect of water quality specifically in west Alabama. In my research I also aim to determine the effectiveness of publishing requirements that differ depending on population.

To conduct my analysis, I first obtained all available CCRs from 2010 to 2015 via the Alabama Department of Environmental Management's document management system. I transcribed all contamination statistics from these CCRs into a spreadsheet and made note of which CCRs reported violations. I obtained demographic information from the United States census bureau, and birth weight statistics from the Alabama Department of Public Health's Center for Health Statistics. Once I obtained all the necessary data, I augmented and merged the datasets in STATA, and conducted Ordinary Least Squares regression analyses to test the two effects, controlling for various demographic statistics that could contribute to variation in birth weight. If contamination reporting is found to affect birth weight, this could have significant policy implications. A case could be made that additional funding to water treatment facilities would be economically beneficial, given the negative externalities that arise from low birth weights.

Title: The effects of bait stations on female eastern wild turkey home range
Primary Author (and presenter): Margadant, Lee A.
Additional Authors: Grand, Barry; Stewart, Briana; Keller, Sky; Moore, Carolyn
College/School: School of Forestry and Wildlife

Description:

To effectively manage for a specific species on a landscape, managers need to be equipped with accurate estimates of population size and structure. Camera survey efforts which utilize bait are a valuable tool with which to achieve those estimates. However, these methods are not without their biases. When utilizing bait in a camera survey effort, we have little idea as to how it effects the movements and home ranges of Eastern Wild Turkeys (*Meleagris gallopavo silvestris*). I utilized GPS and Satellite transmitters to examine turkey probability of use at specific sites in response to bait presence. This research will ensure that estimates gathered from baited camera surveys are not biased and accurately reflect the population on the landscape.

Title: The impact of document design on alcohol-harm awareness
Primary Author (and presenter): Martin, Katie E.
Department: English
College/School: College of Liberal Arts

Description:

According to the National Institute on Alcohol Abuse and Alcoholism, over 1,825 college students die every year from an alcohol-related accident. In addition to this, almost 700,000 college students are physically or verbally assaulted in an alcohol-related situation, and around 97,000 college students are sexually abused in an alcohol-related incident. These statistics make a compelling case for sobriety on college campuses, yet according to the National Council on Alcoholism and Drug Dependence, nearly 80% of college students drink alcohol, and half of those individuals also participate in binge drinking. This research project explores the disconnect between these statistics and college students' attitudes toward intoxication. Rhetorical analysis, document design theory, and design thinking were employed to reveal how the consequences of alcohol consumption could be more effectively communicated to college students in written media. The rhetorical analysis revealed the predominant narrative that is presented to college students: drink, but drink responsibly. In response, two alcohol-harm-awareness campaigns were created and presented to college students in focus groups, which revealed the design choices and rhetorical approaches that most effectively communicated the sobering reality of alcohol-harm.

Title: Investigating the steric contributions in helicate formation for pyrrolic superstructures
Primary Author (and presenter): Mayhugh, Jacob T
Additional Authors: Klann, Nicholas; Gorden, Anne
Department: Chemistry and Biochemistry
School/College: COSAM

Supramolecular systems are designed with well-studied building blocks that make up the large molecular architecture. These preorganized structures exhibit properties from their chosen analogs and allow the formation of functionalized materials. Herein, we investigated the regioisomers of bis(pyrrole)phenylenediamine (H_2L) and their assembly to Zn(II) to characterize its binding patterns for preorganization. Spectral studies reveal the ligand has coordination through the Schiff base and pyrrole nitrogen atoms. Furthermore, x-ray structures indicate unique binding patterns exhibited by the para- and ortho-phenylenediamine complex derivatives, resulting in a tetranuclear coplanar structure (Zn_4L_4) and dinuclear double-stranded helical structure (Zn_2L_2), respectively. The observations provide insight into the effect of peripheral substituents on pyrrolic supramolecular self-assembly.

Title: Synthesis, characterization and electro chemical analysis of Ni-dithio complexes for Redox Flow Battery

Primary Author (and presenter): Mazumder, Md Motiur R.
Additional Authors: Richburg, Chase; Gorden, John; & Farnum, Byron, H.
Department: Chemistry and Biochemistry
College/School: College of Sciences and Mathematics

Description:

Energy storage is a vital aspect for the successful implementation of renewable energy resources on a global scale. Arguably the best method of energy storage is within small molecules via the formation of chemical bonds coupled to multi-electron redox reactions. Herein, we demonstrate the development of novel $2e^-$ redox couples based on nickel 1,1-dithio-complexes for potential use as catholytes in non-aqueous redox flow battery's (RFBs). 1,1-dicyano-ethylene-2,2-dithiolates (*i*-mnt) and 1,1-dithio- pyridine scorpionate arm ligand (*i*-mnt-Py) has been successfully synthesized and characterized by NMR, FTIR, UV-Vis, XRD and MS spectrometry. The electrochemistry of Ni((*i*-mnt)$_2$ and Ni((*i*-mnt-Py)$_2$ complexes have been studied to investigate Ni(IV//II) redox cycles. Quasireversible 2 electron transfer redox process have been monitored in our systems where we found oxidation peak ($Ni^{2+} \rightarrow Ni^{4+}$) at around 0.5 v and reduction peak ($Ni^{4+} \rightarrow Ni^{2+}$) at -0.2 v Vs Fe^+/Fe.

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Energy storage is a vital aspect for the successful implementation of renewable energy resources on a global scale. Arguably the best method of energy storage is within small molecules via the formation of chemical bonds coupled to multi-electron redox reactions. Herein, we demonstrate the development of novel $2e^-$ redox couples based on nickel 1,1-dithio-complexes for potential use as catholytes in non-aqueous redox flow battery's (RFBs). 1,1-dicyano-ethylene-2,2-dithiolates (*i*-mnt) and 1,1-dithio- pyridine scorpionate arm ligand (*i*-mnt-Py) has been successfully synthesized and characterized by NMR, FTIR, UV-Vis, XRD and MS spectrometry. The electrochemistry of Ni((*i*-mnt)$_2$ and Ni((*i*-mnt-Py)$_2$ complexes have been studied to investigate Ni(IV//II) redox cycles. Quasireversible 2 electron transfer redox process have been monitored in our systems where we found oxidation peak ($Ni^{2+} \rightarrow Ni^{4+}$) at around 0.5 v and reduction peak ($Ni^{4+} \rightarrow Ni^{2+}$) at -0.2 v Vs Fe^+/Fe.

Title: Nutrition education for dietary phosphorous intake in patients receiving hemodialysis
Primary author (and presenter): McCollough, Dylan R.
Additional author: Peterson, Mary H.
College/ School: School of Nursing

Description:

Strong evidence supports that dietary education provided for patients with End Stage Renal Disease (ESRD) receiving hemodialysis (HD) promotes improved adherence to dietary guidelines/recommendations. Studies have focused on specific patient education regarding dietary phosphorous control, which is a key factor in patients' long-term health outcomes. The purpose of this project was to provide patients with ESRD on HD individualized education regarding dietary phosphorous guidelines and adherence to improve phosphorous levels. The target patient population was patients (age 35-95 years) with ESRD receiving HD and have received dialysis treatments at least six months. Following participant agreement, participants completed a 5-question general phosphorous knowledge questionnaire and were asked to complete a 7-day food diary. After food diary completion, participants were provided education based on the self-reported food diary. The participants were asked to strictly follow the dietary guidelines/recommendations for one week. Then, serum phosphorous levels were drawn and the general phosphorous knowledge questionnaire was completed again. The project is in progress. Descriptive statistics will be used to describe participant demographics, prevalence of poor dietary phosphorous control, and patient knowledge about dietary phosphorous guidelines. Follow-up data will include comparison of pre-post serum phosphorous levels and pre-post phosphorous knowledge questionnaire scores. The pre-post questionnaire mean scores will be compared with paired t-tests (alpha=0.05). Providing patients with ESRD on HD with education about dietary phosphorous can be beneficial in achieving goal serum lab levels. Individualized education and recommendations based on each patient's dietary choices improved serum phosphorous levels in this HD clinical setting and further implementation of the project is warranted.

Title: Simulated learning in new graduate registered nurses
Primary Author (and presenter): McCrary, Joshua K.
Secondary Author: Watts, Sarah
College/ School: School of Nursing

Description:

Findings from numerous studies support orientation for new graduate nurses because it is a critical learning time and is the foundation for positive skill development. Evidence suggests simulation is one of the most effective teaching methods to ground skill development. During orientation, simulations should be conducted in a peer learning environment to foster an open learning environment for retention and application of knowledge. The purpose of this study is to provide additional simulated learning experiences for new graduate nurses to improve their knowledge of evidence-based central line care. The target population for this project includes all new graduate registered nurses hired to the Cardiovascular Intensive Care Unit at Children's of Alabama. Following participation agreement, participants will complete a pre-test before receiving the current central line education provided during orientation. Project participants will be divided into pairs and practice central line dressing changes on low fidelity mannequins. After sufficient skill practice, a post-test will be provided to assess knowledge gained. A follow-up survey will be distributed and advised to be completed after successful skill implementation in the clinical setting. This project is currently in progress. Analysis of descriptive statistics using SPSS will be used to describe the population, the study results, and recommendations based on the follow-up surveys. Pre and post test results will be compared by paired t-test (alpha=0.05). Using simulation in the peer learning environment can improve new graduates' knowledge of proper central line dressing care and has the potential to reduce the occurrence of central line infections. Further implementation of this project is warranted.

Title: Systematic review of the effects of blast trauma on auditory and cognitive abilities
Primary Author (and presenter): McElroy, Sallie E. & Patton, Sara E.
Additional Authors: Krishnamurti, S.
Department: Communication Disorders
College/School: Liberal Arts

The current systematic review looked at prevalence of blast-related injuries and their impact on auditory and cognitive abilities. A total of 795 articles were initially selected from Internet searches (Google Scholar) for systematic review. In this study, we calculated Cohen's D to investigate effect size and auditory/cognitive factors associated with blast injuries. Cohen's D is a commonly used statistic to identify the effect size (power) of data for published studies. The number of significant factors was identified during the statistical analysis. Blast injuries produced significantly higher rates of tinnitus (four times greater prevalence); a large effect size was found. For eardrum perforations, blast injuries had a 28% higher prevalence rate and a large effect size was found. For hearing loss, blast injuries showed a twelve times higher rate of prevalence and a large effect size. When hearing loss was broken up into categories (low frequency, high frequency, ultra- high frequency) medium to large effect sizes were found. Electrophysiological measures of change for cortical responses (P1, P2) led to small effect sizes. Auditory memory changes associated with blast injuries showed only small effect sizes. Both loss of memory and balance showed medium effect sizes. The results of this study show that the maximum impact of blast injuries on the auditory system (tinnitus, hearing loss, perforation) far exceeds cognitive impairments.

Title: PolyFold: Augmenting human intuition with machine learning to solve protein folding
Primary Author: McGehee, Andrew J.
Additional Authors: Bhattacharya, Debswapna; Chromy, Hudson; Stowe, Carmen
Department: Computer Science and Software Engineering
College/School: Engineering

The protein folding problem is a vastly complex problem which holds extraordinary potential for drug discovery and early diagnosis and treatment of existing conditions which relate to malformed proteins in the body. PolyFold is a crowdsourcing computer game which exists to offer insights into the protein folding problem. The objective of PolyFold is to encourage citizen scientists to solve interactive, intuitive, and visually appealing puzzles which are modifiable 3D conformations of proteins. Players compete and are scored based on how well their submission agrees with experimentally determined protein contact maps. PolyFold seeks to explore the relationship between human intuition and common machine learning and optimization strategies and to identify the role of each in solving some of the world's most complex problems.

Title: The DASH diet for management of hypertension
Primary Author (and presenter): McIntyre, Patrick
Additional Authors: Peterson, Mary H.
College/ School: School of Nursing

Description:

Hypertension (HTN) is a major health problem in the United States affecting 75 million people. The condition increases the risk for heart disease and stroke. The Dietary Approaches to Stop Hypertension (DASH) diet is one way to lower or manage HTN and can lower systolic blood pressure (SBP). Less than 25% of patients with hypertension have education about the DASH diet that emphasizes foods lower in sodium and rich in potassium. Patients expect their primary care provider (PCP) to teach dietary health, but PCPs have on average one minute per office visit for education. The purpose of this project was to implement a DASH diet educational program in an urban primary care clinic. The target population included adults (age 19 to 65 years) diagnosed with primary HTN. Following participant agreement, participants completed an educational program of a one-minute introductory video about the DASH diet followed by a one-page handout with details about the specific type and quantity of foods to eat on the DASH diet. The Starting the Conversation (STC) tool assessed dietary quality and was completed pre and post education to measure patient knowledge. A brief questionnaire was given to the healthcare providers to measure the number of patients receiving dietary education. The project is in progress. Descriptive statistics will be used to describe the patient population, prevalence of hypertension and patient DASH dietary education. The pre- and post- STC knowledge mean scores will be compared with paired t-tests (alpha=0.05). The DASH diet can be an effective treatment for patients to lower or manage HTN and is achievable in this primary care clinic. An assessment of dietary intake and a DASH diet educational program was implemented for patients diagnosed with primary HTN. Further implementation is warranted.

Title: Mosquito surveillance in Alabama highlights regions of arboviral risk
Primary Author (and presenter): McKenzie, Benjamin
Additional Authors: Zohdy, Sarah; Ziska, Sara
Department: Wildlife Sciences
College/ School: School of Forestry & Wildlife Sciences

Description:

The number of infections by mosquito-borne pathogens is on the rise, both in the US and abroad. Due to its climate and environmental factors, the Gulf Coast of the US has been identified as an area of risk for the establishment and re-establishment of mosquito-borne pathogens such as dengue virus (DENV), chikungunya virus (CHIKV) and Zika virus (ZIKV), which have already been detected in the Gulf States of Florida and Texas. To determine the potential for establishment and re-establishment of these arthropod-borne viruses (arboviruses) in other parts of the US, we conducted surveillance of vector mosquito species at 203 sites across all 67 counties of the Gulf State of Alabama. We collected both adult and larval mosquitoes to determine distributions of vector mosquitoes, and inferred population density through container index (% containers with mosquito larvae at each site). Female mosquitoes from target vector species were then pooled by site and assayed via qPCR to determine presence of DENV, CHIKV or ZIKV. We found a mean container index of 31.1% for sites across the state. We successfully emerged 410 larvae representing 3 genera and 5 species and collected 4,595 adults representing 5 genera and 9 species. Of these, we assayed 1,874 mosquitoes for presence of DENV, CHIKV or ZIKV. Assays detected low levels of all three arboviruses in Alabama mosquito populations, with >1% of all mosquitoes testing positive for one or more of these three viruses. These results indicate that there is indeed a potential for arboviral establishment in the wider Gulf Coast region.

Title: The effect of repeated measurements and varying conditions on the reliability of the English version of the acceptable noise level test

Primary Author (and presenter): McManus, Lisa A.
Additional Authors: Jones, Alisha L.
Department: Communication Disorders
College/School: College of Liberal Arts

Description:

Acceptable Noise Levels (ANLs) are used to measure a person's acceptance of noise while listening to speech. ANLs quantify the amount of background noise that a person accepts when following speech presented at their most comfortable level (MCL). ANLs are determined by subtracting a person's background noise level (BNL) from their MCL. The purpose of measuring ANLs is to find an efficient and accurate procedure to predict success in new hearing aid users. Previous studies involving ANL measurements have used either 1, 2, or 3 repetitions to measure the MCL, but it is unknown whether the MCL is a reliable measure within the ANL test. A study done by Brännsrtöm et al (2014), investigated the effect of 12 repetitions on the MCL during ANL testing. However, this study was completed using Swedish instructions and a non-semantic ANL test. The aim of the present study is to replicate the Brännsrtöm et al (2014) study using an English version of the ANL test and English instructions. All 44 subjects were 18 years or older and had normal hearing. Subjects were randomly assigned one of two test conditions: the traditional ANL test (ANLx12) in which each MCL repetition preceded a measurement of the BNL, or the MCLx12 condition in which their MCL was measured 12 times before measuring BNL 12 times. The repeated measures ANOVA for the MCLx12 condition showed a significant main effect of MCL test order (Wilks'Λ=0.136, F[11,11]=70.075, p=0.002, η^2=0.864). Post hoc tests revealed that only the mean difference between repetition 1 and repetitions 2, 9, 10, and 11 were significant ($p<0.005$). The repeated measures ANOVA for the ANLx12 condition failed to show a main effect of MCL test order (Wilks'Λ=0.293, F[11,11]=26.578, p=0.080, η^2=.707.). Overall, this study supported the reliability of the MCL within the ANL test.

Title: On the valorization of local softwood biomass: production and characterization of nanofibrillated cellulose

Primary Author (and presenter): McMichael, Philip S.
Additional Authors: Iglesias, Maria C., Peresin, Maria S.
Department: Forest Products Development Center
College/School: Forestry and Wildlife Science

Historically, wood has been primarily used as raw material for the pulp and paper industry. Over the years, the emergence of nanotechnology has positioned cellulose to be used in a number of high-performance applications. As the main component of wood, cellulose is the most abundant naturally occurring polymer in the world. When reducing its size into the nanoscale, cellulose fibers can be separated into small particles generally known as nanocellulose. These nanoparticles can be obtained by different approaches; the most commonly used are chemical and mechanical treatments to obtain cellulose nanocrystals (CNC) and cellulose nanofibrils (CNF), respectively. In recent years, nanocellulose has been increasingly studied for its many intriguing properties and immense potential. To facilitate an increased variety of applications, proper characterization of the nanofibers must be performed in order to gain a better understanding of its properties.

In this study, we propose to use softwood wood chips as the raw material to produce Kraft cellulose pulps with different chemical compositions, focusing on lignin and hemicellulose content. Nanofibrillated cellulose was obtained from the cellulose fibers by mechanical treatment using a Masuko Supermasscolloider (Masuko, Japan). Lignin content quantification and chemical composition of the cellulose fibers and corresponding nanocellulose were investigated according to TAPPI standards.

To gain a better understanding of the properties of the obtained colloidal suspensions, CNF stability was investigated by charge density and zeta potential. Atomic force microscopy (AFM) imaging and thermal gravimetrical analysis (TGA) were performed in order to assess the morphology and thermal stability of the samples, respectively. FTIR was used to analyze the chemical composition of the cellulose nanofibrils.

Title: Urban city structures in the pre-modern era
Primary Author (and presenter): McPherson, Louisa, J.
Additional Authors: Bruno, Nicholas; Ding, Shijin; Littlefield, Grace; Shay, Victoria
Department: Architecture World History I
College/School: Architecture

Description:

Within the course, history of world architecture, my team and I developed a website that outlines various urban city structures that transformed the development of civilizations within architecture during the pre-modern era. Digging deeper into structures, we researched topics that created significant impacts in cities that allowed them to grow larger. Being able to research topics and see how cities developed is an important aspect to understand how our world works today and what ideas or structures are still being used after hundreds of years. City development drives progression of a civilization by allowing communities to grow and further advance. Through theoretical inquiry, our team was able to explore the question of which urban city structures created a major impact by allowing for or progressing the city further. Through our research, we were able to find how the first developed cities were arranged and how they used their natural resources around them to their advantage. Later on, the cities became more complex through using their knowledge of previous attempts of trying new ideas, which helped the cities flourish. Many ideas about building various structures were developed over time, and some of those ideas are still used today.

Title: Harnessing big data for in-season maize yield forecasting: A machine learning based framework

Primary Author (and presenter): Medina, Hanoi
Additional Authors: Tian, Di
Department: Crop, Soil, and Environmental Sciences
College/School: College of Agriculture

Description:

In-season maize yield forecasting is crucial for improving food accessibility risk management, and plays a critical role in global markets, policy and decision making. In this study, we develop and test competing machine learning models to predict the county-level maize yields over five major producer states of the U.S. using the Moderate-resolution imaging spectroradiometer (MODIS) datasets, the North American Land Data Assimilation Phase 2 (NLDAS-2) datasets, and the other ancillary climate and satellite remote sensing information. We evaluated the forecast performance of using different data clustering strategies as well as three machine learning algorithms: partial least square (PLS), the least absolute shrinkage and selection operator (LASSO), and the random forest (RF). The techniques were selected because of their ability to deal with collinearity issues among predictors. The forecasting models are cross-validated using observed county-level maize yields over 16 years, from 2002 to 2017. The performance was variable among years with $0.56 < R2 < 0.82$ for the best strategy. LASSO and RF performed similarly well and consistently better than the PLS model. The combination of three predictors (NDVI, EVI and LAI) yielded the best performance among all possible combination of the MODIS subsets. Overall, the NDVI and EVI over the end of July were the most important predictors. The inclusion of monthly weather variables improved the forecast performance compared to the MODIS data alone, with the minimum temperature from July and the vapor pressure deficit from May and June, as the most critical weather variables.

Title: Effects of orchestra training on plasticity in the auditory system
Primary Author (and presenter): Melton, Robert D.
Additional Authors: Weaver, Aurora ; Krishnamurti, Sridhar
Department: Communication Disorders
College/School: College of Liberal Arts

Description:

The purpose of this study was to determine the relationship between auditory processing in children, with and without instrumental orchestral music instruction. Fifteen children (ages 13 to 16 years), nine enrolled in orchestra instruction and seven individuals with minimal music instruction, were recruited. All participants had hearing within normal limits and normal nonverbal intelligence (TONI). Participants completed a music sophistication index (Gold-MSI), behavioral listening tasks (e.g. pitch discrimination, speech in noise perception, etc.), and electrophysiological tests of brainstem function (e.g. auditory brainstem response (ABR), complex ABR, and musical-chord evoked P1N1) in response to sound. Preliminary data analysis indicated significant enhancement of spectral-temporal processing for those enrolled in orchestral instruction and a significant delay in left ear only ABR latency. There were no other significant group effects for behavioral and electrophysiological measures. However, a trend enhanced amplitude for P1NI in the enrolled orchestra students was identified, yet not significant (p = .052); potentially, due to low power for this analysis. There were significant correlations identified among cABR latency and speech in noise perception [r= .65; p = 016]; P1N1 amplitude in the left ear and spectral-temporal processing [r= .60; p = 0.17]; and ABR latency and music sophistication score [r= .67; p =.013]. Preliminary results identified relationships among behavioral listening performance and electrophysiological processing within the auditory system. It appears individuals enrolled in orchestra training have enhanced spectral-temporal processing. These advantages correlate with P1N1 responses evoked by a music-chord. Future work, with enough power, may reveal additional behavioral and cortical advantages of orchestral instruction.

Title: Growth response of loblolly pine to *Leptographium terebrantis*
Primary Author (and presenter): Mensah, John K.
Additional Authors: Sword Sayer, Mary; Nadel, Ryan; Matusick, George; Fan, Zhaofei; & Eckhardt, Lori
Department: Forest Health
College/ School: School of Forestry and Wildlife Sciences

Description:

Pinus taeda L (loblolly pine), one of the economically important and predominant timber species in the Southeastern United States but suffers from growth decline and or mortality. Southern pine decline is one of the disease complexes associated with root-feeding bark beetles and their ophiostomatoid fungal associate after predisposition by environmental stressors. Nonetheless, the role of the bark beetle vectored fungi in southern pine decline remains unresolved among researchers. In contributing to the ongoing debate, a study was designed to evaluate the role of the root pathogen, *Leptographium terebrantis* and quantify the amount of growth decline associated with the pathogen. The study was installed in a 13-year-old loblolly pine plantation and artificial inoculations were done using *L. terebrantis* colonized toothpicks to simulate the natural feeding habits of bark beetles. Twenty-one months of post inoculation treatment, the pathogen caused a 16.3% reduction in basal area increment and 13% mortality in the high inoculum treatment trees. The results demonstrate that *L. terebrantis* negatively influence loblolly pine growth.

Title: Effects of experimental warming on *Solenopsis invicta* and southeastern arthropod communities

Primary Author: Merchlinsky, Alex R.
Additional Authors: Mohan, Jacqueline; Frankson, Paul; Ray, Charles.
Department: Wildlife Sciences
College: Forestry and Wildlife Sciences

The red imported fire ant (RIFA, *Solenopsis invicta*) is an ant native to the Amazon River Basin which was introduced to the United States in the early 20th century and has since expanded across most of the Southeast. RIFA have become a significant economic pest species, and additionally have been shown to harm native wildlife species.. As global temperatures rise, average temperatures in the Southeast United States will grow closer to those of RIFA's native range, leading to concern about possible range extensions and increases in activity in its introduced range. We used 3.6 meter x 5 meter chambers in Whitehall Forest, Athens, GA, equipped with buried heating cables, to warm enclosed areas based on 4 treatments: ambient temperature, 3 degrees Celsius above ambient, 5 degrees above ambient, and unenclosed non-chamber control plots. We deployed pitfall traps in 3 chambers of each treatment to monitor arthropod activity under each treatment. Traps were left open continuously, starting in October of 2018, and samples were collected for analysis approximately weekly. Over the course of sampling, we have observed 526 total ants across 25 species, primarily *Solenopsis invicta* and *Prenelopis imparis* We have found that, in trapping sessions that contained ants, RIFA on average accounted for 34.8% of captured ants in non-chamber control plots, 31.1% of captured ants in chambers at ambient temperature, 43.1% of captured ants in chambers heated by 3 degrees Celsius, and 60.2% of captured ants in chambers heated by 5 degrees Celsius. Additionally, for each 1 degree Celsius increase in temperature, RIFA can be expected to make up a 3% larger proportion of captured ants ($p=.01$). These results can act as a predictor for how biologically similar heat-adapted invasives can be expected to react to global climate change.

Title: Advances in culturing the plant pathogen '*Candidatus* Liberibacter asiaticus' by culture medium optimization

Primary Author (and presenter): Merfa, Marcus V.
Additional Authors: De La Fuente, Leonardo
Department: Entomology and Plant Pathology
College/School: College of Agriculture

Description:

'*Candidatus* Liberibacter asiaticus' (CLas), a heretofore unculturable bacterium, is associated with citrus huanglongbing (HLB), the current most devastating citrus disease worldwide. In the US, this bacterium has been causing extensive damages in citrus orchards, mainly in Florida. The lack of CLas culturing, except transiently, and absence of methods to transfer it to either insect or host plants, precludes fulfilment of Koch's postulates and effective screening of antimicrobials, hampering the study of HLB. Recently, the environments where CLas lives, including the hemolymph of the insect vector (Asian Citrus Psyllid – ACP) and phloem sap content of host plants, were characterized. Since these studies have elucidated the chemical conditions of these environments, our objective was to use this knowledge to increase the viability of CLas in laboratory conditions. Thus, in this study we aimed at optimizing grapefruit juice (GJ), the culture medium previously used by our group to establish transient cultures of CLas, to enhance its growth *in vitro*. In our assays, CLas inoculum was obtained from seeds of infected citrus plants or guts of infected ACPs, and was inoculated in 24-well plates containing GJ, used here as basis medium, and GJ modified by addition of different compounds to be tested. After incubation for 21 days at 28ºC, the amount of CLas was determined by RT-qPCR. To obtain replicates, sub-cultures of each condition were performed. Results revealed that increasing the pH of GJ from 3.5 to 5.85 enhanced growth of CLas. Furthermore, a highly repeatable growth pattern was observed in which CLas grows better starting from a low number of cells, but grows only to a certain limit before the culture starts to die. These results add information to the effort of culturing CLas *in vitro*. We believe that reaching this goal will ultimately lead to a better understanding of CLas, so appropriate management strategies can be developed.

Title: Evaluation of biorational insecticides against two-spotted spider mite (Acari: Tetranychidae) on tomato

Primary Author (and presenter): Mertoglu, Gamze
Additional Authors: Balusu, Rammohan & Fadamiro, Henry
Department: Entomology and Plant Pathology
College/ School:

Description:

Tomato (*Solanum lycopersicum)* is one of the most popular and potentially the most profitable crops grown in high tunnel production. The two-spotted spider mite, *Tetranychus urticae* Koch (Acari: Tetranychidae), is a major threat to tomato production due to its short life cycle and high fecundity, especially in high tunnels. Chemical control has been used intensively to control spider mite populations. This has resulted in widespread resistance to pesticides and undesirable effects on non-target organisms and the environment. The goal of this research is to mitigate spider mite problem in high tunnel tomato production by evaluating biorational acaricides such as microbials, botanicals, essential oils and horticultural oils in laboratory and field studies. In addition, the predator *Phytoseiulus persimilis* (Koppert) was released in field studies to compare its efficacy with the tested biorational acaricides in the high tunnel. In laboratory toxicity bioassays, higher mortality rates were recorded for spider mites treated with rosemary and horticultural oils. On high tunnel planted tomatoes, *P. persimilis*, rosemary oil and horticultural oil showed a higher capacity to reduce spider mite population compared with other tested treatments. The ecological significance of the results is discussed.

Title: Harnessing solar energy for self-folding origami
Primary Author (and presenter): Miller, Noah S.
Additional Authors: Mailen, Russell W.
Department: Aerospace Engineering
College/School: Samuel Ginn College of Engineering

Self-folding origami has generated significant interest in recent years for its ability to convert flat, patterned substrates into three-dimensional shapes. Applications for self-folding origami include self-deploying shelters, containers for food and water, and biomedical devices. Pre-strained polystyrene sheets that can be printed on using a desktop printer may be used for self-folding origami. These sheets shrink to approximately half their size when heated above their glass transition temperature of 103°C. Self-folding using this material has been demonstrated in a laboratory setting by using a heated support (hotplate) and infrared heat lamps to locally increase the temperature of the polystyrene sheets through local light absorption of ink patterned regions. This causes the sample to fold into a pre-determined shape. Unfortunately, the need for electrical power and the cost of the test apparatus can be prohibitive. We address these limitations by utilizing inexpensive materials to harness the energy of the sun and produce the same self-folding end-result of the heat-lamp apparatus. Our apparatus utilizes fire safety blankets to reflect sunlight and uniformly heat a sample platform. This platform supports the self-folding sample and brings the material close to the folding temperature. A convex lens above the platform focuses a portion of the light onto a sample placed on the heated platform. The focused light further raises the temperature of the inked regions, initiating the self-folding process. We evaluate multiple reflector designs due to the low cost of materials and manufacturing. The reflector designs are compared and the effects of reflector area, orientation, and shape are evaluated. The tested devices include pentagon, hexagon, and heptagon shaped reflectors. We also demonstrate the ability of these devices to fold representative SMP origami samples using only the energy of the sun.

Title: Effect of 3-position functional groups on GRIM-synthesized polythiophene reactivity ratios and resulting regiochemistry
Primary Author (and presenter): Minkler, Michael J.
Additional Authors: Beckingham, Bryan S.
Department: Chemical Engineering
College/School: Samuel Ginn College of Engineering

Description:

Poly(3-substituted thiophenes) have become exceedingly important for applications such as organic-based thermoelectric generators, solar panels, and other flexible electronic devices. Due to limitations in physical, solution and optoelectronic properties of polythiophene homopolymers, groups commonly copolymerize two or more 3-substituted thiophene monomers using a modified Grignard Metathesis (GRIM) polymerization technique to produce highly regioregular polythiophenes. However, one common drawback to this route is that the substituent groups detract from the charge transport mechanism of the resulting semiconductive solid-state polymer through defects. Copolymerization with unsubstituted thiophene provides a method to synthesize polythiophenes with enhanced charge transport and better mechanical stability. Due to the nature of GRIM polymerization the lack of the 3-position substituent group on thiophene, the regiochemistry of the resulting copolymers is greatly complicated as the steric hindrance is not present. This work aims to investigate the effects of unsubstituted thiophene on polythiophene copolymers with 3-hexylthiophene synthesized using GRIM polymerizaion by synthesizing a series of statistical copolymers. Aliquots of the reaction mixture will be taken at a series of timer intervals in order to determine reactivity ratios of the two comonomers from the compositional drift profiles. The aliquots will be distilled to separate oligomers/polymers from any remaining monomers and both will be analyzed via ^{1}H NMR spectroscopy and MALDI-TOF mass spectrometry to determine the composition of each. Additionally, the polymers will be subjected to differential scanning calorimetry (melting temperature and equilibrium melting enthalpy), gel-permeation chromatography (dispersity and relative molecular weight), and UV/Vis spectroscopy to investigate the role of copolymerization on molecular structure, thermal behavior and optoelectronic behavior.

Title: Diabetic noncompliance: The effect of culturally-appropriate education on diabetic outcomes

Primary Author (and presenter)*:* Minor, Jessica S.
Additional authors*:* Ellison, Kathy Jo
College/ School: School of Nursing

Description:

Strong evidence indicates mortality and morbidity among persons with diabetes are associated with poor treatment compliance and poor glycemic control. Possible reasons for treatment noncompliance may be related to an individual's understanding of treatment. Ethnic and minority populations are most at risk for poor health literacy. Evidence based practice recommends the use of Diabetes Conversation Maps as reinforced, culturally-appropriate diabetic education. The purpose of this project was to implement Diabetes Conversation Maps to reinforce diabetic education to improve diabetic knowledge, treatment compliance, and glycemic control. The target population included adults (age 18 and older) having type 2 diabetes within a diabetes education clinic. Following the acquisition of participation agreements, participants completed the DKQ-24 to assess baseline diabetic knowledge and compliance using the Morisky Adherence scale (MGL). Participants submitted baseline average blood sugar data. Participants participated in diabetic education using Diabetes Conversation Maps. The same assessments were conducted after education and again 2 weeks after education. The project is in process. Descriptive statistics will be used to describe the patient population and data from pre/post education blood sugars, diabetic knowledge, and compliance. The pre-post education questionnaire scores and blood sugar data will be compared with dependent t-tests (alpha= 0.05).

The use of Diabetes Conversation Maps as reinforced diabetic education can improve outcomes for persons with diabetes including those in ethnic or minority groups. These maps can be implemented in a diabetes education clinic to improve glycemic control, diabetic knowledge, and treatment compliance among persons with diabetes and further implementation of the project is warranted.

Title: National trends in proton pump inhibitors use and patient factors associated with ppis use in the U.S.: 2002-2015

Primary Author (and presenter): Mishuk, Ahmed Ullah
Additional Authors: Hansen, Richard; Chen, Li; Gaillard, Philippe; & Qian, Jingjing
Department: Health Outcomes Research and Policy
School: Harrison School of Pharmacy

Description

Proton pump inhibitors (PPIs) are among the highest-selling classes of drugs, but evidence in its utilization patterns is limited. The aim of this study is to examine PPIs use trends and identify patient factors associated with PPIs use among nationally representative, noninstitutionalized US population. A serial cross-sectional analysis on 2002-2015 Medical Expenditure Panel Survey (MEPS) data was conducted and use of PPIs was identified by matching generic PPI names in the MEPS household prescribed medicines event files in each calendar year. Trends in annual proportion of participants with any PPI use, overall and by patient's self-reported age (<25, 25-39, 40-64, 65+), race/ethnicity (non-Hispanic white, black, Asian, other), sex (male, female), geographic region (Northeast, Midwest, West, South), income (poor, low, middle, high), health insurance status (public, private, uninsured), body mass index (BMI: under weight, normal, overweight, obese), marital status (married, widowed, never married, other), and esophageal disorder (presence, absence) were examined using simple linear regression models. Multivariable model with generalized estimating equation was used to identify patient factors associated PPIs use, controlling for year and health status. Results were weighted to represent national estimates and $P<0.05$ was set for statistical significance. Overall PPIs use increased from 5.5% (standard error (SE)=0.2) in 2002 to 8.8% (SE=0.3) in 2015 ($P_{trend}<0.001$). PPIs use trend was statistically significant in different patient age (except 40-64), race/ethnicity, sex, region, income, and marital status subgroups (all $P_{trend}<0.05$). Trends also increased in participants with public health insurance and those who were obese. Among patients with esophageal disorders, PPIs use was 73.8% in 2002 and 78.8% in 2015 ($P_{trend}>0.05$). Multivariable results found that participants aged >25, female, non-Hispanic white, residing in Northeast, with higher income, having public or private health insurance, obese, and married had higher likelihoods of using PPI. PPI use trends were similar across most patient factors but varied by patient's health insurance and BMI. Understanding utilization patterns of PPI could inform practitioners to identify potential treatment disparities and suboptimal uptake.

Title: Lifestyle management in heart failure
Primary Author (and presenter): Mitchell, Christie
Additional Authors: Gibson- Young, Linda
College/ School: School of Nursing

Description:

Cardiovascular disease continues to be a deadly preventable disease process. Hospital rates in 2010 estimate one million admissions associated with heart failure, and the prevalence is rising with 6.5 million adults currently affected by heart failure. The purpose of this project is to explore how a multifaceted intervention effects heart failure exacerbations and hospital admissions. The target population includes patients age 18 and older with heart failure. Participants will complete a pre-teaching and post-teaching Morisky Medication Adherence Scale (MMAS)and heart failure questionnaires. For the intervention, each participant will be provided a heart failure pamphlet and face-to-face scripted education teaching sessions on lifestyle management (heart failure, medications, diet, and exercise).. Two days after the office visit, patients will be contacted promoting educational review on lifestyle management allowing for further questions. Outcomes measured will be blood pressure readings, weights, ankle measurement, MMAS questionnaire, and heart failure questionnaire. A sample of fifteen patients age 18 and above were used of mixed gender and nationality. A paired samples t-test reviewing pre and post-systolic blood pressure, diastolic blood pressure, weights, ankle measurements, pre and post-Morisky medication assessment, and pre and post heart failure assessment. The t-value was 19.858 ($p = 0.000$) will be used for this project. A Wilcoxon matched pair signed rank test rejected the null hypothesis with varied p values. The multifocal measures indicate that the intervention strategy was successful in increasing congestive life style management lessoning rate of heart failure exacerbations and hospital admission. Since the interventions was successful on a small scale, these interventions should be put into effect for a larger patient population.

Title: Improving HbA1c using interactive technology
Primary Author (and presenter): Mitchell, Sheila K.
Additional Authors: Gibson-Young, Linda
College/ School: School of Nursing

Description:

Most health complications associated with diabetes can be prevented by eating healthy, physical exercise, maintaining suggested HbA1c levels of less than 7 and keeping blood pressure and cholesterol within suggested parameters. Identifying interventions is critical in providing optimal diabetic care. To self-manage type 2 diabetes (T2DM), patients must understand the disease and know why it is significant to control it. A review of the clinics monthly diabetes statistics indicate that the clinic cannot reach its overall goal of 85% of veterans to reach and maintain an HbA1c of less than seven. The target population included all veterans with type 2 diabetes. Use of interactive electronics to effectively manage T2DM by improving glycemic control and ultimately, preventing or delaying further complications of diabetes. Diabetic Connect Application allow veterans to enter daily blood glucose levels, weight and carbohydrate intake. This automation provides an educational, behavioral or motivational message to veterans regarding their disease process and self-management skills. Data collected from each participant is retained and can be reviewed and tracked for analysis. The small test of change is in progress. Participants in the study use interactive electronics to lower their HbA1c and average daily blood glucose by 1.5% over a three-month period. The pre-post questionnaire mean scores will be compared with paired t-tests (alpha=0.05). The project leader gained significant knowledge related to what a small test of change project (STOC) can accomplish by finding new innovative tools to improve health care for all patients. HbA1c improvements in the STOC using interactive electronics gives each veteran knowledge on how to enhance their own health. Participants making improvements is achievable using interactive electronics and access to diabetic educator. Further implementation of the STOC project is warranted.

Title: Comparing group differences in cognitive errors in juvenile delinquent populations
Primary Author (and presenter): Mitchell, Taylor A.
Additional Authors: Thompson, Kelli
Department: Psychology
College/School: College of Liberal Arts

Description:

Adolescents perpetuate about 20% of sex offenses committed in the United States (Kolkoo, Bukstein, & Brown, 1999). Consequently, the treatment and rehabilitation of these individuals plays a key role in preventing such behaviors as adults. Addressing cognitive errors is a key feature of many treatment programs designed to address deviant and illegal sexual behavior. One of the prominent issues at hand is the impact of cognitive errors in rationalizing and justifying deviant sexual behaviors. Cognitive errors have been defined as cognitive processes by which individuals build their attitudes, beliefs, and behaviors on irrational or inaccurate ideas (i.e., cognitions). Additionally, cognitive errors can be formed into preconscious patterns of automatic thinking and cognitive schemas, which influence future behavior in a perpetuating cycle (Rich, 2011). Adolescents are undergoing developmental changes, so it is even more important to help healthy cognitions become a part of the way they understand themselves, their world, and how they develop as individuals (Rich, 2011). To the authors' knowledge, there are no published studies comparing the rate of cognitive errors related to appropriate sexual behavior between adolescents adjudicated for illegal sexual behavior (AISB) and those adjudicated for general delinquent behavior (AGDB). The Adolescent Cognition Scale is a 32-item self-report questionnaire used to identify such cognitive distortions. Higher scores indicate more cognitive errors in regards to inappropriate sexual behavior. The current study aims to determine differences in cognitive errors in a sample of AISB and AGDB placed at a residential juvenile correctional facility. Data collection and analysis are currently ongoing for this project. Given the lack of prior research comparing these populations on this domain, no hypotheses regarding direction of magnitude of group difference have been made at the moment. Clinical implications will be discussed.

Title: Synthesis and characterization of block-copolymers towards smart gating membranes
Primary Author (and presenter): Alisa Mobley
Additional Authors: Breanna M. Dobyns, Bryan S. Beckingham
Department: Department of Chemical Engineering
College/School: Auburn University- Engineering

The development of an on-demand drug delivery vehicle has many potential medical benefits. Diabetes affects millions of individuals in the United States and insulin delivery is a common treatment, but it has low patient compliance. The implementation of an on-demand drug delivery vehicle would reduce the need to monitor blood glucose levels and reduce the risk of diabetes related complications. Polymer membranes were synthesized and solute transport through them (permeability) was examined as a preliminary step towards developing glucose-sensitive smart-gating pores that can deliver insulin. Membranes synthesized from homopolymers are somewhat limited by their characteristic properties, but copolymers present the opportunity to tune these properties. A copolymer includes at least two monomers and the composition can vary based on the desired properties of the material. Block copolymer, polystyrene-*block*-polybutyl acrylate (PS-*b*-PBA), was synthesized by air-free, anionic polymerization and converted to polystyrene-*block*-polyacrylic acid (PS-*b*-PAAc) block copolymers post-polymerization by titrating p-toluene sulfonic acid to the PS-*b*-PBA changing the PBA to PAAc. Block copolymer compositions were verified using 1H nuclear magnetic resonance (NMR) spectroscopy and gel permeation chromatography (GPC) was used to determine polymer dispersity and relative molecular weight. Following successful synthesis and characterization, membranes were fabricated from viable block copolymer samples. Permeability was tested for bovine serum albumin (BSA) in water using attenuated total reflectance Fourier-transform infrared (ATR FTIR) spectrophotometry. A system of water and BSA was used to emulate real biological conditions to gain more realistic insight into the gating properties of these polymers.

Title: Effective hazardous materials closed-loop supply chain network design with cost minimization and risk equity

Primary Author (and presenter): Mohabbati Kalejahi, Nasrin
Additional Authors: Vinel, Alexander
Department: Industrial and Systems Engineering
College/School: Samuel Ginn College of Engineering

Description:

The hazardous material (hazmat) plays an important role in industrialized societies. It includes a wide variety of substances from the fuel for our vehicles to raw materials which are used in purifying water, producing medicine and making farming fertilizers. Hazmat transportation has been expanding due to the increasing demand of different hazmat types for specific uses at distinct locations. Hazmat incidents can occur in origin during loading, in transit, in transit storage, and in destination during unloading. These incidents include explosions, fires, and poisonous gas leakage that can cause catastrophic consequences such as fatalities, severe injuries, and property and environment damage. There are two perspectives in hazmat shipments: a) carriers intend to minimize their cost of operation and in contrary b) governments intent to promote risk equity by forcing the carriers to avoid populated areas even if it is more expensive. In this research, we developed an effective bi-objective mathematical model for hazmat closed-loop supply chain network design problem. This model aims to optimally locate the hazmat facilities such as production, distribution, collection, recovery and disposal centers, and select the routes and quantity of shipments in order to provide minimum cost routes for carriers as well as spreading out the shipments to reduce the imposed risk in the network. It also helps in deciding about the optimal location of emergency response teams to control and reduce the catastrophic consequences of hazmat incidents. Our experimental results based on the Albany County in NY state shows that the proposed model minimizes the cost and the risk exposure of the shipments by finding the optimal locations of the centers, routes, and quantity of shipments as well as the optimal locations of emergency response teams in the network.

Title: Urban Sustainability: A look in stormwater management at Auburn University Campus, AL.

Primary Author (and presenter): Molla, Alamin
Additional Author: Mitra, Chandana
Department: Geosciences
College/School: College of Science and Mathematics

Description:

Urban Sustainability is the mostly uttered word in urban area discussion now-a-days. Almost all of the city decision makers, officials around the world are looking forward to make their cities sustainable. Among the components of sustainability, stormwater management, stormwater management is one of the vital thing. Because, urban area means more impervious area. And more the impervious area, more the runoff during storm event. Auburn University Campus is one of the campuses which situated in urban settings. This University still don't have fully developed stormwater sewer network. This study aimed to assess existing network capacity in terms of different return periods storm and (if needed) propose a storm sewer network as ultimate output. This study will use DEM prepared with LiDAR point cloud data because of its effectiveness in high quality DEM generation. High resolution DEM has been used for sub-catchments delineation with PCSWMM(Personal Computer Strom Water management Modeling) software. With rainfall data (collected from rain gauge placed suitable places in Campus) and other inputs(slope, roughness etc.) processed in ArcGIS environment will be used as inputs for flooding scenario animation in PCSWMM 2D modeling. After visualizing potential flooded area and runoff volume estimated, suitable sewer pipe size will be suggested with specific location for junctions, nodes, outfalls and outlet. Another important aspects of this research is to find out how spatial data can improve storm water modeling. This study also aimed to make Object based Image Analysis (OBIA) Classification for Auburn Campus area. NAIP Imagery from USGS has been used to produce OBIA classification with eCognition software.

Title: Insights on the redox properties of two- and three-dimensional supported vanadia oxide catalysts using Raman-spectrokinetics
Primary Author (and presenter): Moncada, Jorge
Additional Authors: Adams, William R. & Carrero, Carlos A.
Department: Chemical Engineering
College/School: Samuel Ginn College of Engineering

Description:

Metal oxide catalysts have held an important role in industrial scale reactions for the selective oxidation of hydrocarbons. A better understanding to correlate molecular structure and chemical nature in these systems is still awaiting. Newer processes that utilize metal oxides, such as oxidative dehydrogenation and direct valorization to oxygenates, require improvements in selectivity, productivity, and stability in order to achieve their promise as viable improvements over methodologies that are more conventional. In addition, among the transition metal oxide catalysts implemented to produce olefins and oxygenates, those containing vanadium have demonstrated the greatest potential. Recently, we have employed a novel spectrokinetic approach with Raman spectroscopy to gain unique insights on the structure-reactivity relationships of silica supported vanadium oxide catalysts. We define spectrokinetics as an operando spectroscopic methodology in which reaction rates (kinetics) are obtained directly from spectroscopic data. In prior work, redox reactions with a series of ternary metal oxide catalysts were time-resolved using pulsed injections of gaseous reagents while following by mass spectrometry and monitoring the evolution of the (2D-dispersed) vanadyl Raman transition. With our current work, we endeavor to improve upon the Raman-spectrokinetic approach by studying a series of V-SiO_2 catalysts at different metal loadings containing both 2D (dispersed) and 3D (nanoparticle) vanadium species, providing two distinct Raman vibrations that can be monitored (994 and 1035 cm^{-1}). Tracking these two signals during reduction and oxidation reactions, unique rate information from two separate surface species was obtained.

Title: Drought management plans in major cities in Alabama and the Southeastern U.S.
Primary Author (and presenter): Moore, Meredith K.
Additional Authors: Chaney, Philip; Burton, Christopher; & Brantley, Eve
Department: Geosciences
College/School: College of Sciences and Mathematics

Description:

The severe drought conditions impacting California over the last several years have led to greater awareness of the consequences of water scarcity and the need for effective drought policy. The Southeastern U.S. is not immune to this threat, as evidenced by the devastating droughts of 2007 and 2016 and the ongoing Tri-State Water Wars. Without adequate management and effective planning, drought impacts are likely to become longer lasting and more severe. Major cities in the southeast could learn from the drought crises of major cities in the west, where drought management plans are likely to be more comprehensive. Characteristics of local management plans in the West and Southeast U.S. were evaluated on three levels for key elements of sustainable policy (i.e., social, environment, and economic), the stages of drought management (i.e., pre-drought, during drought, and post-drought), and the level of detail and overall quality. This study presents a multi-state policy analysis for 18 key cities in the Southeast (Alabama, Georgia, Mississippi), and the Western U.S. (California and Arizona). The results confirm the assumption that drought management plans are more comprehensive in the west and they provide a roadmap for how cities in the southeast can increase the level of preparedness. Recommendations for the development of successful local plans, particularly from the environmental pillar, pre-drought, and during-drought framework, are provided based on the higher scores of the Western plans. These methods are a proactive approach to sustainably addressing water scarcity issues.

Title: Oxidative degradation of lignin to value added products
Primary Author (and presenter): More, Ajinkya R.
Additional Author: Jiang, Zhihua
Department: Chemical Engineering
College/School: Samuel Ginn College of Engineering

Description:

This research study was conducted to develop innovative techniques to improve the yield of value added products from lignin. This product development intends to diversify the products portfolio of pulp and paper industry for a sustainable bio-refinery. Oxidation of lignin can generate value added products, however, there is a need to selectively degrade the structure of lignin. The aim of this research is to deepen fundamental understanding of factors governing the oxidative degradation and integrate it to current pulp and paper industry. This was done by carrying out experimental study varying operational parameters of lignin oxidation. This includes oxidizing agents, temperature and pressure, stabilizing agents, type of lignin and reactor configurations. The products were detected using high performance liquid chromatography using RI and UV detectors and verified with gas chromatography mass spectrometry. Typically high value aromatic aldehydes and carboxylic acids have been obtained which are vanillin, vanillic acid, oxalic acid, formic acid. The selective improvement of yields of these products will lead to a sustainable process that can be integrated to paper and pulp industry making it more profitable. In this study, improved yield of products has been observed by varying operational parameters.

Title: Intestinal parasites found in black-and-white ruffed lemurs (Varecia variegata variegata) in Ranomafana National Park, Madagascar

Primary Author (and presenter): Morgan, Abigail B,
Additional Authors: Andrea. Zohdy, Sarah.
Department: Anthropology
College/School: Forestry & Wildlife Science.

Parasites can influence host survival, reproduction, and behavior and parasitic infection can be used as an indicator of host health. Lemurs are female dominant non-human primates native to the island of Madagascar. Here, we conduct a surveillance of fecal parasites from endangered black-and-white ruffed lemurs (Varecia variegata variegata), to gain a better understanding of lemur parasite ecology, seasonal infections in a rainforest environment, and sex-linked differences in parasitic infection. A total of 697 fecal samples from 29 individual lemurs were sampled in southeastern Madagascar at Ranomafana National Park between February 2008- December 2008 and preserved in 10% formalin to maintain parasite morphology. Samples were screened for endoparasites using fecal flotation techniques. The most common parasites detected were pinworms (Lemuricola sp. and Callistoura sp.), obligate parasites which are often specialized to their host species. These pinworms have yet to be identified in V. variegate, and here we present morphological descriptions of the pinworms. Our results also suggest that pinworms are likely to be found during the rainy season (November-July) than during the dry season (n=719 for wet season and n=49 for dry). Males had significantly higher mean pinworm counts than females (n=563 for males and n=205 for females). The study presents new pinworm descriptions and suggests seasonal and sex-linked associations with parasitism in endangered lemurs.

Title: Improving maternal infant bond and breastfeeding adherence with skin-to-skin contact

Primary Author: Moss, Rachel R

Additional authors: Gibson-Young, Linda

College/ School: School of Nursing

Description:

Evidence shows a link between skin-to-skin contact, breastfeeding adherence, and maternal/infant bond. Skin-to-skin contact has shown to have numerous benefits to both mother and infant. Studies have shown women who perform skin-to-skin contact are more likely to breastfeed longer than women who do not perform skin-to-skin contact. Current practice guidelines include practicing skin-to-skin contact after birth to increase breastfeeding adherence and maternal/infant bond. The purpose of this project is to examine skin-to-skin contact, bonding, and breastfeeding adherence. The target population includes women who have delivered an infant in the last six weeks, received pamphlet on skin-to-skin contact on admission, are breastfeeding, and plan to spend twelve weeks at home with infant. This cross-sectional design focuses on bonding and breastfeeding outcomes. After consent to participate is obtained, participants completed a brief questionnaire during the postpartum appointment. This project is currently in progress. Patient demographics, infant feeding preferences, maternal/infant bond, and skin-to-skin contact will be described using descriptive statistics. Data will include the percent of women who are breastfeeding, performing skin-to-skin contact, and increasing maternal/infant bond. Skin-to-skin contact, maternal/ infant bond and breastfeeding adherence scores will be compared with paired t-tests (alpha=0.05). Skin-to-skin contact has a positive impact on maternal/infant bonding and breastfeeding outcomes. Early skin-to-skin contact is the goal in every delivery to help ensure more successful breastfeeding and closer maternal/infant bond. Further implementation of this project is necessary to gather more research to support the link between skin-to-skin contact, breastfeeding adherence, and maternal/infant bond.

Title: Amylin and pramlintide increase AD pathology in TgSwDI mouse model by modulating γ-secretase activity and APP processing in lipid rafts
Primary Author (and presenter): Mousa, Youssef
Additional Authors: Kaddoumi, Amal
Department: Drug Discovery and Development
College/School: Harrison School of Pharmacy

Description:

One of the major characteristics of Alzheimer's disease (AD) is the accumulation of misfolded amyloid-β (Aβ) protein. Several studies linked AD with type 2 diabetes (T2D) through reported similarities between Aβ and human amylin. A number of studies has shown that amylin is involved in the pathogenesis of AD by inducing neuroinflammation and apoptosis, but little is known about the mechanism by which amylin exacerbates AD pathology. This study investigates the effect of amylin and pramlintide on AD pathogenesis and the predisposing molecular mechanisms behind the observed effects in TgSwDI mouse model. Multiple biochemical analysis techniques such as IHC, Western blotting, ELISA, enzyme activity studies, and lipid rafts isolation were used in this study. The chronic intraperitoneal injection with either amylin or pramlintide increased Aβ burden. Furthermore, amylin and pramlintide increased AD pathogenesis by inducing neurotoxicity, apoptosis, glial cells activation, and increasing Aβ plaques deposition in brain microvessels. Findings from our study demonstrated a novel mechanism by which amylin and pramlintide increase AD pathogenesis. Both peptides have shown to modulate the amyloidogenic pathway proteins and increase Aβ production by modulating the localization of amyloid precursor protein (APP) and γ-secretase activity in lipid rafts. These results were accompanied by increasing B4GALNT1 and GM1 ganglioside levels which were shown to be associated with regulating the amyloidogenic pathway proteins in lipid rafts. Moreover, treatment with amylin and pramlintide showed reduction of LRP1 transporter in lipid rafts which could be explained by the reduction of total PSD-95. Amylin is endogenously produced peptide and it may be associated with AD development especially in patients with T2D.

Title: Fatigue crack growth prediction of 316L SS and Inconel 718 alloys fabricated using a laser powder bed fusion process

Primary author (and presenter): Muhammad, Muztahid
Additional authors: Imandoust, Aidin & Shamsaei, Nima
Department: Mechanical Engineering
College/School: Samuel Ginn College of Engineering

Description:

The aim of the present research is to develop a defect sensitive fatigue model to predict fatigue life of additive manufactured parts using a fracture mechanics based approach, which incorporates the effects of defects present in the specimen. Defects such as lack of fusion (LoF) and gas entrapped pores, some naturally occurring, while some were intentionally induced using non-optimized process parameters. Size of the defects responsible for crack initiation and failure were measured employing Murakami's $\sqrt{area}$ method obtained from the fracture surfaces of the specimens subjected to strain controlled fatigue testing. Elastic-plastic energy release rate, ΔJ_{eff}, a fracture mechanics based method capable of incorporating size and location of defects was employed to determine the fatigue limit as well as predict the fatigue life of AM parts using an NASGRO software.

Title: Use of blockchain in data provenance and version control
Primary Author (and presenter): Mukhopadhyay, Ujan
Department: Computer Science & Software Engineering
College/School: Samuel Ginn College of Engineering

Description:

Data Provenance keeps track of modifications to the information in a system. Provenance systems do not currently maintain data integrity or authenticity. Version Control allows users to retrieve previously saved versions of the system. Current version control systems are limited to general version control, as opposed to file specific version control.
The blockchain is a distributed public ledger used by cryptocurrencies. The Blockchain was introduced by Bitcoin in 2008. It records cryptocurrency transactions through cryptographically linked hashes stored on distributed ledgers that jointly ensure that these transactions cannot be tampered with. Git is a distributed version control system that maintains a version database where each version of the system is stored after a commit, which can be retrieved at will.
In this research paper, a novel data provenance approach is introduced. First, we present the fuller motivations and design. This novel provenance approach named Flakes is based on blockchain concepts and in part on Bitcoin source code. Flakes yields a reusable distributed service architecture achieving scalability by using distributed services to maintain ledger information. The key contributions of this work including a novel, lightweight mining algorithm different from Bitcoin that is particularly apt for secure provenance and incorporates the feature of version control. Flakes is a development on Scrybe, a previous Auburn project and the Flakes blockchain allows version control without having to maintain a separate version database. This system is evaluated for its resilience to threats.

Title: Design of a model for the experimental testing of the effects of sound waves on plant growth in an alternative agricultural system
Primary Author (and presenter): Murphy, Justin T.
Department: Industrial Design
College: College of Architecture, Design and Construction

Description:

By the year 2050, it is predicted that food production must increase by 70% to feed the world's increasing population. Unfortunately, using current agricultural techniques would require a proportional increase in practices that cause documented environmental damage and potentially devastating adverse health consequences for numerous biological life forms. As a result, environmentally friendly methods must be found that either match or exceed current agricultural practices. One environmentally friendly method for increasing crop yield is the use of sound waves to promote plant growth. This method uses acoustic technology to apply sound pressure and frequency levels to crops in an attempt to increase crop yield and nutrient density. This researcher proposes to combine the use of acoustic technology to an environmentally friendly system that is showing great promise, aeorponics. Aeorponics is a system that uses a nutrient rich mist to grow plants in a controlled indoor environment without the use of soil or an aggregate media. Research has demonstrated that aeroponic techniques decrease water usage by 90%, reduce fertilizer need by 60%, eliminate the need for pesticides, and has an ability to increase yearly crop yields by up to 75%. I will be testing the effects of acoustic technology on various crops grown in a high-pressure aeroponic system built using guidelines reported by NASA. This experiment will test the hypothesis that exposing plants grown in a high-pressure aeroponic system to sound waves of appropriate pressure and frequency levels will increase plant growth and quality.

Title: Permo-Carboniferous evolution of Eastern Gondwanaland: constraints from petrofacies and detrital geochronology
Primary Author (And Presenter): Mustaque, Sharif
Additional Author: Uddin, Ashraf
Department: Geosciences
College/School: College of Science and Mathematics

Description:

Gondwanaland, the last major supercontinent, was broadly divided into the eastern region consisting of present-day India and Australia and western region consisting present-day South America and South Africa with Antarctica at the center. Sediments from Permo-Carboniferous time periods records shifting of the entire supercontinent throughout the southern hemisphere resulting in significant variation of climatic condition starting with the late Paleozoic episode of both glaciation and deglaciation. This initiated a multi-directional continental scale drainage system in eastern Gondwanaland depositing sediments in multiple intra-cratonic basins that can be used to trace back the geological evolution of the region. Petrofacies analysis from sandstone and siltstone from the intra-cratonic basins in present-day Indian subcontinent reveal multiple possible source areas correlatable to the Kuunga, Pinjarra and Albany-Fraser orogeny's. $^{40}Ar/^{39}Ar$ geochronology of detrital muscovite samples show coherent peaks reaffirming the continent scale drainage hypothesis. Previous individual studies of Permo-Carboniferous sequences using U-Pb geochronology from southwestern Australia and northeastern Antarctica also indicate similar age range and source area. Hence, a comprehensive petrofacies and geochronological analysis from the intra-cratonic basins of all three regions using $^{40}Ar/^{39}Ar$ along with U-Pb for detrital grains, XRD analysis of mudstone and organic content from coal layers would provide a first-hand window for continental-scale correlation leading to the paleo-climatic and tectonic evolution of eastern Gondwanaland.

Title: Impact of sperm to egg ratio on hatching success for hybrid channel catfish (*Ictalurus punctatus*) × blue catfish (*I. furcatus*) embryos

Primary Author (and presenter): Myers, Jaelen
Additional Authors: Nichols, Zoe; Abualreesh, Muyassar; Husseini, Nour; Taylor, Zach; Coogan, Mike; Gurbatow, Jeremy; North, James; Minh Vo, Khoi; Zadmajid, Vahid; Dunham, Rex; & Butts, Ian
Department: School of Fisheries, Aquaculture and Aquatic Sciences
College/School: College of Agriculture

Description:

Hybrid catfish, the progeny of channel catfish (*Ictalurus punctatus*) females [Symbol] blue catfish (*Ictalurus furcatus*) males, are in high demand by the aquaculture industry due to their superiority for pond and raceway culture. Unfortunately, fry production can be a limiting factor due to a lack of natural hybridization between the two species and the necessity to sacrifice males for artificial fertilization. Therefore, it is essential to efficiently use gamete resources by using the minimum amount of sperm that allows for high fertilization from these valuable males. In this study, channel catfish eggs were fertilized with 6 different sperm to egg ratios ranging from 1.0×10^3:1 to 1.0×10^5:1, and embryos produced from these fertilizations were incubated until hatch. Mean hatch success, using sperm to egg ratios between 1×10^3 and 1.0×10^5:1, increased from 11.2% to 50.6%. There was an effect of sperm to egg ratio ($P < 0.0001$), such that hatching success increased from 1×10^3 to 1×10^4:1 sperm per egg (37.3%). Thereafter, adding > 1×10^4:1 sperm per egg had no impact on hatching success. The coefficient of variation (or between female variability) differed ($P = 0.044$) between the lowest (1×10^3:1) and highest sperm to egg ratios (1.0×10^5:1), such that female variability decreased as the sperm to egg ratio increased. There was also an apparent maternal effect on hatch success with significant female variance components, such that the minimum sperm to egg ratio required to achieve the highest hatch was 5.0×10^3:1 for Female 1 ($P < 0.001$), Female 2 ($P = 0.008$), Female 4 ($P = 0.012$), and 1.0×10^4:1 for Female 3 ($P < 0.001$). Based on these findings, we suggest that the 1.0×10^4:1 sperm to egg ratio will maximize hatch while simultaneously using minimal amounts of sperm, reduce natural variability between females to maintain consistent fry production, and maximize the fertilization capacity for each sacrificed male.

Title: Elucidating the role of periplasmic nitrate reductase (Nap) in Pseudomonas aeruginosa physiology

Primary Author (and presenter): Myles, Amanda N.

Additional Authors: Suh, S. J.

Department: Biological Sciences

College/School: College of Sciences and Mathematics

Description:

Pseudomonas aeruginosa is an important bacterial pathogen that predominantly infects immunosuppressed patients. This pathogen is recalcitrant to antibacterial therapy because of its natural resistance and its propensity to form thick biofilms that inhibit penetration of antibiotics and antibodies. Therefore, understanding its basic mechanisms of survival in the host may suggest better therapeutic approaches by targeting its environmental adaptability. In the lungs of people with cystic fibrosis, P. aeruginosa is believed to live in anaerobic/hypoxic environment. Under those conditions, P. aeruginosa relies on nitrate respiration for energy generation. Periplasmic nitrate reductase (Nap) is one of the three nitrate reductases in P. aeruginosa. The physiological role of Nap in P. aeruginosa stress resistance and pathogenesis has not yet been elucidated. We hypothesized that Nap may catalyze redox balancing in P. aeruginosa, functioning in the aerobic dissipation of excess reducing power, perhaps, preparing the cell for the transition to long-term anaerobiosis. We validated previous data in the lab that suggested the nap operon may be under the regulation of the general stress response regulator RpoS in P. aeruginosa. In addition, the effect of nitrate in the growth medium during aerobic growth was assessed. The RpoS regulation of nap was apparent in all of the nitrate concentrations tested, and nap expression increased as the nitrate concentration increased. We also tested whether the nap expression is affected by the redox state of the bacterium. We hypothesized that when P. aeruginosa is grown on more reduced carbon sources, it would accumulate more reduced molecules than when grown on more oxidized carbon sources and, thus, express nap operon higher for redox balancing. Using four carbon sources of the tricarboxylic acid cycle, we determined that the nap expression correlated with the reduced state of the carbon source.

Title: A novel approach for determining the low performance grade of asphalt binders
Primary Author (and presenter): Nakhaei, Mostafa
Additional Authors: Jalali, Farhang & Timm, David
Department: Civil Engineering
College/School: Samuel Ginn College of Engineering

Description:

Low temperature cracking is one of the major distresses in asphalt pavements, manifests itself as a series of transverse cracks equally spaced throughout the entire pavement. This type of cracking affects the riding quality and accelerate the pavement deterioration which eventually increases the maintenance costs. The current worldly accepted method for preventing these cracks is through appropriate selection of asphalt binders obtainable through a bending beam rheometer (BBR) test. According to the current standard specification, test should be conducted at 10 °C higher temperature than the low performance grade (PG). The choice of 10 °C shifting temperature in the BBR test of asphalt binders affects the low temperature performance (PG) grade directly. This temperature difference depends on temperature sensitivity of asphalt binders which may not be necessarily the same for binders from different sources due to chemical variability. In this study, 82 binders from two distinct sources were considered, most of which were tested at National Center for Asphalt Technology. The activation energy concept in conjunction with time-temperature superposition principal were utilized to validate the 10 °C criterion. The results indicated that the average temperature differences were 12.08 °C. This tiny difference can have huge implication on asphalt binder designation across the world. It was shown that 97% of the binders had temperature differences higher than 10 °C required by the standard BBR procedure, which can be considered conservative. However, consideration of 10 °C for all binders underestimates the low PG grade for about 30% of all binders. The finding of this study can affect all international transactions related to binder purchasing since with the current method 30% of binders are mischaracterized. The existing method can also result in severe distresses in some areas that the binder is purchased incorrectly.

Title: In vitro antimicrobial activity and mode of action of Zinckicide™ against *Liberibacter crescens*, a surrogate of '*Candidatus* Liberibacter asiaticus'

Primary Author (and presenter): Naranjo, Eber
Additional Authors: Santra, Swadeshmukul; Young, Mikaeel; Johnson, Evan; De La Fuente, Leonardo
Department: Entomology and Plant Pathology
College/School: College of Agriculture

Description:

The in vitro mode of action of Zinkicide™, a zinc oxide-based nanoparticle compound, was evaluated using *Liberibacter crescens* (Lcr) as a biological model for ´Candidatus *Liberibacter* spp.´ The minimum inhibitory concentration in microtiter assays was 125 ppm, while the minimum bactericidal concentration was 150 ppm. Lcr biofilm formation was inhibited to constant minimum values above 125 ppm. Interestingly, Lcr biofilm/planktonic ratios increased significantly from 25 ppm to 100 ppm, probably as a Lcr stress response mechanism against Zinkicide™. In microfluidic chambers (MC), Zinkicide™ inhibited biofilm formation at 125 ppm but did not affect Lcr cell-surface attachment. The use of the Live/Dead BactLight cell viability kit inside the MC revealed that Zinkicide™ killed the remaining attached cells in the treated channel. Zinkicide™ did not disrupt Lcr preformed biofilms in batch assays or MC at concentrations as high as 300 ppm, however cell viability assessment revealed that sessile cells in Zinkicide™ treated channels were also killed by the compound. To better resemble the expected uneven distribution of this compound and ´*Candidatus* Liberibacter asiaticus´ in mature citrus plants, Zinkicide™ was applied at sub-lethal concentrations in MC for both biofilm inhibition and biofilm disruption assays, and visually assessed for cell viability. Results showed Zinkicide™ bactericidal effect gradually decreases as the distance from the inoculation point was increased, and varied according to structural splits, flow direction, and cell concentration. Observation of Zinkicide™ effects in cell shape by transmission electron microscopy showed that when used at 125 ppm this compound caused cell deformation, abnormal cell budding, cytoplasm coagulation, and cell lysis at 24 hours after inoculation. Ongoing work is focused in assessing the transcriptional response of Lcr against sub-lethal concentrations of Zinkicide™ by RT-qPCR and RNAseq.

Title: Authorship verification and adversarial authorship
Primary Author (and presenter): Narayanan, Mina, J
Additional Authors: Packer, Sadaira; Allred, Jordan; Dozier, Gerry
Department: Computer Science and Software Engineering
College/School: Engineering

Description:

The amount of information that can be gleaned from online data is growing. Writing excerpts on the Internet, such as blogs or tweets, are examples of data that carry a wealth of information because they act as unconventional biometrics. Features contained in these writing samples can be used to uniquely identify an author based on her writing style. Although these characteristics can inform the author of her writing mannerisms, they may pose a security threat. For example, a malicious actor may imitate the features of another author and spread misinformation under a false name. We aim to empower authors to take control of their identity online and protect Internet users from cyberattacks. We have developed an authorship attribution system, AuthorCAAT-IV, that enables authors to visualize how minor changes in their writing style can make them more or less susceptible to attack. To make AuthorCAAT-IV more robust, we experimented with several author verification systems to determine whether it would be beneficial to incorporate such a system into our software. The systems returned mixed results depending on the nature of the unknown text; however, the two author verification systems Caravel and Glad showed promise with accuracies close to 0.70. With the help of these systems, people will gain more control over their data by conceptualizing how the use of salient features affects the way that adversaries classify their writing samples.

Title: Synthesis and characterization of hydrogels for medical application
Primary Author: Naro, Joseph, J
Additional Authors: Joshi, Prutha; Auad, Maria
Department: Chemical Engineering
College/School: Engineering

Description:

Hydrogels are polymeric materials with extensive medical applications because of their biological similarities with components of the body. Hydrogels are biocompatible materials that promote cell proliferation and tissue support. Some components allowing hydrogels to perform efficiently in biomedical applications include their hydrophilic nature, porous structure and elastic properties.

The objective of this research is to obtain poly (ethylene glycol) diacrylate (PEGDA) based polysaccharide interpenetrating networks (or double networks). The mechanical and structural features of the PEGDA hydrogel was modulated by comprising polysaccharide networks, such as gelatin and chitosan.

First, methacrylated gelatin and chitosan were synthesized with methacrylic anhydride. Moreover, synthesis of the PEGDA macromere was completed using linear poly (ethylene glycol) (PEG) with an excess of methacrylic anhydride. Second, the synthesized and freeze-dried powder of modified gelatin and modified chitosan were completely dissolved in a phosphate buffered saline and mixed with the aqueous PEGDA solution. Finally, the completely dissolved mixture of both polymers was UV cured using a commercial photo-initiator, Irgacure 184 (1-Hydroxycyclohexyl phenyl ketone). The mechanical properties and swelling characteristics of the cured hydrogels were then investigated.

Altogether, the properties of the biomaterial hydrogel are precursors to innovative applications in the field of medicine. Mechanical properties of these hydrogels were demonstrated to be tunable for various biomedical applications through modification of the degree of methacrylation and the gel chemical composition. The characterization of the systems suggests that the produced hydrogels could find applications in complex tissue engineering.

Title: Synthesis of unique surface functionalized cellulose nanocrystals and their applications in cancer cell detection

Primary Author (and presenter): Nori, Uma Madhuri
Additional Authors: Gomez-Maldonado, Diego; Davis, Virginia & Peresin, Maria
Department: Chemical Engineering
College/School: Samuel Ginn College of Engineering

Description:

Renewable and biodegradable cellulose nanocrystals (CNC) are considered to have great potential to be utilized as supports for protein immobilization due to their high strength and modulus (10 and 150 GPa, respectively). In this study, a novel strategy was developed to detect the ovarian cancer cell antigens by utilizing the unique surface functionalized CNC in combination with monoclonal anti-carcinoembryonic antigen (CEA) antibodies. The surface functionalization was performed via silylation using 3-aminopropyltriethoxysilane (APTES) to impart hydrolytic stability to the CNC, followed by reaction with glutaric anhydride (GA), an organo-linker to immobilize the antibodies. Cross-polarized optical microscopy was performed to investigate the birefringence and aggregation in dispersions and cast films. The scanning electron microscopy (SEM) was performed to observe the morphology and evaluate the dispersion state of films assembled from the dispersions. Attenuated total reflection infrared spectroscopy (ATR-IR) was used to determine the initial functionalization, antibody immobilization, and antigen detection. In addition, surface functionalization of CNC, antibody immobilization and antigen detection were followed in real time using quartz crystal microbalance with dissipation monitoring (QCM-D). These insights will be employed to discern the challenges and merits for fabricating the CNC based MEMS (Micro-Electro-Mechanical Systems) sensors targeted towards multianalyte detection in the future.

Title: Educational intervention to improve knowledge and attitudes toward insulin pumps with glucose monitors
Primary author: Norris, Emily S
Additional authors: Howell, Eleanor
College/School: Auburn University School of Nursing

Description:

Subcutaneous insulin pumps with continuous glucose monitors (CGMs) have been shown to improve hemoglobin A1C levels, decrease diabetic complications, and increase quality of life for diabetic patients. However, less than 30% of diabetic patients use these devices. Hindrances to use include unfavorable attitudes toward and perceptions about the technology, loss of control when using technology, difficulty in using pumps, and discomfort with changes in body image. This project used an interactive educational intervention to increase understanding of the benefits and use of insulin pumps and CGM and to address body image concerns. The target population included adults over the age of 18 with diabetes mellitus who manage diabetes using multiple daily injection. Following participant agreement, participants completed an insulin pump and CGM knowledge quiz and a survey on attitudes toward the technology. An interactive educational class was provided and participants repeated the knowledge quiz and attitudinal survey immediately after the session and six weeks later. This project is in progress. Descriptive statistics will be used to describe the participants. Changes in scores on the knowledge quiz and results of attitudinal surveys will be compared pre and post the education intervention using paired t-tests (alpha=0.05). Interactive education can increase knowledge and change attitudes or beliefs towards the use of insulin pumps with GCM in diabetic patients. Group, interactive educational classes are effective in these areas, and are achievable at the Diabetes and Nutrition Center and further implementation of this project is warranted.

Title: Improving gestation diabetes management with technology-based intervention
Primary Author (and presenter): Nummy, Amanda P.
Additional Authors: Watts, Sarah
College/School: School of Nursing

Description:

There is strong evidence that poorly controlled gestational diabetes mellitus (GDM) can lead to negative outcomes in expecting mothers and their babies. Studies have demonstrated that proper glucose management, monitoring dietary intake, and appropriate exercise can be effective in controlling gestational diabetes in this population. The purpose of this project was to implement a technology-based intervention to assist expecting mothers diagnosed with gestational diabetes to better manage their condition. The target population included pregnant women diagnosed with GDM. Following participant agreement, participants attended a classroom-based educational session on GDM where they were taught proper glucose monitoring techniques, safe exercise options, and given dietary recommendations. Participants completed a pre-knowledge assessment for the project leader to assess baseline knowledge level. Participants then downloaded the mobile application Glucose Buddy where glucose results, dietary intake, and exercise was recorded. Patient follow up took place at appointment sessions. Results were recorded and questions/concerns were addressed individually. During the final appointment participants completed a post-knowledge assessment for the project leader to assess and record. The project is in progress. Descriptive statistics will be used to describe the patient population, pre/post-knowledge assessment, and glucose results at diagnosis. Follow up data will include glucose results after initial diagnosis. Results will be analyzed using SPSS to assess the significance of the small test of change using the paired t-test (alpha=0.05). Proper control of GDM has demonstrated to be effective in improving outcomes for expecting mothers and their babies. Proper management and increased compliance can be achieved with technology-based intervention in this patient population and further implementation of the project is warranted.

Title: Urban growth comparison of two culturally homogenous cities of South Asia: Dhaka and Kolkata

Primary Author (and presenter): Nur, S M Shihab
Additional Authors: Mitra, Chandana
Department: Geosciences
College/School: College of Sciences and Mathematics

Description:

South Asian cities are among the fastest growing megacities of the world. At present, 6 cities of South Asia are regarded as mega cities for having a population of over 10 million. Two megacities, Dhaka, Bangladesh and Kolkata, India situated across borders with same history and language, have experienced the brunt of major political decisions which have molded and transformed the cities, culturally, demographically and environmentally over the past century. In this study we will qualitatively and quantitatively compare Dhaka and Kolkata in three time frames - the ‘partition of Bengal’ in 1905; the ‘independence of Indian subcontinent’ in 1947; and the ‘liberation of Bangladesh’ in 1971. These political events have a significant impact on the growth and urban form of the two cities in the 20th century dramatically. They have had profound influence on the form and shape of the two cities. Some urban environmental issues like temperature rise, urban heat island, environmental pollution, urban flooding, traffic congestion and lack of green and open spaces have also transformed along with shape and form changes of the cities. Geospatial and statistical techniques will be used to highlight the ramifications of political and cultural changes on Dhaka and Kolkata megacities.

Title: Toxicity profiles of aromatic and aliphatic essential oil component against strains of German cockroach, *Blattella germanica*

Primary Author (and presenter): Oladipupo, Seun O.
Additional authors: Appel, Arthur; Hu, Xing
Department: Entomology and Plant Pathology
College/School: College of Agriculture

Description:

The toxicity profiles of aromatic (eugenol and tropolene) and aliphatic (Limonene and α – pinene) essential oil component was investigated against the German cockroach, *Blattella germanica* (L.) (Dictyoptera: Ectobiidae). This study was conducted on three strains; a susceptible strain and two insecticide resistant strains. Using topical application methods, 1-µl dose of an essential oil component was applied between the metathoracic legs of adult male cockroaches and mortality assessed at 1, 2, 4, 8, 16, 24 and 48 h post-application. Also, a synergy bioassay, using piperonyl butoxide (PBO) was conducted. The toxicity (median lethal dose; LD_{50}) of each essential oil component to each strain was estimated by probit analysis (PoloPlus software). Correlation analysis was used to relate toxicity with physical and chemical properties of an essential oil component. The dose response for an essential oil component in the synergist bioassay was subjected to CompuSyn to calculate for synergism or antagonism. The insecticide resistant strains were generally more tolerant to the bioactivity of the essential oil component than the susceptible strains. Also, aromatic essential oil component had higher toxicity than their aliphatic counterparts. This work discusses the significance of structural and physical activity of an essential oil component in predicting susceptibility in German cockroaches.

Title: The rahima moosa mother and child extension design
Primary Author: Olver, Cailin, G
Additional Authors: Petersen, Alex; Wolf, Taylor
Department: Consumer and Design Sciences
College/School: Human Sciences

Johannesburg, South Africa offers both private and public healthcare options. Their private healthcare system is world class, but 84% of the population use the public healthcare services, which are inadequate in both access and quality. In conjunction with inadequate care, employee retention is substantially low due to increasing work load and lack of medical resources. There is a clear need for improved employee and patient satisfaction, which will be solved by increased access and better-quality healthcare facilities in the public sector.

The Rahima Moosa Mother and Child will explore the public healthcare sector, providing the underserved population adequate healthcare. With a focus on care for mother and child, the extension will include labor and delivery units along with antepartum and postpartum recovery suites. To further accommodate the space requirements, the center will include a cesarean surgery suite, a newborn nursey, as well as a Neonatal Intensive Care Unit. A pediatric ward will be implemented with access to natural daylight, a garden, and a community play space.

To further address the need for improved access and better-quality healthcare in the public sector, an education facility will be integrated into the hospital design to prepare and send trained professionals into rural areas of South Africa. This space will be designed to accommodate educational labs and an observation auditorium for procedures. Simulation labs with pre-brief and de-brief spaces also will be implemented to test students and professionals before they are sent out into rural areas.

The design challenge is being addressed through: 1) pre-design research of healthcare facilities standards and healing environments; 2) space allocation study with space planning typicals; and 3) cultural research for expectations of the environment of care in Johannesburg, South Africa.

Title: Using a research-based gene screening panel to investigate a large African-American family

Primary Author (and presenter): Omeler, Sophonie M.
Additional Authors: Bishop, Madison R. & Merner, Nancy
Department: Pathobiology
College/School: College of Veterinary Medicine

Description:

African Americans (AA) make up a breast cancer (BC) population that is widely understudied due to barriers such as mistrust of researchers and lack of accessibility to institutions providing these research opportunities. A younger age of diagnosis is a known hallmark of hereditary BC that is more commonly seen in AA BC incidences. Additionally, it is typically observed that AA women with BC have a higher mortality rate at every age and are more likely to be diagnosed with triple-negative breast cancer, a more aggressive breast cancer sub-type. Having knowledge of such disparities coupled with AA BC statistics, the Merner lab set out to reach underrepresented women throughout the state of Alabama through a community-based recruitment (CBR) program for a genetic study. It is through this recruitment method that Family 1CAD was recruited into our study.Members of Family 1CAD (n=13) were recruited and enrolled through the CBR protocol. Five cancer-affected members of the family were screened using a research-based gene panel, B.O.P. (**B**reast, **O**varian, and **P**rostate). Three of the five were determined to carry *BRCA1* p.M1796R, a clinically-recognized pathogenic mutation. Interestingly, these *BRCA1* mutation carriers also harboured a truncating *MAD1L1* (p.S40fs) mutation. To investigate *MAD1L1* as a potential genetic modifier, AA BC cases from The Cancer Genome Atlas were assessed for mutations. Aggregation analyses revealed *MAD1L1* truncation variants to be associated with BC in AAs under the age of 45 (P=0.02), suggesting that *MAD1L1* truncation mutations, coupled with a mutation in a clinically relevant gene, such as *BRCA1*/2, are associated with early onset AA BC, but further study is required.

Title: Sampling of remote estimation through queues: Age of information and beyond
Primary Author (and Presenter): Ornee, Tasmeen Zaman
Additional Authors: Sun, Yin;
Department: Electrical and Computer Engineering
College/School: Samuel Ginn College of Engineering

Description:

The age of information, as a metric for evaluating information freshness, has received a lot of attention. Recently, an interesting connection between the age of information and remote estimation error was found in a sampling problem of Wiener processes: If the sampler has no knowledge of the signal being sampled, the optimal strategy is to minimize the age of information; however, by exploiting causal knowledge of signal values, it is possible to achieve a smaller estimation error. In this project, we extend a previous study by investigating a problem of sampling a stationary Gauss-Markov process, namely the Ornstein-Uhlenbeck (OU) process. The optimal sampling problem is formulated as a constrained continuous-time Markov decision process (MDP): The optimal sampling policy is a threshold policy on instantaneous estimation error and the threshold is found. Further, if the sampler has no knowledge of the OU process, the optimal sampling problem reduces to an MDP for minimizing a nonlinear age of information metric. The age-optimal sampling policy is a threshold policy on expected estimation error and the threshold is found. These results hold for (i) general service time distributions of the queueing server and (ii) sampling problems both with and without a sampling rate constraint. Numerical results are provided to compare different sampling policies.

Title: Antihypertensive medication adherence and blood pressure control
Primary Author: Osborne, Kendall J.
Additional author: Howell, Eleanor
School: School of Nursing

Description:

Hypertension is a major risk factor in developing heart failure, ischemic heart disease, left ventricular hypertrophy, and stroke. Although hypertension (HTN) is a life-threatening condition, approximately half of patients exhibit lack of blood pressure control. Research suggests that a lack of blood pressure control may be attributed to poor adherence to antihypertensive medications and that patients who monitor their blood pressure are more likely to adhere to their medication regimen. This project implemented screening for antihypertensive medication adherence and provided education and tools to promote self-monitoring of blood pressure (SMBP) in persons with HTN. The target population included adults diagnosed with HTN who are currently prescribed an antihypertensive in a primary care office. Following participant agreement, participants completed a medication adherence screening tool, and received education on HTN management and SMBP. Participants were telephoned at 4 and 6 weeks to assess SMBP and medication adherence progress. A repeat medication adherence screening was completed at 6 weeks. The project is in progress. Descriptive statistics will be used to describe patient demographics, duration of HTN diagnosis, and medication adherence. Pre and post blood pressure measurements and medication adherence mean scores will be compared using paired t-tests (alpha=0.05). Assessing medication adherence in patients with HTN can provide an opportunity to educate patients on SMBP, an intervention that may help patients to become more compliant in their medication regimen. Detection of nonadherence and opportunities to intervene through SMBP are achievable at this primary care setting and further implementation of the project is warranted.

Title: Death by design: A premodern architectural dictionary
Author (and presenter): Osborne, Hailey K.
Additional Authors: Dettlinger, Madison; Deck, Lauren; Pelafos, Allie; & Rafio, Lily
Department: Architecture
College/School: College of Architecture, Design, and Construction

Description:

Death by Design is a premodern architectural dictionary that explores the significance of the afterlife with regards to its representation in the built environment. It captures the fundamental role of how a design can give clarity to our understanding of different cultures' spiritual values associated with death, and provides an opportunity to learn about mortality's influence on form and structure in the pre-modern era. After months of research, we have carefully curated a collection of architectural terms and sites based on how each shows the evolution of death architecture and what connections we can draw from analyzing their similarities. This dictionary captures the fundamental role of how a design suggests meaning in spiritual practices and how it has shaped funerary architecture. As we look back to ancient times, we can see that various monuments were built to show the hierarchical order of a society. They were also a reflection of society's understanding about mortality. The meaning behind each site varies due to cultural perspectives of afterlife, which are represented in their architecture. Ancient peoples designed and built temples, tunnels, tombs, and other spaces that were all centered around life after death. Some of the most elaborate and sophisticated structures were constructed simply for the death of just one person. This dictionary explores topics from glorious, gold brick temple complexes commissions by Egyptian Kings that took decades to construct, to simple above ground mausoleums built for those of the middle class. Either way, both constructions were thought out and thoroughly designed with a specific purpose. Today as architects we marvel at how these incredible structures were built. We wonder how the designs suggest hierarchy and spiritual movement, and how the materiality of these structures help further the purpose of the site. The forms of funerary architecture and their relationship to death have evolved with society.

Title: Effects of whole corn inclusion in pelleted feed on broiler performance and carcass characteristics

Primary Author (and presenter): Ovi, Fozol Korim
Department: Poultry Science
College/ School: College of Agriculture

Description:

Previous research suggests that inclusion of whole grains in broiler starter diets improve gastrointestinal tract development and reduces grinding costs. This experiment was conducted to evaluate the effect of whole corn inclusion on flock performance and carcass characteristics of male Ross 708 broilers. One-thousand Ross × Ross male were randomly assigned to 4 treatments with 10 replicate pens of 25 broilers in each pen. Every pen was fed diets with different levels of whole corn (WC) inclusion (0%, 2.5%, 5%, 7.5%) as a replacement of ground corn. Starter diets were fed in crumbled form whereas grower and finishers were fed as whole pellets. Body weight, feed intake, feed conversion ratio (FCR) were evaluated at 14, 28, and 42 days of age. Mortality was accurately considered and subtracted while calculating FCR. At 43 days, 10 broilers from each pen were processed to evaluate carcass characteristics (carcass weight and yield and breast meat weight and yield). Processed carcasses were chilled in slush ice for 3 hours and then weighted to determine cold carcass weight. At 44 days, carcasses were deboned to determine processing yield. Data were statistically evaluated using one-way ANOVA and the means were separated by Tukey honestly significant different procedure. Whole corn inclusion in diet didn't significantly influenced the feed intake, and body weight at 14, 28, and 42 days of age. However, broilers fed diets with 5% WC had lower FCR ($P < 0.05$; 1.94 vs. 2.00) than the control broilers fed with 0% WC. In addition, broilers fed diets with 5% WC inclusion had higher breast meat weight than the broilers fed diets with 7.5% WC but similar to control population (0% WC inclusion). This experiment demonstrated that 5% WC can be used to replace ground corn in broiler diets from 1 to 42 days of age without effecting flock performance and carcass characteristics of broilers.

Title: Geochemical exploration for molybdenum and other metals within the Farmville Metagranite, Lee County, AL
Primary Author (and presenter): Owen, Evan J.
Additional Authors: Bilenker, Laura
Department: Geosciences
College/School: College of Sciences and Mathematics

Description:

The Farmville Metagranite, a foliated, medium-grained granitic gneiss located mainly within Lee County, Alabama, contains pegmatites locally enriched in the molybdenum bearing mineral molybdenite. Molybdenum is an important metal found in high-strength steels and other alloys. The Vulcan Materials Notasulga Quarry located west of Auburn provides excellent exposure of the Farmville Metagranite and the molybdenum-bearing pegmatites. Pegmatites are coarsely-crystalline intrusive igneous rocks that typically form in dikes and veins. Pegmatites can be enriched in rare minerals and are a global source for elements such as lithium and tantalum, as well as gemstones such as beryl and topaz. Geologic mapping within the quarry will illustrate which pegmatites contain molybdenite and how these pegmatites are distributed within the granitic body. Samples collected from within and around the quarry will be examined using traditional petrographic techniques to discern the relationship between the molybdenite and the host pegmatites. Trace element geochemical and mineralogical analysis will be used to identify other elements of economic interest present in the samples and allow for the comparison of this molybdenum occurrence with one that is nearby within a separate intrusion, which also contains anomalous gold. The spatial distribution of anomalous concentrations of molybdenum or other economically significant elements will be illuminated, potentially vectoring to a zone of higher enrichment. This study will answer outstanding questions pertaining to the geologic history of the region by investigating a link between these felsic intrusions. It will also provide insight into the mechanisms responsible for concentrating economically important metals in Alabama.

Title: Distress and quality of life screenings of cancer patients attending support groups
Primary Author (and presenter): Owings, Brittany N.
Additional Authors: Ellison, Kathy Jo
College/School: School of Nursing

Description:

Patients with cancer often develop negative side effects that can lead to a decrease in quality of life. Studies have been performed to determine that the use of support groups can lead to an overall improvement in quality of life. The focus of this small test of change project was to implement distress and quality of life screenings to identify patients that could benefit from support group involvement. The target population included adults with a recent cancer diagnosis in an oncology clinic. Following the participation agreement, the NCCN distress tool and the EORTC QLQ-C30 quality of life questionnaire were completed. All patients whose score indicated distress were given information and encouraged to attend the support group. Four weeks after referral, the distress and quality of life outcomes were administered again to assess for change. The project is in progress. Descriptive statistics will be used to describe the patient population, and prevalence of distress and quality of life scores will be recorded at the initial visit. The patient will be referred to a support group based on this score. Follow-up data will include distress and quality of life scores in 4 weeks. Paired t-tests will be used to analyze the pre-post distress scores and quality of life scores for improvements in outcomes (alpha= 0.05). Screening for distress symptoms and decreased quality of life among cancer patients identified participants that could benefit from involvement in a support group. Routine screenings leading to support group referral should be further implemented in a full project at this clinic.

Title: Using intermediary relationships to support school wellness promotion
Primary Author (and presenter): Page, Jamilah R.
Additional Authors: Parmer, Sondra M; Funderburk, Katie; & Struempler, Barb
Department: Nutrition, Dietetics, and Hospitality Management
College/School: College of Human Sciences

Description:

An intermediary, a person or organization, acts as a link between organizations to create collaborative partnerships to accomplish a common goal. Specifically, intermediaries, such as nutrition educators, can be vital in providing the support and technical assistance for school wellness policies enhancing nutrition and physical activity. Alabama SNAP-Ed at Auburn University serves as an intermediary between the Alliance for a Healthier Generation (AHG) Healthy Schools Program and Alabama public schools. SNAP-Ed is committed to improving the lives of SNAP individuals and families through access to healthy nutrition and physical activity. The AHG is a national organization committed to the development of lifelong healthy habits of children. Using an intermediary model, AU SNAP-Ed created *Quest for Healthy Schools* (QHS) to influence nutrition and physical activity policies, systems, environments and practices in Alabama schools. Alabama SNAP-Ed at Auburn University partners with schools across 58 Alabama counties. Alabama schools with 50% or more of the student population receiving free or reduced-price meals are eligible to participate in QHS. SNAP-Ed nutrition educators engage school stakeholders to identify, recruit and assemble a diverse group of school administrators, teachers, staff, parents and community members as a School Wellness Committee. QHS will support the School Wellness Committee in completing and analyzing the AHG Healthy Schools Program School Wellness Assessment. Based on assessment findings, SNAP-Ed guides the School Wellness Committee will utilize strengths and areas for improvement to develop and implement a School Wellness Action Plan for nutrition and physical activity. A key to improving school environments is the relationships built through an intermediary support model.

Title: Novel approach in developing cellulose nanofiber and polypyrrole based conducting composites with improved conductivity and mechanical strength
Primary Author (and presenter): Parit, Mahesh Baburao
Additional Authors: Du Haishun; Zhang Xinyu; & Jiang Zhihua
Department: Chemical Engineering
College/School: Samuel Ginn College of Engineering

Description

Conducting polymers such as polypyrrole exhibits high conductivity and good environmental stability and it has gained considerable attention as a substitute for metallic conductors or semiconductors in a wide variety of electrical and electronic devices. However, polypyrrole is difficult to process unlike the conventional thermoplastic and thermoset polymers using methods such as melt processing and solution casting. It is insoluble in common solvents and decomposes before reaching its melting temperature. Cellulose nanofibers can act as biodegradable and flexible substrate for improving the processability. Most of the methods in literature have used in situ polymerization of pyrrole onto nanofibers followed by film preparation. This approach produces flexible conducting nanopaper with good conductivity but poor mechanical strength due to reduction in hydrogen bonding between the nanofibers. To address this issue in this research we have developed a novel approach for improving the conductivity as well as mechanical strength of the resultant polypyrrole based cellulose nanopaper. The novel and simple approach developed in this research enabled superior properties of CNF and polypyrrole based composites compared to conventional methods.

Title: Can cell phones detect mosquitoes infected with canine heartworm?
Primary Author (and presenter): Park, Doyeon
Additional Authors: Bowles, Joy; Kalin, Haluk; Starkey, Lindsay; Blagburn, Byron & Zohdy, Sarah
Department: Wildlife Sciences
College/School: School of Forestry & Wildlife Sciences

Description:

Dirofilaria immitis is a filarial nematode and the causative agent of canine heartworm. *D. immitis* can be transmitted by mosquitoes *of the genera Aedes, Anopheles, Culex,* and *Ochlerotatus*. Within the mosquito, the nematode parasite matures through three developmental larval stages (L1, L2, L3). A recent study has shown that mobile phones are capable of capturing acoustic data from mosquito wingbeats. Since each mosquito species has a different wingbeat frequency by which they attract mates, with just a brief recording (<1/10th of a second) these acoustic signatures can be analyzed to quickly determine if mosquitoes belong to a species that is known to transmit disease. Here, we examine wingbeat signatures and flight duration patterns of infected and non-infected *Aedes aegypti* to determine if wingbeat mobile phone recordings can be used to distinguish infected mosquitoes from non-infected ones. Female mosquitoes were recorded prior to and at various time points after feeding on infected or non-infected dog blood by placing individual mosquitoes into a chamber and recording for 60 seconds using a standard mobile phone. To uniformly analyze audio data, recordings were processed using programs Python and Anaconda to determine wingbeat frequency and flight duration. One hundred sixty recordings were gathered, and mosquitoes were dissected to confirm the presence and number of heartworm larvae. Our findings indicate that L3 (infective stage) infected mosquitoes have significantly lower (mean=429 Hz) wingbeat frequencies than age-matched negative mosquitoes (mean= 577 Hz; $p<0.0001$). Flight duration based on wingbeat recordings was substantially lower (17.6% of the time) in L3 infected mosquitoes than non-blood fed mosquitoes (35.9% of the time). We present data suggesting that wingbeat frequencies may be used to identify mosquitoes infected with pathogens of public health or veterinary concern.

Title: Innovative water recycle strategies for reducing water and energy use in pulp and paper industry

Primary Author (and presenter): Parkhi, Amod
Additional Authors: Cremaschi, Selen & Jiang, Zhihua
Department: Chemical Engineering
College/School: Samuel Ginn College of Engineering

Description:

The pulp and paper industry is one of the largest consumer of water in the US industrial sector. Application of water in the industry ranges from it being used as a chemical reactant, solvent and it being used in physical application as a conveyor of final or intermediary material. In recent years there has been an increase in the industry for adoption of the waste minimization strategies covering various aspects and avenues in mill operations. Process modelling and simulations is an effective approach for identifying innovative strategies for improving the industry's water efficiency and productivity while strengthening its economic sustainability. In this study, WinGEMS (Windows General Energy and Mass balance System) is used as the software tool for modelling bleaching and the paper machine sections of a mill. The project entails modelling the replacement of fresh water use for final bleaching stage shower washer with white water from paper machine and to access the change within the bleaching and paper machine operations.

Title: Healthcare design in Malawi
Primary Author (and presenter): Parkman, Dalton, C
Additional Authors: Author King, Kit; Author Baltas, Caitlyn; Author Foley, Brianna
Department: Consumer and Design Sciences
College/School: Human Sciences

Infant mortality and the high burden of diseases are factors that are plaguing Malawi's limited resources. While Malawi has made strides in reducing rates of HIV infection in the country over the last decade, HIV/AIDS remains the number one killer in the country. According to the RIPPLE Africa project, the maternal mortality rate in Malawi is one of the highest in Africa, with obstetric complications contributing to a significant number of deaths.

Auburn University's South Africa Initiative and Senior Interior Design Students are collaborating to help major healthcare providers prototype a new healthcare facility. A renovated commercial building in Lilongwe has been donated for this project and will cater to our specific design proposal for this space. This new healthcare facility will be a pediatrics hospital focusing on HIV/AIDS treatment and prevention. There will also be a prenatal wing to reduce risk of infection passed from mothers to children. Most Malawians do not feel personally susceptible to HIV and therefore do not take necessary precautions to prevent the infections. With a facility that is welcoming and that provides top quality health services, our goal is to draw the community of Lilongwe in and start preventing these infectious diseases from the start.

Title: The relationship between sleep behavior with obesity, television exposure and dinner time in children

Primary Author: Parra, Emily P.
Additional Authors: Ayine, Priscilla; Venkatapoorna, Chandra M. K.; Koenigs, Taylor; Selvaraju, Vaithi; Jeganathan, Ramesh B.; & Thangiah, Geetha
Department: Nutrition, Dietetics, and Hospitality Management
College/School: Human Sciences

Description:

Childhood obesity is a major public health concern. In the United States, approximately 12.7 million children and adolescents are classified as obese. In Alabama, 35.5% children are overweight and obese; it is 6th highest ranked in United States. The most common causes of childhood obesity are diet, behavioral, or genetic factors. In this study, we are assessing the effects of sleep, dinner and television timing behavior on BMI in Alabama elementary school children. 169 elementary school children aged between 6 to 10 years participated in this study. Height and weight were measured, without shoes and wearing only light clothing. Body mass index (BMI) *z*-score was calculated using WHO growth reference. Parents reported child's typical weekday bedtime, wakeup time, dinnertime and television watching time of their children. Bedtime and wakeup time were classified into early and late using median splits. The participants were grouped into four sleep-wake behavior groups: early bed-early rise (EE); early bed-late rise (EL); late bed-early rise (LE) and late bed-late rise (LL). These four groups, dinner and television time were compared with the BMI z-score. Late bed-late rise children had a significant higher BMI z-score compared to early bed-early rise even though the sleep duration in both the groups are same. Children who had late dinner and watched television for more than I hour had higher BMI z-score compared to those who ate earlier and less television time exposure. Late bedtime, late dinnertime and longer television exposure are associated with increased obesity.

Title: Single crystal $^{40}ar/^{39}ar$ ages and metamorphic p-t-t history of crystalline rocks within the ross orogen, central transantarctic mountains
Primary Author (And Presenter): Parsons, Kyle Wayne
Additional Authors: Hames, Willis
Department: Department of Geosciences
College/School: College of Science and Mathematics

'Orogens' are mountain belts formed by tectonic deformation of the Earth's crust, typically with large proportions of igneous and metamorphic rocks. One approach to understanding the history of an orogen is to accurately define the Pressure-Temperature-time path (P-T-t) of the rocks it contains. The Miller Range, located in the Central Transantarctic Mountains (TAM) has an orogenic history that is complex, obscuring comprehension of this region's genesis. The focal point of this study is to accurately map the P-T-t history of rocks from Miller range formed by the Ross orogeny, the result of the creation of Gondwana. Previous attempts to understand the cooling history of this range were met with conflicting ages from bulk analysis of rocks dated using K/Ar and $^{40}Ar/^{39}Ar$ methods. The Byrd Polar Rock Repository (PRR) possesses many hundreds of rocks collected previously, which are freely available to study by geoscientists. Rocks loaned from the PRR gathered from the Miller Range will be used to date single crystals of K-bearing minerals including biotite, feldspar, hornblende, and muscovite. Rocks will be dated using the $^{40}Ar/^{39}Ar$ method with Auburn University's Auburn Noble Isotope Mass Analysis Lab, with use of a laser to melt individual grains, releasing their Ar isotopes for measurement in a mass spectrometer. Single grain dating will allow for detailed analysis and more concrete conclusions to be drawn from this region's history and account for outliers. Through this study, a more accurate thermal history of the Ross orogeny in the Miller Range will be uncovered, as well as a better understanding of the evolution of Gondwana. Information uncovered from this study will be useful to a wide range of studies concerning Earth's history and processes, such as: orogenic processes to form the TAM belt, subsequent extension and exhumation of crust in the TAM, provenance studies of Gondwanan sequences, and studies of modern glacial sediment transport.

Title: Jobs at face value? Mental accounting of job-organization characteristics
Primary Author (and Presenter): Parsons, Lauren
Additional Author: Herringdon, Caroline, P. & Acosta, Joshua, S.
Department: Psychology
College/School: Liberal Arts

Description:

By borrowing and applying theories from decision-making science and industrial and organizational psychology, we will examine the underlying cognitive processes present as individuals evaluate job offers. We propose that individuals evaluate job offers through the assessment of job-organizational characteristics, often categorized broadly as internal or external characteristics. Internal characteristics are the aspects of a job or organization that are perceived by the individual, such as fit or network expansion, whereas external factors are the aspects elucidated in the formal job offer, such as salary or benefits. The purpose of this research project is to uncover how these organizational characteristics are mentally evaluated and appraised and if there are systematic individual differences in their subjective evaluations. We will be examining individual preference in job-organizational characteristics by giving participants a forced-choice survey where they must choose between two characteristics. Exploring this complex decision process will better inform organizations on how to create an employee-centered workplace and drive better managerial decision making. We anticipate that helping lead workers to more suitable jobs will result in increased organizational performance due in part to individual job satisfaction, fit, and, in turn, performance.

Title: Phase behavior of Manganese Dioxide (MnO_2) nanowires in different solvents
Primary Author (and presenter): Parsons, Lindsey E.
Additional Authors: Hamade, Fatima; Davis, Virginia A.
Department: Chemical Engineering
College/School: Engineering

The focus of this work is to investigate the phase behavior of inorganic manganese dioxide (MnO_2) nanowires dispersed in various polar solvents. Understanding the phase behavior of nanowires in solvents is important because it has been shown that liquid crystal ordering in the dispersion can facilitate alignment and anisotropic properties in materials produced from nanowire dispersions. However, the phase behavior of MnO_2 nanowires has not yet been studied. The nanowires were synthesized using an established solution based method. Spectroscopy and microscopy techniques were performed to characterize the synthesized product including the average nanowire dimensions. The particle-particle and particle-solvent interactions were studied by examining the behavior of one concentration of MnO_2 in different solvents through a preliminary solvent screening protocol using optical microscopy. Among the various solvents tested, MnO_2 was easily dispersed and stable for up to two weeks in ethylene glycol, dimethyl sulfoxide, ethanol, and methanol. Since the greatest stability was in ethylene glycol, the effects of MnO_2 concentration on dispersion microstructure and potential liquid crystalline ordering were studied in more detail. These results will contribute to the overall field of nanowire liquid crystal research and facilitate understanding of how dispersion microstructure can be linked to the nanowire alignment in, and properties of, dried films.

Title: Sustainable fuels with recycling: Co-pyrolysis of plastics and lignin with locally sourced red-clay catalyst

Primary Author (and presenter): Patil, Vivek
Additional Authors: Adhikari, Sushil & Cross, Phillip
Department: Biosystems Engineering
College: College of Agriculture

Description:

Co-pyrolysis of lignin with cheap hydrogen sources, such as waste plastics, has shown a considerable increase in the phenolic monomers from lignin. In the current study, waste plastics such as low-density polyethylene (LDPE) and polystyrene (PS) were co-pyrolyzed with dealkaline lignin in a micro-reactor. The lignin and plastics samples were mixed in a weight ratio of 1:1 and pyrolyzed in a nitrogen atmosphere at 500°C under fast conditions. The products were analyzed with GC-MS/FID to quantify the phenolic monomers, aromatics and aliphatic compounds. The synergistic effect of co-pyrolysis of plastics and lignin was studied by measuring the changes in the quantities of pyrolysis products. In addition to the thermal pyrolysis, natural red clay was tested as a catalyst for the fast co-pyrolysis process. Red clay was placed 'in-line' with the lignin and plastics mixture in the micro-reactor and the pyrolysis vapors could pass through the macroporous red clay catalyst. The trials were carried out at 500,600,700 and 800°C to identify the temperature at which this catalyst shows the optimum performance. The study explores a novel approach to enhance lignin depolymerization with red clay catalyst while utilizing waste plastics.

Title: Correlation of *Mt*sk inhibitory activity with chemical constituents identified by LC-MS
Primary Author: Patrick, Madison
Additional Authors: Zhang, Yilue & Calderón, Angela I.
Department: Drug Discovery and Development
College/School: Harrison School of Pharmacy

Description:

Alpinia galanga rhizomes have been discovered to have antitubercular properties. This is due to 1-s'-1 Acetoxy chavicol acetate (ACA), one of the active compounds responsible. Specifically, *Mycobacterium tuberculosis* shikimate kinase (*Mt*SK) is a promising drug target in tuberculosis therapy due to the pathway being pertinent to the survival of the bacterium, and ACA is known to target this pathway. This study aims to screen extracts of *A. galanga* for their inhibition potentials on the shikimate pathway by monitoring shikimate-3-phophate (S3P) production, and identifying compounds working in synergy with ACA. *A. galanga* rhizome extracts were prepared using hexane and dichloromethane (DCM); samples were collected and named accordingly. Hexane extracts, DCM extracts, ACA and Rottlerin (the positive control) were incubated with *Mt*SK for 30 min in a reaction matrix, and the resulting samples were injected into a 4.6 x 100mm, 3.5 µm Pheny-Hexyl reverse-phase column forLC - MS investigation. The resultant LC-MS chromatograms were analyzed using MassHunter Qualitative Analysis software. The Hexane extract showed the highest inhibition potential at a concentration of 50 µg/mL, at a 47% inhibitory rate, while the DCM extract inhibited 27% of MtSK activity at the same concentration. Rottlerin and ACA, at concentrations of 50 µM in solution, showed inhibitory activity of 36% and 10%, respectively. The LC-MS-based chemical profiling of the bioactives in the hexane and DCM extracts is underway. This research can have future impacts in identifying leads for developing antibiotics from *A. galanga* to combat strains of *M. tuberculosis.*

Title: A rapid thermal modeling approach for additive manufacturing
Primary Author (and presenter): Paudel, Basil J.
Additional Authors: Thompson, Scott M.
Department: Mechanical Engineering
College/School: Samuel Ginn College of Engineering

Description:

Additive manufacturing (AM) is a layer-by-layer manufacturing method that differs substantially from the more conventional subtractive approaches. Due to its potential benefits and promises to modern industry, AM is evolving quickly, but so are the challenges. High thermal gradients exist in vicinity of the highly-localized laser irradiation and this complicates the quality of material processing. Thermal analysis of the energy deposition process forms the basis for understanding and predicting the microstructure of the final/manufactured part. Numerical codes utilizing Computational Fluid Dynamics (CFD) have been able to model the temperature response of parts during laser-based AM, but the solutions are unrealistic or fall behind significantly from full-scale modeling. In this study, a different analytical approach has been undertaken which utilizes conventional understanding of a thermal resistance network. While some errors are deliberately introduced due to the inherent assumptions, this approach can be used to estimate and assess a part's thermal response in significantly less time and with reduced computational investment. This approach presents the possibility of developing a feed-forward process control mechanism of AM systems, which can be employed to engineer parts with site specific properties.

Title: Effects of *Azospirillum brasilense* on microalgae UTEX 2714 and biofuel production
Primary Author (and presenter): Peng, Haixin
Additional Authors: Peng, Haixin & Higgins, Brendan
Department: Biosystems Engineering
College/School: Samuel Ginn College of Engineering

Description:

Microalgae are photosynthetic microorganisms with rapid growth and the potential for production of lipids, proteins, and carbohydrates. In this research, we tested the impact of live *Azospirillum brasilense* cells as well as spent *Azospirillum brasilense* media on algal UTEX 2714 growth and composition to better understand the coculture system metabolic changes and bioproduct applications. Results showed that, the growth rate of microalgae has been promoted by *Azospirillum*. Data from a neutral lipid assay and thin layer chromatography suggest that secretions of Azospirillum may support higher triacyglycerol production in algae UTEX 2714, potentially benefitting biodiesel production.

Title: Towards large-scale energy-efficient data centers
Primary Author (and presenter): Peng, Xiaopu
Additional Authors: Ting Cao & Taha Khalid Al Tekreeti
Department: Computer Science and Software Engineering
College/School: Samuel Ginn College of Engineering

Description:

To improve environment friendly and energy-efficient of data centers, it is prudent to leverage onsite renewable sources like solar and wind. Data centers deploy distributed UPS systems to handle the intermittent nature of renewable energy. We propose a renewable-energy manager called REDUX, which offers a smart way of managing server energy consumption powered by a distributed UPS system and renewable energy. REDUX maintains a desirable balance between renewable-energy utilization and data center performance. REDUX makes judicious use of UPS devices to allocate energy resources when renewable energy generation is low or fluctuate condition. REDUX not only guarantees the stable operation of daily workload, but also reduces the energy cost of data centers by improving power resource utilization. Compared with existing strategies, REDUX demonstrates a prominent capability of mitigating average peak workload and boosting renewable-energy utilization.In this paper, we first introduce the REDUX system by the updated framework description and a new problem statement for mathematical foundation. Then we present the stage conclusion of some comparation of REDUX with other design and build confidence for us to conduct some more detailed and sophisticated research on this system design. Finally, we make comments on future work direction when necessary and proposed schedule on the project.

Title: Piano technology
Primary Author: Perry, Isabel & Mulholland, Rebecca
Additional Authors: Geng, Ying & Perkins, Edmon
Department: Mechanical Engineering
College: Samuel Ginn College of Engineering

Description:

The modern piano has remained largely unchanged since the 1800s. The currently used piano and its tonal system evolved through science and engineering advancements; its current form has subtle and obvious implications to Western music, such as its equal-tempered tonality. The modern piano is a popular instrument, but it has several obvious limitations, including frequent maintenance, heavy/cumbersome weight, a painstaking fabrication process, and an expensive price. It also has a more subtle shortcoming: the modern piano was designed as an equal-tempered instrument. Temperament refers to the tuning scheme used for a musical instrument. On an equal-tempered instrument, the interval between adjacent notes is approximately equal. From an ethnomusical perspective, many pieces played on the modern piano are distorted in this equal temperament (e.g., J.S. Bach's Well-Tempered Clavier). To remedy several of these shortcomings, two directions are explored. First, a 3D printed grand piano action is presented, which the authors believe is the first of its kind, using a carbon fiber reinforced thermoplastic. By lowering the difficulty of the fabrication process and the frequency of maintenance requirements, the cost of the piano could be significantly reduced. Second, a novel self-tuning controller is presented, which the authors believe is the first frequency controller that could be easily implemented on a high-tension piano. This frequency controller uses a Red Pitaya, Hall Effect sensor, and stepper motor to modify the frequency of a monochord, which is demonstrated by an experiment. The tuning assembly design of the monochord could be implemented on a high-tension piano. The presented technology could be utilized to advance the modern piano, increasing its versatility and decreasing its cost.

Title: Public art project abstract
Primary Author: Petersen, Mary, A.; Dunlap, Amy
Additional Authors: Burton, Monique; Hoffmaster, Megan; Stovall, Ava; and Fluker, Hannah
Department: Consumer and Design Sciences
College/School Name: Human Sciences

There is an evident lack of art incorporated into Auburn University's campus. The Public Art Project is intended to attract various students from different backgrounds to encourage interaction between one another and the art piece itself. This experience will bring students to an area of campus they're not used to visiting and encourage positive habits among these students.

The goal of this installation is to inspire Auburn students and visitors to interact with the exhibit as well as encourage positive habits outside of their interaction with the exhibit. The idea proposed is the use of an amphitheater built into the ground on the library green space. Large steps, wide enough to double as benches, will lead down to the center of the amphitheater. The center of this space will have more seating as well as room for Enos, or portable hammocks, to hang from the beams above which will provide shade over the seating. Power outlets will also be incorporated throughout to encourage students to come work here and be a part of the piece. Along the edges of this amphitheater, color-coded clear tubes will line the walls in the shape of a tree. The colored objects that will go into these tubes are plastic bottle caps, metal soda can tabs, plastic straws, and other small recyclable items. These tubes will also be separated by the type of material being recycled.

The design problem is being addressed through pre-design research of public art pieces, the various standards required to implement them, and research of Auburn University's standards for art exhibition on campus.

Title: Instar determination of *Blattella asahinai* (Blattodea: Ectobiidae) using digital measurements of the pronotum and number of cercus annuli

Primary Author (and presenter): Peterson, Madison K.
Additional Authors: Appel, Arthur G. & Hu, Xing Ping
Department: Entomology and Plant Pathology
College/School: College of Agriculture

Description:

The Asian cockroach, *Blattella asahinai* Mizukubo, is the closest relative of *B. germanica* (L.), the most prevalent domestic cockroach pest in the United States. Unlike *B. germanica*, *B. asahinai* lives outdoors and can fly. Few data have been collected on details of the life cycle of *B. asahinai*, including the number of instars during nymphal development. Details on the number of instars of a species assists efficient application and timing of insecticides and baits. *Blattella germanica* males commonly have five instars, and females commonly have five or six. Traditional instar determination applies the Brooks-Dyar Rule to head width measurements of dead nymphs. To determine the number of instars of *B. asahinai* and explore the possibilities of instar determination through digital photography and software, deceased nymphs were photographed and sexed, and their pronotum lengths and widths were digitally measured. The number of instars of *B. asahinai* was determined through Gaussian mixture models using the pronotal data, and the number of annuli on the cerci of nymphs were counted to support the results. Both the model and the cercal annuli indicated that *Blattella asahinai* normally has 6 instars when reared at 25 ± 2 ˚C. Clustering also indicated an equal number of sixth instar males and females. Our results indicate that *B. asahinai* males undergo six instars more frequently than *B. germanica* males. The constant growth ratios of the pronotum for each instar, calculated by the Brooks-Dyar Rule, were consistent with those of hemimetabolous insects. For future studies, using digital measurements and Gaussian mixture models may provide a method to determine instars with live specimens in development studies without handling the animals in a way that alters growth.

Title: A high-throughput approach to the characterization of interlayer coupling in 2D heterostructures

Primary Author (and presenter): Pfeifle, Adam M.
Additional Authors: Kuroda, Marcelo A.
Department: Physics
College/School: College of Sciences and Mathematics

Description:

Following the isolation of individual graphene layers, several other two-dimensional (2D) materials have been discovered such as boron-nitride and transition metal dichalcogenides. These two-dimensional materials lack dangling bonds allowing for their seamless stacking to create multilayered heterostructures preserving their sharp interfaces. The physical properties of these multilayer structures, including out-of-plane tunneling rates, may be tailored via composition and stacking order. As thousands of 2D materials have been isolated or predicted to be stable, the number of heterostructures that can be formed grows very rapidly. Here we develop methodology to create and characterize carrier transport through heterostructures formed with 2D materials. Our approach efficiently combines high-throughput first principles calculations and ballistic quantum transport. The results obtained may prove useful to the study of novel physical phenomena such as tunneling and spin transport in complex heterostructures based on 2D materials.

Title: The relationship between athlete anthropometrics and hitting performance
Primary Author (and presenter): Phan, Johann A.
Additional Authors: Friesen, Kenzie & Downs, Jessica
Department: Kinesiology
College/School: College of Education

Description:

Although softball is a popular sport, there are limited data available examining hitting mechanics, and much less data regarding batter anthropometrics. Hitting requires an efficient kinetic chain with energy generation beginning in the lower extremity and transferring through the trunk to the upper extremity. Therefore, efficient energy transfer and acceleration of the upper extremity is vital in the performance outcome of softball hitting. Therefore, the purpose of this pilot study was to examine the relationship between arm length, circumference, and percent body fat between batted ball speed, distance, and launch angle in softball athletes. Nine Division I National Collegiate Athletic Association softball athletes participated. Dominant arm length, upper arm circumference, height, weight and body fat percentage were measured. Following the anthropometric measurements, participants were instructed to take 8 maximal effort swings off of a tee placed at the participants' desired location. Batted ball data were collected using the Rapsodo®. Of the 8 trials, 3 were used for analysis. The 3 trials used were determined by the average launch angle of the 8 trials. The 3 trials, with the closest launch angle to the average, were analyzed. A Pearson's correlation was used for analysis ($p < 0.05$). Data revealed a strong negative correlation between height and percent body fat ($r^2 = -.786$, $p = .012$), as well as four strong positive correlations between ball speed and height ($r^2 = .763$, $p = .017$), upper arm circumference and percent body fat ($r^2 = .690$, $p = .040$), ball distance and arm length ($r^2 = .824$, $p = .006$), and launch angle and ball distance ($r^2 = .811$, $p = .008$). Our data suggests that players with longer arm lengths tend to have farther batted ball distance and taller players tend to have faster batted ball speeds. Therefore, taller players with longer limbs and levers may be at an advantage offensively against their shorter counterparts.

Title: Elucidation of the neurotoxic effects of developmental cannabinoid exposure in adolescent rodent offspring

Primary Author (and presenter): Pinky**,** Priyanka Das
Additional Authors: Majrashi, Mohammed; Fujihashi, Ayaka; Bloemer, Jenna; Suppiramaniam, Vishnu; & Dhanasekaran, Muralikrishnan
Department: Drug Discovery and Development
College/School: Harrison School of Pharmacy

Description:

Cannabis is the most commonly used illicit drug during pregnancy. The use of Cannabis during pregnancy in part is due to its ability to reduce the nausea and morning sickness. Developmental cannabinoid exposure results in cognitive and behavioral deficits due to alteration to the neural network. However, the role of oxidative stress and apoptosis is not well characterized. The aim of this study is to determine the cerebellar neurotoxic effects of developmental cannabinoid exposure. Osmotic pump filled with either vehicle or the cannabinoid agonist WIN55,212-2 (2 mg/kg body weight/day) was implanted subcutaneously in the pregnant rats at gestational day-3 which delivered the drug at a constant rate until the pups were born. The pups were then euthanized at PND 40 and cerebellum was collected for experimental studies. Western blot was performed to analyze the expression of pAKT, ILK, JNK and pGSK3β. Spectrophotometric and fluorimetric methods were used to study the effect of prenatal cannabinoid exposure on the markers of oxidative stress and apoptosis. Prenatal cannabinoid exposure significantly reduced pAKT, ILK, and JNK but increased pGSK3β in the cerebellum. WIN55,212-2 did not affect the nitrite content, lipid peroxide content and the activities of caspase 1 and 3. Based on the data obtained from our study it can be postulated that, cannabinoid exposure during developmental period can result in alteration in cellular functions by altering the ILK-AKT-GSK3β pathway.

Title: Transcriptomic analysis to identify candidate genes conferring gossypol tolerance in *Fusarium oxysporum* f. sp. v*asinfectum*

Primary Author (and presenter): Pokhrel, Ambika
Additional Authors: Coleman, Jeffrey
Department: Entomology and Plant Pathology
College/School: College of Agriculture

Description:

Fusarium oxysporium f.sp *vasinfectum* (*Fov)* is a soilborne filamentous fungus that causes vascular wilt on cotton. In response to pathogens such as *Fov*, cotton plants produce the phytoalexin gossypol as a defense mechanism. This research aims to explore the molecular mechanism(s) utilized by *Fov* to tolerate the antimicrobial action of gossypol during infection and colonization of cotton. Candidate genes that could be responsible for gossypol tolerance were identified through RNA sequencing. Four RNA samples were extracted from germlings of a highly virulent race 4 genotype *Fov* isolate that was grown in minimal medium in the presence of 80 μg/mL of gossypol for 1, 2, and 4 hours as well as untreated control. RNA-seq data showed upregulation of ABC and major facilitator transporters, fungal transcription factors, cytochrome P450s, and several classes of dehydrogenases when compared with transcripts isolated from the non-treated *Fov* RNA sample. KEGG pathway analysis identified genes involved in various metabolic pathways, including the biosynthesis of secondary metabolites and antibiotics. The RNA-seq data was validated through RT-qPCR where out of the selected 29 upregulated genes, 16 were significantly expressed through a paired t-test. Even though some genes were not significantly expressed, the expression was increased 70 to 240-fold for at least a single time point. Importantly, candidate genes and gene classes that could be involved in conferring gossypol tolerance were identified Including a beta lactamse, a tannase, several dehydrogenases, transcription factors, cytochrome P450s, and multiple ABC and major facilitator superfamily transporters. Collectively, these findings provide a framework for further investigation into *Fov* virulence and the mechanisms underlying gossypol tolerance.

Title: Effects of severe weather phenomena on commercial aviation accidents and incidents
Primary Author: Potter, Shelby, G
Department: Aviation
College: Liberal Arts

Safety remains a pertinent topic in discussing the success of commercial aviation. Weather specifically has a profound effect on commercial aviation safety since it is difficult to predict and impossible to control. According to the study of 1,104 aircraft accidents from the 1950s to the 2000s, twenty-eight percent were due to some factor of weather. As such, the continued study of weather and its effect on commercial aviation is required. This includes research into the weather phenomena themselves, such as understanding the development of a thunderstorm, as well as the study of the weather technology available for commercial aviation. Reducing the number of commercial aviation accidents due to weather also includes analyzing NTSB reports of past accidents. In doing so, one will understand what effect weather had on a pilot's action or lack thereof. From this analysis, it was identified that a common factor to an accident is the outside influence on a pilot. Company pressure, be it for economic or political means, was identified as the greatest contributor to a pilot's response to weather phenomena. As a result, the prevention of commercial aviation accidents due to a factor of weather is an ongoing conflict between capitalist aviation companies and safety measures established and maintained by governmental aviation organizations.

Title: 3D printed 316L metal implants coated with dexamethasone for sustained drug delivery
Primary author (and Presenter): Poudel, Ishwor & Annaji, Manjusha
Additional authors: Babu, R. Jayachandra; Arnold, Robert; Amal Kaddoumi; Shamsaei, Nima; & Masoud M, Samani
Department: Drug Discovery and Development; Mechanical Engineering; Electrical and Computer Engineering
College: Harrison School of Pharmacy; Samuel Ginn College of Engineering

Description:

Bone implants are inevitable treatment options for complicated bone fracture surgery. The installation of bone implants on the site of injury is bound to trigger immune cascade and inflammatory mediators. In this study, 3D printed 316L metal implants coated with an anti-inflammatory drug, dexamethasone were prepared for sustained drug delivery characteristics, *in vitro*. The 316L metal implants with various surface porosities were prepared. The surface texture of the implant before and after drug coating was characterized by Keyence microscopy. The *in vitro* dexamethasone release from the implant as a function of drug loading, surface porosity and polymer blend composition. We have shown in this study that the implants have adequate surface porosity to deposit dexamethasone and a biocompatible polymer such as poly-lactide co-glycolide (PLGA). These drug loaded implants have shown sustained drug release for a prolonged period as assessed by UV spectrophotometric analysis. Microscopy images have shown that the surface porosity was adequate enough to accommodate an appropriate therapeutic levels of dexamethasone for its anti-inflammatory effect. The dexamethasone eluting medical devices were prepared by 3D printing and tested for their drug delivery properties.

Title: Methodological variations among health state valuation studies using eq-5d-5l: A systematic review

Primary Author (and presenter): Poudel, Nabin
Additional Authors: Ngorsuraches, Surachat; Qian, Jingjing; & Garza, Kimberly
Department: Health Outcomes Research and Policy
College/School: Harrison School of Pharmacy

Description:

To systematically review methodological variations for deriving health state values for EQ-5D-5L. A systematic literature search for articles published in English from January 1990 to September 2018 was conducted. Relevant databases, including PUBMED, PsycINFO, and CINAHL, EconLit, and Cochrane Library, were searched. In addition, targeted search on websites such as https://euroqol.org and Google Scholar was conducted to cover the grey areas and minimize bias in search outcomes. Inclusion criteria included health state valuation studies using EQ-5D-5L. Search key words included EQ-5D-5L, valuation, value set, and tariff. Based on the abstracts and the full texts of the articles, two researchers independently selected relevant studies. A consensus was needed to retain studies. A total of 227 articles were identified through the initial search. After eligible criteria were applied, 16 articles were retained. The majority of the studies (n=11) used quota sampling technique, while other studies used stratified cluster (n=2), two stage sampling (n=1), and systematic approach (n=2). These studies used either face-to-face interview (n=15) or online survey (n=1) method to collect data from general populations. Sample sizes ranged from 1,000 to 8,222 participants. Final health state values in these studies were derived by using the hybrid (n=9), composite time trade off (cTTO) (n=6), and discrete choice experiment (DCE) (n=1) approaches. Tobit regression model was used to analyze the data in the majority of cTTO studies (n=5), while conditional logit and hybrid regression models were used in the DCE and all hybrid studies, respectively. This study found that although the EuroQol Group's standardized valuation study protocol is recommended to derive health state values for EQ-5D-5L, methodological variations among studies exist. Further studies are needed to examine the impact of these variations on the health state values.

Title: Enhancement of aqueous solubility of hispolon by complexation with sulfobutyl ether β-cyclodextrin
Primary Author (and presenter): Poudel, Ishwor
Additional Authors: Babu, Jayachandra R.; Al Saqr, Ahmed; & Oladiran, Fasina
Department: Drug Discovery and Development
College/School: Harrison School of Pharmacy

Description:

Hispolon, a structurally related compound to curcumin has been shown to possess anti-inflammatory, anticancer and antioxidant properties. The poor aqueous solubility of hispolon could limit its oral absorption. This study successfully utilized sulfobutyl ether β-cyclodextrin (SBE βCD) to form an inclusion complexes with hispolon to increase the water solubility and dissolution rate for improved permeability across GI tract. The liquid and solid state complexation was confirmed by phase solubility studies, Differential scanning calorimetry(DSC), X-ray diffraction(XRD), Fourier transform infrared spectroscopy(FTIR), Scanning Electron Microscopy(SEM), Molecular Docking and Nuclear Magnetic Resonance(NMR) analyses. The intrinsic dissolution rate of hispolon was much higher as compared to its physical mixture with SBEβCD. The findings provided a new possibility to utilize hispolon for enhanced oral absorption and bioavailability.

Title: The effects of footwear and orthotics on biomechanics
Primary Author: Price, Morgan C.
Additional Authors: Rodich, Reed; Matthews, Chase; & Zabala, Michael
Department: Mechanical Engineering
College/School: Samuel Ginn College of Engineering

Description:

Orthotics are commonly prescribed to treat many conditions such as patellofemoral pain syndrome, bursitis, plantar fasciitis, pes planus, diabetic ulcers, and other sources of foot, ankle and heel pain. Otherwise properly functioning parts of the body such as the hips, knees, and back can also be adversely affected by the presence of foot problems. The foot has a complex functional anatomy allowing humans to efficiently interface with the environment during bipedal locomotion. Tendons, ligaments, fascia, and other foot tissues give the foot a variable effective tension that provides the capability of passively bearing loads and actively adjusting position due to uneven surfaces or other perturbations. Existing literature on orthotic insoles is overarchingly inconclusive in assessing the notion that orthotic insoles are effective for correcting biomechanical dysfunction. The purpose of this study is to lead to the development of customized orthotic insoles using additive manufacturing of metals and polymers which emulate the biomechanical benefits of unshod (barefoot) conditions. Characterization of optimal foot movement is necessary for developing an orthotic insole that encourages effective foot function. As such, biomechanical analysis and comparison of various footwear conditions is being conducted to explore the mechanisms by which orthotics affect gait. The deformation of the foot is being measured during various barefoot and shod conditions while walking and running using a retro-reflective marker-based motion capture system and ground-embedded force plates to determine the effects of each condition on kinetics, kinematics, ground reaction force, and muscle activation. Data collection continues and preliminary results will be presented at the 2019 Auburn Research Symposium.

Title: Cover crop response to residual herbicides in peanut-cotton rotation
Primary Author (and presenter): Price, Katilyn J.
Additional Authors: Li, Steve & Price, Andrew J.
Department: Crop, Soil and Environmental Sciences; USDA-ARS National Soil Dynamics Laboratory
College/School: College of Agriculture

Description:
Cover crops provide benefits to cropping systems in terms of suppressing weeds, conserving soil moisture, increasing organic matter, and reducing erosion. However, in fields where residual herbicides were used during the growing season the establishment of cover crops can be negatively affected. The objective was to investigate the responses of six cover crops (daikon radish, cereal rye, cocker oats, crimson clover, winter wheat, and common vetch) to twelve common soil herbicides used in peanut and cotton. A multi-year, multi-location study was conducted in Macon and Henry County in Alabama. Herbicide treatments applied at 10% the labelled rate included: *S*-metolachlor, acetochlor, pyroxasulfone, diclosulam, imazapic, chlorimuron ethyl, bentazon plus acifluorfen, pyrithiobac sodium, trifloxysulfuron sodium, diuron, prometryn, flumioxazin, and a non-treated check. At 50 and 150 days after planting (DAP), plant heights and stand counts were evaluated as well as biomass at 150 DAP. In 2016, significant stand reductions ($p \leq 0.05$) of 30-52% in rye and 22-75% in wheat respectively were observed at 50 DAP for *S*-metolachlor, acetochlor, pyroxasulfone, diclosulam, imazapic, chlorimuron ethyl, and bentazon plus acifluorfen over both locations. Vetch had significant stand reductions for all treatments from 12-80%. *S*-metolachlor, pyroxasulfone and acetochlor had the largest negative impacts on stands for rye, wheat and vetch. In 2017, wheat had a significant stand reduction of 22% for flumioxazin at 42-45 DAP over both locations. At 147-149 DAP, clover had a reduced stands of 29-38% for diclosulam and trifloxysulfuron sodium. Radish had a significantly reduced stand of 64% for diclosulam. No cover crop had a significantly reduced biomass either year regardless of stand losses, with oats showing the most tolerance to residual herbicides. Although initial injury and stunting may occur, biomass of those cover crops may not be affected by herbicide residues evaluated in this study.

Title: Novel interdisciplinary 'speed-dating' and augmentation of traditional diabetes self-management education to improve diabetes care
Primary Author (and presenter): Priest, Anna Kathryn
Additional Authors: Smith, Warren & Whitley, Heather
Department: Pharmacy
College/School: Harrison School of Pharmacy

Description:

To improve health outcomes in patients with diabetes, the Baptist Family Medicine clinic in Montgomery, Alabama currently utilizes a two-part group educational program composed of traditional Diabetes Self-Management Education (DSME) augmented with a novel interdisciplinary "speed-dating" clinic. To evaluate the impact of the two-part diabetes education program on improvement of diabetes self-care knowledge and surrogate health markers for patients attending both sessions. Adult diabetic patients present to an initial 8-hour DSME class and consent to complete a 20-item pre-program survey that examines their knowledge of diabetes, monitoring parameters, nutrition, exercise, medication adherence, and therapeutic goals. Two-weeks later, patients attend an interdisciplinary speed-dating clinic where they individually rotate every 30 minutes through five stations hosted by a family medicine physician, clinical pharmacist, nurse or dietician, case manager, or clinical psychologist. Mutually agreed upon patient/provider recommendations are distributed and collected throughout, and patients complete the identical survey as a post-test. Baseline and changes in objective criteria are followed over time. Average pre/post-survey results are compared to changes in surrogate markers of diabetes self-management for those attending one versus both sessions. Patients in attendance were mostly black (82%) females (65%) with an average age of 53 years old, T2DM (92%), and on insulin therapy (66%). Since 2016, the pre/post-survey has been completed 123 times. With a follow-up rate of 60%, roughly one-third of patients did not attend both sessions or complete the post-survey. Change in patient knowledge per pre/post survey results correlated to changes in surrogate markers will be presented during the Auburn Research: Students Symposium 2019.

Title: Investigating UAV near infrared imagery for turbidity nonitoring in small streams
Primary Author and Presenter: Prior, Elizabeth M.
Additional Authors: Frances, O'Donnell & Brodbeck, Christian
Department: Civil Engineering
College/School: Samuel Ginn College of Engineering

Description:

Unmanned aerial vehicles (UAV) are increasingly being used for field data collection and remote sensing purposes. Their ease of use, ability to carry sensors and cameras, low cost, and precise maneuverability and navigation makes them a versatile tool. The goal of this research project is to investigate if near infrared imagery obtained from an UAV can be utilized to measure the turbidity and total suspended solids of small streams at various depths. This has been demonstrated for large rivers ranging from the surface to almost two meters in depth, but not for small streams at various depths. Turbidity of a waterway is caused by agitated sediments flowing from construction sites, roads, or erosion from riparian zones due to anthropogenic or natural causes. Turbidity is an important measure of a creek's health because it affects water quality. For this study, UAV near infrared imagery and water samples at varying depths were collected before and after rain events from a recently restored reach of Moores Creek in Lanett, Alabama. The water samples were processed for levels of turbidity and total suspended solids. Data collection is still underway, but once the data has been received and analyzed, a regression model relating near infrared imagery of the stream to the samples will be developed. If successful, this method would allow an entire stream to be assessed as a whole rather than relying on single data points from turbidimeters or turbidity sensors.

Title: Self-efficacy of mainstream pre-service and in-service teachers for English Language Learners

Primary Author (and presenter): Putz, Abigail N.
Additional Authors: Harrison, Jamie
Department: Curriculum and Teaching
College/School: College of Education

Description:

This study focuses on the differences in self-efficacy of mainstream pre-service and in-service teachers in teaching English Language Learners (ELLs). English Language Learners exist in classrooms across the country, and many times these students spend more time in mainstream classrooms than in specialized language pullout classes. To better understand how to prepare mainstream teachers for ELL education, pre-service and in-service teachers in Lee County, Alabama and Putnam County, Tennessee answered a survey with a series of demographic and self-efficacy questions. Additionally, three teachers from each category will be interviewed in order to gain a deeper understanding of personal self-efficacy that mainstream teachers have towards teaching ELLs. The goal of this study is to identify in which areas pre-service and in-service teachers feel effective and ineffective. The analysis of both the surveys and interviews can then be applied to identify strengths and weaknesses within related curriculum at the university and professional training course levels.

Title: Methods for collecting design inspirations: A research about how designers gain inspirations

Primary Author (and presenter): Qi, Qiang
Department: Industrial and Graphic Design
College/School: College of Architecture, Design and Construction

Description:

Design inspirational methods and sources are an important part of the design process and can vary from designer to designer. This research aims to collect information about how different designers gain inspirations when they design. This research project utilizes survey interviews, conversational interviews and cultural probes to inquire of practitioner designers and student designers about their design experience and habits. After categorizing and analyzing those responses, the author created a figure to show inspirational methods systematically. Hopefully, the outcome of this research can empower designers with sources of inspiration to let them be able to come up with new ideas more efficiently.

Title: Impact of image resolution on quantification of mineral properties and simulated mineral reactions and reaction rates

Primary Author (and presenter): Qin, Fanqi
Additional Authors: Beckingham, Lauren E.
Department: Civil Engineering
College/School: Samuel Ginn College of Engineering

Description:

Imaging has emerged as a valuable tool to characterize geological samples and parameterize reactive transport simulations. Analysis of scanning electron microscopy (SEM) and X-ray computed tomography (CT) images of rock samples can provide information on porosity, mineral composition and accessible surface area at the pore scale. These data can be upscaled and applied in continuum scale reactive transport modeling to enhance understanding of mineral reactions. Images can be collected at various resolutions, yet the impact of image resolution on measured mineral properties, and simulated reaction rates, is largely unknown. In this work, the impact of 2D image resolution on calculated porosity, mineral volume fractions, accessibilities and effective surface areas were evaluated for a sample from the Paluxy formation, Kemper County, MS. SEM backscatter electron (BSE) images of thin sections were captured under resolutions ranging from 0.3 to 6 μm and used to calculate mineral volume fractions and mineral accessibilities. This was combined with 3D X-ray CT imaging to calculate mineral accessible surface areas. Minimum variations in mineral volume fractions occurred with changing image resolution. Large variations were observed in mineral accessibilities, the calculated accessibility of smectite/illite and muscovite decreased with decreasing resolution while the accessibility of quartz increased. The impact of observed variations in mineral properties on simulated mineral reactions rates will be assessed through continuum scale reactive transport modeling in the context of geologic CO_2 sequestration. Continuum scale models will be developed using data from each image resolution to assess variations in simulated reaction rates and the overall evolution of mineralogy and porosity. The "Establishing an Early CO_2 Storage Complex in Kemper, MS" project is funded by the U.S. Department of Energy's National Energy Technology Laboratory and cost-sharing partners.

Title: Longitudinal braking forces on bridges
Primary Author: Quinn, Anna J.
Department: Civil Engineering
College: Samuel Ginn College of Engineering

Description:

When heavy vehicles stop rapidly on bridges, large longitudinal braking forces are transferred to the structure. When the AASHTO highway bridge design specifications were completely overhauled in the 1990s, the longitudinal force that bridges must be designed to resist was increased. For the most common short- to medium-span highway bridges, this increase was as much as 400 percent, which can have a significant influence of the required strength of substructure elements like piers and foundations. Previous research concerning the path and intensity of substructure forces that result from truck braking is lacking. The primary focus of this study was to investigate the magnitude of braking forces induced in the substructure of a common highway bridge. This was accomplished through static pull tests and truck braking tests on an actual bridge. The motion of a braking 70,000 lb truck was tracked using an inertial measurement unit, while the displacement and acceleration response of key bridge elements were monitored. A finite-element model (FEM) of the bridge was developed for analytical determination of the substructure forces under dynamic conditions. Model choices and level of detail were selected based on the results from the static and dynamic field tests. The FEM includes the effects of soil-structure interaction on the bridge response to braking. From the truck braking data, a dynamic truck-braking signature is recommended for bridge design purposes. Furthermore, a set of practices is recommended for implementing FEMs to analyze and design bridges to respond to longitudinal braking forces.

Title: The reaction between methanesulfinate and triiodide in aqueous media
Primary Author (and presenter): Rajakaruna, Pradeepa I.
Additional Authors: Stanbury, David
Department: Chemistry and Biochemistry
College/School: College of Sciences and Mathematics

Description:

In this study, kinetics of the reaction between methanesulfinate (MSA) and triiodide in weakly acidic aqueous media has been monitored by observing the change in triiodide concentration with varying reactant concentrations at excess MSA and iodide at 25 ^{o}C, μ = 0.1 M ($NaClO_4$). The instant. reaction between MSA and triiodide yields methanesulfonyl iodide (MSI), (K = 1.01 ± 0.04 M) which shows an absorption feature at 309 nm. (ε ~500 M^{-1} cm^{-1}) The change in pH corresponding to the hydrolysis of MSI to produce the final product methanesulfonic acid (MA), was used to monitor the kinetics of hydrolysis. MSI hydrolysis shows slow first order kinetics in the pH range 3.25-6.9, and the rate constant is inversely proportional to the iodide concentration. The proposed mechanism consists of two steps; a rapid equilibrium to form MSI, and hydrolysis of MSI to form MA. The overall reaction is $CH_3SO_2^- + I_3^- + H_2O \rightarrow CH_3SO_3^- + 3I^- + 2H^+$. The crystal structures of MSI with RbI and KI have been obtained. These are the first reported structures of alkanesulfonyl iodides.

Title: Assessing the pharmacodynamics and pharmacokinetic effects of Designer Drugs using computational design

Primary Author: Rajendran, Soorya Gokulan
Additional Authors: Alturki, Mansour; Majrashi, Mohammed; Almaghrabi, Mohammed; Fujihashi, Ayaka; Ramesh, Sindhu; Moore, Timothy; Forrest, Smith; Clark, Randall; Deruiter, Jack; Dhanasekaran, Muralikrishnan
Department: Drug Discovery and Development
College/School: Pharmacy

Designer Drugs are a group of psychoactive substances synthesized from chemicals to emulate the pharmacodynamic and pharmacokinetic actions of widely used substances of abuse. A minor modification of the chemical structure can alter the pharmacodynamic and pharmacokinetic profile. In this study, we assessed the possible pharmacodynamic and pharmacokinetic effects of 3-Trifluoromethylphenylpiperazine (TFMPP) derivatives using Qikpro. In this study, we analyzed the possible pharmacodynamics and pharmacokinetic effects of 2-TFMPP, 3-TFMPP, 4-TFMPP, 2-TFMBzPP, 3-TFMBzPP, 4-TFMBzPP and BZP. Based on Lipinski's rule of five, Jorgensen's rule of three, QPlogBB and the QPPCaco, the TFMPP derivatives can undergo passive diffusion and can be highly absorbed after oral administration (can be bioactive orally). TFMPP derivatives have lower cLogp, HBD and HBA values. Therefore, these designer drugs can cross the BBB and possibly exhibit significant pharmacodynamic effects in the central nervous system. Furthermore, PISA and FOSA values can be used to correlate with the neurotoxicity of a drug / chemical. The structural changes can lead to increase in potency or toxicity of these designer drugs, making them even more stimulatory, addictive and toxic than their parent compound (stimulants / drugs of abuse). However, there is a possibility that these designer drugs can become less toxic and still exhibit the required pharmacodynamic effects compared to the parent compounds. Thus, the non-toxic designer drugs can exhibit potent therapeutic effects to treat various ailments in humans and veterinary purposes.

Title: Compressible biglobal instability analysis of cylindrical solid rocket motors
Author (and presenter): Ramesh Kumar, Tharikaa
Additional Authors: Majdalani, Joseph
Department: Aerospace Engineering
College/School: Samuel Ginn College of Engineering

Description:

In this work, a compressible biglobal stability approach is adopted to investigate the hydrodynamic and vorticoacoustic responses of unsteady waves in right-cylindrical porous chambers with radial wall injection. The retention of compressibility in the governing equations enables us to predict both hydrodynamic and vorticoacoustic wave motions simultaneously. Due to the wave equation being fully embedded within the compressible Navier-Stokes equations, in the absence of a mean flow field, we recover traditional "organ-pipe" acoustic frequencies. In order to simulate the flowfield in solid rocket motors, the closed-form analytical expression of the compressible Taylor-Culick profile is substituted for the base flow. This approach can also pinpoint the flow induced longitudinal, radial, and mixed modal frequencies. It is observed that increasing the mean flow Mach number leads to a slight reduction in the vorticoacoustic frequencies relative to their pure acoustic countermodes in a quiescent, impermeable chamber. Similar results are achieved while increasing the Reynolds number and chamber length, thus affirming the origin of frequency shifts observed in actual motor firings and the eigensolutions corresponding to the vorticoaoustic velocity fluctuations resemble those predicted analytically. The compressible biglobal approach adopted by this work may be viewed as a milestone in advancing our modeling capabilities at the forefront of the combustion instability analysis.

Title: Atorvastatin attenuates lysophosphatidic acid (LPA)-induced tau hyperphosphorylation through inhibition of p38 MAPK pathway

Primary Author (and presenter): Ramesh, Sindhu
Additional Authors: Mitra, Amit; Dhanasekaran, Muralikrishnan; & Moore, Timothy
Department: Drug Discovery and Development
College/School: Harrison School of Pharmacy

Description:

The number of Alzheimer's disease (AD) cases – currently estimated to be greater than 5.4 million – is predicted to rapidly increase in the coming decades. As well, the total current, estimated worldwide healthcare costs associated with managing dementia is $818 billion (US currency), according to the World Alzheimer's Report, 2016. Current AD treatments provide, at best, only modest and temporary symptomatic relief failing to alter the underlying pathophysiology, which leads to the progression of the disease. Lysophosphatidic acid (LPA), a bioactive phospholipid involved in inflammation, has been associated with development of AD. Hence, the aim of this study was to investigate whether LPA might promote AD pathology through tau hyperphosphorylation and identify the putative molecular signaling mechanisms by which LPA elicits this effect. Furthermore, this study tested whether atorvastatin can attenuate LPA-induced tau hyperphosphorylation. Using human SH-SY5Y cell lines differentiated with 10µm retinoic acid to achieve a neuronal phenotype, dose-dependent effects of LPA and LPA (+) atorvastatin on cell viability and dendritic morphology were determined. PrestoBlue™ cell viability assays showed LPA decreased cell viability at 5 µm and 10µm that was prevented with 1µm atorvastatin. LPA also caused neurite retraction in a time-dependent manner over 48 hours, which was also attenuated by atorvastatin (1µm). Neurite retraction was accompanied by the phosphorylation of tau (Ser404 and Thr231). The tau phosphorylation was significantly attenuated by atorvastatin. The beneficial effects of atorvastatin were similar to the responses elicited by treatment with SKF 86002, a MAPK inhibitor, suggesting the involvement of p38MAPK pathway. Taken together, these studies provide evidence for LPA as a tau-dependent inducer of neuronal degeneration involving the p38MAPK pathway. Prevention of the LPA-induced effects are accomplished by atorvastatin, and therefore these findings open a new avenue for exploring statins as potential therapeutics for AD.

Title: Landscape architecture theory and practice: Three case studies
Primary Author (and presenter): Ramos, Alejandro
Additional Authors: Anderson, Alex; Fonte, Amanda; Orjuela, Andres; Ossenfort, Christian; Nisbett, Joseph; Hamrick, Rachel; Liu, Yubo; Wang, Rui; Yi, Zhu
Department: Landscape Architecture
College/School: College of Architecture, Planning and Landscape Architecture

Description:

In the recent past, the approach of landscape architectural discourse has emphasized only limited aspects of the practice, including the social role of architects, the environmental and economical concerns, the technological innovations in design and construction, formal and typological experimentations, and the city and public space. These foci have reduced the space for dialogue towards landscape architecture itself. Our research aims to uncloud landscape architecture's own sovereign rules, to decipher whether landscape architecture is autonomous due to its own transmissible knowledge, to make explicit these principles, and to determine if landscape architecture can be consistent with reality while remaining consistent with itself. We explored these questions through 1) theoretical inquiry into the existing discourse of landscape architecture itself and 2) the direct and indirect explorative study of three sites of landscape architecture through first hand field study, photography, GIS mapping, written record, secondhand source analysis, and three dimensional physical and digital spatial modeling. The three sites were *Perry Lakes Park*, Rural Studio, Perry County, Alabama (2002); *Patio Fresnos*, Jorge Ambrosi and Gabriela Etchegaray, Nacozari de Garcia, Mexico (2014); and *Orquideorama*, Plan B Architects + JPRCR Architects, Medellin, Antioquia, Colombia (2008). Our team first defined landscape architecture and its self-determined rules based on theory and experience, then our research took a critical eye toward the three selected sites to determine if they contribute to architectural tradition and are coherent within the rules of landscape architecture. We have defined landscape architecture as a cultural, ecological, and geological construct that allows or creates dynamic relationships between biotic and abiotic systems. We found that landscape architecture sites must address all these aspects in order to be coherent with the logic of the discipline; none of the sites of study fully encapsulated our definition of landscape architecture, but they were found to be worthy of further research in the lens of architecture. We also found that the differentiation between the rules of architecture and the rules of landscape architecture is fruitless and we believe in a collaborative, discursive relationship fostered between the sister disciplines.

Title: Development and validation of the Dietary Habits and Colon Cancer Beliefs Survey (DHCCBS): An instrument assessing healthbeliefs related to red meat and green leafy vegetable consumption

Authors: Kristen S. Smith, Savannah Rundquist (presenter), Michael W. Greene, Andrew D. Frugé
Department: Nutrition/ Dietetics
College/ School: Human Sciences

Dietary patterns characterized by higher red meat (RM) consumption are associated with increased colon cancer (CC) risk. Preclinical and epidemiological evidence suggest higher green leafy vegetable (GLV) consumption may mitigate these risks. Determining the relationship between dietary habits and expected health outcomes is needed.
Methods: The Health Belief Model (HBM) was used to assess perceived CC susceptibility and severity, and related dietary benefits, barriers, and motivators. RM and GLV consumption were quantified using select DHQII items (n=15) capturing the previous 30 days' intake. A 34-item Qualtrics survey was provided to a convenience sample of 1,075 adults residing throughout the U.S. Confirmatory factor analysis measured fitness with HBM, and Cronbach's alpha assessed subscale reliability. A subsample (n=47) completed a 2-week follow-up for test-retest reliability. Independent sample t-tests were used to compare RM and GLV intake and DHCCBS responses between genders. Individual barrier questions and RM and GLV consumption were compared using ANOVA for each gender; post-hoc analyses between barrier question responses were assessed with Bonferroni correction. Results were considered significant with a p-value of less than 0.05
Results: 990 U.S. adults (52.7% female, 79.1% white, 50.8% aged 35+ years) completed valid surveys. Factor analysis with varimax rotation validated the construct of HBM subscales; only one question had a loading less than 0.745. Subscale Cronbach's alphas ranged from 0.478-0.845. Overall test-retest reliability was acceptable ($r=0.697$, $p=5.22x10^{-8}$). Participant BMI was (mean±SD) 26.7±6.6 kg/m^2. Participants consumed (median, IQR) 2.3, 0.9-4.7 cooked cup equivalents GLV/week and 12.2, 5.8-21.5 ounces RM/week. Over half of respondents agreed or strongly agreed with the statement "I can't imagine never eating red meat," while less than one eighth of respondents agreed or strongly agreed with the statement "I don't like the taste of green leafy vegetables."
Conclusion: The DHCCBS is a valid instrument for measuring health beliefs related to red meat, green leafy vegetables, and perceived colon cancer risk. Additionally, these findings suggest increasing GLV may be more feasible than reducing RM for CC risk reduction in meat-eaters.

Title: Acyclovir gel for enhanced transdermal drug delivery
Primary Author (and presenter): Rangari, Shivani
Additional Authors: Aldawsari, Mohammed; Ramapuram, Jay
Department: Drug Discovery and Development
College/School: Pharmacy

Topical application of acyclovir is a common treatment for Herpes Labialis infection. Acyclovir demonstrates poor skin permeability which limits the efficacy of this drug. There is a need to enhance the skin permeability of acyclovir into deep layers of skin and ultimately improve therapeutic efficacy in treating the infection. We formulated acyclovir gels to enhance the drug permeation across human skin.

Acyclovir nano-suspension produced by ball milling was directly incorporated in carbopol® 974P NF polymer as a gelling agent. The gel was included with penetration enhancers such as ethanol, oleic acid and propylene glycol. The particle size and polydispersity index were determined by Nicomp ZLS380 Nanosizer. The gel viscosity was determined by Brookfield viscometer. Drug content and uniformity of acyclovir were determined by HPLC assay. In vitro drug release of gels was studied using Franz diffusion cells as compared to the commercial product of acyclovir (Zovirax).

Ball milling produced acyclovir particle size at 270 nm. These nanoparticles in the gel formulation showed a pH, 6; viscosity 7177 cP (5 rpm), and drug content 25 mg/gm. All other formulations (with skin permeation enhancers) showed similar parameters with respect to particle size, polydispersity index, viscosity, drug content and pH. The formulations showed significantly higher acyclovir release as compared to Zovirax, (control). Acyclovir gel formulations with ethanol as a penetration enhancer demonstrated a pronounced effect on enhancing acyclovir. These results indicate that a gel formulation could be a much effective treatment as a topical antiviral agent as compared to Zovirax.

Title: Shape complementarity calculations based on protein backbone positions and amino acid identities
Primary Author: Redden, Jacob J
Additional Authors: Pantazes, Robert; Chauhan, Varun
Department: Chemical Engineering
College: Engineering

Many algorithms have been developed for the design of proteins to bind to a specific antigen. These algorithms use general structure motifs and force fields to create atomistic predictions of the protein's structure and the binding energy between the protein and the antigen. However, the use of these force fields is computationally prohibitive and often requires the use of a super computer. Recently, an Algorithm for Ultra-rapid Binding Interaction Engineering (AUBIE) has been developed to optimize binding energy without the need to determine the position of all atoms, eliminating the need to use a force field. AUBIE is capable of predicting many possible protein designs with optimal binding energy in as little as a few minutes on a personal computer.

While predicting binding energy is important in designing proteins that bind to antigens, shape complementarity is also known to correlate with how well computational predictions perform when experimentally tested. Currently, AUBIE does not include shape complementarity calculations because existing methods require the spatial coordinates of all atoms to be known. Since AUBIE does not place all the atoms is space, a different metric must be developed. This poster describes the shape complementarity metric developed for AUBIE the uses only protein backbone positions and amino acid identifiers. The metric was developed using a previously-published database of 492 non-redundant antibody-protein complexes. It was validated using a set of 300 AUBIE-designed, anti-HER2 antibodies and compared to the existing shape complementarity calculations of Rosetta, the standard in this field, demonstrating that these calculations can be achieved for significantly less computational expense than existing methods.

Title: Overexpression of the notch intracellular domain results in abnormal adrenal development
Primary Author (and presenter): Reid, Olivia R.
Additional Authors: Laprocina, Kari; Cleary, Courtney; Rodriguez, Karina; Yao, Humphrey; & Huang, Chen-Che Jeff
Department: Anatomy, Physiology, and Pharmacology
College/School: College of Veterinary Medicine
Description:

During adrenal gland development, newly formed cortical cells move from the outer cortex inward to the corticomedullary boundary. Throughout this migration, cells at different developmental stages express different marker genes which lead to concentric zones of the adrenal cortex (zonation). In mice, cells in the corticomedullary boundary (X-zone) are considered the aged cell population and regresses over time. Disruption of signaling pathways such as Wnt, Hedgehog and TGF-beta can cause abnormalities in the development of the adrenal cortex. However, the role of the Notch signaling pathway in adrenal development has not yet been fully studied. Notch signaling pathway involves a variety of gene regulatory mechanisms that control cell function. Inhibition of canonical Notch signaling affects cells development and differentiation in many tissues and organs. We used immunostaining to show that the removal of Hes1, one of the most common Notch target genes, does not affect the zonation and proliferation of the adrenal cortex. Next, we used Sf1-Cre mice to overexpress Notch intracellular domain (NICD) in the adrenal cortex to determine whether the up-regulation of the Notch signaling pathway will affect adrenal cortex zonation. In this mouse model, the over-expression of NICD in the adrenal cortex disrupted normal zonation and led to a small, disorganized adrenal. The medulla in the mutant adrenals is irregularly distributed in the margin of the gland underneath the adrenal capsule with clusters of 3βHSD low-expressing cells partially surrounding the 3βHSD high-expressing cortex. Moreover, X-zone cells (labeled by 20αHSD) were significantly reduced in NICD over-overexpressed adrenals in two weeks old male and female mice. Our data suggest that overactivation of Notch signaling in the adrenal cortex not only disrupts the development of the definitive cortical zones but also affects the aging and the differentiation of fetal cortical cells (X-zone) in mice.

Title: Shape memory polymer programming techniques
Primary Author (and Presenter): Reyna, Aura P.
Additional Authors: Mailen, Russell W.
Department: Aerospace Engineering
College/ School: Engineering

We seek to investigate the shape memory effect in commercially available polymers. These materials can then be adapted to shape-morphing applications in industries from medicine to aerospace. A polymer's ability to demonstrate the shape memory effect is highly dependent on its processing, i.e., pre-straining. To date, this has not been investigated fully at the lab scale due to availability of cost-effective pre-straining equipment. Pre-straining, or programming, requires deforming the polymer at an elevated temperature before rapidly cooling to maintain the temporary shape. Our research seeks to study several polymers under different pre-straining conditions. By developing an in-house programming device, we gain total control of parameters involved in processing, including temperature, compression, and cooling. We considered several techniques for pre-straining, such as uniaxial tension, an iris stretcher, and through thickness axial compression. Ultimately, a dual heated roller setup was selected, which utilizes both compressive and rotational force to program bi-directional pre-strain into the polymer. The device allows for material testing and analysis while identifying critical parameters in processing. It also determines the ideal conditions for processing each polymer. This investigation will expand the scope of shape memory polymers available for research and industrial use.

Title: Effect of tumor necrosis factor alpha on equine colony forming cell function in culture
Primary Author (and presenter): Reyner, Claudia L.
Additional Authors: Winter, Randolph & Wooldridge, Anne
Department: Clinical Sciences
College/School: College of Veterinary Medicine

Description:

Endothelial colony forming cells (ECFCs), facilitate vasculogenesis in adult life. New blood vessel formation in ischemic disease occurs in an inflammatory microenvironment. During inflammation, pro-inflammatory cytokines such as tumor necrosis factor alpha (TNFα) regulate many cellular processes including cellular proliferation and apoptosis. The objective of this study was to evaluate the effect of TNFα on equine ECFC function in culture. We hypothesized that stimulation with TNFα would decrease cell migration, adherence, and tubule formation of equine ECFCs. Equine ECFCs were grown in culture until 70-80% confluence, and stimulated for 6 hours with TNFα (50 ng/mL) or sham control. For the cell adherence assay, stimulated and control cells were inoculated into new wells, and the number of adherent cells at one hour were counted within five different fields of view. For the scratch assay to evaluate cell migration, gap closure was measured at 3 and 6 hours following wound creation, and presented as percent change from baseline. In vitro tubule formation on basement membrane was evaluated at 0, 5, and 24 hours. Images were assigned a score (1-4) based on tube quality and tube formation. Results of the adherency and migration assays were compared using a paired t-test ($P<0.05$). No significant differences were observed between ECFCs stimulated with TNFα and control cells. Results of vascular tube formation assays were evaluated using a Mann Whitney test ($P<0.05$). No significant differences were observed between TNFα and control cells. While no significant difference in cell function was observed in this study, additional investigation is warranted. This includes evaluation of other pro-inflammatory cytokines, as well as effects on ECFCs from different horses.

Title: Distinguishing the effects of verbalizing a motor skill on performance and retention in novices and skilled populations

Primary Author (and presenter): Rhoads, Jence & Hulebak, Gunnar
Additional Authors: Sandstrom, Peter; Simpson, Will; & Miller, Matthew
Department: Kinesiology
College/ School: College of Education

Description:

Verbal overshadowing is the theory that verbalizing a memory that consists mostly of procedural knowledge creates a verbal representation of that knowledge, which interferes with the memory's representation/retrieval. Previous research has shown that verbalizing a motor skill hinders immediate retrieval in skilled performers, but not in novice performers, due to the latter having little procedural knowledge to be disrupted. However, it is unknown whether verbalization is limited to immediate skill retrieval or causes a reconsolidation of the skill memory, leading to a relatively permanent change in representation/retrieval. The present study examined the impact of verbalization on performance in an immediate posttest and retention in a delayed posttest for novice/skilled performers. On Day 1, 51 novices and 42 skilled basketball players completed a pretest of 10 basketball free throws to determine baseline motor performance. Half of the novices and half of the skilled participants were assigned to a verbalization condition, wherein they wrote a description of the free throw task; the remaining participants were assigned to a control condition writing a description of the weather. Next, all participants performed an immediate posttest and 24h delayed posttest of 10 free throws. Free throw shooting accuracy was submitted to a 2 Condition (verbalization/control) x 2 Skill (novice/skilled) x 3 Test (pretest/immediate posttest/delayed posttest) mixed factor ANOVA. Results revealed main effects of skill and test (ps $\leq .001$), such that skilled participants were more accurate than novice participants ($p < .001$). Also, participants performed better in immediate ($p \leq .001$) and delayed posttests ($p = .05$) compared to pretest; posttests did not differ from one another ($p = .09$). Crucially, there was no effect of condition ($p = .471$), and no interactions among factors (ps ≥ 227). Results failed to show a verbal overshadowing effect for either skilled or novice participants.

Title: Understanding the unique multi-electron redox cycle of nickel dithiocarbamates and characterization of a nickel (III) intermediate
Primary Author (and presenter): Richburg, Chase S.
Additional Authors: Farnum, Byron H.
Department: Chemistry and Biochemistry
College/School: College of Science and Mathematics

Description:

High valent nickel chemistry is a challenging and underdeveloped field. Nickel, similar to platinum and palladium in its electronic configuration, is an intriguing alternative to these precious metals in the fields of C-C/C-H catalysis and renewable energy storage due to its high earth-abundance and cost-effective nature. Additionally, unlike traditional $1e^-$ redox couples of first row transition metals, nickel dithiocarbamates exhibit a unique multi-electron redox cycle that could increase energy storage capabilities of redox flow batteries. Herein, we report mechanistic insight to the nickel diethyl dithiocarbamate ($Ni(Et_2dtc)_2$) redox cycle and characterization of high valent nickel (III) and nickel (IV) oxidation states of these complexes by in-depth chemical and electrochemical analyses. These results provide a greater understanding of what enables the unique $Ni(Et_2dtc)_2$ redox cycle and the conditions that drive these complexes to undergo $1e^-$ or $2e^-$ transfer reactions. Also reported is the addition of an ancillary ligand, pyridine, to the electrochemical cycle and how it enables stabilization of an interesting nickel (III) intermediate. This greater understanding of Ni(III) and Ni(IV) chemistry is fundamental in nature and demonstrates the need for further exploration and application of dithiocarbamates in the fields of catalysis and renewable energy storage.

Title: Analyzing the effects of surface energy on algae with specialized attachment mechanisms
Primary Presenter: Rodriguez, Marisa G.
Additional Authors: Karimi, Zahra; Blersch, David M.; Davis, Virginia A.
Department: Chemical Engineering
College/School Name: Engineering

The goal of this research is to investigate algae species that have specialized attachment mechanisms and how the surface energy of the substrata they adhere to affects their attachment. The substrata materials tested are glass, polylactic acid (PLA), and Teflon (PTFE). The algae species in focus for this experiment are filamentous green algae, specifically Oedogonium, which is known to have holdfasts as a specialized attachment mechanism. Holdfasts are root-like structures that aid algae in anchorage to substrates. In nature, multiple types of algae can grow together on rocks and other surfaces, but the details governing algae attachment are not fully understood. Commercially, algae are cultivated for fuel, nutrient supplements, and for pollutant removal. However, different types of algae are preferred for different applications. A better understanding of the algae attachment would improve the economic viability of algae cultivation for specific applications.

Title: Irrigation and water use reporting in the Tennessee River valley region of Alabama
Primary Author (and presenter): Roland, Jarrett L.
Additional Authors: Chaney, Philip
Department: Geosciences
College/School: College of Sciences and Mathematics

Description:

Understanding agricultural water use is a critical step in sustainably managing water resources. In 1993, Alabama passed the Water Resources Act which established water use reporting requirements for users withdrawing more than 100,000 gallons per day. Users must apply for a Certificate of Use (CoU) for each pump that draws from a water source and report their monthly water usage on an annual basis. This project investigates the CoU reporting program and its effectiveness within the Tennessee Valley Region of Alabama, one of the most active regions in the state for irrigated agriculture. NAIP imagery for 2011, 2013, and 2015 were used to map the locations of center pivot (CP) irrigation within the region. The pump locations (latitude and longitude) are required for the CoU application and are used together with tax parcel data available through county tax assessor offices to connect CPs in the region to their respective CoU. Once the CPs in the region have been connected to their correct CoU, the reported water usage and irrigated area for each CoU will be compared to assess the reliability of the water use reports in the Tennessee Valley.

Title: Implementation of STEADI to prevent falls in community-dwelling adults aged sixty-five years and older
Primary author: Rolling, Brandi S.
Additional authors: Ellison, Kathy
College/ School: Nursing

Description:

Falls among people aged sixty-five years and older are the leading cause of both injury deaths and emergency department visits for trauma. Research shows that many falls are preventable. In the clinical setting, an effective fall intervention involves assessing and addressing an individual's fall risk factors. STEADI (Stopping Elderly Accidents, Deaths, and Injuries), a fall prevention tool kit that contains a collection of health care provider resources for assessing and addressing fall risk in clinical settings. The purpose of this small test of change was to see if assessing and addressing fall risk in this particular age group and implementing fall prevention techniques/interventions would decrease the number of falls. The target population included adults (>/=65) that are at risk for falls. Following participant agreement, participants completed a fall risk screening survey. PCP reviewed the results to assess the level of fall risk of the participant to guide treatment recommendations. Health care providers then incorporated fall risk assessment and fall interventions into routine clinical practice and linked clinical care with community-based fall prevention programs. A follow up phone calls were made to assess if there have been any falls and participant adherence with recommended treatment. The project is in progress. Descriptive statistics will be used to describe the patient population, number of patient falls, intervention recommendations, and patient adherence. The fall risk survey will be given again post-education to compare results of pre-education level of risk with a dependent t-test. The STEADI tool kit is a broad, evidence-based resource designed with input from health care providers and intended to help them incorporate fall risk assessment and individualized fall interventions into clinical practice. This tool has been found useful in fall prevention in a primary care setting.

Title: Improving standardized hand-off report in the medical intensive care unit
Primary Author (and presenter): Rowe, Danielle N.
Additional Author: Watts, Sarah
College/ School: School of Nursing

Description:

The lack of consistent nursing hand-off reporting that can lead to errors in patient care such as medication errors, improper testing and even death. The purpose of this project is to provide registered nurses at a healthcare institution with an educational intervention to improve standardized hand-off reporting. By educating registered nurses on the importance of hand-off reporting and implementing standardized reporting tools such as a hand-off report sheet, patient care improves and errors are reduced. This project will take place in the Medical Intensive Care Unit (MICU) of a respected academic healthcare facility in a large urban city of a southeastern state. The MICU was chosen for the STOC due to the large number of new registered nurses with limited experience using hand-off reporting tools and change of shift reports. First, a review of the current hand-off tool would take place to evaluate the need for revisions and education will be provided to registered nurses on the proper use of the tool. Two to four weeks would be allocated to allow time for transition into practice. Next, an evaluation of the understanding and use of the reporting tool by the participants and to provide feedback as needed. After implementation, participants will be evaluated on use with a five question Likert Scale style evaluation form. The outcomes measured will be based on the results from participant's responses regarding hand-off of care. Descriptive statistics will be analyzed. The results will be used to describe the participant population and the pre-post mean scores will be compared using paired t-tests. Standardized hand-off reporting is vital in improving patient care by ensuring effective communication during transition of care. Concise hand-off reporting also reduces errors and promotes continuity of care.

Title: Improved random pattern delay fault coverage using inversion test points
Primary Author (and presenter): Roy, Soham
Additional Authors: Stiene, Brandon; Millican, Spencer; & Agrawal, Vishwani
Department: Electrical and Computer Engineering
College/School: Samuel Ginn College of Engineering

Description:

Circuit test is a critical part of the integrated circuit (IC) manufacturing process which confirms circuit reliability, and the cost of circuit test is increasing in-step with circuit complexity. Circuit test applies stimulus to manufactured ICs to excite and detect defects created as a natural consequence of the silicon manufacturing process, and the cost of testing circuits for defects is a significant portion of IC manufacturing costs. The primary challenge of IC test is to reduce test-related costs while preventing the release of defective circuits and the discarding good devices. Pseudo-random testing has repeatedly been demonstrated to be effective for detecting defects in previous generations of technology, but its utility is degrading for complex circuits due to the presence of random-pattern resistant (RPR) faults. These faults are a natural consequence of increasing circuit complexity and will continue to be present in new technologies. Many methods have been developed to improve the quality of pseudo-random test patterns, with an established method being test point insertion (TPI): modifying the logic of a circuit during test using circuit controlling and circuit observing “test points” (TPs) has been of interest due to its ease-of-implementation by circuit designers. This study demonstrates the capabilities of inversion TPs which can be implemented in lieu of control TPs: defect coverage is analyzed and improvements in this and other metrics are achieved compared to traditional TP architectures. Using inversion TPs is not standard practice today, and this study motivates the electronic design automation industry to support inversion TPs in their software tools.

Title: Effect of conditioning temperature on productive and processing performance, and nutrient digestibility of broilers

Primary Author: Rueda, Martha S.
Additional authors: Pacheco, Wilmer & Rubio, Andrea.
Department: Poultry Science
College/School: College of Agriculture

Description:

Pelleting involves mash conditioning with steam, to increase production rate, pellet quality, starch gelatinization and reduce bacterial load and percentage of fines. However, high temperature conditioning can negatively affect the availability of thermolabile nutrients such as vitamins and amino acids. This study was performed to evaluate the effect of conditioning temperature on broiler performance, processing yield and nutrient digestibility from 1 to 49 d of age. A total of 1120 Ross x Ross 708 broilers were randomly distributed among 4 treatments with 10 replicate/treatment and 28 birds/pen. The treatments consisted of 4 conditioning temperatures; 71, 77, 82 and 88°C and were applied on grower and finisher diets. Starter diet was fed as crumbles whereas grower and finisher were fed as whole pellets. Titanium dioxide was added as indigestible marker (0.5%) during the grower phase. At 28 d of age, ileal digesta was collected for determination of fat and protein digestibility. Performance variables were determined at 14, 28 and 49 d of age, FCR was calculated by adding the BW of mortality to the BW of live birds in each pen. At 50 and 51 d, birds were processed to determine carcass and processing yield. Data were statistically evaluated using ANOVA procedure and means were separated by Tukey's HSD test. As conditioning temperature increased from 71 to 88°C there was an increment in pellet quality ($P<0.05$) and moisture content ($P<0.05$) resulting in a reduction of fines ($P<0.05$) of finished feeds. However, broilers fed diets conditioned at 77°C had higher ($P<0.05$) fat digestibility compared with broilers fed diets conditioned at 88°C. In addition, birds fed diets conditioned at 82°C had higher ($P<0.05$) tender weight compared to birds fed diets conditioned at 71 and 77°C. These results demonstrate that conditioning at high temperatures has influence over fat digestibility and feed quality while not affecting performance parameters.

Key words: conditioning, thermolabile nutrients, digestibility.

Title: Exotic, invasive parasitic copepods (*Salmincola* spp.) infecting wild and farmed trouts (Salmonidae) in the southeastern United States

Primary Author (and presenter): Ruiz, Carlos F.
Additional Authors: Ksepka, Steven; Rash, Jacob; Besler, Doug; Hickson, Brian; Chappell, Devin; & Bullard, Stephen
Department: School of Fisheries, Aquaculture, and Aquatic Sciences
College/School: College of Agriculture

Description:

Branchial-parasitic copepods (or "gill lice"; *Salmincola* spp.) are important to the aquaculture sector and fisheries management agencies because they can cause disease in farmed and hatchery-reared fish stocks. As exotic-invasive pathogens in the southeastern United States, they also threaten the health of economically-important wild fish populations. *Salmincola* spp. have been translocated with infected salmonids, but a systematic survey of trouts in the southeastern US has not been conducted. In 2017, we diagnosed infections of 2 species in North Carolina (NC): *Salmincola californiensis* in rainbow trout (*Oncorhynchus mykiss*) from a private, pay-to-fish farm in the Watauga River (Watauga River Watershed) and *Salmincola edwardsii* in wild brook trout (*Salvelinus fontinalis*) from Big Norton Prong (Little Tennessee River Watershed). We herein report new infection records of *S. californiensis* in rainbow and brown trout (*Salmo trutta*) from 13 localities and *S. edwardsii* in brook trout from 6 localities in NC. Further, we report the first detection of *S. californiensis* in stocked (put-and-take) rainbow trout from Smith Lake Tailrace (Smith Lake Watershed), Alabama, and trophy-managed rainbow trout from the Soque River (Soque River Watershed), Georgia. We differentiated adult females of *S. californiensis* and *S. edwardsii*, respectively, by the morphology of the antenna (terminal endopodal segment with ventral processes shorter than vs. longer than or equal to dorsal hook) and maxilliped (myxal seta length ≤1/3 vs. 1/3–1/2 subchela length) plus the mandibular dentition formula (P5 or P6 vs. P7). Further, we used light and scanning electron microscopy to identify and provide supplemental morphological observations of juvenile females and adult males. The results of this study enhance our understanding of the distribution and biology of exotic, invasive gill lice and the need for a regional aquatic animal health plan in the southeastern US.

Title: Precise genetic modification of canine adenovirus 2 (CAV-2) genome by CRISPER/ Cas9

Primary Author (and Presenter): Sajib, Abdul Mohin
Additional authors: Nance, Becca; Kretzschmar, Will; Agarwal, Payal; Smith, Bruce
Department: Pathobiology
College/School: College of Veterinary Medicine

Description:

Genetically modified oncolytic adenoviruses are an outstanding and common vehicle for efficient cancer gene therapy. They account for 23.8% of nearly 1700 clinical trials that were conducted using both viral and non-viral vectors. Successful virotherapy will require targeted modification of several viral components, such as viral capsid, fiber-knob, and the insertion of transgenes for expression, to conduct the necessary transductional and transcriptional targeting of adenovirus. However, the conventional approach to modify adenoviral genome is time consuming, complex and less feasible, for being, dependent on the presence of unique restriction enzyme sites that may or may not be present in the target site. Clustered regularly interspaced short palindromic repeat (CRISPR) along with an RNA-guided nuclease called Cas9 (CRISPR/Cas9) is one of the most powerful tools that has been adopted for precise genome editing in various cells and organisms. However, whether the CRISPR/Cas9 system can precisely and efficiently make targeted genetic modification in adenoviral genomes remains essentially unknown. Here, we propose to utilize in vitro CRISPR/CAS9 mediated editing of the canine adenovirus type 2 (CAV2) genome to promote targeted modification in the viral genome. To demonstrate the feasibility of this goal, we have conducted CRISPR/Cas9 mediated insertional mutagenesis and successfully inserted the RFP (red fluorescent protein) reporter construct into the CAV-2 genome. Initial results provided high efficiency and accuracy for in vitro CRISPR mediated editing of the large CAV2 genome. Furthermore, we are also in the process of utilizing the CRISPR/Cas9 system to conduct wild type gene replacement with our desired ligand into the CAV-2 genome to construct tumor-targeted vectors. Thus, we hope that our work will provide a significantly improved and efficient method for targeted editing of adenoviruses to generate oncolytic adenoviruses in the shortest possible time.

Title: Supplementation of crystalline aminoacids at different levels to reduced protein diets in Channel Catfish *Ictalurus Punctatus*

Primary Author (and presenter): Salem, Shimaa M.
Additional Authors: Nguyen, Lay; Mohamed, Tarek; & Davis, Allen.
Department: School of Fisheries, Aquaculture and Aquatic Sciences[1]; Department of Nutrition & Nutritional Deficiency Diseases[2].
College/ School: [1]College of Agriculture; [2]Mansoura University, Egypt.

Description:

This study was performed to assess the efficacy of crystalline indispensable amino acids (IAA) in the reduction of intact protein (IP) content in channel catfish diet and balancing the amino acids (AA) profile by using IAAs supplementation at different levels with and without dispensable AA (DAAs). Nine isolipidic 8% experimental diets were formulated as the following; (30%IP basal , 24IP+IAAs added to restore IAAs profile the same as basal diet +DAAs), (24IP/IAAs 100, 120 &140% NRC), (24IP, 27IP & 30IP IAAs 120% NRC), (24IP/ IAAs 100%NRC W/WO DAAs, 24IP/IAAs 120% NRC W/WO DAAs).Experimental fish (average initial weight 23.68 g) were randomly distributed into 9 groups, 3 replicate and 15 fish/ aquarium in recirculating system.Fish were fed on experimental diets two times/day % of body weight and weighing bi-weekly for measuring fish growth parameters. The growth results based on t-test analysis showed that, there were no significant differences ($P>0.05$) in ; final mean weight, FCR, TGC and ANPR between catfish fed 30% IP (basal) and fish fed 24%IP/IAAs added to restore IAAs profile the same as basal with DAAs. While, the regression line and ANOVA demonstrated that supplementing IAAs at graded levels 100, 120 &140% NRC 2011 to 24%IP showed significant ($P<0.05$) improvement in final mean weight, body weight gain, TGC and ANPR, but FCR significantly lowered with increase IAAs supplementation. Also, supplementing 120% IAAs to graded levels of IP 24, 27 & 30% did not improve final mean weight, body weight gain and TGC significantly ($P<0.05$) based on ANOVA and regression analysis. Final mean weight increased significantly with increase IAAs supplementation from 100 to 120% to 24%IP. While, adding of DAAs to 24% IP in both levels of IAAs 100 &120 did not show a significant contribution on fish growth.

Title: Supplementation of crystalline aminoacids at different levels to reduced protein diets in Channel Catfish *Ictalurus Punctatus*

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Title: The effect of crystalline amino acids supplementation in the reduced intact protein diets on muscle growth and intestinal morphology of Channel Catfish *Ictalurus Punctatus*

Primary Author (and presenter): Salem, Shimaa M.
Additional Authors: Mohamed, Tarek & Davis, Allen
Department: School of Fisheries, Aquaculture and Aquatic Sciences; Department of Nutrition & Nutritional Deficiency Diseases
College/School: College of Agriculture; Mansoura University, Egypt

Description:

This study was aimed to assess the effect of indispensable (IAAs) and dispensable amino acids (DAAs) supplementation with the reduction of intact protein (IP) content in channel catfish diets and their effect on fish growth, intestinal morphology and other health indicators. Nine experimental isolipid 8% lipid diets were formulated with different IP levels (32 , 30, 28, 26, 24 %) with supplementation of IAAs; Lysine and Histidine , to meet IAAs minimum requirements as recommended by NRC 2011 with and without addition of DAAs; Glutamic acid and Glycine to the low protein diet 24% at different rate(2, 4, 6, 8%) . Experimental fish (average initial weight 10.56± 0.1g) were randomly allocated into 9 groups, 4 replicate per each 15 fish/ aquarium in indoor recirculating system. Fish were fed experimental diets two times /day as percentage of body weight and were weighted bi-weekly to determine fish growth response. Water quality parameters were measured 2times/day while, Total ammonia nitrogen, Nitrite and pH 2 times/week. At the end of the growth trial, 4 fish per tank were randomly chosen then anesthetized for blood collection and subsequent serum analysis. Then, samples from dorsal muscle and intestine were collected and kept in 10% buffered formalin for measuring the skeletal muscle fibers diameter and numbers. Also, the intestinal fold, enterocyte and microvillus height were measured. The growth results showed that, there is no significant difference ($P>0.05$) in the final means (g), total weight gain(g) and feed conversion ratio (FCR) among fish groups which fed on 32, 30, 28 & 26% IP supplemented with IAAs Lysine and Histidine. However, fish fed with 24 % IP supplemented with IAAs showed significant difference ($P<0.05$) compared to 32 and 30% IP diets. While, the DAAs supplementation to 24% IP diet with IAAs did not show an obvious improvement in catfish growth response. Histological analysis still ongoing and data will be presented in the conference.

Title: Pulmonary function variations in women wearing sports bra, regular bra, and no bra
Primary Authors (and presenters): Anderson, Kelsey,
A., Gurmendi, Marina, M., Moyer, Kyra, A., Sandlin, Kylie, E., & Williams, Kennedy, A.
Additional Authors: Dr. Mary J. Sandage
Department: Department of Communication Disorders
College/School: College of Liberal Arts

Description:

Typically, sports bras are worn during physical activity because they are more restrictive around the chest in order to limit breast motion and pain. To date, there is little published evidence assessing the pulmonary function of women while wearing a sports bra, compared to their pulmonary function while wearing a regular bra or no bra. For this investigation, thirty women were consented for participation and asked to forcefully inhale then exhale into a spirometer during three conditions: while wearing a sports bra, a regular bra, and no bra. Forced vital capacity (FVC) is based on measurements of the total amount of air exhaled during a forced expiratory volume test. FVC was determined via the AstraTouch Spirometer (SDI Diagnostics) and with the use of a handheld mouthpiece and nose clip. Data were collected for each participant for three trials under each condition. It was hypothesized that significant differences in forced vital capacity would be determined with the sports bra condition realizing the smallest FVC volume.

Analyses of the data indicated a significant difference between the no bra trial and the other two trials, with the no bra trials yielding the largest FVC volumes. There was no significant difference between the two bra trials indicating that young, healthy women are more likely to produce a higher FVC without any support garment on. This may have implications for assessment of FVC in hospitals, when patients typically wear a hospital gown without a supporting garment on. This difference may also partially account why the FVC for women is typically lower than that for men, given the difference in what they are wearing when tested. The broader impact of the study may result in researchers understanding how various degrees of chest constriction affect forced vital capacity determination. The research may also bridge a gap in our understanding of the pulmonary function of women and others who wear constricting garments on their chest.

Title: LC-MS-based analysis of antimicrobial compounds produced by *Streptomyces coelicolor* harboring metagenome-derived biosynthetic gene clusters
Primary Author (and presenter): Sandoval-Powers, Megan & Zhang, Yilue
Additional Authors: Kim, Hannah; Santana-Pereira, Alinne; Mead, David; Liles, Mark; & Calderón, Angela
Department: Biological Sciences & Drug Discovery and Development
College/School: College of Sciences and Mathematics & Harrison School of Pharmacy

Description:

Mass spectrometry has been a critical part of the microbial natural product discovery process, and by integrating modern MS-based techniques with recent advancements in microbial metagenomics we can improve our access to novel natural products from underexploited microorganisms. In this study, biosynthetic gene clusters encoding polyketide synthases and non-ribosomal peptide synthetases derived from a soil metagenome were expressed in a *Streptomyces coelicolor* host to identify and characterize metabolites with antibacterial activity. *S. coelicolor* clones found to inhibit the growth of multidrug-resistant pathogens were analyzed with high-resolution LC-MS to identify metabolites with bioactivity. Supernatants from *S. coelicolor* M1154 recombinant clone cultures and control samples were extracted with ethyl acetate, concentrated, and solubilized in methanol or DMSO. Crude extracts were filtered, analyzed by LC-MS QTOF, and chromatograms were recorded at a mass range of *m/z* 100 to 1700 in both positive and negative mode. Resultant MS chromatograms were compared using Mass Profiler Professional (MPP) software to identify uniquely expressed compounds. The constituents of extracts from two *S. coelicolor* clones (P21A5 and P01P12) that showed antibacterial activity were successfully separated on the Poroshell C18 column, and the LC-MS chromatograms contained multiple peaks between 1 – 22 min for both positive and negative scan modes. A chemometrics MPP analysis and visual inspection of mass spectra of bioactive clone and control extracts identified 81 compounds exclusively present in clone P01P12 extract. A simpler chemical profile was detected from P21A5 extracts, and the MPP analysis identified 23 unique compounds that were not present in the control extracts. The dereplication of extracts and MS-based chemical structure elucidation is underway to identify and characterize the metabolite(s) responsible for antimicrobial activity expressed by *S. coelicolor* clones.

Title: Development of an ENSO based approach to rainwater harvesting for irrigation
Primary Author (and presenter): Sangha, Laljeet S.
Additional Authors: Kumar, Hemendra; Lamba, Jasmeet; Srivastava, Puneet; Dougherty, Mark; Prasad, Rishi; & Ortiz, Brenda
Department: Biosystems Engineering
College/School: Samuel Ginn College of Engineering

Description:

In the past two decades, percentage of cropland area irrigated in Alabama (AL) has increased from 42 to 51 percent. In AL, in addition to using groundwater for irrigation, farmers withdraw water from streams to irrigate crops. However, if water withdraw from streams is not done using an ecologically-sustainable in-stream flow criteria, it may potentially harm stream ecology and reduce the dilution capacity of streams, resulting in water quality impacts. In the Southeast U.S.A., El Nino Southern Oscillation (ENSO), climate-variability phenomena affect quantify of water that is available for irrigation. The objective of this study was to evaluate how farmers can use ENSO forecasts to withdraw water sustainably from the streams. The study was conducted in the Swan Creek watershed located in Limestone County, AL, U.S.A. The Soil and Water Assessment Tool (SWAT) model was used to simulate stream flows and develop water withdrawal prescriptions. The La Nina phase of ENSO generated more rainfall in the winter months, and El Nino phase generated more rainfall in the summer months. Trends were similar between precipitation and stream flow. The results of this study indicate that water can be sustainably withdrawn from streams in the winter months during a La Nina phase that could be stored in the on-farm storage ponds. The water from the ponds can be used to irrigate crops during the summer months

Title: Multi-parameter paramagnetic particle characterization by particle tracking velocimetry and optical absorbance

Primary Author (and Presenter): Sannidhi, Abhinav
Additional Authors: Hanley, Thomas & Todd, Paul
Department: Chemical Engineering
College: Samuel Ginn College of Engineering

Description:

Magnetic particles widely varying in composition, size and magnetization are used in cell purification, cell labeling, endocytosis, drug targeting, magnetic resonance imaging, hyperthermia, and in vivo diagnostics. The particle size uniformity and colloidal stability of magnetic particles have been the focus of most producers, whether research or commercial, but magnetization is never specified and is typically mentioned only in terms of percent iron oxide content. Bulk measurements of magnetic susceptibility and saturation magnetization, using a SQUID magnetometer or vibrating sample magnetometer, provide an average value at best and do not account for the distributed nature. By means of particle tracking velocimetry in dark field illumination, we measured multiple characteristics of several thousand individual particles per sample. The Hyperflux™ velocimeter is utilized to provide quantitative video analysis of particles using a high definition camera and capture the particle trajectories in an isodynamic field. Image analysis software converts the image data to the parameters of interest. By measuring calibrated magnetophoretic mobility and diameter, we report apparent magnetic susceptibility and saturation magnetization on a particle-by-particle basis in a short period of time. The dark field imaging technique is limited to the detection of particles with a size above 400 nanometers. The size limitation could be overcome with the help of bright field absorbance technique. Using modified instrument settings, magnetophoretic mobility of magnetic nanoparticles could be estimated based on optical absorbance versus time measured using ImageJ image processing software. In conclusion, estimation of distributions of magnetophoretic mobility, susceptibility, and saturation magnetization allows economical and time-efficient magnetic evaluation of a full range of magnetic particle sizes, nano- and micro.

Title: Public Healthcare in Johannesburg, South Africa
Primary Author (and presenter): Sapienza, Natalie, Anne
Department: Interior Design
College/School: College of Human Sciences/ Auburn University

In Johannesburg, South Africa the healthcare industry has a history of research and innovation, but in recent years private facilities have surpassed public hospitals in providing a wider range of services, with more staff and better equipment. In this study I will be exploring how to provide a public healthcare system that provides high-end healthcare equipment and facilities for women in South Africa. The public healthcare sector in South Africa is extremely underfunded and outdated; the majority of people in Johannesburg that can afford private healthcare opt for that decision. Johannesburg, has become known for its world class healthcare, which is causing people from around the world to seek medical procedures at both private and less well supported public facilities.

The public sector provides healthcare access to 84 percent of patients in South Africa, mainly women and children, and this group is being denied access to healthcare or are receiving treatment in inadequate conditions.

To address this urgent problem of access, we are designing a large-scale healthcare facility that will not only provide public access to top-quality healthcare services for women but will also provide educational programs to train young people to become doctors, nurses, and midwives. This will give women, doctors, and nurses the proper training and healthcare in a high end and updated facility that patients will be able to afford thanks to an innovative public-private partnership. The facility will have evasive learning programs and education stations for doctors and nurses to further their education and update their techniques with constant advancements being made in the medical world. As well as using color theory in the design of the hospital to help patients moral throughout their stay in the facilities and lead them to a quicker recovery.

Title: The study and comparative analysis of pre-modern vernacular architecture
Primary author (and presenter): Sardinha, Amie T.
Additional authors: Toledano, Ansley; Honeycutt, Andrew; & Flowers, Chelsea
Department: Architecture
College/School: College of Architecture, Design, and Construction

Description:

The built environment, to be more specific, the homes in which people live are a reflection of a society's way of life and belief systems. The basis of our dictionary comes from when we noticed that looking at the living spaces of those who came thousands of years before us allow us to understand key aspects of early communities that cannot be learned solely from other gathering and religious spaces that most historical architecture studies base their research on. For us a comparative analysis and dictionary of pre-modern vernacular architecture allows the ability to understand the organization of ancient cities, topics such as their use of complex city grids and central organization. These topics are important because they were the building blocks that were vital to the planning of irrigation and sewage systems in the pre-modern world. Our team not only wanted to focus on the buildings in totality but also the structures and methods behind these buildings, thus the dictionary includes basic structural elements found in primitive huts to the more complex systems found in later pre-modern history. An important conversation to have while discussing living structures is the parallel between human needs and our architecture. For our group another one of our main focuses was how architecture was shaped based off of the social class of the people who occupied them. The architecture dictionary covers the use of different structures that signify wealth and power in pre- modern societies, the organization of pre-modern dwellings to the center of cities, palaces, and temples and what that tell us about the social classes found in that society, and the complexity of the buildings and structures.

Title: Microwave-initiated manufacturing of MoS_2/graphene catalyst for enhanced hydrogen evolution reaction

Primary Author (and presenter): Sarwar, Shatila
Additional Authors: Nautiyal, Amit; Cook, Jonathan; & Zhang, Xinyu
Department: Chemical Engineering
College/School: Samuel Ginn College of Engineering

Description:

The development of low-cost, highly efficient catalysts for hydrogen evolution reaction (HER) is very important to advance an energy economy based on clean hydrogen gas. In this work, we successfully demonstrated the production of MoS_2/graphene catalyst through ultra-fast microwave-initiated synthesis. During the synthesis process graphene played a vital role by absorbing microwave energy and converting it to heat energy, which facilitated the precursors to react vigorously. Moreover, high specific surface area and conductivity of graphene delivered a favorable conductive network for the growth of MoS_2 nanoparticles, along with rapid charge transfer kinetics. As produced MoS_2/graphene nanocomposite exhibited superior electrocatalytic activity for the HER in acidic medium, with a low onset potential of only 100 mV, large cathodic currents and a Tafel slope of 43.3 mV/decade, suggesting the Volmer-Heyrovsky mechanism of hydrogen evolution. Beyond excellent catalytic activity, MoS_2/graphene revealed an unusual ability to enhance the accessible active sites during the HER proceeds. This led to a long cycling stability with a very high cathodic current density of around 1000 mA/cm^2, providing the opportunity of practical application for scalable processing.

Title: Implementing technology to encourage lifestyle change among patients with hypertension
Primary Author (and presenter): Savelle, Michael W.
Additional Authors: Watts, Sarah
College/ School: School of Nursing

Description:

Research indicates that incorporating a heart-healthy diet with the use of technology are effective tools to lower blood pressure in patients suffering from chronic hypertension. This project will examine the use of email and text messaging to encourage healthy eating and increased exercise in order to improve overall results in blood pressure reduction and management. The purpose of this project is to determine the effectiveness of technology-based education through the use of email and instant messaging as it relates to education on a heart-healthy diet and regular exercise in the treatment of high blood pressure in patients living in a rural community.The target population consists of adults (18-75 years) suffering from chronic hypertension. Project participants will be asked to communicate through email and instant messaging to receive heart-healthy diet information, exercise suggestions, and additional education on a healthier lifestyle. These participants will be evaluated via pre/post REAP surveys, blood pressure readings and weights. Participants will also complete an exit interview conducted by the project manager. The project is in progress. Descriptive statistics will be used to describe patient participation, weight loss, and improvements in blood pressure. Patient participation will also be included in follow-up data. The pre-post REAP mean scores will be compared using paired t-tests (alpha =0.05) for patients all patients included in this project. This project will utilize technology (i.e. internet portals, email, and various messaging systems) to improve the treatment of patients suffering from chronic hypertension. Implementation of new communication technologies can be mutually beneficial by dramatically improving patient care as well as saving time and resources for small, rural medical practices.

Title: Strength assessment of soil cement base
Primary Author: Scales, Matthew C.
Additional Authors: Schindler, Anton & Anderson, Brian
Department: Civil Engineering
College: Samuel Ginn College of Engineering

Description:

Soil cement is a mixture of soil, cement, and water that, when compacted and cured, is used as a base for pavements. When creating this mixture during construction, many concerns regarding quality control and strength testing have arisen due to significant variances in core strengths. A difficulty of using soil cement base is finding a suitable method to reliable assess its strength for quality assurance purposes. It has been found that there is a correlation between the dynamic cone penetration (DCP) testing and the strength found in a soil cement cylinder. Using the plastic mold method in the laboratory and in the field, this project's goal is to develop a procedure to reliably assess the strength of soil cement for the Alabama Department of Transportation (ALDOT) to use during full-scale field projects. In the laboratory, data were collected for 3-day and 7-day cylinder strengths as well as DCP results for different types of soil cement. These results were compared against one another over strengths ranging from approximately 150 psi to 800 psi. Laboratory results found a strong correlation between cylinders strength and the DCP output, with a logarithmic function providing the best-fit to the measured results. Further research in the field will be performed to help to finalize the plastic mold method, which will help to provide the industry with a methodology to reliably assess the strength of soil cement base.

Title: Healing the hearts of bereaved caregivers: Impact of legacy artwork on grief in caregivers whose children died of cancer

Primary Author: Schaefer, Megan R.[1]
Additional Authors: Wagoner, Scott T.[1]; Young, Margaret E.[1]; Madan-Swain, Avi[2]; Barnett, Michael[3]; & Gray, Wendy N.[4]
Department: Psychology
College/School: [1]College of Liberal Arts; [2]University of Alabama at Birmingham, Division of Pediatric Hematology and Oncology, Birmingham, AL; [3]University of Alabama at Birmingham, Center for Palliative and Supportive Care, Birmingham, AL; [4]Children's Hospital of Orange County, Orange, California

Description:

Approximately 12% of youth with cancer do not survive, representing a devastating loss for caregivers. Strategies to improve parent coping have been understudied, and no studies have examined the impact of legacy-making interventions on bereaved caregivers' grief. Though legacy-making is frequently offered as standard care to children with terminal illness and their families, these interventions have received little empirical attention in the literature. Thus, this study qualitatively explores the legacy artwork experiences of bereaved caregivers whose children died of cancer. Twelve bereaved caregivers (92% mothers) and 12 healthcare providers participated in individual semi-structured interviews guided by the Dual Process Model of Grief and Continuing Bonds theory. Data was analyzed via conventional content analysis based on an inductive approach. Our findings indicate three themes: 1) Creating legacy artwork allows for family bonding and opens lines of communication between family members regarding the child's impending death, 2) Legacy artwork provides opportunities for caregivers to engage in life-review and meaning-making of the child's death, and 3) Following the child's death, caregivers display the legacy artwork in their home and take comfort in using these projects to continue their bond with their deceased child. These continued bonds facilitate positive coping. In regard to feedback on program development, participants noted that legacy artwork should be offered earlier to all children with cancer in order to mark their illness journey rather than exclusively posing it as an end-of-life project. In conclusion, our findings suggest that incorporating legacy artwork into pediatric palliative care programs may result in positive psychological outcomes for bereaved caregivers. Additionally, they highlight the significance of implementing complementary supports on pediatric medical units to comprehensively address the needs of patients and their families.

Title: Evaluating impacts from large-scale climate circulations on crop failure risks in the United States using a Bayesian approach

Primary Author (and presenter): Schillerberg, Tayler A.
Additional Authors: Tian, Di
Department: Crop, Soils, and Environmental Science
College/School: College of Agriculture

Description:

Large-scale climate variability, through teleconnections, potentially contributes to crop yield variability both regionally and globally. Crop failures, which are partially due to climate variability, threaten global food security. Regions that produce a large supply of agriculture commodities can be susceptible to crop failure, thus causing concern for global food security. The United States, as one of the major agricultural producers in the world, is influenced by several large-scale climate circulations that contribute to climate variability: Atlantic Multidecadal Oscillation (AMO), North American Oscillation (NAO), El-Niño Southern Oscillation (ENSO), Pacific Decadal Oscillation (PDO) and Pacific-North American (PNA). Since many of the climate extreme events are associated with these climate oscillations, they are potentially influencing risks of crop failure. The objective of this study is to assess climate-induced changes of annual crop failure risks for maize and winter wheat from 1960 to 2016. We assess the influence of large-scale climate circulations on the frequency of crop failure in the rainfed regions of the United States using a Bayesian approach. The crop failure, for each climate division, is defined as the lower 25th percentile of the de-trended annual yield for maize and winter wheat. A positive phase of AMO greatly increases the crop failure frequency in maize. Crop failure frequency increased when AMO is in positive phase and PDO is in negative phase, likely due to drought conditions experienced. Crop failure for both maize and winter wheat increases when ENSO and PDO are out of phase. These findings have implications for understanding long-term changes in crop risks and the potential for improving seasonal forecasting in agriculture.

Title: Neurotropic effect of β-hydroxybutyric acid
Primary Author: Schwartz, Jack
Additional Authors: Majrashi, Mohammed; Almaghrabi, Mohammed; Fujihashi, Ayaka; Alghenaim, Fada; Reed, Miranda; Suppiramaniam, Vishnu; & Dhanasekaran, Muralikrishnan
Department: Drug Discovery and Development
College/School: Harrison School of Pharmacy

Description:

Ketone bodies are useful alternative source of energy when glucose is not metabolized effectively. Ketone bodies synthesized in lipid stores in the liver where they are produced during periods of starvation. Ketone bodies have been the topic of research for their possible therapeutic neurotropic effects in various neurodegenerative diseases such as Parkinson's disease, dementia, and seizures. Ketone bodies provide a superior energy source and they have been shown to increase mitochondrial function along with biogenesis. Continuing research on Ketone bodies as a therapeutic for neurodegenerative diseases, is necessary to find an effective way to administer/treat patients with Ketone bodies to mitigate their symptoms. In the current study, hippocampal HT-22 cells were treated with β-hydroxybutyric acid at different doses to elucidate the neurotropic effect. Markers of oxidative stress, mitochondrial function and apoptosis were investigated. The ketone body (β-hydroxybutyric acid) showed significant dose-dependent increase in cell viability. β-hydroxybutyric acid exhibited antioxidant effect by decreasing oxidative stress markers such as reactive oxygen species and lipid peroxidation. Moreover, β-hydroxybutyric acid improved mitochondrial functions by increasing Complex-I and Complex-IV activities. Furthermore, β-hydroxybutyric acid significantly decreased apoptosis as seen by decrease in caspase-1 and caspase-3 activities in a dose-dependent manner. We hypothesize that the neuroprotective effect of Ketone bodies is a promising route for research into therapeutics in neurodegenerative diseases.

Title: If These Vessels Could Talk: The Importance of Archaeological Collections Management
Primary Author (and presenter): Seemann, Lillian Catherine
Department: Anthropology
College/School: Liberal Arts

One day on an archaeological field survey will generate upwards of one month of lab work. When lab work stockpiles, many objects remain unattended from the site for decades until a new scholar comes to use them. The issue with this system is that it does not effectively use the collections of an archaeological repository nor the resources therein. There is no real organizational scheme, so artifacts become difficult to access. Over the course of this semester I will accession parts of the Auburn University archaeological type collection in an attempt to shape it into a more valuable resource and highlight sherds that are the best example of their type. The accessibility of the collections is vital for future use in the scholarship surrounding past lifeways and their reconstruction as well as a hands-on experience with archaeological artifacts. Our collection features pieces that show variation on the standard type, which reflects the use of local materials. It shows interaction between different groups of people over time in trade relationships, and also what life could have been like in terms of subsistence. My focus for this presentation will be the importance of collections management, the skills required for handling these artifacts, and their value as a collective whole.

Title: Comparative genomic analysis of *Fusarium* wilt isolates associated with virulence on cotton

Primary Author (and presenter): Seo, Seungyeon
Additional Authors: Coleman, Jeffrey
Department: Entomology and Plant Pathology
College/School: Agriculture

Description:

Fusarium wilt is one of the devastating diseases of cotton (*Gossypium* species). The causal agent, *Fusarium oxysporum* f. sp. *vasinfectum* (Fov), is genetically diverse and the molecular mechanisms contributing to pathogenicity on cotton have been understudied. A comparative genomics approach was undertaken to elucidate fungal virulence factors for cotton by identifying differences in genes and genomic organization between isolates. The genomes of five Fov isolates were assembled with high-quality and compared with each other as well as published genomes of *F. oxysporum* that are not virulent on cotton. Genome analysis revealed that Fov 89-1A, the representative from the highly virulent race 4 genotype, had the largest genome size, number of predicted genes, and repetitive elements when compared to the other four Fov genomes. Further comparative analysis with a total of 17 *F. oxysporum* genomes revealed they had similar proportions of putative secreted proteins; however, we found a specific subset of putative small secreted proteins existed only in isolates able to infect cotton and could be serving as effectors for Fov colonization. Furthermore, this comparative approach may yield insights into the development of disease management strategies for cotton wilt.

Title: Effect of LEC-specific P301L Tau on synaptic transmission and learning and memory
Primary Author (and presenter): Setti, Sharay E.
Additional Authors: Bloemer, Jenna; Pinky, Priyanka D.; Du, Yifeng; Suppiramaniam, Vishnu; & Reed, Miranda N.
Department: Drug Discovery and Development
College/School: Harrison School of Pharmacy

Description:

Alzheimer's disease (AD) is biologically characterized by accumulation of beta-amyloid plaques, neurofibrillary tangles containing hyperphosphorylated tau protein, and pervasive neuronal damage ultimately leading to neuronal death. Because of the irreversible nature of the neuronal death, early detection of AD is important for any treatment aiming to halt or prevent neuronal damage. Currently, existing cognitive screening tasks for AD are optimized for learning and memory associated with brain regions affected later in the disease state, such as the hippocampus and prefrontal cortex, but do not selectively assess function of one of the first brain regions affected in AD, the lateral entorhinal cortex (LEC). Tasks aimed to assess LEC function, as it is the first area to exhibit tau pathology, would aid in early detection of AD, thereby offering a better prognosis for affected individuals. Thus, our goal is to develop a cognitive test sensitive to alterations in LEC functioning within the context of tau pathology. To do so, we utilized a viral vector to induce mutant P301L tau pathology in the LEC of otherwise healthy mice. Our results indicate that compared to controls, LEC-P301L mice exhibit early AD associated tau pathology, as indicated by increased phosphorylation and conformation specific changes in tau protein. Additionally, LEC-P301L mice exhibit impaired basal synaptic transmission as indicated by a reduction in long-term potentiation. To be determined is whether the presence of pathology and impairments in synaptic transmission are also associated with cognitive deficits in LEC-dependent learning and memory. Results from this study will aid in the creation of a novel tool that is sensitive in early AD pathology induced cognitive deficits, leading to earlier detection of AD and subsequent improved patient prognosis.

Title: Understanding student's mental illness and their problem-solving behaviors in the digital age

Primary Author (and presenter): Sexton, Stephanie L.
Department: Communication
College/School: College of Liberal Arts

Description:

One third of all adult ill health in the United States, is a result of mental health issues such as depression and anxiety. Despite the importance of understanding how cyberspace can play a significant role in coping for people suffering mental health illnesses, previous research has paid little attention to the relationship between individuals' communicative behaviors online (cybercoping) and their coping outcomes such as addressing negative feelings or improving medical outcomes. This gap in mental health research indicates a need for further research to understand cybercoping. This study will focus on college students, preceding future research with the general population, addressing the need to better understand how people cope with mental illness online. College students at Auburn University responded through the online survey tool, Qualtrics, providing information about their mental health and online coping processes. Using structural equation modeling (SEM), this study provides a greater understanding of a successful model of communicative behaviors online and coping methods. Consequently, this contributes to extending the knowledge of mental health by testing the theoretical framework of cybercoping in the context of mental health issues. Addressing mental illness crises earlier, may yield a reduction in the mental illness crisis affecting adult ill health.

Title: Design of Darrieus type vertical axis water turbine for shallow water channels
Primary author (and presenter): Shah, Syed Hassan Raza
Department: Aerospace Engineering
College /School: Samuel Ginn College of Engineering

Description:

The rising need of energy supplies and its shortfall in the world has greatly affected the socio-economic life specifically in third world countries and far flung areas. Hydel energy is considered as one of the most inexpensive form of energy which can deployed through mega projects or micro hydel plants. The conventional hydro turbines projects require a significant high initial infrastructure development cost and they operate on the principal of converting potential energy of the falling water into mechanical/electrical energy. Whereas, run-of-the river type turbines convert kinetic energy of the flowing water into mechanical/electrical with minimal infrastructure requirements i.e. their cost is lower. Vertical axis turbines (VAT) are well suited for run-of river hydel projects. VAT are categorized by their rotor among which Savonius and Darrieus are the most common one. Darrieus rotor type turbine is driven by the lift force and has higher efficiency as compared to Darrieus turbine. The aerodynamic/hydrodynamic design of such turbine is very complex as the rotor blades experience wakes, which is generated by themselves and by other blades. The aim of the research is to carryout hydrodynamic design, experimental testing and analysis of straight blade H-Darrieus type vertical axis turbine suitable for shallow water channel having water velocity of 3m/s and 1.5 m depth. Turbine is designed using double multiple stream tube model (DMST) and effect of each design variable on the overall efficiency of the turbine to develop a design methodology for Darrieus turbine. The results through DMST are also compared with the experimental results.

Title: Urban hygge: public space, urban design, and their impacts on mental health
Primary Author (and presenter): Shannon, Ian, D
Additional Authors:
Department: Environmental Design
College/School: Architecture, Design, and Construction

There exists a growing need to better understand how our cities impact our well-being; not just in terms of physical health, but social and mental health as well. This trend in urban design thinking has been started by figures like Jane Jacobs and Jan Gehl, and continued today by groups like the Centre for Urban Design and Mental Health. It reflects stronger integration of people into the actual design and planning of the cities that they live in. In this thesis I present some of the literature and research on the relationship between urban design and mental health, including the groups and individuals mentioned prior, as well as a range of sources through Gary Evans' *The Built Environment and Mental Health*. This research serves as a base for my own research, which builds off an established claim that cities impact mental health in a variety of ways. My focus in this thesis, and the focus of my studies abroad in Copenhagen, is the relationship between the Danish concept of hygge and the design of public space. Throughout the three weeks I spent in Copenhagen, I set about analyzing three city squares with the following criteria: centers of activity, overall comfort, sensory detail, and the presence of other people. Ultimately I found the square of Kultorvet to be the most successful of the three, and the presence of other people to be the chief quality of a successful and hyggelig public space. To give context in a local setting, I compare my findings in Copenhagen to Samford Lawn, an iconic public space in Auburn. It is my firm belief that our current and emerging cities have immense potential to embody these ideas of hyggelig urban design, not only in squares and streets, but in all parts of the city.

Title: Suppression of cytoplasmic incompatibility
Primary Author (and presenter): Sharma, Gagan Deep
Additional Authors: Beckmann, John F.
Department: Entomology and Plant Pathology
College/School: College of Agriculture

Description:

Mosquitos spread diseases like Zika, Dengue, and Malaria. Controlling reproduction is a simple means of mosquito control. If one sterilizes mosquitos, they will not reproduce. *Wolbachia* is a maternally inherited bacteria that infects insects. *Wolbachia* sterilizes mosquitos sperm resulting in an embryonic lethal phenotype, called cytoplasmic incompatibility, wherein eggs from un-infected females fail to develop when fertilized from *Wolbachia*-infected males. Contrary to this, if male and female both are infected, embryos are viable. CI can be rescued and suppressed under certain conditions. The molecular mechanism of CI involves a deubiquitylating enzyme, CidB. Ubiquitin is a post-translational modification which commonly regulates substrate stability. *Wolbachia's* CidB removes ubiquitin from a substrate, but this target substrate is unknown. As a strategy to uncover this target, our research has focused on identifying host genes with the ability to modulate CI penetrance. We measure CI penetrance by counting hatch-rates of insect eggs in a model *Drosophila* system. By finding alleles capable of suppressing CI, we will gain insights into the upstream targets of CidB. With knowledge of the molecular mechanism of CI, we can better optimize the system for application of the sterile insect technique.

Title: Microcapsule based self-healing for 3D printed polymer composites
Primary Author (and presenter): Shelke, Shreyas
Additional Authors: Celestine, Asha-Dee
Department: Polymer and Fiber Engineering
College/School: Samuel Ginn College of Engineering

Description:

Self-healing materials have gained ~~an~~ increased traction among the research community, over the years~~,~~ because of their inherent ability to detect and autonomously heal any damage to a material system. Various attempts have been made to develop increasingly efficient self-healing systems, that can be successfully integrated into a material for large scale production. There are three main approaches for achieving autonomous self-healing in a material system: microcapsule-based healing systems, vascular-based healing systems, and intrinsic healing systems. This research is focused on the preparation of a self-healing system with microcapsules as the healing agents. High impact polystyrene (HIPS) and Polylactic acid (PLA), two materials that exhibit excellent 3D printing properties, are used as the bulk polymer in these systems. Melt casting and solution casting methods are used to produce the bulk HIPS and PLA polymer respectively, loaded with microcapsules filled with ethyl phenyl acetate (EPA) or dicyclopentadiene fluid. Comparative tests of samples with and without ~~the~~ self-healing microcapsules will be conducted to determine the effect of the microcapsules on the virgin and healed properties of HIPS and PLA. Characterization tests will include Dynamic Mechanical Analysis (DMA), Differential Scanning Calorimetry (DSC), Thermogravimetric analysis TGA), as well as tensile and fracture tests.

Title: A memoryless walk: The forecast of women faculty movement based on the Markov chain model

Primary Author (and presenter): Shi, Yuewei
Additional Authors: N/A
Department: Educational Foundations, Leadership and Technology
College/School: College of Education

Description:

With the development and expansion of U.S. higher education, the number of women faculty is continually growing. The increase of women faculty number promotes the advancement of social justice and improved social status of women in higher education settings. The increase of women faculty number has caused a more frequent and regular human resources movement in academic area. The purpose of this study is to explore the academic flow model of women faculty in higher education. It is expect that the findings could assist the higher education administrators to understand the complex trends of women faculty movement, and approach suitable strategies for the women faculty position planning and resources allocation to promote gender equality in college settings. This research uses Markov forecasting method and the original data related employment statistics of women faculties which retrieved from the Integrated Postsecondary Education Data System (IPED). The author chooses four southeastern higher education institutions as research samples. The employment statistics of tenure and non-tenure women faculties from these four institutions are organized and used to predict the future changing trend of women faculty employment. This research is divided in to four parts. The first part introduces the current situation of women faculty employment in higher education. The second part presents the employment data of women faculty from four colleges. The third part introduces the Markov chain forecasting method and data analysis process. The forth part discusses the predictive findings and the suggestions for current women faculty employment fair.

Title: Microcapsule-based self-healing for 3D printing
Primary Author (and presenter): Shinde, Vinita
Additional Authors: Celestine, Asha-Dee & Beckingham, Bryan
Department: Chemical Engineering
College/School: Samuel Ginn College of Engineering

Description:

Additive manufacturing technologies have seen a dramatic increase in both attention and industrial application. Revolution of the technology is caused due to mass customization, decreasing costs of 3D printing equipment, low waste generation and overall progress in ease-of-use through software improvements. There are currently a limited range of polymer materials available for 3D printing. This results in new opportunities for developing material platforms for 3D printing to improve properties or tailor properties for specific applications. We aim to improve the lifetime of 3D printed polymeric objects through the incorporation of self-healing properties. Inspired by biological self-healing in which a damage event triggers an automatic healing response, microcapsules containing healing agents can be embedded into a host material that upon rupture during a damage event heal the surrounding material by polymerization, entanglement or cross-linking. We aim to synthesize microcapsules and leverage microcapsule shell wall chemistry to tune their properties to both withstand high shear stresses during 3D printing and promoting the automatic release of healing fluid to the crack site.3D printable self-healing polymers will increase product shelf life, mechanical performance and thereby improve material sustainability and long-term cost. Double shell wall polyurethane/poly (urea-formaldehyde) microcapsules are synthesized by in-situ polymerization. Microcapsules with both solvent and monomer core fluids are prepared to investigate both solvent-healing and monomer healing mechanism of self-healing. Microcapsules containing healing agent are incorporated into the host polymer matrix or are coated on polymer filaments to produce 3D printed polymer objects capable of self-healing. Microcapsules survivability after 3D printing process is evaluated as the healing efficiency and mechanical strength of fabricated 3D printed objects.

Title: Estimating illegal take of white-tailed deer over bait in east Alabama
Primary Author (and presenter): Shortnacy, James, W.
Additional Authors: Gulsby, William, D., and Ditchkoff, Stephen, S.
Department: Wildlife Ecology and Management
College/School: Forestry and Wildlife Sciences

Many states, including Alabama, prohibit the use of artificially concentrated bait (e.g., corn) to aid in harvest of white-tailed deer (*Odocoileus virginianus*). Specifically, in Alabama, any bait must be ≥100 yards away and out of sight of the hunter. Nevertheless, poachers often disregard this law and a number of deer are illegally killed over bait each year in Alabama. However, little is known about the prevalence of this practice within the region. Therefore, we visited deer processing facilities in east Alabama, as well as west Georgia where hunting directly over bait is legal (as a control). At each processing facility, we aged and sexed deer and inspected their oral cavity for the presence or absence of corn. We assumed that if corn was present in the oral cavity during our inspection, then it was present in the deer at time of death, and the deer was harvested while consuming corn. We sampled a total of 187 deer in Alabama, 13 (7.0%) of which had corn present in their mouths, and we sampled 31 deer in Georgia, 3 (9.7%) of which had corn present in their mouths. Based on a chi-square test, the proportion of deer harvested over bait in each state did not differ statistically ($P = 0.59$). Although these are preliminary results and our sample sizes are relatively limited, it appears as though baiting deer is a relatively common practice, regardless of legality. Further, because most who harvest deer over bait do so before the animal has the opportunity to ingest bait from the pile, our estimates of the proportion of deer harvested over bait are likely low.

Title: Cultural appropriation vs appreciation in illustration
Primary Author (and presenter): Shorts, Noel, A.
Department: Art History
College/School: Liberal Arts

This poster investigates the difference between cultural appropriation and appreciation in the practice of illustration. As artistic practice becomes more multicultural artists must learn to have respect for other artistic practices and traditions which are not their own. Cultural appreciation is being inspired by another culture to create while still respecting another that culture's values and aesthetic traditions in practice. Cultural appropriation is the taking of aesthetic elements without respect or credit to the culture they came from. To understand the difference between appropriation vs appreciation I looked at artists from Japan, Iran, Ghana and India that I felt fit my model of appreciation, and created my own work in response to the work I studied. Through this research I have developed a greater understanding of the difference between appropriation and appreciation. The key impact I took away is the importance of understanding the cultural and aesthetic traditions to remain respectful when artists create their own work inspired by other cultures.

Title: Urban vulnerabilities of Kathmandu Valley: A case study of urban flooding in the most populated city of Nepal
Primary Author (and presenter): Shrestha, Megha
Additional Authors: Mitra, Mitra; Burton, Christopher; & Marzen, Luke
Department: Geosciences
College/School: College of Science and Mathematics

Description:

Disasters are defined as an occurrence of disruptive events that cause the normal condition of existence difficult. Natural disaster is an event that is caused by the natural forces of earth and man-made disasters are due to human activities. Urban flooding is an example of man-made disaster and hurricanes are the example of natural disaster. Nepal is a poor country and one of the least urbanized countries in the world. However, it is one of the fastest urbanizing countries in Asia with a level of urbanization of 18.2 percent since 2014 and urbanization rate of 3 percent. Kathmandu, being the capital of the country, has witnessed the most rapid urbanization with 4.3 annual population growth rate. Kathmandu does not have much scope for urban sprawl, but the city is expanding further and further out with increasing infrastructural density and unplanned-unmanaged urbanization causing various environmental impacts. With increasing impervious surfaces there is decrease in evapotranspiration, decrease in storage and increase in runoff and changes in natural drainage system. This puts pressure on the man-made drainage system increasing the likelihood of the drainage system being overwhelmed resulting in urban flooding. Kathmandu receives an annual rainfall of 1400 mm per year ranging highest from June to September. There has been number of recorded cases of urban flooding and with increasing construction projects, the scenario is worse. This study examines the flood potential of five major rivers running through Kathmandu using 1-D HecRAS with HecGeoRAS extension in coordination with ArcGIS. High-risk, flood-prone areas were identified, which showed the inundation of huge areas of urban land. This study also makes a comparative analysis with a developed city like Kyoto and analyze the mitigation techniques adapted by them. This paper suggests few low budget and applicable strategies adopted from Kyoto for Kathmandu to better prepare from the impacts of such disasters.

Title: Investigation into property-performance relationships for laser-powder bed fusion additive manufacturing
Primary Author (and presenter): Shrestha, Rakish
Additional Authors: Shamsaei, Nima
Department: Mechanical Engineering
College/School: Samuel Ginn College of Engineering

Description:

The influence of part size and geometry on the thermal history and resulting mechanical properties of additive manufactured 17-4 precipitation hardening (PH) stainless steel (SS) fabricated using a laser-powder bed fusion (L-PBF) process is investigated. Three different types of geometries including a dog-bone part (i.e. representing the specimen or the witness coupon) and two square rods with different cross-sectional sizes (i.e. representing the parts) were designed in this study. Mechanical properties were determined under quasi-static tensile and uniaxial strain-controlled fully-reversed fatigue loading conditions. Experimental results confirmed a minimal effect of part geometry on the tensile behavior of the L-PBF 17-4 PH SS, while part geometry had a significant impact on the fatigue behavior in the high cycle regime. Specimen fabricated from the large square blocks contained the lowest amount of porosity, and consequently, exhibited the highest fatigue resistance. On the contrary, highest amount of porosity was observed in the specimens fabricated from the dog-bone parts resulting in them having an inferior fatigue resistance as compared to the other sets.

Title: Study of multi-rotor helicopter flowfield in close proximity of ground
Primary Author (and presenter): Silwal, Lokesh
Additional Authors: Munz, Karlyle & Raghav, Vrishank
Department: Aerospace Engineering
College/School: Samuel Ginn College of Engineering
Description:

The downdraft of air below the helicopters can be very dangerous to its surroundings when they are operating close to the ground. In addition, brownout phenomena can also occur which is the formation of dust cloud around the helicopter, lowering the pilot's visibility and leading to accidents. Thus, the study of the flowfield of the helicopters close to the ground is very important to understand and mitigate these effects. The aerodynamic characteristics of the rotorcraft wake in presence of ground has been studied thoroughly for conventional helicopters, which consists of a main rotor for thrust generation and a tail rotor for torque balance. However, limited research has been carried out for next generation multi-rotor helicopters, which have distinct advantage of speed, range and payload over their traditional counterparts. Thus, this study is focused on the flowfield characterization of one of the multi-rotor configurations – the counter-rotating coaxial rotor system, in close-proximity of the ground. In this poster, the flowfield is studied using flow visualization and particle image velocimetry (PIV) in a thrust scaled experimental setup operating in torque matched condition. The nature of the flowfield was observed to be highly unsteady which is further investigated across important design parameters.

Title: Hypertension management using a home telemonitoring program
Primary Author (and presenter): Sims, Whitney B.
Additional Authors: Howell, Eleanor
College/ School: School of Nursing

Description:

Nonadherence to medication regimens is a common occurrence; however, patients diagnosed with hypertension are four to six times more likely to be non-adherent. The purpose of this project was to improve medication compliance among newly diagnosed hypertensive adults by early identification of compliance barriers through the use of telemedicine (e.g., affordability, negative side effects, adverse drug reactions, forgetfulness, etc.). The target population included adults aged 18 or older, newly diagnosed with hypertension in a primary care clinic. Following participant agreement, patients completed a pre-implementation evaluation assessing the individual's confidence in managing health. The patient received individualized teaching on hypertension. Patients received a follow-up phone or email conversation every two weeks after the initial office visit to assess home blood pressure readings, medication compliance, and compliance barriers for two months. The project is currently in progress. Descriptive statistics will be used to describe the patient population, office and home blood pressure readings, hypertensive symptoms, medication compliance, and compliance barriers. Pre and post implementation blood pressure readings, pre and post levels of medication compliance, and pre and post health confidence surveys will be compared using paired-samples t-tests. Among patients newly diagnosed with hypertension, bi-weekly follow-up phone or email conversations could aid in the early identification of patients at risk for noncompliance. Telemedicine facilitates patient-provider communication and could greatly increase medication adherence and hypertensive control. Identification and follow-up with newly diagnosed hypertensive patients is attainable in this primary care setting and further implementation of the project is necessary.

Title: Regression and correlation analysis for runoff ratio and runoff deviation ratio
Primary Author (and presenter): Singh, Arshdeep
Additional Authors: Kumar, Sanjiv
Department: School of Forestry and Wildlife Sciences
College/ School: College of Agriculture

Description:

Climate, vegetation, potential evapotranspiration and precipitation determine the annual runoff and runoff deviation rates defined as ratio of inter-annual runoff variability to precipitation variability. The ratio of annual potential evaporation to precipitation, referred to as the dryness index, has been shown to describe the runoff ratio (the ratio of annual runoff to precipitation) of catchments from a range of climatic regimes in several studies. It has been shown that dryness index alone can be used to obtain an estimate of ratio of standard deviation of annual runoff estimates to that of precipitation (the runoff deviation ratio). We have assessed the theoretical formulation of runoff processes using streamflow data from USGS, precipitation and dryness index data from PRISM and vegetation index data from MODIS Earth data websites. Runoff ratio and its deviation are predictant variable; and Dryness index and vegetation index are predictor variables. We have performed analysis for a total of 125 watersheds across United States, and a subset of 68 watersheds with dryness index less than one. i.e., the wet regions. Our analysis shows that dryness index is the primary predictor (xx% of variance explained) of runoff ratio and followed by a smaller contribution from the vegetation index (yy% variance explained).

Title: Application time and rate impact of poultry litter and urea on corn grain yield in Alabama
Primary Author (and presenter): Singh, Rajveer
Additional Authors: Prasad, Rishi; Balkcom, Kip; Guertal, Beth; Lamba, Jasmeet; & Ortiz, Brenda
Department: Crop, Soil and Environmental Sciences
College: College of Agriculture

Description:

In Alabama, poultry is a major industry having a total economic impact of $15.1 billion and generating an estimated 1.4 billion kg of poultry litter (PL). PL is regarded as relatively cheap source of nutrients particularly N and P for row crops especially corn (*Zea mays* L.). However, there is little information regarding yield benefits with respect to PL application rate and time contrary to urea-based fertilization. The study compared the application rate and time effects of urea and PL on corn grain yield. The research was conducted at two sites (E.V Smith and Wiregrass) in a randomized complete block design with four replications. The treatments included two N sources applied at two rates i.e. 168 (low) and 336 (high) kg N/ha for urea and a similar N equivalent of PL (5.60 and 11.20 Mg/ha); two application times (single application at planting and split application as 25 % N at planting + 75% N at V6) and two urea and PL combinations each with low and high rate. The corn yields were standardized to 15.5 % moisture and 56 pounds per bushel. The results indicated that there was a significant effect of treatment ($P<0.0001$) and location ($P<0.0001$) on grain yield, however the interaction effect of treatment and location was also significant ($P<0.0001$). A significant N source × location interaction effect ($P<0.0001$) and N rate × location interaction effect ($P = 0.0003$) on grain yield was observed. There was no significant difference between single and split application of both PL and urea ($P > 0.05$).

Title: Planetary protection for the Europa lander mission

Primary Author (and presenter): Morgan R. Sisk[1]
Additional Authors: Natalie R. Williams[1], Thomas P. Lampton[2], and Mark R. Liles[1]
Departments: [1]Department of Biological Sciences, Auburn University, Auburn, USA
[2]NASA's Marshall Space Flight Center, Huntsville, USA
College: College of Science and Mathematics

The search for extraterrestrial life requires that measures are taken throughout the course of space exploration to prevent microbial contamination of spacecraft hardware. NASA's Office of Planetary Protection has instituted requirements to minimize the risk of terrestrial contamination. As NASA missions have evolved to meet rigorous scientific objectives, the task of reducing the bioburden of flight systems has become increasingly complex. Bacterial endospores are of paramount concern for contamination due to their demonstrated resistance to the space environment. For the Europa Lander mission, a potential strategy to reduce bioburden associated with the rocket motor is through investigation of antimicrobial properties of rocket motor adhesives used to apply insulation material that is expected to come into direct contact with the Europan surface. Consequently, we tested rocket motor primer and adhesives against four *Bacillus* spp. that were previously documented on spacecraft hardware. We assessed reductions in viable vegetative cells and spores of *Bacillus* spp. with and without exposure to rocket motor adhesives. In the first bioassay, reduction of the fluorescent dye resazurin in viable cells indicated that exposure to rocket motor primer and/or adhesives yielded a 10^6-10^8 reduction in colony forming units (CFUs) for each of the *Bacillus* spp. In subsequent bioassays using *Bacillus* spp. spores, exposure to rocket motor primer and/or adhesives induced reductions in CFUs per mL of 30.3% at 24 h to a 10^9 magnitude reduction in viable spores after 6 weeks, when spores were allowed to germinate in the presence of the antibacterial compounds. LC-MS analyses indicate multiple compounds present in aqueous solutions obtained from these primers or adhesives that could have antibacterial activity. Ongoing studies are evaluating reductions using a cryogrinding procedure and will be used to assess the contribution of these compounds for NASA's life-search missions.

Title: Computational modeling of electrically actuated shape memory polymers
Primary Author (and presenter): Siwakoti, Midhan
Additional Authors: Mailen, Russell
Department: Aerospace Engineering
College/School: Samuel Ginn College of Engineering

Description:

Shape memory polymers (SMPs) are extensively studied for self-folding origami due to their low cost, large strain recovery, low actuation energy, and variety of activation stimuli, for instance light and electricity. SMPs utilize viscoelastic material behavior to change shape in response to an applied stimulus. Previous studies on electrically actuated SMPs reported empirical results on shape recovery for composites subjected to specific conditions, all of which require rigorous experimentation. Here, we introduce a finite element framework capable of predicting the coupled electro-thermo-mechanical response of electrically actuated SMPs. This framework requires as inputs material properties, such as electrical conductivity and viscoelastic parameters. The viscoelastic material model is implemented using a Prony series model that is fit to experimental dynamic mechanical analysis (DMA) data. Using this framework, we predict the shape recovery behavior of electrically actuated SMPs subject to various thermal, electrical and mechanical loads and evaluate the sensitivity of the response to the material properties. Additionally, we show that folding is influenced by the amount of prestrain and voltage applied. This computational framework provides a fundamental understanding to the electro-thermo-mechanical response of electrically actuated SMPs for self-folding origami applications.

Title: Identification of key genes influencing aggressiveness and metronomic treatment for prostate and breast cancer

Primary Author (and presenter): Skarupa, Elena, B
Additional Authors: Jasper, Shanese; Ghosh, Taraswi Mitrah; Arnold, Robert D
Department: Drug Discovery and Development
College/School: Pharmacy, COSAM

The objective of this study was to determine if there is genomic evidence across various cancers of the efficacy of metronomic (METRO) dosing to create more tailored patient treatment. Breast and prostate cancers are among the leading causes of cancer deaths in the United States. Early detection and diagnosis in addition to targeted therapies, have improved survival rates. Chemotherapeutic drugs like docetaxel or cabazitaxel for prostate and doxorubicin for breast cancer, alone or in combination, remain the primary treatment options. However, cumulative dose-limiting toxicity and drug resistance limits clinical utility. Thus, aggressive metastatic prostate or breast cancer have the greatest need for new, effective treatment strategies that will improve survival or delay disease progression. METRO or repetitive, low-dose drug administration, shows the ability to overcome drug resistance and increased drug effectiveness in many cancers, but the underlying mechanisms are not understood completely. Therefore, we performed cancer pathway candidate gene-based expression study following METRO and conventional (CONV) dosing, along with the control (no-drug) treatment, in aggressive prostate cancer cell lines. We identified SERPINE1 as a signature for aggressiveness in prostate cancer and SERPINB5 was an important gene for metronomic therapy. Additionally, we have identified sPLA2-IIA for breast cancer. Further validation of protein expression for SERPINE1 and SERPINB5 in prostate by immunoblotting support our findings. Future studies will focus on determining *in vitro* DOX-METRO *vs* CONV cytotoxicity for metastatic breast cancer cell line, MDA-MB-231 and evaluating sPLA2-IIA gene in breast cancer cell lines by immunoblotting. Thus, using –omics-based approaches we determined gene signatures that may be used to explore the nature of the cancer, to identify targets for therapy and for personalizing treatment regimens with the goal of improving overall survival.

Title: Implementing an exercise treatment program into ADHD treatment
Primary Author: Smith, Shelby A.
Adviser: Ellison, Kathy
College/ School: School of Nursing

Description:

The American Psychological Association (APA) states that in 2011 11% of school-aged children in the United States were diagnosed with Attention Deficit Hyperactivity Disorder (ADHD) (APA, 2014). Medication is the most widely used treatment option for pediatric ADHD, but long-term effects of psychostimulants haven't been studied (CDC, 2017). Exercise treatment is an underused option that can result in decreased symptoms in patients in collaboration with medications or alone. A small test of change project was conducted to test the effects of exercise on pediatric patients' symptoms with ADHD. Patients between the ages of five and eighteen diagnosed with ADHD being treated at East Alabama Psychiatric Services were the target population. The small test of change implemented consisted of the initial use of the Vanderbilt ADHD Parent Rating Scale (VADPRS) and a survey of current weekly physical exercise by the child. A meeting was held with interested parents where the survey was filled out and a short educational session by video and pamphlet were conducted. The meeting allowed parents to discuss methods of physical activity for their child. One month later parents were contacted to complete the survey again. The results were stored in excel, then exported into SPSS for analysis. In SPSS a dependent t-test and independent samples test were performed to analyze the results pre and post project. The data analyzed included patient physical activity pre and post project, as well as VADPRS scores pre and post project. If increased exercise for ADHD patients result in expected decreases in the VADPRS scores, the expansion of education on exercise use with ADHD is warranted in this setting.

Title: Intranasal pramlintide administration for the dissection of metabolic and cognitive outcomes of amylin-based therapies in a transgenic mouse model of Alzheimer's disease
Primary Author (and presenter): Smith, Warren
Additional Authors: Suppiramaniam, Vishnu
Department: Drug Discovery and Development
College/School: Harrison School of Pharmacy

Description:

Recent pre-clinical investigation of the pancreatic hormone amylin and its mimetic pramlintide has generated interest in amylin-based therapies as possible disease-modifying treatments for Alzheimer's disease (AD). *Ex vivo* studies have provided evidence for possible non-metabolic therapeutic mechanisms of amylin and pramlintide, but no *in vivo* assessments to date have prospectively controlled for the significant metabolic impact of these agents despite the well-established positive effects of diet and lifestyle modifications on AD risk and pathologic progression in the absence of pharmacologic intervention. To determine whether amylin-based therapies modify AD via direct cognitive or indirect metabolic mechanisms. The effects of pramlintide on cognition, synaptic plasticity, and AD pathology will be compared following intraperitoneal (IP) and intranasal (IN) administration in the Tg2576 mouse model of AD. Simultaneous adherence to a pair-feeding paradigm will determine if established cognitive and electrophysiological improvements following administration of amylin-based therapies occur independently from caloric restriction and/or weight loss. At the end of the ten-week treatment window, Morris Water Maze (MWM) and Contextual Fear Conditioning (CFC) will be utilized for *in vivo* analysis of learning and memory, long-term potentiation (LTP) electrophysiology for *ex vivo* analysis of synaptic plasticity, and protein quantification for analysis of effects on pathological markers of AD. This project is expected to quantify the magnitude of indirect metabolic involvement for amylin-based therapies in the treatment of AD and provide evidence for viability of a novel route of administration for pramlintide. Ideally, the insight gained from this study will motivate rapid transition into clinical trials with pramlintide and lead to the development of an injection-free disease-modifying therapy for AD.

Title: Obesity may lead to increased survivin levels in tumors.
Primary Author (and presenter): Smith, Elizabeth
Additional Authors: O'Neill, Ann Marie.
Department: Biology and Environmental Science.
College/School: Auburn University at Montgomery - Sciences

Currently in the US, obesity is at epidemic levels with two thirds of the adult population overweight or obese. Obesity is associated with an increased risk of developing a number of diseases, including cardiovascular disease and type 2 diabetes. What is now known is that obesity increases the risk of a number of cancers, including colon, prostate, breast and ovarian. Obesity often results in aggressive tumor growth, reduced efficacy of chemotherapy and increased growth of drug resistant tumors. Previous research has indicated that the anti-apoptotic protein survivin that is not expressed in differentiated tissues is present in tumor cells and fat from obese patients. The goal of this project was to investigate if the expression of *Birc5*, the gene that codes for survivin, is increased in tumors grown in fatty animals.

cDNA obtained from a previous study, where HT29 human colon cancer tumors were orthotopically implanted and grown in both lean mice that were fed a high fat western diet or mice rendered obese by a high fat diet, was used for these experiments. The relative expression of *PCNA*, as a marker of proliferation, and *Birc5* was compared between the two groups using quantitative PCR. Initial indicate that while PCNA expression was increased in the tumors from the obese group, this was not significant however, expression of *Birc5* was significantly increased in tumor tissue from obese mice compared to lean.

These results indicated that Birc5 expression is increased in HT29 colon cancer cells, and obesity results in increased expression. This data suggest that the subsequent higher levels of the anti-apoptotic protein survivin may to the more aggressive growth of tumors observed in the obese.

Title: Additive manufactured lattice structures: A viable solution for bone implants
Primary Author (and presenter): Soltani-Tehrani, Arash
Additional Authors: Shamsaei, Nima
Department: Mechanical Engineering
College/School: Samuel Ginn College of Engineering

Description:

Additive manufacturing (AM) is a promising manufacturing technology in which parts are fabricated in a layer-wise fashion. In laser powder bed fusion (LPBF), a common AM process, powder is used as the feedstock material. It is possible to fabricate parts with thin layers of powder, which provides the manufacturers with more freedom in design. Therefore, structures (e.g., lattice structures) which were once difficult if not possible to be generated with traditional manufacturing methods, can now be straightforwardly fabricated via LPBF. Lattice structures are generated through repetition of unit cells. Due to porous nature of lattice structures, they can significantly reduce the weight. This makes lattice structures a popular alternative for heavy bulk materials for different applications such as aerospace industry. In addition, the feasibility to employ different alloys with LPBF can benefit manufacturers to use materials which are biocompatible to be used as bone implants. As a result, effects of unit cell dimensions on the fatigue behavior of lattice structures fabricated from biocompatible 316 stainless steel will be studied while the volume fraction (i.e., the ratio between the volume of lattice structure and the bulk material) will be kept constant. This will provide us an important insight regarding lattice structure behaviors under cyclic loadings, which accounts for more than 90% of failures.

Title: Poly(3-hexylthiophene-*co*-3-(2'-ethylhexyl)thiophene) Statistical Copolymers and Their Optoelectronic and Solid-State Properties
Primary Author (and presenter): Sparks, Tucker
Additional Authors: Minkler, Michael J.; Beckingham, Bryan S.;
Department: Department of Chemical Engineering
College/School: Auburn University

The study of semi-conducting polymers is increasingly important as they show potential to be utilized in organic-based solar cells, biosensors, thermoelectric generators, and flexible electronics. Some of the largest obstacles with using these polymers are their manufacturing costs, material inconsistencies, poor solubility in common solvents, and an inability to be thermally processed. Thiophene based polymers are known for their conductive properties, and the tunable solubility of the polymer enabled by substitution of various functional groups (typically alkyl groups) on to the 3-position of the aromatic thiophene ring. However, many aspects of structure-property relationships for this important class of materials are largely not well understood. Our work aims to investigate how small changes in polymer side chain chemistry impacts material properties such as crystal melting temperature and absorbance behavior. Grignard Metathesis polymerization was chosen as our synthesis mechanism as it produces poly(3-substituted thiophene)s with a high percentage of regioregularity along the polythiophene backbone. In this work, we synthesize a series of copolymers of two well-known polythiophene derivatives, poly(3-hexylthiophene) and poly(3-(2'-ethylhexyl)thiophene), with varied relative composition. Molecular characterization is performed to obtain the relative molecular weights and dispersities (gel-permeation chromatography), thermal characterization via differential scanning calorimetry to obtain melting temperatures and equilibrium melting enthalpies, and finally UV/Vis spectroscopy will be used to produce absorption spectra that can be analyzed via the Spano Model to estimate optical band gaps. This work will provide insights into how subtle changes in polythiophene side-chain chemistry affects solid-state and optoelectronic properties.

Title: Evaluation of differential scanning calorimetry to assess starch gelatinization of multi-component feed processed with different conditioning temperatures and Hygieniser retention times

Primary Author (and presenter): Spencer, Lindsey F.
Additional Authors: Avila, Luis; Calderon, Allan; Patino, Danny; Pacheco, Wilmer; Monu, Emefa; Fasina, Oladiran; & Starkey, Charles
Department: Poultry Science
College/ School: College of Agriculture

Description:

Starch can gelatinize in the presence of heat and water during thermal processing, which may enhance energy digestibility in broilers. An experiment was performed to investigate the effect of a Hygieniser® (HYG, CPM) and conditioner on starch gelatinization (SG) of a typical broiler breeder feed. Nine treatment combinations were analyzed with 3 conditioning temperatures (CT) (75, 85, and 95 °C) and 3 retention times (RT) in the HYG (80, 160, and 240 s) where samples were collected on 3 separate d to obtain replicate samples (n = 198) for SG analysis with differential scanning calorimetry **(**DSC**).** Feed samples (10 mg each) were weighed into Al hermetic pans with 20 µL of deionized water and left to equilibrate overnight. DSC thermograms were analyzed using TA Universal Analysis 2000 software to assess the enthalpy (J per g) for each sample. Data were analyzed using the GLIMMIX procedure of SAS (V 9.4). Means were considered significantly different when $P \leq 0.05$. Post-conditioner samples with a CT of 75 °C had higher enthalpy ($P \leq 0.018$) than CT at 85 and 95 °C. Enthalpy of samples collected from the HYG with a CT of 75 °C was higher ($P = 0.049$) than a CT at 85 °C. An interaction ($P = 0.02$) was observed for the enthalpy of samples collected after pelleting with a CT of 75 °C and a RT in the HYG for 80 s having greater enthalpy than all other time and temperature combinations. SG is calculated using: $(H_0\text{-}H_1/H_0)*100$, where H_0 represents the enthalpy of uncooked (UC) samples and H_1 the enthalpy of cooked (CS) samples. For this study, the analyzed enthalpy values from the UC meal samples were lower than the enthalpy values from the CS. Therefore, the equation cannot be used to properly determine degree of SG. The combination of proteins, fats, and other carbohydrate fractions don't allow for the use of DSC as an alternative to AOAC 996.11 in complex animal feed. In order to accurately determine SG in animal feed samples, the validated AOAC 996.11 method must be used.

Title: A CXCR3 antagonist ameliorates the hippocampal hyperexcitability and impaired synaptic transmission induced by viral challenge

Primary Author (and presenter): Srinivasa, Sriraja[1,2]

Additional Authors: Bloemer, Jenna[1,2]; Pinky, Priyanka[1,2]; Du, Yifeng[1,2]; Setti, Sharay[1,2], Heslin, Ryan[1,2]; Konat, Gregory[3]; Suppiramaniam, Vishnu[1,2]: & Reed, Miranda N.[1,2]

Department: [1]Drug Discovery and Development

College/ School: [1]Harrison School of Pharmacy; [2]Center for Neuroscience Initiative; [3]West Virginia University School of Medicine

Description:

A body of clinical evidence has demonstrated that viral infections exacerbate neurodegenerative conditions. We have previously modeled this comorbidity by demonstrating that the acute phase response instigated by an intraperitoneal (i.p.) injection of a viral mimetic, polyinosinic-polycytidylic acid (PIC), induces protracted hypersusceptibility to kainic acid-induced seizures. PIC challenge also robustly increases neuronal excitability in the hippocampus and is associated with an increase in the level of tonic extracellular glutamate. These alterations were associated with substantial increases in hippocampal expression of both CXCL10 and CXCL9, which are ligands of the common receptor, CXCR3. Here, we test the hypothesis that blockade of CXCR3 could mitigate the hyperexcitability and synaptic plasticity alterations associated with viral challenge. Mice received the CXCR3 antagonist (AMG 487, 3 mg/kg, icv) two hours prior to the induction of the acute antiviral response with PIC (12 mg/kg, ip). Mice underwent examination 24 hours later for alterations in synaptic basal transmission and plasticity, kainic acid-induced seizure duration and severity, and CXCR3-mediated signaling pathways. Viral challenge induced an imbalance in synaptic plasticity, as indicated by an increase in both LTP and LTD and an increase in presynaptic glutamate release and basal synaptic transmission. CXCR3 blockade rectified the viral-mediated alterations in synaptic plasticity and transmission. CXCR3 blockade also prevented the PIC-mediated increase in kainic acid-induced seizure duration and severity. CXCR3 blockade restored the PIC-mediated alterations in the canonical Ras/Raf/MEK/ERK signaling pathway. Increased neuronal activity has been demonstrated to enhance neurodegeneration. Our findings suggest one mechanism by which viral infections may increase the risk for neurodegenerative conditions and that CXCR3 may be a therapeutic target.

Title: Evaluating contemporary conservation biology texts for bias in biodiversity representation

Primary Author (and presenter): Stahl, Katherine, E.
Additional Authors: Lepczyk, Christopher; Christoffel, Rebecca
Department: Wildlife Science
College/School: Forestry and Wildlife Sciences

A critical component of textbooks is fair representation of the material they cover. Within conservation biology, fair coverage is particularly important given Earth's breadth of species and diversity of ecosystems. However, research on species tends to be biased towards certain taxonomic groups, so it is possible that textbooks may exhibit a similar bias. Our goal was to evaluate contemporary books in the field of conservation biology to determine if they are representative of Earth's biodiversity. To address our goal, we categorized all figures, tables, and boxes in seven recently published conservation biology textbooks. Specifically, we quantified taxonomic group (if described), whether human influence (positive or negative) was noted in the example, if the species or group was a marine or terrestrial organism, continent where the data were gathered, genetic diversity, and ecosystem type. Taxa evaluated included bird, mammal, reptile, amphibian, fish, plant, invertebrate (not including insects), insect, other (fungi, bacteria, protozoa, etc.). Based on our sampling, we found that textbooks did not accurately reflect Earth's actual biodiversity – mammals and birds were used in examples far more often than insects and other invertebrates. Examples of negative human influence on the environment outweighed positive, only a few figures mentioned genetic diversity, and continents were not evenly represented. Our findings suggest that modern conservation biology textbooks are biased in terms of coverage of taxonomic groups, human influence on the environment, and equal representation of ecosystems across the planet. Skewed representation of biodiversity in textbooks could favor an inaccurate view of the world due to insufficient knowledge of its multitudinous ecosystems and biota.

Title: Prison higher education: Impacts on father/child interaction and the effects on child school performance
Primary Author: Standfield, Timothy B.
Department: Interdisciplinary Studies
College/School: Liberal Arts

Description:

Much research has been done on the impact of higher education on the state of mass incarceration. The vast majority of such inquiries have been directed toward the social and financial benefits of reduced recidivism rates, specifically as it relates to the justice-involved individual. As prison higher education programs become more prevalent, the benefits of such programming and the opportunities afforded by Second Chance Pell grants extend beyond the individual incarcerated student to his/her family, as well as the communities to which he/she will return. Little effort has been put forth to investigate the socioeconomic impacts of post-secondary education in a correlation context as it pertains to the children of those obtaining the education, or the community who will surround the offender-student upon release. As statistics show, children of incarcerated parents are at higher risk of incarceration themselves. This research seeks to investigate the impacts of prison higher education on paternal relationships in the form of parent/child interaction, the effects on school performance of children with fathers/mothers involved in higher education programs while in prison, and the influence that the change in perceptions about future opportunities have on both parent and child. Such correlations have major ramifications in assessing and addressing the incarceration risks of future generations, as well as solidifying the need for more higher education programming with current prison populations.

Title: Designing for climate at a fundamental level
Primary Author (and presenter): Stark, Kyra W.
Department: Architecture
College/School: College of Architecture, Design, and Construction

Description:

The research looks at how climate analysis and passive design strategies can be taught at a fundamental level, specifically during undergraduate education. In contrast to current trends, which apply to technical mediation of climate, this research looks at returning to core principals of climate response and building form. The research takes existing topics from the Architecture Environmental Controls I class and expands upon that information to create a printable digital guide. Categorization from the International Energy Conservation Code is used to classify the eight different climate zones in the United States. Zone 3, which includes the majority of Alabama, is used as a precedent for Case Study Buildings and Climate Analysis. The study has resulted in graphically represented climate data, precedent studies that students can refer to for a variety of project types, printed and digital resources that students can use, and a glossary of terms. The key impact of the research is a *Fundamentals of Passive Design* guide book that students can refer to when designing for the climate and using passive design strategies in a particular climate zone.

Title: Mitigating wounds after war: A telephone follow-up program for patients with traumatic brain injuries
Primary Author (and presenter): Starling, Amy L.
Additional Authors: Watts, Sarah
College/School: School of Nursing

Description:

Traumatic brain injury is the leading cause of death and disability worldwide. Traumatic brain injuries result in not only the initial physical injury, but also lead to persistent post-concussive neurocognitive symptoms in over 70% of the affected population. Studies have demonstrated that many post-concussive symptoms are inadequately treated due to poor management related to inadequate patient education and fragmented care. The purpose of this project was to implement a follow-up program providing appropriate education and counseling (e.g., disease process, self-care, and care coordination). The target population included adults (18- 60 years) with traumatic brain injury or persistent post-concussive symptoms in a primary care clinic. Participants completed an assessment of quality of life instrument (AQoL), the medical outcomes study (MOS) compliance tool, and a knowledge assessment. An educational session was then delivered to all participants, explaining the disease process and disease management. Weekly follow-up calls were administered to assess patient status and administer counseling as needed. The project is in progress. Descriptive statistics will be used to describe the patient population, quality of life, patient compliance, and patient knowledge. Follow-up data will include patient's compliance with the program. The pre-and-post quality of life instrument scores (AQoL), compliance scores (MOS), and knowledge level of patients will be compared via SPSS software (alpha=0.05). Early identification and proactive management of post-concussive symptoms is best practice for patients with traumatic brain injury. Patient education and proactive patient management can improve patient knowledge, compliance, and quality of life. Proactive management of traumatic brain injury patients with persistent post concussive symptoms is achievable in the primary care setting. Further implementation of this project is warranted.

Title: Optimizing stereolithography 3D printing for use with biodegradable resins
Primary Author (and presenter): Steeve, Helen M.
Additional Authors: Davis, Edward
Department: Mechanical Engineering, Materials Engineering
College/School: Engineering

Stereolithography (SLA) printing is a form of additive manufacturing that uses a laser to photopolymerize a resin layer-by-layer to build a print. It uses a small laser spot size that allows for the production of high-resolution parts. This technology has the potential to be used for biomedical applications, including printing drug-carrying tablets. This could lead to customized tablets to fit patients' needs, with drug blends, release rates, and tablet shapes able to be modified through both the blend of the printing material and 3D modeling options. SLA printers have the ability to print with third party resins, allowing custom blends to be made in lab. Some biodegradable resins can be mixed and then printed into tablets capable of carrying drugs to be released in the body. The SLA process produces less heat than filament printers, which can affect the drug retention in tablets during printing.

To explore the potential of SLA-produced biodegradable tablets, resins of polyethylene glycol diacrylate (PEGDA) and polyethylene glycol (PEG) were mixed, using diphenyl (2,4,6-trimethylbenzoyl) phosphine oxide (DPTPO) as a photoinitiator to polymerize the PEGDA in the resin. A Formlabs Form 2 commercial desktop SLA printer was used to print these resins. A low molecular weight PEG was used initially, serving as a filler in the PEGDA matrix to aid in drug dissolution. Tablets were printed with varied PEGDA:PEG ratios and then soaked in deionized water and acidic solution baths run at body temperature to see how the ratio of PEG to PEGDA affected tablet mass loss. Higher PEG content resins had greater percentage mass loss, with values nearly equal to mass percent PEG.

In addition, higher molecular weight PEGs were tested for ability to create more viscous resins to achieve better print quality. A model drug will be mixed with resins in the future to see if the tablet degradation patterns carry over to drug dissolution rates.

Title: Pore network modeling study of effect of mineral reaction propagation on porosity-permeability evolution
Primary Author: Steinwinder, Jeffrey H.
Additional Authors: Beckingham, Lauren E.
Department: Civil Engineering
College/School: Samuel Ginn College of Engineering

Description:

Porosity and permeability of a porous media can be altered significantly by mineral dissolution and precipitation reactions, especially those observed by CO_2 injection in a saline aquifer, for example. As injected fluid moves through porous media, a reactive dissolution or precipitation front is created, resulting in complex changes in porosity and permeability. Porosity generally increases with dissolution and decreases with precipitation; however, permeability is driven by the spatial distribution of geochemical reactions in individual pores and pore-throats and in the greater pore network. Mineral dissolution and precipitation reactions have been observed to occur uniformly and non-uniformly in porous media, driven by mineral distribution and grain size, for example. Previous pore network modeling work observed variations in porosity-permeability evolution for uniform and non-uniform distributions of geochemical reactions. These simulations, however, assumed reactions occurred to equal extents throughout the pore network where in reality, reactions propagate with fluid flow. This work seeks to enhance the understanding of the evolution of porosity-permeability as dissolution and precipitation reactions propagate using pore network modeling simulations. Simulations consider propagating reactions to occur uniformly on impacted surfaces and non-uniformly, associated with pore and pore-throat sizes, for example. Simulation results are compared to simulations impacting the entire pore network and porosity-permeability calculated using common macroscopic porosity-permeability relationships.

Title: An ecological perspective on the factors that promote school connectedness: A literature review

Primary Author (and presenter): Stephens, Morgan
Additional Authors: Joyce, Hilary
Department: Anthropology, Sociology, and Social Work
College/School: College of Liberal Arts

Description:

School connectedness is an increasingly recognized protective factor against mental health problems, poor school performance, high-risk behaviors, and other adverse experiences for youth. Understanding the individual, relational, and contextual factors that promote school connectedness is critical to developing interventions that target and support school connectedness and prevent students from becoming disconnected. Bronfenbrenner's ecological perspective asserts that a person's ecosystem is comprised of multiple, nested settings that include the micro-, meso-, exo-, macro- and chrono-systems. According to this framework, individual systems (e.g., biological, psychological) act in combination with these environmental systems to influence youth development. For example, a person's microsystem is comprised of their immediate social environment including direct or face-to-face settings containing the person and represents the pattern of activities, roles, and interpersonal relationships experienced by that person in the immediate environment. A microsystem for a student would likely contain their teachers and classmates as well as extracurricular activities. To illustrate the importance of intervening at all system levels, this paper uses the ecological perspective to organize and synthesize the literature on the factors that promote school connectedness to help inform intervention planning at multiple system levels.

Title: 3D Printing quadruped orthotics: Stepping towards a brighter future
Primary Author (and Presenter): Sterling, Amanda J.
Additional Authors: Suhling, J.; Gard, J.; & Taylor, D.
Department: Mechanical Engineering
College/School: Samuel Ginn College of Engineering

Description:

A common ailment seen in equine and bovine quadrupeds is an arch dysfunction in the foot, more frequently referred to as a "dropped arch". This syndrome leads to excessive foot pain in the animal, which can lead to a significant negative impact on performance in movement, milk production, reproduction, and more. Due to recent advances in fabrication capabilities, Additive Manufacturing will be used to design innovative orthotics for horses and cattle to cushion and support injured tissue in the foot. These new orthotic designs will provide immediate pain relief by decreasing step impact, providing arch support, and realigning the skeletal displacement that coincides with a dropped arch. Unlike many orthotics on the market today, this new design concept will be rehabilitative, providing short term relief *and* a long-term solution. Taking advantage of the new design space permitted by 3D printing, the orthotics will be customized to the animal's body geometry, injury type, and the walking surfaces in their living environment. Furthermore, by implementing Finite Element Analysis, the orthotic structure will be optimized to be lighter, less invasive, longer-lasting, and to best mimic the mechanical response of the actual foot. Tensile and nano-indentation properties have been measured, and testing is ongoing.

Title: Automated techniques for interpreting game camera images from surveys for Eastern Wild Turkeys

Primary Author (and presenter): Stewart, Briana D.
Additional Authors: Grand, Barry: Margadant, Lee; Moore, Carolyn; & Keller, Skylar
Department: Alabama Cooperative Research Unit
College/ School: School of Forestry and Wildlife Sciences

Description:

Estimating eastern wild turkey (*Meleagris gallopavo silvestris*; hereafter turkeys) population demographics precisely and accurately is essential for making effective harvest and habitat management plans. Demographic estimates once based on expert opinion or harvest data are now being collected through game camera surveys that can be repeated across space and time. However, game camera surveys usually result in large numbers of images that must be interpreted in a timely manner. Classifying these images based on expert review can be time-consuming, costly, and error-prone. To address these issues, we developed a model using supervised classification and machine learning in MATLAB (Mathworks, Inc.) to determine the presence of turkeys in images. The models were trained using 500-point features from 3,342 training images that were collected on two study areas at 44 locations and manually interpreted. We compared 23 image classification methods; the top five methods were: cubic support vector machine (SVM, 89.2% accuracy), quadratic SVM (88.6% accuracy), ensemble subspace k-nearest neighbor (KNN, 89.2% accuracy), fine KNN (89.0% accuracy), and medium gaussian SVM (86.5% accuracy). Cubic SVM was the most accurate method with omission rate of 6.1% and commission rate of 4.7%. The use of machine learning will greatly reduce the time required to interpret the thousands of photos that are often collected in game camera surveys, and with appropriate training data could be extended to other species of wildlife.

Title: Efficacy of fire in restoring Chinese privet degraded bottomlands
Primary Author (and presenter): Stiles, James A.
Additional Authors: Cash, James & Anderson, Chris
Department: School of Forestry and Wildlife Sciences
College/School: College of Agriculture

Description:

Exotic invasive species are considered one of the primary threats to global biodiversity and Chinese privet (*Ligustrum sinense*) is one of the most pervasive exotic species in the southern United States. Current privet control methods require the use of herbicide which can have serious ecological and human health concerns. This project is investigating the utility of fire as an effective alternative to restore forests infested with privet. There is some anecdotal evidence to suggest that privet might be controlled using prescribed fire. Therefore, we are testing this idea coupled with propane torch treatments on a property located along the Black Warrior River near Moundville, AL. The addition of torch treatments could decrease the time needed to achieve control objectives in bottomland hardwood forests that can be challenging to burn. To examine the efficacy of these approaches, study plots occupied by Chinese privet were cut down. After privet stumps re-sprouted, treatment plots received either prescribed fire only or prescribed fire coupled with torch treatments. Additionally, control plots where privet was cut and not treated were established. Pre- and post-treatment data were collected on percent cover of privet and other vegetation. Individual stems were marked and tracked to detect the rate of privet mortality. Preliminary data collected in 2018 indicated that both methods reduced privet cover. However, more privet was killed in plots that received the torch treatments. In addition to examining the efficacy of these control techniques, we report the time and propane required to conduct torch treatments. This knowledge will help improve restoration planning and decisions to apply these techniques. Burning with torch treatments appears to be a viable alternative where herbicide application is not desired. Both methods show promise as useful tools in a land manager's arsenal to fight against this destructive invasive species.

Title: Controlling particle size of silica nanoparticles by Stöber process for colon cancer targeting application

Primary Author (and presenter): Sultana, Nayer
Additional Authors: David, Allan
Department: Chemical Engineering
College/School: Samuel Ginn College of Engineering

Description:

Colon cancer is one of the major health problems due to its high mortality rates. Chemotherapy is the main therapeutic strategy which uses different drugs or combinations of drugs to reduce the division of cancer cells but it leads to severe side effects such as non-specific toxicity. There is a significant concern toward site-specific delivery of chemotherapeutic drugs specifically to the affected site of the colon. Nanoparticles with targeting abilities offer a novel approach for site-specific delivery of chemotherapeutic drugs. Thus the purpose of this study was to synthesize silica nanoparticles of different sizes via Stöber method as particles of different sizes provide different pharmacokinetics and biodistribution that affects targeting efficiency. The silica particles were obtained by hydrolysis of tetraethylorthosilicate (TEOS) in ethanol medium and the effects of different parameters such as temperature and concentration of water, ammonia and tetraethylorthosilicate (TEOS) were investigated. Particle sizes have been found to vary with increasing temperature and also with increasing TEOS, ammonia and water concentration. These findings suggest that particle size of silica nanoparticles is affected by these parameters.

Title: Linked social and environmental consequences of exurban development
Primary Author (and presenter): Summersell, Cole H.
Department: Environmental Design
College/School: College of Architecture, Design, and Construction

Description:

Exurbs (a ring of prosperous communities beyond the suburbs that are commuter towns for an urban area) are an increasingly dominant form of American development, and often serve as the front line in urban sprawl. Though residents often don't realize it, the cultural and environmental effects of building large new homes far from the city center can be catastrophic. Using Birmingham, AL as a case study, my research used qualitative and quantitative data to understand these consequences. Census data shows that exurban developments preserve segregationist residential patterns, especially in regard to school district boundaries. In addition, 'white flight' to the exurbs dramatically reduced metro Birmingham's tax base, perpetuating the cycle of poverty in North and West Birmingham. In terms of environmental damage, exurban dwellers emit 3 times as much carbon per capita as those within the city limits; and their car-based lifestyles preclude any use of, or advocacy for, public transportation. Birmingham's upper-middle-class population has fled from downtown to the periphery in order to live in the least sustainable manner possible; and, in so doing, has left the city center impoverished and lacking in reliable transit options. These results are fairly typical of exurban development nationwide. My findings invite further study on housing typologies which would alleviate these cultural and ecological stressors.

Title: Test point insertion using artificial neural networks
Primary Author (and presenter): Sun, Yang
Additional Authors: Millican, Spencer
Department: Electrical and Computer Engineering
College/ School: Samuel Ginn College of Engineering

Description:

In the present day, integrated circuits (ICs) on silicon are becoming ever-more complex and are ever-more more prone to manufacturing defects. Ensuring operational reliability of defect-free circuits is a paramount concern for the circuit design industry, hence much research effort has spent on creating methods to test ICs. To test ICs, apply stimulus (such as cost-effective pseudo-random patterns) is applied to circuit inputs and responses are observed at circuit outputs. When applied to modern circuits, pseudo-random tests can fail to excite and observe "random pattern resistant" (RPR) faults. An established way to detect these faults is to modify the circuit to make RPR faults more easily tested with random stimulus. This is known as test point (TP) insertion (TPI), which is used in industry due to its ability to be easily integrated into circuits with minimal effort from circuit designers. With modern complex circuits, however, established methods of performing TPI are being computationally infeasible and TPI performance must be revisited. A method using artificial neural networks (ANNs) for evaluating TP quality, its use in a TPI algorithm, and its effectiveness at detecting RPR faults is presented here. The TPI method analyzes a circuit and determines where to insert TPs to improve the testability of circuits under pseudo-random stimulus, but as opposed to conventional TPI algorithms using heuristically-calculated testability measures, the proposed method uses an ANN trained through fault simulation to evaluate a TP's quality. The time of TP evaluation is demonstrated to be significantly faster compared to heuristic-based TP evaluation, and the impact of inserted TPs is shown to be superior compared to conventional heuristic-based testability analysis. This study is the first in a series which leverage new computational paradigms (i.e., ANNs) to increase circuit reliability and decrease circuit testing costs.

Title: Evaluating the effects of varying prostate cancer to fibroblast cell ratios within bioengineered tumor tissues

Primary Author: Suresh, Joshita
Additional Authors: Habbit, Nicole; Anderson, Luke, Lipke, Elizabeth
Department: Chemical Engineering
College/School: Engineering

Studies have shown that potential oncological drugs that have passed pre-clinical trials have a 3.4% chance of obtaining approval from the Food and Drug Administration. To bridge this gap, new pre-clinical testing models must be developed that better represent the *in vivo* tumor microenvironment (TME). The native TME is comprised of cancer cells and supporting stromal and immune cell types, with regional heterogeneities. In this study, different ratios of PC-3 prostate cancer cells and BJ-5ta fibroblast cells were encapsulated in a protein-coupled polymer to form a bioengineered tumor tissue; quantification of colony growth and whole tissue characterization was performed to evaluate the impact of stromal cell populations. PC-3 to BJ-5ta cell ratios of 5:1, 1:1, and 1:5 were evaluated along with monocultures of each cell type. A viability assay was conducted, and analysis of the results indicated that both cell types survived the encapsulation process and remained viable throughout 29 days of co-culture *in vitro*. Phase contrast images of the tumor tissues were taken on a weekly basis for 29 days to monitor colony growth and proliferation. The PC-3 cells showed appropriate signs of colonization, decreasing in colony area with increased concentration of fibroblast cells, signifying that both cell lines maintained a characteristic morphology and physiology. The mechanical stiffness of the bioengineered tumor tissue was quantified through parallel plate compression testing. Analysis of force versus displacement data showed a significant decrease in the Young's Modulus at early time points in the presence of fibroblasts; an opposing trend to that observed with other cancer types.

Title: Development and validation of metal 3D-printed helium-filled soap bubble system
Primary Author (and presenter): Swiney, Paul A.
Additional Authors: Taylor, Harrison; Fischer, Ralf; Prorok, Bart; & Raghav, Vrishank
Department: Aerospace Engineering
College/School: Samuel Ginn College of Engineering

Description:

Analyzing high-shear flows and flows in large volumetric spaces is essential for many engineering applications, such as studying helicopters in ground-effect or the flow around UAVs. Particle Image Velocimetry (PIV) is a flow quantification technique used to measure instantaneous velocity fields using small tracer particles and a pulsed laser light source. Traditional tracer particles used for PIV impose a limitation during time-resolved PIV measurements, where the laser pulse energy is nominally low, limiting them to small-scale flow analyzation and do not work well for volumetric PIV. One solution to overcome this limitation is the use of neutrally buoyant helium-filled soap bubbles (HFSBs) as tracer particles, which have a much higher light scattering intensity than traditional tracer particles. To this end, a HFSB system was designed and fabricated at Auburn University to enable time-resolved velocity field measurements. An orifice nozzle was designed based off of designs in previous research, but was modified to be completely fabricated using a metal 3D printer with sufficient spatial resolution. Using additive manufacturing will allow for the system to be scaled quickly and be able to operate with multiple nozzles in order to increase the quantity of HFSBs being produced. The HFSB system was characterized by measuring the bubble diameter and production rates as a function of the nozzle design parameters. HFSBs will be used to measure velocity data for free and wall-bounded shear flows, as a validation of the tracing fidelity of the bubbles by comparing them to traditional particles. The HFSB system will be optimized to ensure appropriate time response characteristics of the HFSBs for such high-shear flows with the goal of applying the HFSBs to flows commonly associated with rotorcraft.

Title: Performing uncertainty analysis on crop yield parameters in SWAT at regional scale
Primary author (and presenter): Tadych, Danielle E.
Additional authors: Karki, Ritesh & Srivastava, Puneet
Department: Crop, Soil and Environmental Sciences
College/School: College of Agriculture

Description:

Crop models are an important aspect of hydrological models in agricultural watersheds as the crops can effect evapotranspiration, surface run-off, groundwater recharge, and soil water. The Soil Water Assessment Tool (SWAT) is a physically based, distributed hydrological modelling software capable of modelling complex surface processes with minimal input data. SWAT can model crop yields by evaluating planting dates, crop specific growth properties, temperature, precipitation, soil moisture, and management practices to determine a probable yield under given conditions. A systematic uncertainty analysis is a method to judge the level of confidence of models' estimates and identify sources of uncertainty of model parameters. Very few uncertainty analyses have been performed on crop models in SWAT at a regional scale, and none on cotton and peanut cotton yield data. The Flint River Basin in Georgia, a main producer of cotton and peanuts in the U.S., is subject to frequent drought and high intensity storm events making it an ideal location for modelling hydrological processes with SWAT. The objective of this study was to perform an uncertainty analysis on peanut and cotton crop yields in the lower Flint River Basin in order to provide a better understanding of SWAT crop yield parameters. A Nash-Sutcliffee efficiency, percent bias and coefficient of determination tests were used to compare the SWAT crop yield produced in this study to county-level statistics from the National Agricultural Statistical Survey. The results from this study will not only further assess the efficacy of SWATs crop yield parameters, but it will also provide more accurate data to assist hydrologists and policy makers in water conversation decisions.

Title: Recombination Rate Plasticity in *Drosophila pseudoobscura*
Primary Author (and presenter): Taylor, Hannah N
Additional Authors: Stevison, Laurie; Altindag, Huma; Pownall, Keeley
Department: Biological Sciences
College/School: COSAM

Many organisms experience changes in their meiotic recombination rate due to environmental stresses. Some of these factors, including age, starvation, and nutrition deprivation, increase recombination rate and produce new allelic combinations that promote evolutionary process. However, increased recombination can also lead to mutations and diseases. The most common stress that has been studied in past research is temperature. It has been found in *Drosophila melanogaster* that recombination rate increases when flies are kept at temperatures higher or lower than optimal, but only recently has this been shown in *Drosophila pseudoobscura* whose optimal temperature is 21°C. In this research, two experiments were conducted to determine when the maximum difference in recombination rate occurs between the control and the treatment. In the first experiment, *D. pseudoobscura* flies of a *yellow-vermillion* stock were crossed at 20 and 25°C, the female progeny were backcrossed to mutant recessive males, and the final progeny were collected at different timepoints. The phenotypes of the 9,755 flies collected determined a significantly higher recombination rate of 46% in the control and 48% in the treatment ($p=0.035$), with a peak difference at days 7-9 ($p= 0.009$). However, this experiment revealed that the mutant markers were not linked, meaning the recombination differences were inconclusive. In the second experiment, flies of a *yellow-cut-scalloped-sepia* stock were crossed at 21°C and 26° C for a slightly better control and stronger stress. The phenotypes of the 8,387 flies collected determined a recombination rate of 34% between yellow-scalloped and 1.2% between scalloped-cut. In this experiment, a decrease in recombination rate due to temperature was observed, and it was found to be significant at days 7-9 ($p= 0.008$). This time point was a similar result to the first experiment, but with recombination decreasing, indicating that recombination rate may change in either direction for flies experiencing stress.

Title: Design and construction of a phase change flight experiment for the international space station using micro-structured surfaces

Primary Author (and presenter): Teitge, David S.
Additional Authors: Bhavnani, Sushil & Sridhar, Karthik
Department: Mechanical Engineering
College/School: Samuel Ginn College of Engineering

Description:

In microgravity environments, the buoyant force that removes a vapor bubble from a surface is greatly reduced. This means that any hot surface where boiling occurs is covered by an insulating layer of vapor, due to surface tension, that can cause overheating. In order to prevent this, the project seeks to show that a micro-structured surface is capable of passively transporting the vapor bubbles away from the boiling location. Preliminary parabolic flight experiments performed aboard the NASA Zero-G aircraft by this research team have demonstrated the suitability of this method in a microgravity environment, albeit one that is limited by the presence of g-jitters. To prove this phenomenon under a more pristine microgravity environment, an experiment will be performed on the International Space Station. Before this occurs, a ground experiment will be constructed to refine the flight experiment and obtain preliminary data readings. Boiling will be initiated on metal surfaces that are additively manufactured to create a microscopic saw-toothed surface pattern with even smaller nucleation sites on the sloped faces. These cavities create a preferential location for the vapor bubbles to form. This process will occur inside of a glass ampoule formed by the fusing of different types of ports onto a glass tube with a square cross section. One of the ports will lead to stainless steel bellows where the volume changes of the FC72 dielectric fluid can be accounted for while keeping pressure constant. The surface features will transport nucleated bubbles to a nearby Peltier cooler which will condense the vapor. Demonstrating that this method of transport is possible allows for a more powerful, passive cooling technique to be employed in space where gravity is weak, and power is limited.
Funding from the National Science Foundation and the NASA Center for the Advancement of Science in Space demonstrates the interest from the scientific community in this capability.

Title: Improving mental health in Hobson Bay, New Zealand through healing villages
Primary Author (and presenter): Kile, Kensie J., Temples C. Camille
Department: Interior Design
College/School: Human Sciences

Auckland, New Zealand is facing a significant and alarming increase in depression and anxiety in young people, ultimately making New Zealand among the highest in rates of suicide in the region. There is a clear and urgent need to design wellness and healing environments for patients recovering from anxiety, trauma, and self-harm.

People dealing with the complex challenges of depression and anxiety often feel isolated from their families and community. It is usually difficult for families to know how to support their loved ones who are going through tough times with their health. *Healing Villages* may offer one model for outpatient care that supports individuals and promotes family engagement and community connectivity.

Our poster will present creative scholarship of an outpatient healthcare facility to be located in downtown Hobson Bay that uses the *healing village* model to normalize the treatment experience and help patients have better self-confidence, sense of belonging, and decreased healing time by staying engaged in their daily lives while seeking treatment.

The healing village model focuses on health and wellness of the whole person, not just treating a disorder in an isolated manner. Our design demonstrates one application of this model to a practical design problem and suggests some best practices that could be implemented on similar projects.

Title: Built environment and its relationship to astrology
Primary Author (and presenter): Teo, Yi Xuan; Han, Li
Additional Authors: Carter Hoff, Gail Hudson, Weihang Zhou
Department: Architecture
College/School: Architecture, Design and Construction

This study addresses the built environment of pre-modern architecture and its relationship to nature and astronomy. The purpose is to compile and link various elements that relate to one another in the whole concept on a single platform. This subject matters and relates not just to architecture but to people as well. Astrological and natural phenomenons have influenced how we live and design architecture because humans cannot be divorced from neither architecture nor nature and this relationship will always exist. Many research regarding this topic has be vauge, scattered and in a micro view. Our approach in this case was to adopt a macro view and through theoretical inquiry and anylysis of multiple sources relate findings and information that are might be similar. Despite being from the pre-historic era there is great significance for the knowledge which is advance for its time and still very relatable in the present. With the results we can look into the evolution of architecture in the post-modern era as well as serve as a comprehensive resource starting point for anyone who wants to understand the relationship between arhciteture, nature and astronomy.

Title: Extension empowers Alabama youth and parents to eat better and move more
Primary Author (and presenter): Terry, Kara M.
Additional Authors: Parmer, Sondra M.; Struempler, Barb; & Funderburk, Katie
Department: Nutrition, Dietetics and Hospitality Management
College/School: College of Human Sciences

Description:

Alabama's adult obesity rate is 36%, and the adolescent obesity rate is 18%. National and state data indicate limited fruit and vegetable consumption, excessive SSB intake and inadequate physical activity (PA) participation in both adults and youth have been associated with obesity. It is also documented that Alabamians have low fruit and vegetable intake and PA; however, the Centers for Disease Control and Prevention have no data on sugar-sweetened beverage (SSB) consumption in Alabama. Alabama SNAP-Ed at Auburn University developed *Eat Better, Move More* (EBMM), a 6-week intervention adapted from CATCH Kids Club to stimulate healthy eating and PA of youth and their caregivers. The purpose of this quasi-experimental study was to determine the efficacy of EBMM and evaluate the types of SSBs in the home. A convenience sample of elementary youth attending summer programs and their caregivers were recruited. Youth completed pre/post surveys measuring daily fruit, vegetable and beverage intake and daily PA participation. Before EBMM instruction, caregivers completed in the home and returned a survey measuring daily fruit, vegetable and beverage intake, PA participation and beverage availability and accessibility. Topics of EBMM instruction emphasized vegetables, fruits, dairy products, SSBs, PA and energy balance. Caregivers received educational handouts, child-friendly healthy recipes and text messages with healthy eating and PA tips. Data were analyzed using paired samples *t*-test; students (n =144) reported significant increases in daily vegetable consumption (p = .004), daily fruit variety (p = .027) and significant decreases daily SSB consumption (p = .002). Caregivers data (n= 263) showed 35.7% of caregivers reported drinking 2 SSB a day. More than 50% of caregivers answered "yes" to having the following SSBs available in the home: Regular Soda Pop, Sport Drinks and Fruit Drinks. EBMM improved health behaviors that contribute to obesity in its youth sample and filled knowledge gaps about the type of SSBs in Alabama homes to help tailor future programming.

Title: Dry reforming using modified metal carbides
Primary Author (and presenter): Thakur, Raj
Additional Authors: Smith, Justin & Carrero, Carlos A.
Department: Chemical Engineering
College/School: Samuel Ginn College of Engineering

Description:

The upgrading of natural gas is a ubiquitous goal in the chemical industry, and it can be achieved through catalysis. Our research focusses on the conversion of methane (CH_4) and carbon dioxide (CO_2) to syngas. Focus is being stressed upon the utilization of CO_2 in catalytic processes to manufacture valuable chemicals and fuels, since CO_2 conversion is more valuable than its sequestration. Prior performing the dry reforming reaction, a series of catalysts comprised of vanadium oxide were converted to vanadium carbide. Novel parameters for the preparation of the catalyst were introduced, and their effect on the structural and catalytic properties was analysed. Kinetic studies were performed to determine the optimal conditions for maximizing activity, selectivity in terms of CO/H_2 ratio, and stability towards syngas. Our preliminary results show a correlation between the activity/selectivity-stability with the conditions applied in the carburization process. In this presentation, we will show our most recent results in the conversion of CH_4 and CO_2 towards syngas using vanadium based catalysts. The developing of a distinct methodology for performing the dry reforming of methane, especially by tuning the carburization process, will drive this preliminary study.

Title: Group-based education for diabetes mellitus type 2
Primary author (and presenter): Thompson, Maranda K.
Additional Authors: Ellison, Kathy
College/ School: School of Nursing

Description:

More than 30 million people are living with diabetes in the United States and the most common form is diabetes mellitus type 2. The disease is the seventh leading cause of death. Many patients diagnosed with the disease receive individual counseling from their primary care providers during their visits. Evidenced-based research recommends providing group-based education to persons with diabetes to address the gap in education. The purpose of this project was to implement a group-education program and measure the improvement outcomes of self-care knowledge, self-care management, and A1C levels. The target population included adults (18 or older) diagnosed with diabetes mellitus type 2 at the Primary Health Care clinic. Following the participation agreement, the participants completed a demographic form and self-care knowledge and self-care activity questionnaires and A1C levels were collected. They then participated in the group-education program which consisted of three 60 minute education and sharing sessions. The project is in progress. Data will be collected on the demographic variables of gender, age, ethnicity, months diagnosed, weight, and comorbidities. The outcome variables will include pre-and post-education scores from self-care knowledge and self-care activity questionnaires and A1C levels. The post-education scores from the self-care knowledge questionnaire will be collected at the end of the final group meeting and 4 weeks post group education. The post-education self-care activity questionnaire scores and A1C levels will be collected 4 weeks post education. Pre-post data will be compared with paired t-tests. Group-based education gives the participants the opportunity to learn self-care management skills from one another through sharing personal experiences and struggles with the disease. Further implementation of the project is warranted to fully evaluate the outcomes.

Title: Cultural influence on personality strengths among global leaders
Primary Author: Thompson, Megan, A
Department: Foreign Language – Spanish
College: Liberal Arts

The research presents a comparative analysis of leadership strengths in American and Hispanic cultures. Because of the lack of cross-cultural fluency among global leaders, it is pertinent to identify common approaches to leadership to promote cultural integration. Despite expanding globalization, there has been limited effort towards highlighting the cultural impact on leadership. Understanding one's approach to leadership with reference to culture prompts both appreciation and comprehension between differing cultures. Using the Clifton Strengthsfinder, an online assessment which sequences 34 talents used to "build relations, think strategically, execute plans and influence others to accomplish goals," as well as qualitative data gathered from interviews with certified Clifton Strengths Coaches, the research concludes that culture some significant impact on one's leadership approach. These findings will help future global leaders to consider both individual personality and cultural impact when interacting with and working alongside Hispanic leaders.

Title: Effect of different inlet velocity profiles on patient-specific CFD simulations of healthy trachea

Primary Author (and presenter): Tiwari, Bipin
Additional Authors: Kore, Tarun; Bodduluri, Sandeep; Bhatt, Surya P.; & Raghav, Vrishank
Department: Aerospace Engineering
College/School: Samuel Ginn College of Engineering

Description:

Expiratory central airway collapse (ECAC), defined by >50% collapse of large airways during expiration, resulting from either cartilaginous weakening or redundancy of the posterior membranous wall of the trachea, is an increasingly recognized disorder associated with cigarette smoking and chronic obstructive pulmonary disease (COPD). Pathophysiology of ECAC is multifactorial and the biomechanics of airflow in the trachea could be an important factor resulting in the progression of the disease. With improving our understanding of ECAC as the motivation, this study aims to establish a computational methodology to comprehensively investigate the biofluid mechanics in healthy and diseased patient-specific trachea. Previous studies have utilized patient-specific trachea models with various mesh sizes, use of flow extensions, and a wide range of inlet and outlet boundary conditions. However, none of the studies have conducted the assessment and comparison of CFD simulations of respiratory flow with the use of different velocity profiles as the inlet boundary condition. In this study, the effects of different idealized inlet flow assumptions on CFD simulations using patient-specific trachea models are explored and aim to ascertain if the velocity profile affects the CFD-derived wall shear stress (WSS) results. Here, the patient-specific trachea simulations are compared to discern the differences in the wall shear stress parameters with different flow conditions at the inlet. Thus, the present study is conducted in two ways, simulating 1) steady flow and 2) nominal tidal flow both using the different inlet velocity conditions of a) flat profile and b) parabolic profile. In this research the flow field metrics such as wall shear stress variations along with Time-Averaged Wall Shear Stress (TAWSS) and Oscillatory Shear Index (OSI) were computed to quantify the differences among different inlet velocity profile condition.

Title: Build orientation considerations in additive manufacturing fatigue life modeling
Primary Author (and presenter): Torries, Brian A.
Additional Authors: Suhling, Jeffrey & Shamsaei, Nima
Department: Mechanical Engineering
College/School: Samuel Ginn College of Engineering

Description:

While additive manufacturing allows for the fabrication of novel component geometries, process defects such as porosity and inclusions can negatively impact the fatigue behavior of these components. Therefore, in order for additive manufacturing technologies to attain widespread adoption, there must be reliable methods of predicting the fatigue life of these components. This study investigates the effects of build orientation and porosity on the fatigue life of additively manufactured Ti-6Al-4V specimens fabricated via laser-based powder bed fusion through the use of the Murakami method of fatigue life prediction. As-built specimens and rod stock to be machined into specimens were fabricated in vertical, diagonal (45°), and horizontal orientations, heat treated, and subjected to fatigue testing. After failure, fractography was conducted to determine the size and location of crack initiation sites. Using this information, the fatigue life was predicted via the Murakami method and compared to the experimental fatigue life. Results showed that that while build orientation little effect on the overall fatigue life, when the Murakami accounted for orientation the fatigue life predictions improved.

Title: Potential use of guano core records in reconstructing historic precipitation patterns for northern Alabama

Primary Author (and presenter): Tsalickis, Alexandra
Additional Authors: Waters, Matthew; Campbell, Joshua; & Medina, Martin
Department: Crop, Soil, and Environmental Science
College/School: College of Agriculture

Description:

The need to understand long-term precipitation patterns in Alabama is of great concern considering population increases, climate change, and other environmental stressors. Current management strategies are typically based on modern records spanning the past ~50 years, forecasting models based on these records, and dendrochronology records spanning the past hundreds of years. One scientific medium capable of tracking moisture regimes over millennial timescales but has received very little attention is guano deposits in cave systems. Guano deposits have been shown to track moisture and precipitation and are common in multiple caves systems throughout Alabama and the southeastern US. Here, we present a 9,000-year record of moisture and rainfall periods based upon stable isotopes ($\delta^{15}N$, $\delta^{13}C$, $\delta^{2}H$) in a guano core collected from Cave Springs in Priceville, Alabama. Moisture was inferred from carbon and nitrogen stable isotopes showing alterations between C_3 and C_4 plant abundance indicating changes from cooler to warmer environments, respectively. Deuterium will be measured from chitinous insect parts that have accumulated in the guano and bulk guano and will be used as an evaporation/precipitation measurement. Results demonstrate periods of terrestrial vegetation change indicating periods of changing precipitation throughout the Holocene. This study suggests that future research investigating guano deposits from Alabama caves can provide a unique and long-term record of water changes across the state.

Title: Modulus and damping as a function of temperature tested through natural frequency of a cantilever beam

Primary Author (and presenter): Tucker, Alexander
Additional Authors:
Department: Mechanical Engineering
College/ School: Engineering

In precision satellites, material modulus and damping are critical design parameters. Satellites are subject to many sources of mechanical impulse, creating vibration and jitter that affect pointing accuracy and performance. Dynamic launch loads can be extreme, and systems must be designed to avoid passing through their natural frequency, lest they be damaged by their own vibration. Low earth orbit satellites are also subject to significant temperature variations of over 100°F as they orbit the earth approximately once every 90 minutes. Therefore, precise knowledge of material modulus and damping as a function of temperature is needed to predict satellite performance.

For these reasons, the effect of temperature on modulus and damping is investigated in a graphite epoxy composite. The change in modulus is found through analysis of natural frequency. Natural frequency is analyzed through frequency response of a fixed end beam at various temperatures, measured with an interferometer. An FFT of raw data is used to generate an amplitude as a function of frequency plot. Excel Solver fits the function of a damped system to estimate the natural frequency and damping factor from the frequency response. Natural frequency is known to be a function of elasticity, mass, and dimensions. Therefore, thermal expansion effects are accounted for in calculating change of modulus as a function of temperature.

Title: Use of alternative pain medications and physical therapy for adults with chronic non-cancer pain to control pain

Primary Author (and presenter): Tulshi, Nicholas B.
Additional Authors: Howell, Eleanor
College/ School: School of Nursing

Description:

Opiates are commonly prescribed for pain management but are associated with elevated risk for misuse and addiction. Evidence-based guidelines recommend as a first line of defense against opioid abuse appropriate prescribing and the use of alternative pain medications and nonpharmacologic therapy for adults with chronic non-cancer pain (CNCP). This project implemented alternative pain medications such as nonsteroidal anti-inflammatory drugs, combined with physical therapy, such as exercises, acupuncture, and/or cupping, in managing chronic pain. The target population includes adults 18 years and older with a history of CNCP lasting 3 months or longer and who are treated with opiates. Following completion of a participation agreement, participants rated their pain on the numeric pain scale and completed a questionnaire describing their current pain management regimen. The prescription drug monitoring program was reviewed at baseline and 4 weeks to determine whether the patient is receiving opioid dosages. Following implementation of a revised pain management plan, participants were contacted by telephone at 2 and 4 weeks after the initial visit to collect data on pain rating and adherence to the treatment plan. The project is in progress. Descriptive statistics will be used to describe the patient demographics, source and type of CNCP chronic pain, symptoms, and use of pain medications and nonpharmacologic treatments. Outcome data will include number and percent who show improvement. The pre and post NPS mean scores and pre and post opioid dosage will be compared using paired t-tests (alpha=0.05). Introduction of alternative pain medications and physical therapy can reduce pain and opiate abuse and misuse in adults with CNCP who use opioids. Use of combination therapies for pain management is achievable in the primary care setting and further implementation of the project is warranted.

Title: Modeling the influence of ground surface roughness and building attributes on the physical vulnerability of low-rise buildings to hurricane winds.

Primary Author (and presenter): Turner, Kelly, N.
Additional Author: Roueche, David B.
Department: Civil Engineering
College/School: Engineering

Hurricane Harvey made landfall on the coastline of Texas on August 25, 2017 as a Category 4 hurricane, causing an estimated $125 billion dollars in economic losses, and damaging nearly 60% of the housing stock in the coastal counties impacted by the hurricane. Immediately following landfall, the second author led a team of engineering investigators in assessing the performance of 1200 single-family residential structures by means of an unbiased, cluster-based sampling technique. The focus of this study is on exploring the influences of and interactions between potential factors driving high variability in building performance observed following Hurricane Harvey. Factors included common building attributes, peak wind speed estimates at each building, and the localized terrain surrounding each building. The building attributes considered include year built, number of stories, number of and orientation of openings such as windows and doors, roof shape, first floor elevation, roof cover years in service, risk zone (as defined by insurance regulations), building value, and living area. The first author implemented a rigorous post-processing effort to aggregate and standardize the building attributes and couple them with the engineering observations of building performance, which were quantified as discrete levels of damage. The influences of wind speed and building attributes to the observed damage levels to residential buildings were then quantified using the proportional odds model, a multinomial logistic regression model for ordinal response. The study finds that wind speed, terrain and risk zone strongly influence the damage. Garage door orientation was not a significant predictor of damage. The goal of the study is to evaluate what key factors contribute to hurricane damage vulnerability in order to more efficiently focus mitigation efforts for reducing future hurricane impacts.

Title: A database to continuously record and monitor laboratory conditions in ASAPLab
Primary Author: Unzicker, Brady N.
Additional Authors: Vaughan, John; Laurent, Guillaume
Department: Physics
College/School: COSAM

Attosecond lasers offer new levels of precision in fields such as optical physics, metrology, and microscopy, yet they are highly affected by the optical properties throughout the experiment, which are usually highly temperature dependent. In order to account for this, we have developed a simple, effective system to constantly record temperature and humidity data in ASAPLab in real time. By interfacing LabVIEW with Arduino and a SQL database, we are able to maintain a database of experimental conditions. This allows us to both monitor laboratory conditions in real time, as well as store them in an electronic record. From this data, we can calculate and account for several optical properties of the lab in order to be as precise as possible in our measurements.

Title: Highly stable 2D metal carbide electrode architectures for ultrafast supercapacitors
Primary Author (and presenter): Vahid Mohammadi, Armin
Additional Authors: Beidaghi, Majid
Department: Materials Engineering
College/School: Samuel Ginn College of Engineering

Description:

Two-dimensional (2D) transition metal carbides (MXenes) are among the promising electrode materials for supercapacitors. MXenes are a family of 2D transition metal carbides and nitrides with a general formula of $M_{n+1}X_nT_x$ (M is a transition metal, X is carbon and/or nitrogen, n=1,2, and 3, and T_x represents different functional groups present at their surface) that are produced by selective etching of the A layer atoms from MAX phases, a large group of layered ternary carbides and nitrides. The high interest in 2D MXene electrodes for supercapacitors, stems from the fact that they offer ultrafast intercalation of different ions and reversible redox reactions at the surface of their outer-layer transition metals. However, from 20 different MXene compositions that are experimentally synthesized, so far only pseudocapacitive behavior of $Ti_3C_2T_x$ MXene has been systematically studied in supercapacitor systems with aqueous electrolytes. The main reason that has hindered such investigations is instability and rapid structural degradation of delaminated (2D) form of other MXene compositions such as V_2CT_x. Here we demonstrate fabrication of highly stable freestanding films of 2D vanadium carbide (V_2CT_x) MXene with superior pseudocapacitive properties. We show that a variety of cations including Li^+, Na^+, K^+, Mg^{2+}, and Al^{3+} can electrochemically intercalate fabricated V_2CT_x in aqueous electrolytes, offering capacitances of over 1300 F cm^{-3}. Supercapacitors fabricated using V_2CT_x MXene films can deliver gravimetric capacitances of over 200 F g^{-1} at a high rate of 100 A g^{-1} with cyclic performance of over one million cycles. Our research findings will provide a new venue for designing high performance binder-free electrodes based on 2D MXenes for ultrafast supercapacitors.

Title: Work-family conflicts role in resource depletion of cognitive, emotional, and physical resources

Primary Author (and presenter): Vaughn, Jacob; Allen
Additional Authors: Randi, S.; Shifrin, Nicole
Department: Psychology Department
College/School: Liberal Arts

While there is an abundance of research linking work-family conflict (WFC) to a host of negative outcomes, including compromised physical and mental health, there has been little research dedicated to understanding how the work-life interface influences these health outcomes. Identifying the mechanisms that underlie the relationships between work and life factors and health and well-being is essential in the development of effective organizational interventions and programs designed to support employee health and well-being. The present study explores the relationship between WFC and physical health, testing the depletion of cognitive, emotional, and physical resources as mediators of this relationship. Three time points of data were collected through Amazon's Mechanical Turk (MTurk) using a 30 day time lag. Path analysis using MPlus was conducted to test the hypothesized pathways. It was observed that each of the three resources had a unique mediating effect on the relationship between work interference with family (WIF) versus family interference with work (FIW) and physical health. WIF was significantly related to depletion of all three resources, while FIW was only significantly related to the depletion of emotional and cognitive resources. These findings suggest that the depletion of energy-related resources stemming from WIF versus FIW impact physical health in different ways.

Title: The drug release rates topical delivery systems mixed with drug loaded Halloysite Nanotubes

Primary Author (and presenter): Vescio, Anna, L
Department: Materials Engineering
College/School: Engineering

The objective of this study was to evaluate the effect of dissolution and drug release rates of topical delivery systems when combined with loaded halloysite nanotubes. It was found that completely hydrophilic emulsions were better vehicles for the loaded nanotubes than gels that did not dissolve completely in water and had significantly higher release rates than hydrophobic gels. The gel that was mainly used in this study was made by melting down polyethylene glycol 3350 and polyethylene 440. The gel was tested separately alone, mixed with halloysite, mixed with Rhodamine B, and mixed with loaded halloysite while submerged in a water medium at 37.3 degrees Celsius. Rhodamine B particles acted as a model drug compound during the testing which is what was loaded into the halloysite nanotubes. The addition of alien particles into the gel did not slow down or speed up the overall dissolution rate of the vehicle. It was found that this hydrophilic gel released a large amount of the contents it was mixed with, but the samples with the loaded halloysite nanotubes released their mixed in contents slower than the mixtures of solely Rhodamine B in the sample. If this delivery process can be controlled and accurately measured, it could be useful in the delayed release of medication on mixed gel impregnated bandages and gauze.

Title: A bioremediation approach for perfluoroalkyl substances (PFAS)
Primary Author (and presenter): Viticoski, Roger L.
Additional Authors: Blersch, David; Mulabagal, Vanisree; Ayers, Meredith; Wang, Danyang; Hayworth, Joel
Department: Civil Engineering
College/School: Samuel Ginn College of Engineering

Description:

Perfluoroalkyl substances (PFAS) are a large group of synthetic organic chemicals that have suspected or known endocrine disrupting properties in wildlife and humans. As a consequence of their fluorinated alkyl chains, options for treating PFAS-contaminated water are limited and require extreme operational conditions. To evaluate the suitability of an Algal Turf Scrubber (ATS) approach to be used an innovative remedial alternative for PFAS, a periphytic algal community was exposed to a mixture of four PFAS (PFOS, PFOA, perfluoro 3,6-dioxaheptanoic acid (referred as Ether), and HFPO-DA) at 2µg/L for 72 hours. Water and algal biomass were repeatedly sampled from each channel, from which 66 water and 4 biomass samples were analyzed using UHPLC-QqQ-MS. The amount of contaminants found in the biomass was equal to 1.24 ± 0.40% for PFOA, 1.21 ± 0.41% for PFOS, 0.26 ± 0.16% for HFPO-DA, and 0.76 ± 0.27% for Ether. Pigments analysis evidenced a significant increase in the production of Chlorophyllide, a degradation product from Chlorophyll-a, indicating that the algal community was under stress after exposure to PFAS. In addition, it was observed that between 35-84% of the initial concentration of PFOS and PFOA remained unaccounted for when a mass balance was performed. To account for this loss, an additional experiment was designed to assess the capability of PFOS and PFOA to sorb into the materials used to construct the experimental system. Preliminary results suggest that the analyzed materials were capable of sequestrating between 43 and 66% of the contaminant's initial mass. Finally, results from this project indicate that ATS might not be an effective alternative for PFAS remediation. However, preliminary results suggest that recycled plastics combined with other constituents were successfully able to sequester PFOS and PFOA, and thus should be further explored as a remedial strategy for PFAS.

Title: Structured telephone support and heart failure readmission rates
Primary Author (and presenter): Wade, Tiffany H.
Additional Authors: Howell, Eleanor
College/ School: School of Nursing

Description:

Congestive heart failure 30-day hospital readmission rates are among the highest readmission rates in the nation. Evidence indicates self-care management deficits after discharge contribute to heart failure readmission and recommend regular telephone contacts between patient and providers to address early symptom management. The purpose of this project was to assess the effect of structured telephone support and education on heart failure self-care management on 30-day hospital readmission. The target population included adults (19 years of age and older) with heart failure who were recently discharged from a hospital and enrolled in a congestive heart failure clinic. Participants were contacted by telephone starting five to seven days after hospital discharge, then weekly for a total of three telephone calls. The telephone calls included five questions and education regarding follow-up care and self-care management. After 30 days, the patient's hospital medical record was reviewed to assess for a hospital admission within 30 days after discharge. The project in in progress. Descriptive statistics will be used to describe the participant population. Heart failure readmission will be calculated as the proportion of participants readmitted to the hospital at least once during the 30-day period following hospital discharge. The heart failure readmission rate will then be compared to current hospital and national average readmission rates. Structured telephone support provided to heart failure patients after discharge can increase patients' knowledge of heart failure symptom management and self-care to decrease heart failure hospital readmission rates. Education provided to patients through structured telephone support is achievable after hospital discharge and further implementation of the project is supported.

Title: Experiential learning aids in the adoption of water elevation level measuring technology
Primary Author (and presenter): Walker, Tegan J.
Department: Curriculum and Teaching
College/School: College of Education

Description:

Farmers in developing countries with low incomes often lack adequate resources to adopt new technologies (Rogers, 2003). The promotion of technologies to increase food production will not be as successful unless projects also work to provide adequate startup resources. The willingness of a farmer can only take them as far as their ability to adopt new technologies. Small household size fish ponds can increase protein consumption, food security, and provide an additional source of income. Constructing small ponds in a rural Panamanian community is a multi-step process that must begin with assessing the availability of a water source. Continual fresh water supply is the priority when choosing a location to build a fish pond. Water capture systems can easily be installed in small streams while a system of pipes carry water from the source to the pond. Measuring the elevation change and loss of pressure of the potential system before installation is crucial for success. A water elevation level can be used to measure distance, elevation change, flow rate, and headloss of a potential water distribution system. During a two-year fish pond construction project in a rural Panamanian community, farmers were first trained on how to properly select a pond site and water source location. Eleven small-scale farmers were trained on proper water elevation level use, record keeping, and calculations. Potential water system placements were first assessed with the use of the water elevation level tool. Calculations were then made to assess the elevation change and headloss to insure an adequate and continual supply of water would reach the pond site location. Four water capture and distribution systems were installed to supply water to nine fish ponds as a result of this project. These fish ponds supply farmers and their families with an additional source of protein and potential additional income to help increase their food security.

Title: Auburn public arts
Primary Author (Presenter): Walker, Caroline E
Additional Authors: Hamilton, Sarah; Ingram, Kendall; Rivers, Natalie; Swartz, Avery; Odom, Kylee
Department: Consumer and Design Sciences
College/School: College of Human Sciences, Auburn University

Public art addresses public health and well-being by reducing stress, providing a sense of belonging, and encouraging pedestrians to slow down and enjoy the community around them. Public art installations are something that are greatly lacking on Auburn's campus and within the local community. With our proposed free public art project, we hope to introduce a culture of art into the community and encourage a sense of appreciation, positivity, adventure, and school spirit among locals and visitors alike. Public arts are important to provide social cohesion, enticing visitors to come enjoy unique sights, and encourage the sense of community and school spirit, which in turn can result in higher applications to the university, higher satisfaction rate among students, higher interest in moving to the community, and higher likeliness of alumnus returning to visit as well as donating back to the school. Public arts are a great way to bring pedestrian traffic to a location, and in turn, free social media marking and economic growth to a community will result. Using the "Tiny Doors ATL" movement as a precedent study, we aim to incorporate a series of hidden sculptural moments of Aubie throughout Auburn University's campus as well as the downtown area. Utilizing a series of evolving installation pieces, we will create an interactive adventure between local artists and the community. Tiny Tigers will become a spectacle and an adventure for students, locals, and visitors to set out on adventure to find each Tiger, which will inspire curiosity and exploration of the local area, as well as foster school spirit for Auburn University. The impact of this public art installation will employ local artists to get involved, revenue more foot traffic around the local community and businesses, and result in an overall sense of joy, economic growth, and social cohesion.

Title: Adverse events reporting with naloxone product use from the FDA Adverse Event Reporting System (FAERS) in 2008-2018

Primary Author: Wallace, Adrienne M.
Additional Authors: Mishuk, Ahmed & Qian, Jingjing
Department: Health Outcomes Research and Policy
College/School: Harrison School of Pharmacy

Description:

Opioid prescribing and abuse is a major health-care related issue in the United States. By July 2017, all state have passed their naloxone overdose prevention laws in extended prescribing of naloxone. However, the safety of increased prescribing of naloxone products is unknown. To examine the adverse events (AEs) reporting with naloxone products in 2008-2018. Using the FDA FAERS online public dashboard we examined trends in AE reports (overall and by patient's sex and age) for naloxone monotherapy (i.e. Narcan, Evzio, and generic naloxone) and combination products, as well as top reactions and outcomes of these AE reports from January 1, 2018 to September 30, 2018. AE reports of all naloxone monotherapy and combination products have increased from 257 in 2008 to 2130 to 2018, majority (90%) of which were related to naloxone combination products and among patients in age 18-64 years old. The top 3 reported reactions for Narcan were vomiting (16.9%), overdose (16.9%), and drug withdrawal syndrome (11.3%). The top 3 reported reactions for Evzio were accidental exposure to product (26.7%), drug ineffective (23.3%), and drug withdrawal syndrome (10.0%). The top 3 reported reactions for generic naloxone injections were overdose (8.1%), pulmonary edema (8.0%), and toxicity (7.8%). Overall, the reported outcomes for all naloxone monotherapy and combination products included 4054 hospitalizations (20.1%) and 1168 death (5.8%). Naloxone prescribing and use plays an important role in reducing the risk of overdose deaths for opioid abuse. Understanding the AEs and outcomes reported with naloxone products will help guide health care professionals on appropriate and safe prescribing of naloxone.

Title: Short-chain perfluoroalkyl substances (SC-PFAS) analysis in environmental samples
Primary Author (and presenter): Wang, Danyang
Additional Authors: Ayers, Meredith; Mulabagal, Vanisree; & Hayworth, Joel
Department: Civil Engineering
College/School: Samuel Ginn College of Engineering

Description:

Per- and polyfluoroalkyl substances (PFAS) are a group of synthetic polymers that are used in manufacturing a number of consumer products. Continuous production of these polymers over the decades has caused the release of numerous short-chain PFAS and their transformed products in to the environment. Due to their known and suspected environmental and health risks, predicting and monitoring the fate of PFAS has become a global priority for researchers and regulatory organizations. Short-chain PFAS (polymers that contain six or fewer carbon molecules, C_4-C_6) are highly stable and resistant to degradation. As a result, these contaminants have been detected in virtually all environmental media and biota (including humans). In this study, we have developed a method for the analysis of eight short-chain PFAS (PFBA, PFBS, PFPeA, PFPeS, PFHxA, PFHxS, PFOA, and PFOS) in environmental water samples. The validated method was applied for the analysis of short-chain PFAS in seven surface water samples collected along the Tennessee River in Huntsville, Alabama using high-performance liquid chromatography-coupled to triple quadrupole mass spectrometry (LC-QqQ-MS). Among the samples analyzed, the total concentration of short-chain PFASs were in the range of 21.2 to 31.8 ng/L.

Title: Comprehensive characterization of high K dielectrics for ultra wide band gap applications
Primary author (and presenter): Wang, Lu
Additional authors: Dhar, Sarit & Kuroda, Marcelo A.
Department: Physics
College/ School: College of Sciences and Mathematics

Description:

Insulators with dielectric constants and band gaps larger than those of SiO_2 are scarce. Here, we present a study of binary high K/large band gap materials that include the family of alkaline earth metal halides (AX_2), as well as lithium fluoride (LiF) and beryllium oxide (BeO). Analysis of their electrical and thermal properties is produced using first principles calculations with different levels of sophistication. Our results show that the most stable phases of these materials are those with larger band gaps. Phonon properties and dielectric response are compared using different exchange-correlation functionals: (i) Localized Density Approximation (LDA), (ii) Generalized Gradient Approximation (GGA) and (iii) Generalized Gradient Approximation including van der Waals forces (GGA+vdW). We find that the dispersive forces correct the mode softening observed in low-frequency phonon modes in the GGA functionals yielding results similar to LDA. We discuss the different trends found in these materials and their potential use in power electronics applications.

Title: Improved the growth of microalgae in pretreated anaerobic digestate by activated sludge
Primary Author (and presenter): Wang, Qichen
Additional Authors: Higgins, Brendan
Department: Biosystems Engineering
College/School: Samuel Ginn School of Engineering

Description:

The combination of anaerobic digestion and microalgae cultivation has the potential to reduce the costs for both processes. With the increasing public concern on freshwater eutrophication and tightening nutrient discharge regulations, waste treatment facilities are making the decision to investigate new technologies to replace costly traditional nutrient removal methods. Many wastewater treatment plants utilize anaerobic digestion to treat excess sludge. Growing microalgae in the liquid effluent from anaerobic digester is ecologically and economically friendly. Our research group is trying to understand and overcome some challenges during this waste conversion process. One of the major challenges is the severe growth inhibition that occurs when microalgae are cultured on full strength anaerobic digestates. 10-20 folds of dilution with freshwater are typically used to overcome this inhibition. In this study, we have developed an approach in which inhibition is alleviated by pretreating full strength digestates with aerobic bacteria. We hypothesize and present evidence that organic compounds in digestate are the likely algal inhibitors. This contrasts with the classical hypothesis that ammonium is the primary algal inhibitor in anaerobic digestate. *Chlorella sorokiniana*, an extreme ammonium tolerant green algae species, was observed to have significant biomass increases in both municipal and food waste anaerobic digestates after pretreatment with activated sludge. Without this pre-treatment, *C. sorokiniana* completely failed to grow on full strength digestates. The nutrients removal is also significantly increased due to the fast growth of algae after the treatment. Further research is underway to identify the specific inhibitory compounds and to better understand the mechanisms of inhibition and alleviation of inhibition.

Title: Detecting recycled SoCs by exploiting aging induced biases in memory cells
Primary Author (and presenter): Wang, Wendong
Additional Authors: Guin, Ujjwal; Harpe, Charles; & Singh, Adit D.
Department: Electrical and Computer Engineering
College/School: Samuel Ginn College of Engineering

Description:

The rise of recycled ICs being sold as new through the global semiconductor supply chain is a serious threat to critical infrastructure due to their inferior quality, shorter remaining life, and potentially poorer performance, compared to their authentic counterparts.
While solutions, such as age monitors, have been proposed for new designs, detecting the recycling of older legacy ICs already in use is much harder; no reliably effective solution currently exist. In this paper, we propose a new and highly effective approach for detecting recycled ICs by exploiting the power-up state of on-chip SRAMs to evaluate the age of the chip. Our methodology does not require the introduction of any special aging detection circuitry, nor the recording and saving of historical circuit performance data to detect degradation from use. It is also low cost since does not require any special test equipment. Since SRAMs exist in virtually all systems-on-chip (SoCs), the approach is widely applicable to both old and new designs. We present experimental results using commercial off-the-shelf SRAM chips to validate the effectiveness of the proposed approach.

Title: Impact of environmental factors, temperature and humidity, on the population dynamics of *Aedes* mosquito in Alabama

Primary Author (and presenter): Wang, Yifan
Additional Authors: Liu, Nannan
Department: Entomology and Plant Pathology
College/School: College of Agriculture

Description:

Mosquitoes population surveillance is the fundamental work for providing valuable information that can be used to develop an efficient model to predict the population dynamics in the field, which can help optimizing the management of mosquitoes and prevent the mosquito disease transfer. Three Aedes mosquito species have been identified in Alabama: *Aedes albopictus*, *Aedes triseriatus*, and *Aedes japonicus.* Except *Aedes japonicus*, which is not responsible for disease transmission, the other two species can transfer serious human diseases. Temperature and humidity are the major factors influencing the population dynamics of mosquitoes; increase of which will cause the arising of mosquito populations. We have found that mosquitoes start to emerge in April at the temperature of ~57°F with 85% of humidity. The highest mosquito abundance occurs in August when the average temperature is around 78°F and humidity is about 78%. The highest mosquito populations have been identified in Mobile and Tuscaloosa compared to the populations in other locations tested in Alabama. Whereas, Dothan has the smallest number of mosquitoes.

Title: Preparation of printable electroactive soft robotics actuators
Primary author: Wang, Yuyang
Additional Author: Barde, Mehul; Alizadeh, Nima; & Auad, Maria
Department: Chemical Engineering
College: Samuel Ginn College of Engineering

Description:

Electroactive hydrogels (EAH) that exhibit controlled deformation under applied electric field have potential in the production soft robotics actuators. Soft robotics present challenges in responsive abilities and morphology under traditional manufacturing process.
In this work, we developed new polymeric materials for stereolithography (SLA) for the design of 3D printing structures. The hydrogel samples were synthesized using 90 wt% acrylic acid as a monomer, 8 wt% Trimethylolpropane trimethacrylate as a cross-linker, and 2 wt% of phenyl bis (2,4,6-trimethylbenzoyl) phosphine oxide as a photoinitiator. A Stereolithography 3D printer "Anycubic Photon" was utilized to fabricate the electroactive hydrogel samples. Finally, they were tested using a cyclic volumetric machine (10V) to test the bending properties. The hydrogel samples were able to bend due to the different concentration of polyion COO^- in the gel, causing changes in the osmotic pressure and conformational of the polymer network.

Title: A phylogeny-regularized convolutional neural network for microbiome-based prediction
Primary Author (and presenter): Wang, Ye
Additional Authors: Bhattacharya, Tathagata & Mao, Jianzhou
Department: Computer Science and Software Engineering
College/School: Samuel Ginn College of Engineering

Description:

With the development and decreasing cost of next-generation sequencing technology, the study of the human microbiome has become one important research field accounting for its huge potential in clinical applications such as drug response prediction, patient stratification, and disease diagnosis. Thus, it is essential to build a microbiome-based predictor for clinical outcomes based on microbiome profiles consisting of taxa abundance and a phylogenetic tree. One important characteristic is all microbial species are not uniformly distributed on the phylogenetic tree but tend to be clustered at different phylogenetic depths. Thus, the phylogenetic tree provides for the structure of microbiome, which might be an important prior information for prediction. However, prediction methods that consider the phylogenetic tree in a rigorous way are under-developed. We develop a deep learning prediction method "Phylogeny-regularized convolutional Neural Network,"(pCNN) for microbiome-based prediction. The advantage of pCNN is that it uses the convolutional kernel to capture the signals of microbiome species with close evolutionary relationship in a local receptive field.
Moreover, pCNN uses different convolutional layer to capture different taxonomic rank (e.g. species, genus, family, etc). Together, the convolutional layers with its built-in convolutional kernels capture microbiome signals at different taxonomic levels while encouraging local smoothing induced by the phylogenetic tree. , Both simulation and real data analysis demonstrate pCNN outperforms competing methods.

Title: Discovery of a new lineage of fish blood fluke (Platyhelminthes: Digenea: Schistosomatoidea) infecting coquina clams (*Donax variabilis*) and lesser electric rays (*Narcine bancroftii*) in the Gulf of Mexico

Primary Author (and presenter): Warren, Micah Brett
Additional Authors: Bullard, Stephen, A.
Department: Fisheries, Aquaculture, and Aquatic Sciences
College/School: College of Agriculture

Description:

Fish blood flukes (FBFs) number 161 species that collectively infect freshwater, marine, and estuarine fishes, are occasional pathogens of cultured fishes, and are the ancestor to the human-pathogenic blood flukes (schistosomes) that debilitate >218 million people annually. The life cycles of FBFs include an invertebrate intermediate host and a fish definitive host. A total of 14 life cycles for FBFs have been elucidated but none have been documented in a shark or ray. Our objective was to morphologically characterize a new species of FBF infecting a ray, search for larval infections among sympatric mollusks, histologically characterize infections in those mollusks, and use genetic sequence data to infer the life cycle of and reconstruct a phylogeny. From 2012−2017, the heart of 14 of 50 (28%) lesser electric rays from coastal Alabama were infected with adults of a new FBF species. It is similar to *Ogawaia glaucostegi*, which infects the giant shovelnose ray in the southwestern Pacific Ocean by having an inverse U-shaped ceca, a looping testis, a post-cecal ovary, and ascending and descending portions of the uterus. It differs by having a vermiform body, a testis with 34 curves, a seminal vesicle that is >1/2 body width, and a uterus posterior to the testis and ovary. From 2017−2018, six of 1,174 (0.5%) coquina clams were infected with hundreds of larval FBFs comprising 4−6 cercariae within each sporocyst. This cercaria resembles *Cercaria asymmetrica*, which infects coquina clams from coastal Florida by having concentric rows of spines distally, tegumental spines, a dorsal finfold, a tailstem, and asymmetrical furcae that lack finfolds. Sequences of the large subunit rDNA from these adult and larval FBFs were identical, indicating conspecificity. The results comprise the first documented life cycle for any species of blood fluke infecting a chondrichthyan, and the new species detailed herein will likely be assigned to a new genus.

Title: Sex trafficking survivors' perspectives on relational resources
Primary Author: Warren, Kalyn, E.
Additional Authors: Gnagi, Taylor; Ruhlmann, Lauren
Department: Human Development and Family Studies
College/School: Human Sciences

Sex trafficking survivors experience adverse physical and mental health outcomes due to physical, sexual, and psychological violence, as well as relational challenges related to affect regulation, attachment, and traumatic bonding. Strong relationships can buffer the negative effects of trauma exposure, but trauma can strain the very relationships critical to recovery. This relational paradox has been explored in few studies. This study adds to the literature by examining survivors' perceptions of the quality and utility of their relationships in the context of their transition out of the sex trafficking industry.

This study was conducted through a partnership with a non-profit residential recovery program that provides comprehensive services to adult female sex trafficking survivors. Six (N = 6) survivors ages 19 to 39 (M = 28.57, SD = 8.42) voluntarily participated in this study. Participants were trafficked for an average of 65.71 months (range = 6 – 144 months; SD = 52.62) and had been in the recovery program for an average of 11.21 months (range = 0.50 – 36 months, SD = 11.96) at the time of data collection.

Under the supervision of a qualified research mentor, students facilitated 45-minute interviews with participants. The interview included 20 questions organized into three sections: 1) trafficking experiences, 2) transitioning experiences, and 3) perspective on transitioning resources. Interviews were recorded and transcribed verbatim.

Framework Method analyses yielded three themes that represented distinct relational domains: 1) *non-professional relationships*, 2) *professional relationships*, and 3) *spirituality*. Sub-codes highlighted nuance within each domain in that some relationships were both helpful and challenging to negotiate. Findings from this study represent survivors' perspectives on the quality and utility of their relationships during a vulnerable time, which can inform the resources provided by recovery programs serving this population.

Title: Sub-bandage pressure and deflection testing with two bandage splint constructs in an ex vivo mid-metacarpal equine fracture model
Primary Author (and presenter): Weatherall, Kathleen M.
Additional Authors: Lutter, John, and Beard, Warren
Department: Clinical Sciences
College/School: College of Veterinary Medicine

Description:

In the event of an equine long bone fracture, proper stabilization in the field is key with bandages and splints commonly used by practitioners in the field to transport the horse for continued diagnostics or referral. The true impact of bandage material application in stabilization of equine fractures is minimally understood, due to lack of objective studies evaluating the recommended techniques in an ex vivo or in vivo fashion. We hypothesized that a single stack bandage with splints would provide similar and adequate neutralization of forces to prevent bending of a metacarpal fracture when compared to the Robert Jones bandage with splints, but would result in greater sub-bandage pressure. We compared the stability of these two bandage types with splints placed in two planes at 90° to each other applied to an equine cadaver limb with a mid-metacarpal transverse fracture. The constructs were stressed under partial weight bearing load and sub-bandage pressure measured to document stabilization of the fracture by measuring deflection distance and angle. Statistically significant differences between the deflection distance and angle were not found, however the single stack bandage obtained significantly higher pressure levels when compared to the Robert Jones construct. These results show that either bandage is adequate for stabilizing a mid-metacarpal transverse fracture with appropriately applied splints, although less layers provide increased pressure. Limitations of the study include use of cadaver limbs and testing in one plane. However, the data obtained provides clinically relevant information for the equine practitioner in an emergency setting.

Title: Comparison of body fat percentage and body mass index as predictors of pre-diabetes
Primary Author (and presenter): Weber, Rachel, L,
Additional Authors: Gamston, Courtney E., ScM, PharmD, BCPS; Kirby, Annie, PhD, RD; Lloyd, Kimberly Braxton, PharmD
Department: Pharmacy Health Services; Pharmacology
College/School: Pharmacy

BACKGROUND: According to the CDC, pre-diabetes affects approximately 84 million American adults, putting them at risk for developing type 2 diabetes. Major risk factors for pre-diabetes include but are not limited to: increasing age, being overweight or obese, race, ethnicity, and inactivity. Body mass index (BMI) is used to assess weight status to determine risk for having pre-diabetes. However, because the BMI scale does not account for the ratio of lean muscle to adipose tissue, body fat percentage may be a more relevant factor for determining risk of pre-diabetes. One major **GAP** in the current literature is how body fat percentage and BMI compare for determination of pre-diabetes risk.

METHODS: This retrospective, case controlled study matched ambulatory care patient data according to BMI, age, gender, and race. The predictive ability of BMI was compared to that of body fat percentage by determining the sensitivity, specificity, predictive value positive and negative, and odds ratios.

CONCLUSION: Body fat percentage consistently demonstrated a greater specificity while BMI demonstrated a consistently greater sensitivity for the detection of pre-diabetes. BMI $\geq 25 kg/m^2$ and body fat percent $\geq 40\%$ demonstrated similar odds ratios (+1.43 and +1.4, respectively), though BMI $\geq 25 kg/m^2$ had a sensitivity and specificity of (87.5 and 16.9, respectively) and that of body fat percent $\geq 40\%$ was (44.4 and 63.6). Though body fat percentage has better specificity than BMI, its limited sensitivity makes it a poor substitute for BMI in the ambulatory care setting.

Title: Tracking biofilm formation of *S. aureus* at different hydrodynamic flow conditions in microfluidic chambers

Primary Author (and presenter): Wesolowski, Alec R.
Additional Authors: Mouslem, Abdulaziz; De La Fuente, Leonardo; & Panizzi, Peter
Department: Drug Discovery and Development
College/School: Harrison School of Pharmacy

Description:

Staphylococcus aureus (*S. aureus)* is a Gram-positive pathogen that it is capable of causing a variety of infections, ranging from skin and soft tissue infections to life-threatening diseases such as endocarditis, osteomyelitis, and sepsis. Due to its prominent behavior to colonize on the skin of healthy adults, *S. aureus* has become the leading cause of healthcare-associated infections in the United States with mortality rates between 19% and 34%. Its ability to form biofilms, an aggregation of bacterial cells, in order to improve survival and dispersion under stressful conditions often leads to the development of complicated infections that may not be susceptible to simple antibiotic treatments. Since the formation of a biofilm is complex and an important subject of research in to bacterial resistance, we propose that a microfluidic device based *in vitro* model of *S. aureus* biofilm can provide novel insights into the mechanism that can affect biofilm formation. One of the requirements that significantly influence biofilm development is hydrodynamic flow conditions (*i.e.* pressure and shear stress). As it is a closed and sterile system, microfluidic devices can very exactly maintain a given micro-environmental condition and allow for us to study contributing factors to the development of bacterial biofilms in real-time. Here we utilize microfluidic chambers and constantly flowing bacterial pathogen in these channels at various flow rates to manipulate the force applied to the chambers, while the impact on the biofilm formation was measured by time-resolved light microscopy and quantified by ImageJ analysis. Furthermore, we believe our data is highly translatable to other biofilm forming pathogens where alterations in hydrodynamic conditions cause bacterial biofilm formation.

Title: Improving the management of chronic non-cancer pain through continuing education
Primary Author: Westberry, Ashley D.
Additional Authors: Peterson, Mary
College/ School: School of Nursing

Description:

Although $3.6 billion is spent on opioid use for managing chronic non-cancer pain yearly, the use of risk mitigation strategies is not required by law. Recent studies focus on education as a solution to the opioid crisis. Although the translation between increasing provider knowledge and improving clinical outcomes is difficult to extrapolate, some studies have shown benefits. The purpose of this project was to examine if education material provided to participants and providers result in improved clinical outcomes regarding increased practice alignment with best practice guidelines. Clinical outcomes included urine toxicology use, patient-provider agreements, and knowledge scores obtained from testing. The target population included adults (>18) that use opioids for managing chronic non-cancer pain at a primary healthcare clinic. Following participant agreement, patients completed a demographic questionnaire and a pre-test. Patients and primary care providers were educated on best practice guidelines per Centers for Disease Control and Prevention (CDC). After four-weeks, patients completed a post-test to assess for knowledge change. Chart reviews were conducted at project initiation and completion to assess urine toxicology screens and patient-provider agreements. The project is in progress. Descriptive statistics will be used to describe the participant population, knowledge of current guidelines, use of urine toxicology screens, and use of patient-provider agreements. Paired t-tests (α=0.05) will be used to compare pre- and post-intervention knowledge scores. Educating patients and primary care providers about best practice guidelines can increase clinical outcome alignment with CDC guidelines. Outcomes include increased urine toxicology screening, use of patient-provider agreements, and increased knowledge. Further project implementation is warranted and may include other validated educational tools or programs.

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Title: An *in vitro a*ssay of novel antimicrobial compounds and chloramphenicol derivatives
Primary Author (and presenter): Westerfield, Matthew, F.
Additional Authors:
Department: Biology
College/School: COSAM

The number of effective antibiotics available to medical personnel is dwindling. This is due to bacteria developing antibiotic resistances to the most commonly used drugs. Without the ability to appropriately treat infections, previously trivial infections can become life-threatening. This problem can be overcome by discovering novel antimicrobial compounds and by improving existing antibiotics. Dr. Liles's lab at Auburn University is pursuing both approaches by purifying novel antimicrobials from the soil metagenomics library and by identifying naturally occurring chloramphenicol derivatives. Chloramphenicol and numerous clinically relevant antibiotics act by inhibiting protein synthesis. The goal of this project is to test the efficacy of these novel compounds on translation. The efficiency of protein synthesis is monitored by the production of a green fluorescent protein (GFP). This allows for rapid (within a few hours) determination of inhibition. Results can be obtained using a plate reader capable of exciting the proteins and detecting fluorescence. Under the no-drug condition, a large amount of fluorescence is produced, while in the presence of chloramphenicol, there is close to no fluorescence throughout a 12-hour period. Eight chloramphenicol derivatives have been tested from a 10,000 μM to 1 μM range and have produced various levels of inhibition. Three of the eight tested derivatives produced moderate to strong inhibition but were not as potent an inhibitor as chloramphenicol. In a similar fashion, 13 novel compounds have been tested but only at a single concentration. Two of these compounds have shown inhibitory ability. This project is ongoing with new compounds being tested every few months.

Title: Physical restraints and delirium in the ICU
Primary Author: White, Shaina L.
Additional Authors: Watts, Sarah
College/ School: School of Nursing

Description:

The development of delirium in the intensive care unit (ICU) is a significant event in critically ill patients and often leads to negative patient outcomes. Studies have demonstrated that use of physical restraints is one of the most significant independent predictors of developing delirium. Despite the large amount of evidence available, restraints continue to be overused in the ICU, suggesting a need for education of nursing staff. The purpose of this project was to determine if an educational intervention for nursing staff on judicious restraint could decrease restraint use and delirium rates in the adult ICU. The target population included registered nurses currently employed in an ICU at a community hospital in the southeastern United States. Data was gathered on nursing staff perceptions of delirium. An education intervention was then performed on judicious restraint use and nurses were encouraged to decrease restraint use over the next 4 weeks. Data was collected from participants. In addition, the project leader gathered data regarding restraint utilization prior and after the intervention to assess the impact of the intervention on patient care. The project is in progress. Descriptive analysis will be performed on the pre-intervention and post-intervention groups. Outcome improvement will be analyzed using paired samples t-tests for the interval/ratio variables and crosstabs/chi-square tests for the Likert scale measurement outcomes. Wilcoxon matched pair rank tests will be performed on the ordinal variables as well. Both groups will be compared with independent t-tests (alpha=0.05). An educational intervention for ICU nurses on judicious restraint use can decrease overall restraint use, which can decrease the likelihood of patients developing delirium in the ICU. Decreased delirium rates through education are achievable in the ICU setting and further implementation of this project is warranted.

Title: Aerodynamic response of a red-tailed hawk to a vertical gust
Primary Author (and presenter): Wietstruk, Mike
Additional Authors: Swiney, Paul; Gosdin, Levi; & Raghav, Vrishank
Department: Aerospace Engineering
College/School: Samuel Ginn College of Engineering

Description:

Recently there has been significant interest in the development of uninhabited aerial vehicles (UAVs) for civilian and military applications. However, one of the primary limitations to the widespread adoption of UAVs is their inability to perform well in "real world" environments. Developing effective countermeasures requires a comprehensive knowledge of potential evasive techniques to fly in turbulent weather. To this end, this project adopts a bio-inspired approach to improve the performance of UAVs in harsh weather conditions. This will be achieved by studying the aerodynamic response of birds to turbulent/gusty conditions in collaboration with the Southeastern Raptor Center (SRC) at Auburn University. In order to subject the red-tailed hawks to a gust in a controlled environment, a novel gust generation device was developed. The gust generation device consisted of a commercially available air curtain with diverging ducts added to achieve a uniform velocity profile. The device length was similar to the wingspan of a red-tailed hawk (1.2 m) and produced a gust speed of 6.3 ± 0.2 m/s in the flight path of the bird, representing 50% of the birds flight speed. Using high speed imaging, the response of the hawk was recorded. Initial flight trials showed the hawk rotating its tail in a downward direction as it passed through the gust, with no movement being observed in its wings. The hawk's response was compared to a flapping wing UAV traversing a similar flight path. The results of the comparison show the hawk was able to maintain stability by pitching its tail downward, while the UAV became destabilized due to its static tail section. Since the response of the hawk to the gust was minimal, a more powerful gust (12 m/s) covering a larger area will be used in future experiments to elicit a more pronounced response. Such an improved understanding of the mechanics of bird flight in turbulent/gusty weather will allow for improved design of UAVs.

Title: The expected surprise
Primary Author (and presenter): Williams, Carolina
Department: Marketing
College/School: Harbert College of Business

Description:

Subscription boxes are currently causing a major disruption in the traditional retail industry. With the subscription economy recently growing drastically, the shift clearly mirrors the fact that the shopping preferences of consumers are changing, and as a result, marketing tactics are now having to evolve in response. The purpose of this research was to highlight not only the shift in consumer preferences, but also the psychology behind the choices of consumers and subscription box companies' strategies. Because subscription boxes are still relatively new to the retail world, there has been little research done to conclude what marketing tactics a subscription box company should use in order to be successful. Furthermore, the implications of this research — such as understanding the psychology behind these customers and noting what strategies are most successful for these companies — can not only be applied to subscription box marketing, but can influence marketing in other traditional companies and corporations as well. To approach this research, I chose three subscription box companies (HelloFresh, StitchFix, and The Bouqs Company) that are the leading successful company in each of their respective fields (food, fashion, and flowers). I then did qualitative exploration as I completed case studies on each, analyzing the target market, social media tactics, etc. Essentially, the primary findings were that target markets should evolve with a company, and that it is important to create a sense of "community" in marketing strategies so that customers feel connected to the company and stay loyal by continuing to subscribe. Overall, this research suggests that the subscription box industry will continue to grow, and and companies must find a balance between targeting a niche market and trying to appeal to a wide range of ages and genders, as there is a strong base of willing, exploratory, and loyal customers that exist for future innovation.

Title: Changes in sleep efficiency in children and adolescents with Autism Spectrum Disorder during an adapted tennis program

Primary Author (and Presenter): Wilson, Carley S.
Additional Authors: Favoretto, Loriane & Pangelinan, Melissa
Department: Kinesiology
College/School: College of Education

Description:

Sleep disturbances are often reported by parents of individuals with Autism Spectrum Disorder (ASD). In neurotypical populations, exercise and physical activity are associated with a reduction of sleep disturbances (i.e., improved sleep efficiency). The purpose of this study was to determine if an adapted tennis program, which would increase physical activity, would be associated with greater sleep efficiency in children and adolescents with ASD. In addition, we examined the influence of individual characteristics such as age, sex on sleep efficiency. A total of 20 participants (7 females/13 males) ages 7-19 with ASD participated in a 4 week (2x a week for 1 hour per session) adapted tennis program (ACEing Autism). During the program, participants wore Actigraph accelerometers on their non-dominant wrist. Data were recorded up to 2 weeks prior to the program, during the program, and up to 2 weeks after the program. Actilife software was used to validate sleep and quantify sleep indices (e.g., sleep efficiency). Repeated measures analysis of variance was used to determine differences across sleep efficiency from pre-test, during the program, and post-test with respect to age, sex, and all interactions. An age x sex x time interaction was found ($p<0.05$). Follow-up analyses showed that older males exhibited poorer sleep efficiency during the program, while older females exhibited greater sleep efficiency. These results suggest that physical activity may differentially affect males and females with ASD. These results have been influenced by a greater number of medications taken by older males with ASD in this sample. Future studies with a greater number of female participants are needed to validate these results. Future studies with greater overall sample sizes are necessary to determine the influence of medications commonly used by individuals with ASD (e.g., stimulants, anti-anxiety medications, and anti-seizure medications) on activity-related sleep disturbances.

Title: The role of PEA15 in cell migration and proliferation
Primary Author (and presenter): Wilson, Dylan S.
Additional Authors: Watanabe, Rie; Gillespie, James; & Graff, Emily C.
Department: Pathobiology
College/School: Veterinary Medicine

Description:

Recently a loss of function mutation in Phosphoprotein Enriched in Astrocyte (PEA15) was identified in domestic cats at the Scott-Ritchey Research Center. Cats with the PEA15 mutation have severe microcephaly and polymicrogyria along with neurological sensory and motor anomalies. PEA15 has been described in numerous disease states such as type 2 diabetes, polycystic ovary syndrome, and neurological disorders, and is expressed at low levels in all tissues, with increased expression in the brain. Previous rodent studies observed increased wound healing and cell migration in PEA15 knockout mice compared to wild-type controls. The overall objective of this study was to identify potential mechanisms that may contribute to the feline cerebral dysgenesis phenotype, specifically changes in cell migration and proliferation. In order to evaluate these mechanisms, primary dermal feline fibroblasts were collected at necropsy from age matched unaffected cats ($PEA15^{+/+}$) and affected cats ($PEA15^{-/-}$). All studies were performed in triplicate. A scratch assay using an Ibidi Culture-Insert 2 Well was employed as a global assessment of wound closure. Following treatment with FGFb, cell counting was used to measure changes in cell proliferation. Cell random migration was evaluated through a phagokinetic track assay with CML latex beads. ImageJ software was used to determine the wound closure rate, proliferation, and area of bead uptake. Preliminary results suggest that affected cats have increased wound closure and proliferation rates compared to unaffected. Ongoing phagokinetic track assays are still being analyzed and suggest that the PEA15 mutation has effects on cell migration. In conclusion, the loss of function mutation in PEA15 alters normal feline fibroblast migration and proliferation, and may contribute to the microcephaly and polymicrogyria observed in $PEA15^{-/-}$ cats. Further studies are needed to confirm that these mechanisms are retained in neural glial cell.

Title: Creating an antifungal paint using halloysite nanotubes
Primary Author (and presenter): Wood, Liam F.
Additional Authors: Edward Davis & Terri Hathcock
Department: Mechanical Engineering
College/School: Samuel Ginn College of Engineering

Halloysite is a naturally abundant aluminosilicate mineral that forms nanotubes. These nanotubes have an inner lumen that can be vacuum loaded with various chemical solutions. The goal of this research is to use halloysite nanotubes to create an antifungal coating that will slow down or prevent the growth of different fungal agents on a surface. As preliminary research, I have used a strong dye, Rhodamine B, to test the release of the loaded dye onto the surface of the paint. The concentration and release rates were measured using UV-Vis spectroscopy. This research effectively showed that the dye was able to diffuse out of the nanotubes and paint. It also showed that the dye released slower when it was loaded into the halloysite than when the dye was directly added to the paint. Current research is being conducted using the antifungal medicine Clotrimazole. The antifungal paint and various controls are being painted onto glass and wood surfaces. A modified version of ASTM D3273 is being used to determine the effectiveness of the coating due to its safety and ease of use. The fungus being tested against is Aspergillus niger. This research will test the effectiveness of the antifungal paint against different standards of preparation as well as the longevity of the paint coating. An antifungal paint using halloysite could potentially provide an alternative method of fungal control in various settings, including surfaces around water, in forests, and in contact with agriculture and animals.

Title: Memories of rhythms past: evidence for hippocampal core clock disruptions in a murine model of Western diet-induced obesity

Primary Author: Woodie, Lauren, N.[1,2]
Additional Authors: Johnson, Robert[3]; Ahmed, Bulbul[1]; Greene, Michael, W.[1,2,4]
Department: [1]Department of Nutrition, [2]Center for Neuroscience Initiative, [3]Department of Biology, [4]Boshell Metabolic Diseases and Diabetes Research Program
College: [1]College of Human Sciences & [3]College of Science and Mathematics

Description:

Mammalian circadian rhythms are dictated by solar signals transmitted to the hypothalamic suprachaismatic nucleus (SCN). Although the SCN is the central clock for circadian rhythms, molecular clocks are found in every cell and are composed of the core clock proteins BMAL1, CLOCK/NPAS2, Per and Cry. Disruptions in the clock occur in peripheral tissues after Western diet (WD) feeding and contribute to WD-induced disease. The mammalian center of memory, the hippocampus, is also sensitive to the WD, but whether it disrupts the hippocampal core clock is not known. The present research explores this gap in our knowledge by examining hippocampal core clock rhythmicity in a mouse model of WD-induced obesity.

Mice were maintained on either standard rodent chow with tap water or a 45%/kcal fat WD with a 4% sugar solution (WD+S). Diurnal metabolic rhythms were collected for 24 h in metabolic cages during the 16th week of diet exposure. Livers, hypothalami and hippocampi were then collected at 4-h increments over 24 h. mRNA expression was measured using RT-qPCR and assessed by cosinor-based rhythmometry. WD+S feeding increased body weight and normalized liver weight ($p<0.001$) and dampened diurnal rhythms of whole-body metabolism ($p<0.05$). The WD+S also induced significant alterations in the hepatic rhythmicity of *bmal1* and *cry1* expression ($p<0.05$). In line with previous findings, the rhythm of the hypothalamic core clock did not significantly differ between the dietary groups. The hippocampal clock, however, was significantly disrupted by the WD+S. *Bmal1* and *npas2* expression were phase shifted by 16 and 4 h, respectively, while *per2* expression was significantly amplified across all measured time points in the WD+S group ($p<0.01$). WD+S feeding significantly alters the rhythmicity of core clock mRNA expression in the hippocampus. These results indicate that diet-induced disruptions of the core clock may have implications in memory diseases with significant circadian etiologies.

Title: An example of enhanced emission of a pyridine containing Schiff base Zn^{2+} complex
Primary Author (and presenter): Wyss, Kevin M.
Additional Authors: Hardy, Emily E.; Gorden, Anne E.V.
Department: Chemistry and Biochemistry
College/School: Science and Mathematics

Known to be essential cofactors in many biological enzymes, zinc ions are a topic of increasing interest in bioinorganic chemistry and cell biology due to the potential implications in their activity in the immune, nervous, and reproductive systems. Cellular zinc concentrations in human cells can range from 200-300μM, and even very slight variations have been correlated to increased instances of Alzheimer's disease and diabetes. Further understanding function of Zinc ions in cells, present in nearly 10% of human proteins, is of vital importance. To that end, a fluorescent chemo-sensor has been designed using a Schiff base, pentadentate organic ligand. This mixed oxo and aza donor ligand shows highly selective fluorescent response to Zn^{2+} compared to alkali, alkaline, transition metal, and lanthanide ions, exhibiting a quantum yield of 1.60 % when bound to Zn^{2+}. The system exhibits a limit of detection of 7.2 uM. Examination of twelve other metal ions in competition with the ZnL complex found a unique augmentation in fluorescence upon addition of K, Ca, Mg, and Cd ions, an effect not previously observed in similar chemosensor systems. Cooperative binding of ligand, Zn, and K resulted in the largest increase in quantum yield to 2.71%.

Title: Pressure-based pain tolerance and cannabis: A neuropsychological assessment of pain processing in recreational cannabis users

Primary Author (and presenter): Yanes, Julio A.
Additional Authors: Conner, Kaitlyn & Robinson, Jennifer, L.
Department: Psychology
College/School: College of Liberal Arts

Description:

Chronic pain, including pain associated with medical diagnoses, is an ever-growing concern in the United States. Pain-related healthcare costs, lost labor, and medication overdoses cost Americans more $600 billion every year. From a pharmaco-therapy perspective, cannabis represents a promising pain treatment option. Although acute cannabis administration has been associated with anti-pain effects across pain populations, whether such effects endure remains unclear. Characterizing therapeutic windows is one important step towards providing enhanced understanding about if/how cannabis may be used to treat pain. Here, we used an MR-compatible pressure-based pain apparatus to examine mean pain ratings and mean maximum pain tolerance among recreational cannabis users and age- and sex-matched non-users. we found that mean pain ratings were lower among recreational cannabis users than among non-users.
Moreover, we found that mean maximum pain tolerance was greater among recreational cannabis users than among non-users. Furthermore, comparing accuracy and reaction times during a color/word interference task (i.e., “Stroop” task) revealed no differences between users and non-users. Enhanced understanding about cannabinoid-induced pain modulations is important for informed decision-making regarding therapeutic potential.

Title: Functions of the DRYxxI motif and intracellular loop 2 of human melanocortin-4 receptor
Primary author (and presenter): Yang, Li-Kun
Additional author: Tao, Ya-Xiong
Department: Anatomy, Physiology & Pharmacology
College/School: College of Veterinary Medicine

Description:

The melanocortin-4 receptor (MC4R), a member of G protein-coupled receptors (GPCRs), regulates energy homeostasis by controlling food intake and energy expenditure. Gαs-cAMP and ERK1/2 signaling pathways are known as important signaling pathways triggered by MC4R. The DRYxxI motif at the end of transmembrane domain 3 (TM3) and the second intracellular loop (ICL2) are crucial for receptor function in several GPCRs. To study the role of this domain in MC4R function, we performed alanine-scanning mutagenesis on 17 residues. Flow cytometry was used to investigate the cell surface expression of these mutants. Competitive binding assay was then performed to study the ligand binding properties of these mutants. Gαs-cAMP and ERK1/2 signaling properties of these mutants were assessed by radioimmunoassay and western blot, respectively. We showed that T150A had reduced cell surface expression compared with WT receptor, indicating that residue T150 might be critical for receptor synthesis or trafficking to membrane. Alanine mutations of 8 residues impaired the binding abilities of receptor to ligand with either increased IC_{50} (T150) or decreased maximal binding (D146, Y148, Y153, Q156, Y157A, M161, and T162). Alanine mutations of 6 residues impaired ligand-stimulated Gαs-cAMP signaling with either increased EC_{50}s (D146, T150, I151, L155, Q156, and Y157) or decreased maximal response (T150). Mutants at 6 residues (D146, Y148, F149, F152, Y153, and H158) had elevated basal cAMP levels, suggesting that these residues were involved in constraining receptor in inactive state. In addition, 5 alanine mutants could not respond to ligand in ERK1/2 phosphorylation, suggesting that these residues (D146, F149, Y153, Y157, and M161) were critical for ligand-stimulated ERK1/2 signaling pathway. We also showed that some mutants were biased receptors in terms of Gαs-cAMP and ERK1/2 signaling pathways. In summary, we demonstrated that DRYxxI motif and ICL2 were important for MC4R function.

Title: Nanoplasmon ruler for visualizing how cells “talk”
Primary Author (and presenter): Yang, Wen
Additional Authors: Zhang, Zhenzhen & Chen, Pengyu
Department: Material Engineering
College/School: Samuel Ginn College of Engineering

Description:

Unravelling the underlying mechanism of how cells communicate upon external stimulation offers critical knowledge for modern biology and clinical science in a wide range of fields, such as fundamental biology, drug discovery, disease diagnosis, and cancer/stem cell research, to name a few. However, the extremely complex intercellular communication networks in multicellular systems pose significant technical challenges to exploit the cell signalling and cell-to-cell communication. Nanoplasmon ruler, self-assembled dimmers of noble metal nanoparticles conjugated by a biomolecule linker (typically DNA or peptide), have shown great potential in real-time biomolecule analysis with superior sensitivity and selectivity. Upon target analyte binding, the nanoparticle dimers are brought to closer proximity, resulting in strong plasmonic coupling. The resonating free electrons on both nanoparticle surfaces generate light scattering spectra that can be readily tuned by the interparticle distance. The large scattering cross section thus high intensity of the scattering light from the nanoplasmon ruler allows the detection and imaging at ultrahigh spatial resolution even for single molecule binding. In this study, we would like to present a novel approach based on an emerging nanoplasmon ruler coupled with dark-field imaging technique to real-time map multiple cytokine secretion profiles from a single immune cell upon external stimulation. Such a novel approach will establish a new paradigm that permits, for the first time, the direct visualization of the dynamic intercellular communication process in the immune system. The knowledge obtained from this study will facilitate a more comprehensive understanding of the immune intercellular network, unlocking the potential to transform the experimental studies into an information-rich science not only in immunology but beyond.

Title: Aqueous reactions of MESNA with iodine and iodate in acidic medium
Primary Author (and presenter): Yang, Yixuan
Additional Authors: Stanbury, David

Department: Chemistry and Biochemistry
College/School: College of Sciences and Mathematics

Description:
The project details the aqueous reactions of MESNA (sodium 2- mercaptoethansulfonate), which is a water-soluble thiol known for its role as chemo-protectant in anti-cancer therapies, with iodine and iodate in acidic medium. The mechanism study will provide us a better understanding of biological functions of the corresponding species and a deeper insight into the oxidation events at molecular level. The stoichiometry, equilibrium and kinetic studies were carried out by stopped-flow spectrophotometry and UV-VIS spectrophotometry with $[HClO_4]= 0.1$M, $[C_2O_{2-4}]=0.2$ mM, at $T = 25.0\pm0.5$ °C, $\mu=0.35$ M. Overall reaction is determined to be $10RSH+2IO_{-3}+2H_{+}\rightarrow 5RSSR+I_2+6H_2O$. The reaction is relatively fast, depending on the concentration of reactants, acid, and iodide.

The complex reaction dynamics go through 3 complex process: transient formation of I_2; clock reaction; and generation of I_2. The overall reaction of MESNA and iodine is $2RSH+I_{-3}\rightarrow RSSR+3I_{-}+2H_{+}$. This fast reaction proceeds through two steps: an establishment of an instant equilibrium (K_{eq} = $[1.1\times10_3\pm50.0\ ]\ M_2$) with a formation of sulfenyl iodide as an intermediate where the rate law of this process is pseudo-first order in [MESNA]; the second step is formation of the disulfide with a rate constant of $2.4\times10_5\ M_{-1}\ s_{-1}$. The whole reaction scheme is described and simulated through a mechanism network of 13 reactions.

Title: A real-time fake news detection system
Primary Author (and presenter): Zhang, Chaowei
Additional Authors: Kauten, Chrisitan; Heckwolf, Thomas; & Bhattacharya, Tathagata
Department: Computer Science and Software Engineering
College/School: Samuel Ginn College of Engineering

Description:

Fake news plays an increasingly dominant role in spreading misinformation by distorting people's awareness and decision making. The growth of social media and online forums has spurred the spread of fake news causing it to easily blend with truthful information. After proposing a novel text analytics-driven approach, we develop a real-time fake news detection system called *RT-FEND*, implemented using the distributed data processing platform Apache Spark. RT-FEND aims to reduce the risks posed by fake news influence and propagation. In this study, we focus on expanding the features of an existing system - FEND - with three perspectives. First, RT-FEND introduces real-time data collection and processing modules to enable online detection of potentially fake news topics and text. Second, RT-FEND incorporates a topic reduction module to prune redundant topics to address the high dimensionality issue in a large news dataset. Third, RT-FEND utilizes parallel computing platforms such as Apache Spark to provide scalable data analytics results. We start this project by creating event and topic models for fake news detection, followed by outlining the system framework of RT-FEND. At the heart of the RT-FEND framework, we implement a system to collect data and construct a news dataset in a real-time fashion. The detection module in RT-FEND contains a two-layered filter, which seamlessly integrates a fake-topic detection module and a fake-event detection module. We carry out extensive experiments on validated datasets to evaluate the performance and accuracy of the RT-FEND system. The experimental results confirm that RT-FEND achieves a high fake-news detection accuracy while maintaining high data-processing efficiency.

Title: CeO_2/PPy nanocomposites with high performance as electrode materials for supercapacitor
Primary Author (and presenter): Zhang, Miaomiao
Additional Authors: Wang, Ruigang and Zhang, Xinyu
Department: Department of Chemical Engineering
College/School: Samuel Ginn College of Engineering

Description:

Cerium oxide have been attracted as alternative electrode materials for supercapacitors owing to their high energy density and large charge transfer reaction pseudocapacitane.Nevertheless, poor electron conductivity and low surface area limit the specific capacitance of CeO_2 electrode. To overcome these problems, the present work demonstrated a simple method for the preparation of CeO_2/polypyrrole (PPy) nanocomposites used for supercapacitor electrode materials. In this study, CeO_2 nanorods with the diameter of 5-10 nm and length of 30-80 nm were firstly prepared by a mild hydrothermal route. Then, CeO_2/PPy nanocomposites with different loading of PPy have been fabricated by a simple in situ polymerization method. The electrochemical properties and impedance of the composites are studied by cyclic voltammetry and Nyquist plot, respectively. It was found that the specific capacitance of CeO_2/PPy nanocomposites was much higher than that of pure CeO_2, which reveals the introduction of PPy coating improves the capacity of this composite electrode due to the enhanced conductivity. The maximum specific capacitance reached up to 456F/g at the pyrrole loading of 0.01 mL per 50 mg CeO_2.

Title: End-to-end traceability of ICs in component supply chain for fighting against recycling
Primary author (and presenter): Zhang, Yuqiao
Additional authors: Guin, Ujjwal
Department: Electrical and Computer Engineering
College/School: Samuel Ginn College of Engineering

Description:

The rise of recycled ICs in the critical infrastructures causes a major concern to the government and industry because these chips exhibit lower performance and have shorter remaining useful life. The detection of these ICs becomes extremely challenging when they are in the supply chain. It is necessary to power up a chip at a distributor's site to measure the electrical parameters for verifying of its authenticity. However, this can be challenging as many of the distributors do not equip with proper test infrastructures. Moreover, the reliability of authentic chips may be reduced if they have been removed from the packaging boxes for testing purposes. In this paper, we propose a robust and low-cost solution to detect recycled ICs without powering them up. The proposed solution builds a chain of trust among the manufacturer, distributors and system integrator by enabling end-to-end traceability from manufacturing to system integration and provide protection against IC recycling. The proposed solution utilizes a small passive radio-frequency identification (RFID) tag, which needs to be placed on the package. Any entity in the supply chain can verify the authenticity of a chip using a commercial RFID reader.

Title: LC-MS-based chemical characterization of constituents of methanol açaí extract and metabolites obtained from an in vitro intestinal first-pass metabolism study

Primary Author (and presenter): Zhang, Yilue
Additional Authors: Shirley, Turner; Wietlake, Tyler; Qian, Jingjing; Hansen, Richard; & Calderón, Angela
Department: Drug Discovery and Development
College/School: Harrison School of Pharmacy

Description:

Our preliminary data found risk signals of açaí botanical dietary supplement (BDS) on serious adverse events in conjunction with anticancer drugs in real world reporting. Meanwhile, methanol açaí extract showed potential to cause botanical-drug interactions based on *in-vitro* models. The effects of intestinal first-pass metabolism of açaí BDS is not well studied in drug-botanical interaction research, however. In order to improve the prediction of botanical-drug interactions, a parallel artificial membrane permeability assay (PAMPA) along with Mass Profiler Professional (MPP) was used to identify the major components characterized by high abundance or high intestinal permeability in methanol açaí extract. Moreover, an LC-MS-based assay on genotyped human liver microsomes/S9 fractions was optimized to monitor the metabolites of the major components in açaí extract via CYP/UGT/SULT pathways. As a result, the identities of five compounds were established using LC-MS-MS, including protocatechuic acid methyl ester (**1**), isolariciresinol (**2**), dihydrokaempferol (**3**), 5,7-dihydroxy-2-(4-hydroxy-3,5-dimethoxyphenyl)-2,3-dihydro-4H-chromen-4-one (**4**), and homoeriodictyol (**5**). In the metabolism assay, it was found that Phase I metabolites of açaí extracts were relatively minor compared to the Phase II pathway. With the aid of online metabolism site prediction tools, SOMP and MetaPred, 9 metabolites via UGT or SULT pathways were separated and identified.

Title: Truthful quality-aware data crowdsensing for machine learning
Primary Author (and presenter): Zhao, Yuxi
Additional Authors: Gong, Xiaowen
Department: Electrical and Computer Engineering
College/School: Samuel Ginn College of Engineering

Description:

Crowdsensing has found a broad range of applications (e.g., spectrum sensing, environmental monitoring) by leveraging the "wisdom" of a potentially large crowd of "workers" (i.e., mobile users). One important class of applications use the data collected from crowdsensing for data analytics via machine learning. To exploit the potential of crowdsensing for machine learning, it is beneficial to for the crowdsensing requester to know and make use of the quality of worker's data. In this paper, based on a general linear regression model of machine learning, we devise truthful quality-aware crowdsensing mechanisms for quality and effort elicitation, which incentivize workers to truthfully report their private worker quality to the requester, and make effort as desired by the requester. The truthful design of the mechanisms overcomes the lack of ground truth and the coupling in the joint elicitation of worker quality, effort, and data. Under the mechanisms, we characterize the socially optimal and the requester's optimal task assignments, and analyze their performance. We show that the requester's optimal assignment is determined by the "virtual quality" rather than the highest quality among workers, which depends on the worker's quality and the quality's distribution. Simulation results are provided which demonstrate the truthfulness of the mechanisms and the performance of the optimal task assignments.

Title: CT-like image reconstruction with self-invented MiSpinner device in Biomedical field
Primary Author (and presenter): Zhou, Huanyi
Department: Electrical and Computer Engineering
College/ School: Samuel Ginn College of Engineering

Description:

In animal research field, a micro CT system usually costs too much for a researcher to afford it and prevents them from doing related research. My work is trying to develop a CT-like image reconstruction system to help those researchers solve this problem given IVIS Lumina LR machine which provides X-ray images and is widely used in the research lab. With the addition of the self-invented MiSpinner device that successively rotates an object through a sequence of angles, data that approximates of a CT machine can be acquired. Following the reconstruction rules, we can obtain a similar CT-like image and improve it with image processing method. However, unlike the professional CT machine, in this problem, center of X-ray source and detector arrays are always not maintaining in same straight line. Calibration is a very serious problem needs considering. And this is where our research focus on and we present our method to solve the calibration problem both in mathematical and coding area.

Title: A change detection analysis of LULC changes in the Three Gorges Dam area
Primary Author (and presenter): Zhou, Ying
Additional Author: Marzen, Luke
Department: Geosciences
College/School: College of Sciences and Mathematics

Description:

In 2003, the three gorges reservoir constructed on the Yangtze River in China began to store water and it was formally completed in 2006. Since then, the land use land cover (LULC) in three gorges reservoir area has changed substantially. The change of LULC affects the local human and natural environment as well as the economy. In this research, a change detection comparison is done with Landsat satellite imagery of the area around three gorges reservoir to examine LULC changes from 2002 to 2015 in order to determine the local areas impacted by the creation of a large reservoir associated with the dam. An unsupervised classification procedure done with a Geographic Information System (GIS) is used to group image pixels into four LULC categories including vegetation, impervious surfaces (barren and built-up land), and water. After classifying the Landsat images, the two classified thematic images were analyzed using post-classification comparison to identify the LULC changes. The results provide a map showing the areas that have changed and in particular the amount of land that was submerged by the newly formed reservoir. The results of this analysis will show more recent analysis than what has been done in the past and will be used in a future study evaluating the human and economic impacts of the three gorges dam.

Title: Out and proud: Gay and lesbian organizing at Alabama state universities
Primary Author (and presenter): Zinner, Max G.
Department: History
College/School: College of Liberal Arts

Description:

This paper is an attempt to fill a void in the historical literature on gay rights, student activism, and the South by examining the chartering of gay and lesbian focused student organizations at Auburn University and the University of Alabama, the largest institutions of higher learning in the state of Alabama. By examining contemporary sources, particularly student newspapers, I trace these organizations from their first formal appearance at the University of Alabama in 1983 to the recognition of their legal right to exist and receive equal treatment throughout the state in 1996. Despite the fact that gay and lesbian organizations had existed on campuses in other states since the 1960s, they were, perhaps unsurprisingly, still incredibly controversial in Alabama throughout the 1980s and 1990s. These organizations were frequent targets of harassment and their status was challenged on multiple occasions. This story serves as an example of the significance of anonymity and being out for the gay and lesbian community, and how these things were not always mutually exclusive. It also serves as an example of the importance of connection between different movements and the difficulty of seeing any single movement in isolation. I conclude by examining the larger ramifications of this case and how it fits into the broader narrative of southern history and its commemoration.