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THE COLONIZATION OF ARTIFICIAL LEAF SHELTERS BY LEPIDOPTERAN LARVAE AND OTHER ARTHROPODS ON *QUERCUS RUBRA*

Yongzhi Pan and H. George Wang, East Central University

Field manipulative experimentation is useful in discerning ecological community patterns and the mechanisms causing them. Such experiments often utilize artificially constructed structures to simulate variations in biological or environmental conditions. Leaf shelter building by Lepidopteran larvae is a type of ecosystem engineering that creates microhabitats utilized by many arthropods. We conducted an experiment to study the effect of forest edge on the distribution of leaf shelter building caterpillars by creating artificial leaf ties on red oak (Quercus rubra) trees using metal clips. We selected 20 trees at the Nature Conservancy's Pontotoc Ridge Preserve in Pontotoc County, OK, and constructed five artificial leaf ties on each tree by clipping two pieces of leaves together with a metal clip for each tie. The caterpillar and overall arthropod communities in these leaf ties were monitored over the summer of 2019. The majority (over 90%) of the artificial leaf ties were colonized by arthropods by late summer (August 2019).

EPIGENETIC REGULATION OF MICRORNA395 IN *ARABIDOPSIS* IN RESPONSE TO SULFATE DEPRIVATION

Pei Jia Ng and Ramanjulu Sunkar, Oklahoma State University

The chromatin remodeling, histone variants, DNA methylation and histone modifications, all bring changes in the chromatin state and play an essential role in regulating gene expression. In plants, microRNAs act as master regulators in various biological processes such as the plant growth and development and stress responses including nutrient deprivation. Previously we have shown that microRNA395 (miR395) is strongly induced by sulfate starvation in *Arabidopsis* and regulates the transcript abundances of a sulfate transporter (AST) and three ATP sulfurylases (APS) (Jagadeeswaran et al., 2014). In the present study, we propose to decipher the role of H2A.Z (histone variant) and epigenetic regulators in induction of miR395 during sulfate deprivation. Gene expression is positively correlated with the presence of H2A.Z at a locus. To address the role of H2A.Z in miR395 regulation, we are utilizing knockout mutants in genes encoding H2A.Z (hta9 and hta11) in Arabidopsis. Furthermore, H2A.Z promotes the binding of H3K4 methyltransferase (ATX) and promotes H3K4me3 deposition. To address the role of histone modifications (H3K4) in miR395 regulation, we are utilizing mutants defective in H3K4 methyltransferases (ATX1 and ATX2). Our methodology include measuring the expression levels of MIR395 loci using qPCR, and assaying for histone modifications using ChIP assay in H2A.Z mutants (hta9 and hta11) and H3K4 methyltransferase mutants (atx1 and atx2) under sulfate-deprivation. We will present our current progress on this project. Overall, the results will contribute to our understanding on the role of chromatin remodelers and epigenetic regulators in regulating miR395 expression under sulfate deprivation.

STUDYING YFAX IN *ESCHERICHIA COLI*

Brenna Hefley, Samantha Perry, and April Nesbit, East Central University

Outstanding Undergraduate Paper in Biochemistry and Molecular Biology Section

Even though *Escherichia coli* has been studied for over 100 years, the function of some proteins in *E. coli*, including YfaX, are still unknown. YfaX protein is predicted to be a transcription factor, and it is the first gene in the yfaXWVU operon. It has been suggested that other proteins in this operon interact with rhamnonate in vitro. Therefore, we tested the ability of *E. coli* to metabolize rhamnonate in vivo. We observed that *E. coli* cannot grow under aerobic in the presence of rhamnonate. Due to the inability of *E. coli* to metabolize rhamnonate in vivo, we looked at other possible sugars to interact with this operon. One sugar that was mentioned in the in vitro study was lyxonate, which is not commercially available, plays a role in vitro. In the place of lyxonate, we used ascorbate, which is predicted to degrade to lyxonate in the human intestines where *E. coli* often grows. We performed growth curves with ascorbate and found that *E. coli* could grow slowly with ascorbate only under anaerobic conditions. To test the effect on the yfaXWVU operon, we ran gene expression assays and discovered that yfaX promoter expression increased three-fold in the presence of ascorbate compared to glucose. However, there was no difference in gene expression with or without YfaX under conditions tested, indicating that YfaX does not act as a transcription factor to regulate the yfaX promoter. Furthermore, expression was increased in ascorbate compared to glycerol, suggesting that there is an ascorbate-specific response separate from catabolic repression. Based on these studies, we cannot determine whether YfaX is a transcription factor, but ascorbate does play a role in yfaX gene expression.

TRANSPORT AND RECOVERY OF IRON OXIDE, ALUMINUM OXIDE, AND TITANIUM DIOXIDE NANOPARTICLES THROUGH SEDIMENTARY ROCK

Dario Butler, Ricardo Buerra, George Wang, and Randall D Maples, East Central University

Metal oxide nanoparticles like aluminum oxide, iron oxide, and titanium dioxide have an interesting potential for use in subsurface characterization and modeling in the groundwater environment and as well are used along with other nanoparticles in various new materials due to their unique physiochemical properties. A unifying theme in the potential use of metal oxide nanoparticles as chemical tracers or the likelihood of metal oxide nanoparticles being potential contaminants in groundwater would be the transport characteristics and recovery of these nanoparticles. This study continues previous work looking at the transport and recovery of iron oxide nanoparticles through columns packed with limestone or dolostone and groundwater collected from the Arbuckle-Simpson aquifer, and extends this work to both aluminum oxide and titanium dioxide nanoparticles.

COMPARISON OF MICROHABITAT SELECTION BETWEEN RIFFLE DWELLING DARTERS, THE ORANGETHROAT DARTER (ETHEOSTOMA SPECTABILE) AND ORANGEBELLY DARTER (ETHEOSTOMA RADIOSUM) IN UPPER BLUE RIVER OF OKLAHOMA

Kourtney Myskey, East Central University

The Blue River of south-central Oklahoma is a spring-fed stream that drains much of the eastern Arbuckle-Simpson Aquifer, and is one of only two free-flowing rivers in Oklahoma with little to no anthropogenic influences on the natural flow. Not much is known about the riffle-dwelling fish communities in the upper reaches of the Blue River. In collaboration with The Nature Conservancy, assessments of fish inhabiting riffle mesohabitats of the Blue River were conducted in the summer of 2018. Individual fish were identified to species and biological metrics were calculated. Relative abundance from two data sets was measured for the Orangethroat darter (*Etheostoma spectabile*) and Orangebelly darter (*Etheostoma radiosum*). A total of eighteen species of fish were collected from the riffle mesohabitats in the upper reaches of the Blue River. The Orangethroat and Orangebelly darter were more likely to be found in areas in the riffles where river bed particles were in the small to large cobble size range. Looking at biota in this river could give insight into how different habitats function in a free-flowing river, and more specifically, in riffle habitats of the Blue River since these areas will be the first habitats affected if flows are reduced from withdrawals of water from the Arbuckle-Simpson Aquifer.

IDENTIFICATION OF BACTERIA THAT INHIBIT *ENTEROCOCCUS* GROWTH

Constance Green and April Nesbit, East Central University

Although there are many antibiotic-resistant bacteria now known, six species comprise the majority of the infections seen in healthcare settings. One of the six species that is of great interest is *Enterococcus faecium* (*E. faecium*). To find novel antibiotics that might be useful to treat E. faecium infections, we isolated bacteria from soil because soil has high levels of bacteria known to produce antibiotics. After testing sixteen sites for potential antibiotic-producing bacteria, we found four isolates, which show inhibition of the pathogen *E. faecium*. Inhibition was tested with both the patch-patch method and the top agar-cellophane method to verify that the isolated strains were capable of secreting an antibiotic to inhibit *E. faecium* growth. Identification of these isolates used staining and oxygen requirements indicates that all four isolates are Gram positive, endospore-forming bacilli in the Genus *Bacillus*. Future studies are to verify the species and isolate the secreted chemical causing inhibition of *E. faecium*.

*CHARACTERIZATION OF *DIAPORTHE* SPECIES IMPORTED ON GUATEMALA CANTALOUPES

Erin Dempsey, Sanam Kadel, Rita Ghale, Karuna Devkota, Charlie Biles, and Alisha Howard, East Central University

Melons (Cantaloupe; *Cucumis melo* var. *cantaloupensis*) were purchased from local grocers in 2016 through 2019 and observed for post-harvest diseases. Of the 80 melons purchased in 2019, 75% developed fruit rot symptoms caused by fungi. The diseased tissue indicated that the majority of lesions were caused by *Diaporthe* spp. (syn; *Phomopsis*), and to a lesser extent lesions were caused by *Alternaria* and *Fusarium* spp. Plant pathogens such as *Diaporthe* spp. enter the surface of the melon fruit early in development and remain latent until fruit maturity. While ripe fruit is harvested and imported with no external evidence of disease, internal fruit rot becomes evident as the fruit matures. The objective of this study was to characterize *Diaporthe* spp. imported in Guatemalan melons. Fungal isolates were characterized based on culture growth characteristics, spore morphology, and DNA analysis. Guatemalan isolates were morphologically similar to *D. sojae* and *D. curcurbitae*. Deoxyribonucleic acid (DNA) was extracted from fungal hyphae and purified polymerase chain reactions (PCR) products were Eurofin, Inc. for sequencing. Sequencing analysis demonstrated that some of the isolates were a match for *D. pterocarpi* and species within the *D. arecae* complex. Our finding of pathogenic *Diaporthe* spp. suggest that plant pathogens are carried across international borders and imported into the United States. Further analysis is being conducted on the melons collected in 2018 and 2019.

HIGH FREQUENCY STUDY OF THE ACOUSTIC AND MASS ATTENUATION COEFFICIENTS IN LEAD AND ALUMINUM

Karen A. Williams, East Central University

Previous work (Williams, 2017) revealed a high correlation between the acoustic attenuation coefficient at 1 MHz with the mass attenuation coefficient for calibrated lead and aluminum samples. In this work, the relationships of the two coefficients in two materials (lead and aluminum) were studied at 2 and 4 MHz. The mass absorption coefficient of these absorbers was calibrated by the manufacturer, so only the attenuation coefficient was determined for each material at both frequencies. Results at 1 MHz were brought into this study from 2017 data. The samples were: lead disks, square lead sample with aluminum on the back, and aluminum disks calibrated for gamma radiation studies. The Pearson correlation coefficient between the acoustic attenuation coefficient and the mass absorption coefficient at 1 MHz varied from 0.906 to 0.995; at 2 MHz from 0.846 to 0.973; and 4 MHz from 0.863 to 0.934. These correlations were higher than expected as the amplitude measurements depend on gel thickness and user technique. For round lead samples the slopes at 1 and 4 MHz transducer frequencies were 54140 and 51690 (db/cmMHz)/(cm2/mg) respectively, but at 2 MHz the slope was 24580 (db/cmMHz)/(cm2/mg). For the square lead (Al backed) samples the slope was 11300, 9334, 35910 (db/cmMHz)/(cm2/mg) for 1, 2 and 4 MHz transducer frequencies. For the aluminum samples the slopes were 7062, 7312 and 24450 (db/cmMHz)/(cm2/mg) at 1, 2 and 4 MHz. Curve fit analysis using frequency to the first and second power was selected. The curve fit yielded a root mean square error of zero. The slopes listed above versus frequency for all 3 samples appeared similar with the exception of 1MHz round sample. The first data point which represents the 2017 work for lead appears too high in magnitude, however the other two samples contain some aluminum which could lower their values. Temperature is also a variable that might change the acoustic attenuation coefficient.

READERS DIGEST: MYCOBACTERIOPHAGE AND YOU

Emily Hernandez and Greg Mullen, Oklahoma City University

Drug Resistant Tuberculosis (TB) is a worldwide health crisis. According to the World Health Organization, ~240,000 people died from drug resistant TB in 2016. In response to this global emergency, new methods of treatment are being developed and tested, one of which uses mycobacteriophage. Mycobacteriophage (phage) are viruses that specifically infect mycobacteria such as *Mycobacterium tuberculosis*. This form of therapy will use combinations of phage to avoid issues with resistance, which calls for identification of unique types of phage that enter the bacteria through different pathways. I have isolated phage that are capable of infecting all mycobacterium strains tested to date. I am currently cloning and sequencing the genomes of the phage to determine their relationships to existing phage. I have also isolated phage resistant mutants in *M. smegmatis* and *M. phlei*; three of these mutants are completely resistant to phage infection and the remaining five isolates have reduced susceptibility to infection or delayed phage maturation. I am going to use whole genome sequencing to identify candidate mutations in these resistant strains. I will also test phage isolated in other laboratories for their ability to infect the resistant mutants. My goal is to identify genes required for phage resistance and to develop a simple assay to determine which phage can be usefully combined for phage therapy.

CALCIUM CONCENTRATION AFFECTS THE HOST-PATHOGEN INTERACTIONS OF *PSEUDOMONAS AERUGINOSA* WITH LUNG EPITHELIAL CELLS

Deepali Luthra, Marianna Patrauchan, and Erika Lutter, Oklahoma State University

Outstanding Graduate Poster

Pseudomonas aeruginosa is an opportunistic human pathogen that form biofilms in airway mucosal epithelium in the lung cells of cystic fibrosis (CF) patients. Calcium (Ca^{2+}) levels in the lungs of CF patients are highly elevated and it is studied that Ca^{2+} acts as a trigger for expression of virulence factors in *P. aeruginosa*. Studies show that Ca^{2+} binds directly to the Ca^{2+}-binding protein EfhP of *P. aeruginosa*, but little is known about how Ca^{2+} regulates the virulence of *P. aeruginosa* during infection with A549 human lung epithelial cells. My research project focuses on determining how *Ca2+*, EfhP or other virulence factors such as adhesins, which includes flagella (fliC- flagellin Type B filament) and pili (pilA, Type IV fimbrial protein precursor) affect the adherence of *P. aeruginosa* to A549 cells. We focused on determining the effect of Ca^{2+} on initial adherence of *P. aeruginosa* in low and high Ca^{2+} conditions. The *P. aeruginosa* PAO1 and pulmonary isolates FRD1 strains, each having their corresponding Δefhp mutant and complemented background along with transposon mutants for fliC and pilA were used for this study. Adherence studies show that the wild type, efhP mutant and the complemented PAO1 and FRD1 strains exhibited significant increase in adherence to A549 cells in high Ca^{2+} condition compared to low Ca^{2+}. This indicates that Ca^{2+} plays significant role in enhancing adherence of *P. aeruginosa* to host cells. However, no significant difference was noted between in low and high Ca^{2+} conditions between the wild type and EfhP mutants of *P. aeruginosa* in PAO1 and FRD1 backgrounds. It was also observed that transposon mutants were not as adherent to A549 cells when compared with PAO1 wild type in high Ca^{2+}, suggesting that FliC and PilA play some role in affecting the adherence of *P. aeruginosa* in the presence of high Ca^{2+}.

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CLONING, SEQUENCING, AND IDENTIFICATION OF PHAGE 16, AN UNKNOWN SALMONELLA OR EHEC (ENTEROHEMORRHAGIC E. COLI) BACTERIOPHAGE

Shrea Tyagi, Union High School, Tulsa, OK

Nayna Nambiar, Holland Hall, Tulsa, OK

B.J. Reddig and E.L. Blewett, Oklahoma State University – Center for Health Sciences, Dept. of Biochemistry and Microbiology, Tulsa, OK

P. Litt and D. Jaroni, Oklahoma State University – Dept. of Animal and Food Science

Bacteriophage are viruses that infect, replicate and kill bacteria. Salmonella and EHEC food poisoning are caused by Salmonella and E. coli bacteria. Bacteriophage can be used to prevent food poisoning by application to food products or processing machinery. Bacteriophage P16 specifically infects Salmonella and E. coli bacteria. We cloned fragments of the P16 genome, sequence the DNA and used bioinformatics to identify P16. Phage P16 is a Salmonella phage similar to "Stitch". A phylogenetic tree inferring relationships of P16 and other bacteriophage was created.

INHIBITION OF CLINICAL ENTEROVIRUS ISOLATES BY NATURAL COMPOUND OSW-1

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Roberts, Brett and Burgett, Anthony, University of Oklahoma, Dept. of Chemistry and Biochemistry, Norman, OK

OSW-1 is a small, molecular compound isolated from the bulbs of the plant, Ornithogalum saudersiae. OSW-1 has been shown to kill cancer cells and to inhibit viral infection. OSW-1 interacts with cellular oxysterol-binding protein (OSBP) and reduces OSBP in the cell. OSBP is important in host cell cholesterol processing and traffic.

Enteroviruses belong to the Picornaviridae family and are single-stranded RNA (ssRNA) viruses. They cause many important human diseases including rashes, pleurodynia, encephalitis and aseptic meningitis. Many ssRNA viruses use host cell membranes to create replication organelles (ROs) in the infected cell. The virus uses ROs to concentrate and hide virus materials from the host cell, to avoid triggering anti-viral responses.

We hypothesize all ssRNA viruses create ROs in order to replicate in eukaryotic cells. In this project, we test clinical enterovirus isolates to see if these viruses use OSBP and cholesterol to create their ROs. We show that OSW-1 inhibits infection by Coxsackieviruses A and B, Echoviruses and Enterovirus-D68.

CLONING AND SEQUENCING OF THE DEPOLYMERASE-LIKE GENE FROM BACTERIOPHAGE J25

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P. Litt and D. Jaroni, Oklahoma State University – Dept. of Animal and Food Science

Bacteriophage are viruses that infect, replicate and kill bacteria. Salmonella and EHEC food poisoning are caused by Salmonella and E. coli bacteria. Bacteriophage can be used to prevent food poisoning by application to food products or processing machinery. Bacteriophage J25 specifically infects Salmonella and E. coli bacteria. We cloned fragments of the J25 genome, sequence the DNA and used bioinformatics to identify J25. We used genome data from similar bacteriophage in Genbank to design primers to amplify the depolymerase-like gene. We amplified and cloned this gene. When expressed, the gene product will be test with bacteriophage food treatment where it should augment bacteriophage killing.

CORRELATING TELOMERE LENGTH WITH DISEASES AND NOVEL GENETIC VARIANTS

Peter Gerstenberger and Celestino Velasquez, Oral Roberts University

Peter Gerstenberger, Patrick Allaire and Scott Hebbring, Marshfield Clinic Research Institute, Center for Human Genetics, Marshfield, WI.

Best Undergraduate Paper of Academy and Outstanding Undergraduate Paper in Biomedical Science Section

Telomeres are the repetitive non-coding short DNA segments that cap chromosome ends and function to protect vital genetic information. Telomere length correlates directly with the proliferative capacity of the parent cell, shortening by approximately 10 base pairs per replication cycle. When telomeres become too short, the DNA damage-response signaling pathway is triggered, causing cellular senescence. Shortened telomeres are associated with many age-related diseases as well as inheritance-related disorders, including type II diabetes and cancer. The goal of this project included two objectives: 1) find new associations between telomere length (TL) and various diseases via a Phenome-Wide Association Study (PheWAS), and 2) discover associations between TL and genetic variants via a Genome-Wide Association Study (GWAS). All genetic samples from the Personalized Medicine Research Project (PMRP) Biobank (includes ~20,000 patients) were genotyped to determine the relative average telomere length (raTL) using quantitative PCR, and then compared to each patient's electronic health record, containing codes for 8,989 phenotypic diseases (PheWAS). The telomere data was then correlated with over 8 million genomic single nucleotide polymorphisms (SNPs) to define associations between TL and genetic variants (GWAS). Preliminary results from the PheWAS show correlations between telomere length and conditions including atherosclerosis, heart disease, obesity, presbyopia, bronchitis, and diabetes. The strongest preliminary association signals in the GWAS were among variants already known to be linked with TL, including the genes RTEL1, TERC, and TERT. This tells us that our initial GWAS analysis was successful, and other discovered associations can be trusted. We successfully found phenotypic diseases and genetic variants associated with telomere length. The remaining data is still in process of being cleaned, adjusted, and associated with the correct health records, but preliminary data is promising. Follow-up studies will be performed to implement a PheWAS of the TL-associated SNPs.

CARBONIC ANHYDRASE, PSCA1 CONTRIBUTES TO THE VIRULENCE OF THE HUMAN PATHOGEN *PSEUDOMONAS AERUGINOSA*

Reygan E. Braga, Biraj B. Kayastha, and Marianna A. Patrauchan, Oklahoma State University

Outstanding Undergraduate Paper in Microbiology Section

Calcium deposition and calcification of soft tissue has been associated with several bacterial chronic infections including cystic fibrosis (CF). CF is associated with elevated levels of calcium in the body fluids resulting in calcification of organs. However, the exact molecular mechanisms of such calcification are not very clear. The opportunistic human pathogen *Pseudomonas aeruginosa* is the predominant cause of mortality and morbidity in CF patients. We hypothesized that this pathogen deposits extracellular calcium, a process that requires carbonic anhydrases (CAs). Previously, we have identified three β-class carbonic anhydrase genes, psCA1, psCA2 and psCA3 in *P. aeruginosa* PAO1. We showed that the expression of psCA1 is induced by elevated calcium and that this CA plays a major role in calcium deposition. We hypothesized that the ability of *P. aeruginosa* to deposit calcium enhances virulence of the pathogen and that psCA1 contributes to this process. To test this hypothesis, we used Galleria mellonella (wax worm) infection model. We observed that injection with PAO1 grown without added calcium resulted in death of up to 40% worms 20 hours post injection (hpi). However, injection with PAO1 grown at 10mM Ca2+ resulted in death of 80% worms 20 hpi. This supported the inducing effect of Ca^{2+} on *P. aeruginosa* virulence. The psCA1 deletion mutant failed to kill any worms even after 20 hpi, which demonstrated the importance of the enzyme in *P. aeruginosa* virulence. We also tested the effect of acetazolamide, earlier shown as an inhibitor of psCA1 enzymatic activity, but no significant impact on virulence was detected. We aim to use this model to study the effects of other CA inhibitors on PAO1 virulence. We also aim to determine the effect of calcium and other host factors on the transcription of psCA genes by using promoter activity approach both in vitro and in vivo.

A PRELIMINARY SURVEY OF FRESHWATER SPONGES IN OKLAHOMA

Emily Sample, Emily Boyer, Casie Hamill, Destiny Hamilton, Kyler Keef, Tyler McKenzie, Angela Spottedwolf, Rhonda Weigand, and Brenda Witt, Redlands Community College

Outstanding Undergraduate Paper in Applied Ecology and Conservation Section

Freshwater sponge distributions in Oklahoma have been understudied with only two minimal surveys published between 1922 and 1954. To expand upon this previous data, we surveyed littoral areas of selected water bodies throughout central and southern Oklahoma spanning January through March of 2018 and 2019. Water quality parameters including temperature, pH, salinity, specific conductivity, and dissolved oxygen were measured at each site using the In-Situ smarTROLL Multiparameter Handheld probe. Any substrate for which sponges would be likely to attach, such as rocks and logs, were visually examined and samples of adult sponges or reproductive gemmules were collected using sterile razor blades and stored in 70% ethanol to be identified via DNA barcoding. Of the sites sampled, 9 of 21 were positive for sponge presence and sites with and without sponges were marked on a state county map. A non-metric multi-dimensional scaling analysis (NMDS) indicated that sites with sponges were distinctly dissimilar from those where sponges were not found. Further analysis suggested that pH and specific conductivity are the main drivers of these differences, however a larger sample size inclusive of a wider variety of geological and ecological areas will better illustrate trends in preferred environmental conditions. Our study demonstrates that freshwater sponges are established in Oklahoma and that continued statewide surveying will further knowledge of their habitats and role in ecosystems.

THE EFFECTS OF LIGHT INTENSITY ON GROWTH AND CHLOROPHYLL PRODUCTION IN *CANNABIS*

Samantha Middleton and Stanley Rice, Southeastern Oklahoma State University

Outstanding Undergraduate Paper in Biological Science Section - Botany

In June of 2018 residents of Oklahoma effectively legalized the consumption and cultivation of medical cannabis for individuals who have a Medical Marijuana Patient Card. We conducted an experiment to determine the biomass allocation and chlorophyll production patterns in low light and high light *Cannabis indica* plants. Clones from the same mother plant were grown under an optic LED light source positioned at different distances from the light. High light plants were closer to the light source than low light plants, thus the light quality was the same in both treatments while the intensity received was different. We weighed stems, leaves, and roots and measured chlorophyll extracted in DMF to determine plant production and chlorophyll amount. We found low light plants grew taller relative to their total weight than high light plants and had more chlorophyll relative to leaf area. Relative leaf weight was not affected by growth light level. Middleton can cultivate up to 6 nonflowering cannabis plants legally within the state by being a registered medical marijuana patient with the OMMA.

SMART MEDICAL DEVICE

Erin Drewke, Jessica Petty, Mai Pham, and Nesreen Alsbou, University of Central Oklahoma

Outstanding Undergraduate Paper in Engineering Science Section

To provide accurate, non-invasive, real-time, and less painful monitoring of oxygenation and circulation for pediatric patients in hospitals. To optimize Cardiopulmonary Resuscitation (CPR) for patients utilizing non-invasive values: Cerebral and Renal Regional Oxygen Saturation (C-rSO2 and R-rSO2), End-Tidal Carbon Dioxide (EtCO2), Oxygen Saturation (SpO2), and Volume of CO2 (VCO2) signals. Signals are to be intercepted real-time from INVOSTM 5100C Cerebral/Somatic Oximeter and Respironics NM3 Profile Monitor. Values will be processed through algorithms to determine the likelihood of Return of Sudden Circulation (ROSC) using Youden Index. Oxygenation and circulation variables will be measured using Near Infrared Spectroscopy (NIRS). This will output to a monitor and be viewed by a medical official or technician to view along with generated plots of intercepted readings. This approach for non-invasive, real-time monitoring can be evaluated further by implementing algorithms of trending vitals in patients after using this device and gathering data in numerous patients. This can provide early detection of patients likely to undergo cardiac arrest so medical officials can provide medicine or medical attention as needed to address the issues that may lead to cardiac arrest or intervene during cardiac arrest.

PERCEIVING CHARACTERISTICS OF ABDUCTED CHILDREN

Taylor Pjesky and Robert Mather, University of Cental Oklahoma

Outstanding Undergraduate Paper in Social Science Section

The goal of the media is to get recognition and views. Due to this goal, the media does not always provide accurate information to the public. This especially happens when the media covers child abduction cases. This leads to the public misunderstanding a very important topic, our children. This study will aid in the correction of these misunderstandings, which can be used in prevention programs. Participants will be primed with facts and statistics concerning characteristics of abducted children. They will then complete an online questionnaire about the probable characteristics of abducted children. It is hypothesized that the four primed experimental groups will show more accurate knowledge of characteristics of abducted children, whereas, the control group will show beliefs of common myths, and less accurate information surrounding characteristics of abducted children. Data are still being collected.

NUMERICAL MODELING AND SIMULATION OF A MICROFLUIDIC PLATFORM FOR ENRICHMENT OF LOW ABUNDANCE PROTEINS

Frances Matthews, Mohammad Hossan, and Sanjeewa Gamagedara, University of Central Oklahoma

Outstanding Undergraduate Paper in Physical Science Section

Circulating TGF-β1 is one of the key regulators of cardiovascular health. The extremely low abundance of circulating TGF-β1 in blood is one of the major challenges in on-chip purification and extraction. This paper reports numerical modeling and simulation of more than 25000 folds concentration gain of TGF-β1 in a 2D cascade microchannel using isotachophoresis (ITP). The 4.3 cm long microfluidic channel with 250 times reduction in cross-sectional area from inlet to outlet was used for ITP simulation. The initial cross-sectional area was 1250 micrometer x 100 micrometer and the final cross-sectional area was 50 micrometer x 10 micrometer with 2D step changed. The reduction in cross-sectional area were used to complement ITP concentration gain. COMSOL Multiphysics 5.2 was used to simulate the separation and concentration of two proteins-TGF-β1 and albumin. The model used the Nernst-Planck equations to predict protein stacking and separation in the sample solution. Microchip with 1D and 2D step changed microfluidic channels were also explored using numerical simulations. In the simulation, the leading electrolyte (LE) was 10mM Hydrochloric acid (HCl) adjusted to a pH of 9.5 with Tris (1M) and the trailing electrolyte (TE) consisted of 60 mM DNP- epsilon -amino-n-caproic acid (EACA) adjusted to a pH of 10.0 with Tris (1M). A constant DC electric potential of 200 V was applied between anode and cathode reservoir. The proteins migration was observed under a fluorescence microscope and images of proteins band in different locations were taken. The initial concentration of TGF-β1 and alubumin was 1.25 microgram/ml and after ITP concentration, the each protein exhibited more than 25000 folds (~33 mg/ml) concentration gain. This is a significant improvement in protein concentration factor compared to our previous report in an ITP microchip. This demonstration can be utilized in the development of integrated microchip to detect low abundant proteins.

ANTI-PROLIFERATION EFFECT OF DANDELION'S EXTRACT ON HELA CELLS

Brooke Wiens, Chigozie Agu, Eleanor DeCelle, and Christina Hendrickson, University of Central Oklahoma

Outstanding Undergraduate Poster

We are currently working on a project that is determining whether or not dandelion root has the ability to stop cancer cell growth. This prospect originates from a man in Turkey who claimed to be cancer free after 40 days of drinking the root juice every morning. By studying the effects of this juice in varying concentrations, we are looking to investigate the validity of this claim.

GENERALIZED MODULAR POLYGONS

Effouehi Messou, University of Central Oklahoma

Outstanding Undergraduate Paper in Mathematics, Statistics, & Computer Science Section

Long before Sudoku people were interested in a different type of number puzzle called a "magic square" which is a square grid filled with distinct positive integers in the range such that each cell contains a different integer and all of the rows, columns, and diagonals must add to the same value. As early as 190BC, mathematicians have been fascinated by these magic squares and have discovered some amazing results concerning them as well as generalizations and modifications of them. In this talk we will describe one such generalization known as the "modular magic square" in with the rows, columns and diagonals must no longer add to the same value, but rather the remainder we obtain when we divide those rows, columns and diagonals sums by some fixed values must be equal. For instance, we could try to find a magic square in which all of the rows, columns and diagonals sum to an even number; where the remainder is 0 upon division by 2; or find a magic square in which all the rows, columns and diagonals sum to an odd number; when the remainder is 1 upon division by 2. We will also discuss how one could consider other polygonal shapes, such as rectangles and triangles(a magic triangle will be an arrangement of positive integers on the sides of a triangle with the same number of integers on each side, so that the sum of integers on each side add to the same value), resulting in "modular magic polygons". Finally, we will share a few of the results we have proven concerning modular magic rectangles; namely, we will describe conditions for which a modular magic rectangle can have rows and columns which all sum to even, or all sum to odd, values.

COMPUTATIONAL MODELING OF ADVANCED MATERIALS FOR PHOTOVOLTAIC AND BIOSENSING APPLICATIONS

Benjamin O. Tayo, University of Central Oklahoma

Quantum mechanics provides us with a complete set of equations that can be solved in order to determine the properties of any system made up of electrons and nuclei such as atoms, molecules, polymers, and crystals. With the revolution in modern computer technology, it has now become possible to apply quantum mechanics to different fields such as materials sciences, renewable energy, computational biology, drug design, molecular electronics, and genomics. The advantage of computational modeling lies in the fact that we can perform large scale exploratory studies in a fast and cost-effective manner. This can save thousands of dollars compared to trial and error exploratory experimental studies. In this presentation, we discuss how quantum calculations can be used for predicting the properties of redox-active polymers for light-harvesting applications, and 2D materials-biomolecules systems for biosensing applications. This research can shed useful insights that can guide the development of novel photovoltaic devices and DNA sequencing technologies.

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THE EFFECT OF NICOTINE AND COTININE ON THE DEVELOPMENT OF *COCHLIOMYIA MACELLARIA* (FABRICIUS) (DIPTERA: CALLIPHORIDAE)

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Outstanding Undergraduate Paper in Biological Science Section – Zoology

Nicotine, readily available in electronic nicotine delivery systems, poses a lethal threat as it is easily accessible and highly toxic in its liquid form. Seventy-five percent of nicotine is metabolized into cotinine in as little as 20 minutes in the blood plasma and has 10-times longer half-life than nicotine. With the growing prevalence of nicotine-related deaths comes the increased possibility of finding nicotine or cotinine in the tissues of a corpse, which could distort postmortem interval (PMI) estimates. Through entomotoxicology, the study of how drugs and toxins influence the development of insects present on a decomposing body, this study aimed to determine if varying concentrations of nicotine and cotinine affected the development of the forensically important *Cochliomyia macellaria* (Fabricius) [Diptera: Calliphoridae], secondary screwworm. In this study, *C. macellaria* maggots were reared on three different concentrations - 25% (QD), 50% (HD), and 100% (LD) of the lethal dose of nicotine. Knowing 75% of metabolized nicotine is cotinine, we used the 75% of the lethal nicotine dose to calculate the QD, HD and LD concentrations of cotinine. Maggot weights and lengths were determined every twelve hours until post-feeding. This study found that nicotine dosage affected the weight and length of maggots. Maggots reared on untreated liver weighed more and were longer than those maggots reared on liver treated with a lethal dose of nicotine. While there was no effect of cotinine on maggot length and weight, there was a significant difference in the growth rate. These results suggest a negative relationship with nicotine dosage and maggot length and weight and a positive relationship on growth rate with cotinine. These results could greatly affect PMI estimations and, consequently, lead to a wrongful conviction.