ABSTRACTS OF THE 111TH OKLAHOMA ACADEMY OF SCIENCE TECHNICAL MEETING

NOVEMBER 4, 2022

OKLAHOMA STATE UNIVERSITY CENTER FOR HEALTH SCIENCES, TULSA

THE ROLE OF RETINAL ENDOTHELIAL CELL CAVEOLIN-1 IN SMOOTH MUSCLE CELL LOSS IN RETINA MICRO-VESSELS

Jennifer Ballheim and Jami Gurley, University of Oklahoma Health Sciences Center

Loss of Smooth muscle cell (SMC) coverage in retina micro-vessels occurs with age and metabolic disease. At present, the mechanism behind the SMC loss is unclear. Previous data from our lab show that SMC loss in retina micro-vessels also occurs in mice with endothelial cell (EC) Caveolin-1 (Cav1) depletion. Here, we establish a method to silence the Cav1 gene in human retinal endothelial cells (HRECs) to explore the role of EC Cav1 in loss of SMC coverage in retina micro-vessels. HRECs were cultured and transduced with Adenovirus-5 (Ad5) Cav1- silencing shRNA. Increasing viral titers and incubation periods were performed to optimize the shRNA-mediated Cav1 transduction and CAV1 protein knockdown. Transduction was confirmed by the presence of a green fluorescent protein (GFP) reporter imaged via fluorescence microscopy 24 hours post viral transduction. The culture was incubated in viral-infected media for 48 hours before being replaced with new media. The cells were harvested 96 hours post viral transduction. Cav1 silencing was confirmed with Western blotting for CAV1 protein. The Western blot CAV1 protein was quantified via densitometry using LI-COR Image Studio Lite. Our preliminary data suggests that Cav1 protein is reduced by more than 80% with transduction by the Ad5 Cav1 silencing via shRNA compared to the un-transduced HREC samples. HREC Cav1 silencing was achieved with over 80% efficacy with shRNA viral transduction. Depletion of CAV1 in HRECs will allow exploration of retinal EC-CAV1's role in retinal microvascular SMC loss. Future studies include assessments of retinal EC-CAV1 expression on retinal EC metabolic functions.

A STATISTICAL ANALYSIS OF COVID-19 CASE AND DEATH RATES AMONG TRIBAL NATIONS IN OKLAHOMA

Bethany Bengs and Jessica Brumley, East Central University

Outstanding Undergraduate Paper in Mathematics, Computer Science, & Statistics

COVID-19, the infectious disease caused by the variant of coronavirus SARS-CoV-2, has had a significant impact in the United States. Recent research indicates that Native Americans are among the most severely affected groups. However, the data used in these studies are often aggregated and do not accurately reflect the situation in individual tribal nations or populations. This study utilized the Supreme Court case McGirt v. Oklahoma to analyze COVID-19 cases and deaths among areas in seven tribal nations in Oklahoma to determine how they have been affected by COVID-19 compared to the general population of Oklahoma, as well as what factors might have influenced these rates. Descriptive statistics and incidence and case-fatality rates were evaluated and correlated with population density, access to healthcare, and government funding allotments. Time series plots were created to illustrate the rates of new cases per day in each tribal nation. Finally, multiple linear regression models were created to predict COVID-19 deaths from cases, population, and tribal status of counties in Oklahoma. This analysis found that, in general, areas within tribal nations do not have significantly different COVID-19 case and death rates from Oklahoma. Higher population density correlates with higher case and death rates, while healthcare access and government funding have no correlation with incidence and case-fatality rates. Since these results contradict the findings of previous studies, they indicate both the need for more research among Native American populations and the importance of data analysis in research.

ANTIFUNGAL ACTIVITY OF NOVEL COMPOUND EIPE-1 AGAINST THE FUNGAL PATHOGEN *CRYPTOCOCCUS NEOFORMANS*

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Outstanding Undergraduate Paper in Biochemistry & Molecular Biology

Cryptococcus neoformans is an opportunistic fungal pathogen that affects immunocompromised individuals. Antifungal drugs have been used to treat fungal infections for many decades; however, due to similarities between fungal and mammalian cells, these drugs are often toxic. In these last few decades, the fungi have also become resistant to the antifungal drugs. EIPE-1 was synthesized from vanillin, and was shown to have activity against methicillin resistant *S. aureus* (MRSA), and other gram-positive bacterial pathogens. We hypothesized that EIPE-1 could be used to kill fungal pathogens. For this study, we tested EIPE-1 against *C. neoformans* using a minimum inhibitory concentration (MIC) assay and an in vitro model of intracellular fungal growth using RAW macrophages. EIPE-1 has antifungal activity against *C. neoformans* in our MIC assay, with an MIC value of 1.749 μg/ml. In addition, following phagocytosis of *C. neoformans* by RAW macrophages, treatment with EIPE-1 had significant antifungal effects on *C. neoformans* compared to *C. neoformans* alone and compared to *C. neoformans* with RAW macrophages (without treatment). In further studies, we will perform RNA sequencing experiments and more comparison studies with other antifungal drugs.

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CHARACTERIZATION OF A UROPATHOGENIC STRAIN OF *KLEBSIELLA PNEUMONIAE*

Jonathan Crosse, Joseph Moberly, and Janaki K. Iyer, Northeastern State University

Outstanding Undergraduate Paper in Microbiology

Urinary tract infections (UTIs) are common bacterial infections that affect a wide variety of people including children. They account for 25% of the bacterial infections encountered by women and are associated with significant costs for treatment. Uropathogenic *Escherichia coli* (*E. coli*) is the most common etiologic agent followed by *Klebsiella pneumoniae* (*K. pneumoniae*). *E. coli*-mediated pathogenesis, in the context of UTIs, is widely studied but similar detailed information is not available on *K. pneumoniae*-mediated pathogenesis. UTIs caused by *K. pneumoniae* are harder to treat and cause more morbidity. There are also reports of increased antimicrobial resistance in different uropathogenic *K. pneumoniae* strains. In the current study, we have characterized a strain of *K. pneumoniae* (UCI-41) isolated from the urine of a patient diagnosed with a UTI. This strain is resistant to different bacteriostatic and bactericidal antibiotics and hence can serve as a good model to study pathogenesis mechanisms employed by antibiotic-resistant *K. pneumoniae* strains. Experiments involving ELISAs showed that *K. pneumoniae* UCI-41 induced the secretion of pro-inflammatory cytokines in a human epithelial bladder cancer cell line. This strain was able to internalize into bladder cells as determined by a gentamicin protection assay. This indicated that this strain was invasive and hence had the potential to cause recurrent UTIs. These findings support the use of *K. pneumoniae* UCI-41 as a model for future experiments that study invasive antibiotic-resistant uropathogenic bacteria and design novel strategies for treatment of infections caused by these strains.

VOLE (*MICROTUS GUENTHERI*) STABLE CARBON ISOTOPES AS CLIMATE PROXIES FOR THE MIDDLE AND LATE PLEISTOCENE OF THE LEVANT AND CAUCASUS

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Amy Prendergast and Zuorui Liu, School of Geography, University of Melbourne

Orr Comay and Michal Zyztov, The Steinhardt Museum of Natural History, Tel Aviv, Israel

Yoav Motro, Ministry of Agriculture, Israel

The Mediterranean Levant and Caucasus are situated in mid-latitudes. Therefore, climate oscillations during the Last Glacial Period (LGP, c. 115,000–11,700 years ago) are not as pronounced as in northern latitudes such as Europe and North America. One of the main questions is whether the LGP was cold and dry or cold and humid. Stable carbon isotopes are often used to distinguish between C3 vs. C4 plants. However, in mid-latitudes most vegetation is dominated by C3 plants. Hence, δ13C varies according to precipitation. To develop a modern model of the Levant's paleoecology, stable carbon isotopes of modern social voles, *Microtus guentheri*, were sampled from sites across Israel and correlated with GIS-derived mean annual precipitation. For the fossil study, vole teeth were selected from two Israel sites and from one Georgian site. Rantis Cave, Israel, (160 - 120 Kya) is in the central region of Israel, Amud Cave (45 Kya) is in the North of Israel while Dzudzuana (ca. 40 Kya), is found in the Republic of Georgia. Results of the modern study indicate a positive correlation between δ13C and mean annual rainfall with an average of -15.47 ± 1.277 (n=39). This confirms observations of previous studies that more enriched δ13C are indicative of higher mean annual precipitation. Results indicate that the carbon values for all fossil sites were enriched compared to modern voles; Rantis (n=9, -9.8 ± 0.25), Amud (n=20, -7.96 ± 0.46), and Dzudzuana (n=19 -7.2 ± 0.82). This suggests that Middle and Late Pleistocene sites had an increase in mean annual precipitation compared to modern populations. These results support the hypothesis that glacial periods in the Levant were cold and humid rather than cold and dry and demonstrates how stable isotopes in voles can provide relevant palaeoecological information in mid-latitude regions such as the Levant and Caucasus.

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DANDELION EXTRACT ALTERS EXPRESSION OF GENES REGULATING ATP AND NUCLEOTIDE BINDING IN CERVICAL CANCER CELLS

Christina Hendrickson, Oklahoma City University

Melville Vaughan and Nikki Seagraves, University of Central Oklahoma

Cancer continues to be a major public health burden and one of the leading causes of death. Despite many forms of expensive existing cancer therapies, there continues to be a high mortality rate among cancer patients. Therefore, we based our research on plant derived products due to their anti-cancer effects that can help to produce an efficient and inexpensive pharmaceutical that is widely accessible. One such product is dandelion (*Taraxacum officinale*). It was hypothesized that anti-cancer properties of dandelion extract acts by disrupting key cellular processes in tumor cells which can result in growth inhibition, decreased invasiveness, and increased apoptosis of tumor cells. We performed our experiments by preparing dandelion whole extract (DWE), filtering, freeze-drying, and resuspending them in sterile PBS. Then cultured HeLa cells and Human Cervical Epithelial Cells (HCEC), under standard in vitro conditions, were treated with DWE concentrations between 0 to 8 mg/ml for 96 hours. The quantitative polymerase chain reaction (qPCR) was performed to further investigate the anti-cancer mechanism of DWE. The results showed that DWE inhibited proliferation and migration and promoted cell death in HeLa cells while leaving HCEC cells unaffected. The qPCR showed the analysis of 8 most significantly differential expressed genes ($p<0.05$) resulted in enrichment of three annotation clusters. The top annotation cluster included genes associated with UP keywords ATP-Binding, Nucleotide-binding, Kinase, and Transferase as well as GO Terms ATP binding (Enrichment score=1.68). The next annotation cluster included genes associated with GO Term focal adhesion (Enrichment score=1.28). These data can provide a foundation to further investigate the mechanism of DWE toxicity in HeLa cells which can pave the way for future research in finding new anticancer pharmaceuticals.

A SUSTAINABILITY ASSESSMENT OF OKLAHOMA CITY UNIVERSITY

Ellie Howell and Adam K. Ryburn, Oklahoma City University

Outstanding Undergraduate Paper in Environmental Sciences

Over the summer of 2022, a comprehensive sustainability assessment for Oklahoma City University (OCU) was completed. The need for this project presented itself as a response to a growing concern from the campus community about OCU's environmental sustainability, and a lack of transparency from the administration and facilities departments. Utilizing a self-assessment program from the American Association for Sustainability in Higher Education's (AASHE) called STARS (Sustainability Tracking Assessment and Rating System), each section of sustainability at the university was clearly evaluated and the results were compared with that of peer and benchmark institutions who have also enrolled in the STARS program. The main sections of the report detailed Academics, Engagement, Operations, Administration, and Leadership in relation to sustainability in higher education. The main areas for improvement discovered throughout this summer-long survey were primarily in Operations, given that there is currently not a complete recycling program, nor does any designated tracking of emissions, energy, or water usage take place at the university. A more positive part of the results came from the dining services subsection of Operations, in which it was found that our dining services provider actively makes strides to locally source produce and reduce food waste through consistent inventory and documentation. This report establishes a framework for other campuses to follow in order to evaluate and track sustainability in their institutions and suggests possible initiatives to implement in response to areas lacking in sustainability.

SYNTHESIS AND POWER GENERATION CHARACTERIZATION OF PEROVSKITE SOLAR CELLS

McClain Irby, Amanda Nichols, Will Clothier, and Kevin Plumlee, Oklahoma Christian University

Outstanding Undergraduate Paper in Physical Science

Perovskite solar cells are a type of solar cell that uses perovskite as one of the layers due to its semiconductor capabilities. The cell materials are layered to allow electron and hole transport. Patwardhan, et al showed that perovskite solar cells can be constructed using a deposition method by undergraduate students as a way to introduce solar energy and this unfamiliar type of solar cell. While perovskite solar cells that have different halides and divalent cations have been constructed, they have not been made using a simple deposition method. Two other halides were used instead of iodide (bromide and chloride ions), and different mixtures of the halides were used to fabricate the solar cells. Electrical power output of the cells was collected and compared to the commercial and literature values.

COULD ARCHAIC *HOMO SAPIENS* SURVIVE IN THE TROPICS OF SOUTHEAST ASIA? IDENTIFYING SMALL MAMMAL REMAINS FROM YAHUAI CAVE IN GUANGXI, CHINA AT 120 KYA TO DETERMINE THE PALEOECOLOGY

Kathleen Kelley, Guangmau Xie, Qiang Lin, and Miriam Belmaker University of Tulsa

It has been hypothesized that the lack of protein sources and technological skills prevented archaic *Homo sapiens* from penetrating the rainforest to forage for food prior to 40,000 years ago (kya). Accordingly, early modern humans dispersing from Africa to Asia ca. 120 kya would have preferred savanna over tropical environments. As a case study, we present an analysis of small mammal remains (Chiroptera, Rodentia, Eulipotyphla, Primates) from Yahuai Cave, Guangxi, China. The area in Yahuai cave focused on for this research excavated 53 stratigraphic layers, dated by OSL to 124.2 ±16 kya. Early modern human remains were found nearby at several contemporaneous sites, such as Tongtianyan and Mulan cave indicating the region was inhabited by ca. 120 - 100 kya. Species found include a wide range of murids such as *Niviventer andersoni* (Anderson's white-bellied rat), *Mus pahari* (Gairdner's shrewmouse) and other murid specimens identified only to the genus level, such as *Leopoldamys*, *Rattus* and additional species of *Niviventer*. Other species include several squirrel species such as *Hylopetes alboniger* (Particolored flying squirrel), and *Belomys personii* (hairy-footed flying squirrel). Ecological analogy as well as community structure methods are utilized in the paleoecological analysis. This analysis indicates a warm, humid, dense forested environment, probably more humid than the contemporaneous Indochinese peninsula. A diachronic comparison shows no appreciable differences in species composition across strata. This suggests the ecology of the area was similar in the lower strata, ca. 120 kya, to that in the upper levels, ca. 40 kya. This confirms the ability of early modern humans to utilize this novel ecosystem earlier than previously assumed.

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EFFECTS OF ER-SIGNALING ON ADIPOCYTE PROGENITOR EXPANSION: POTENTIAL ROLE FOR WISP2

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Dysfunctional adipose tissue (AT) occurs when progenitors fail to expand and form new adipocytes during a positive energy balance. In this context, mature adipocytes become hypertrophic and ectopic lipid deposition can increase the risk for type 2 diabetes. Disrupted estrogen receptor alpha (ERα) signaling has been shown to contribute to AT dysfunction. We found elevated expression of Wnt1-inducible signaling protein (WISP2/CCN5) in APCs from obese mice after estradiol (E2) treatment. WISP2 regulates APC proliferation in mice and is induced by estrogen in human breast cancer cells. Analysis of human AT revealed a correlation between WISP2 and serum insulin levels. We hypothesized that WISP2 influences APC renewal and differentiation in response to ERα and potentially insulin signaling in AT. We aimed to investigate the connections between WISP2 and the progenitor phenotype plus WISP2 regulation by ERα in an in vitro model of adipogenesis. Mouse APCs (mAPCs) were cultured for all experiments. Adipocyte differentiation was visualized with Oil Red O-staining at days 0, 2, 4, 6, 8, 10, and 15. Expression of ERα and WISP2 after treatment with TAM, fulvestrant (ICI), insulin, and/or E2 in mAPCs was analyzed by PCR and Western blotting. The effect of WISP2 and E2 on mAPC progenitor proportions was measured by flow cytometry analysis of CD24 and Sca1. ORO-staining confirmed mAPC adipocyte differentiation over time. WISP2 expression increased after insulin-, E2-, and insulin+E2 treatments and decreased in treatments containing ICI. All treatments decreased ESR1 expression except ICI+E2+insulin. Western-blotting confirmed gene expression analyses. Consistent with previous work, E2 and insulin induced WISP2 expression in mAPCs. Further classifying associated signaling cascades will aid in investigating AT expansion and the pathology of adipocyte progenitors in obesity and diabetes.

ATR-FTIR DETECTION OF CHLORINATED HYDROCARBONS IN GROUNDWATER

Randall Maples, East Central University

Chlorinated hydrocarbons including aliphatic and aromatic compounds (CHCs) are toxic contaminants commonly found in groundwater samples and efficient detection and monitoring of these contaminants is an important part of the evaluation of water quality. Analysis is often complicated due to the presence of many compounds as well as interfering molecules. In this preliminary study, with an overall end-goal of the development of a novel, time and cost-efficient procedure for the determination of complex mixtures of CHCs in groundwater employing digital signal processing techniques, a method was developed for the determination of various CHCs in aquifer groundwater using Attenuated Total Reflectance Fourier Transform Infrared Spectroscopy (ATR-FTIR).

TURMERIC FOR CANCER PREVENTION

Madeline McTigue and William P. Ranahan II, Oral Roberts University

Outstanding Undergraduate Paper in Biological Sciences

Most chemotherapy, though advancing in its complexity, is killing healthy cells, and harming patients while generally providing low efficacy against tumor suppression. Given that many of the successful drugs on the market today are naturally occurring or designed from natural sources, a holistic cancer prevention model will be fundamental to fighting this disease, and plants are our best bet in preventing such an elusive illness. In 2011, scientists Douglas Hanahan and Robert Weinberg consolidated our understanding of cancer progression into ten "hallmarks of cancer". The ten hallmarks of cancer describe the ten steps required for a normal or healthy cell to become tumorigenic. It is in these ten areas that cancer must be addressed to properly treat and prevent the disease from occurring. Medicinal plants and herbs were identified that biochemically interact with each of these hallmarks to prevent cancer progression. Of the identified plants, turmeric root was found to interact with the most hallmarks via its polyphenolic pigment curcumin. As such, we began to deduce the process of sterilization and tissue culturing the turmeric root. Once this process was successful, a callus was induced, providing the future site for epigenetic modification using a biolistic particle delivery system. The aim of such epigenetic modification is to upregulate turmeric's expression of curcumin for a more potent anti-cancer product.

CELL SURFACE HYDROPHOBICITY PROPERTIES AND BIOFILM ADHESION IN OPPORTUNISTIC *SERRATIA* SPECIES HAVING DISPARATE SUSCEPTIVITY TO TRICLOSAN SENSITIZATION

Katherine Nehmzow, Abby S. Rigsbee, Christopher Godman, Sam Hudgeons, Sue Katz Amburn, and Franklin R. Champlin, Northeastern State University

We have shown all but one of 1 *Serratia* species capable of opportunistic pathogenicity to be intrinsically resistant to the hydrophobic biocide triclosan. However, they differed markedly regarding their susceptivity to triclosan sensitization by outer membrane permeabilization using the cationic detergent compound 48/80. Representative organisms exhibiting slight (*Serratia marcescens*), complete (*Serratia fonticola*), transitorily complete (*Serratia liquefaciens*), and intermediate (*Serratia rubidaea*) susceptivity were selected for further analysis. The purpose of the present study was to determine if cell surface hydrophobicity properties of these phenotypically disparate Serratia species are related to susceptivity to triclosan sensitization and the initial adhesion stage of biofilm formation. NPN fluorescent probe and hydrocarbon adherence assays were employed to quantitatively determine cell surface hydrophobicity properties, while an in vitro biofilm assay was used to assess adhesion of planktonic cells to a solid substrate. While S. rubidaea was seen to be extremely hydrophobic, *S. marcescens* and S. liquefaciens were only slightly to moderately hydrophobic, and *S. fonticola* was seen to be hydrophilic to slightly hydrophobic. These data do not appear to support the notion that the degree of susceptivity to triclosan sensitization by outer membrane permeabilization is directly related to cell surface hydrophobicity. However, the initial adhesion stage of biofilm formation appears to be influenced to some degree by cell surface hydrophobicity properties.

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INVESTIGATING ANTIMICROBIAL EFFECTS OF AQUEOUS DANDELION EXTRACT

Ashley Nguyen, Kayla Nguyen, Stephanie Rojas, Lindsey Morris, and Christina Hendrickson, Oklahoma City University

Certain plant-derived products have pharmaceutical uses due to their anti-inflammatory and anti-cancer effects. Dandelion (*Taraxacum officinale*) is one of them. It has long been consumed safely as part of Middle Eastern and Ancient Chinese Medicine. Anticancer effects of aqueous DWE (Dandelion Whole Extract) have been vastly studied on HeLa cells and other cancer cell lines. As some anticancer compounds are also used as antibiotics, this study aimed to further investigate the antibacterial effects of DWE. The disk diffusion method was utilized to test various concentrations (5 - 100 mg/mL) of DWE on bacterial growth. DWE was tested on six bacteria: *Escherichia coli*, *Citrobacter freundii, Morganella morganii, Salmonella typhi*, *Staphylococcus aureus*, and *Neisseria sicca*. All bacterial cultures were incubated at 37 ℃ for 24 hours. Isolated bacterial colonies were suspended in tryptic soy broth (TSB), compared with 0.5 McFarland Standard, and cultured on Mueller-Hinton Agar (MHA). Sterilized paper disks were impregnated with DWE and applied to bacterial plates. A Mueller-Hinton Agar plate devoid of bacteria was treated with DWE disks to serve as a control to ensure the DWE disks did not introduce contamination. After incubation, all plates were visualized for indication of DWE impact on bacterial growth. The results showed no zone of inhibition; indicating all six bacteria were resistant to aqueous DWE in this method. In the future, broth dilution antibiogram assays will be conducted utilizing additional bacterial species and different formulations of dandelion extracts.

MICROWAVE IMAGING SYSTEM (PASCO SYSTEM) MOTION DETECTION AND TRACKING OF MOBILE PHANTOM FOR HUMAN TISSUE

Moses Omeneki, Kwabena Boateng, and Nesreen Alsbou, University of Central Oklahoma

Imad Ali, University of Oklahoma Health Sciences Center

Outstanding Graduate Paper

Breast cancer is a disease that occurs mostly in female cancer patients and is the leading cause of cancer-related death among females worldwide. Breast screening and early detection are currently the most successful, most common method for the management, reduction, and treatment of this disease or mortality rate. Various imaging methods such as X-ray and MRI are currently utilized for detecting breast cancer. Microwave Imaging is gaining quite a lot of attention as a promising diagnostic tool for early breast cancer detection. MWI is inexpensive, fast, convenient, and a safe screening tool. The purpose of this research is to use a specially designed object that is utilized as a human tissue equivalent material and can be scanned/imaged to evaluate, analyze, and fine-tuned the performance of an imaging device. This is an effort to provide an update on the principles, developments, and current research status of MWI for breast cancer detection. The project is structured to provide an overview of MWI system techniques used for detecting the motion of fourteen different human tissue equivalents to provide reliable and quantitative data to determine how effective an imaging system is compared to imaging systems used in a real-world setting. For this project, a Pasco system consists of a transmitter, a receiver, a breadboard circuit, an Arduino, a stepper motor driver, a computer, and a DC power supply. The innovative technique of the MWI system is significant in that it has the potential to provide a safe and reliable method of enhancing the overall performance of imaging systems in a very safe, cost-effective, and non-invasive way before it can be applied in a clinical setting.

EFFECTS OF MULTIPLE POLYCYCLIC AROMATIC HYDROCARBONS ON CARDIAC DEVELOPMENT IN CHICK EMBRYOS

Yulianis Pagan, Hallum Ewbank, and Christopher Goodchild, University of Central Oklahoma

Outstanding Undergraduate Paper in Applied Ecology & Conservation

Following oil spills, avian embryos may be exposed to polycyclic aromatic hydrocarbons (PAHs) when crude oil is transferred from oiled nesting material or oiled feathers of brooding parents to the eggshell surface. While several studies have examined the effects of PAHs on adult birds, the developmental effects of embryonic exposure to PAHs remain unclear. In other taxa, like fish, embryonic exposure to PAHs causes cardiac impairments like bradycardia and a decline in cardiac output. Similar trends have been detected in avian embryos, specifically external application of crude oil to the eggshell reduces embryonic heart and metabolic rates. However, the mechanism and specific PAHs driving these effects in developing avian embryos are still poorly understood. This experiment investigated the effects of sublethal exposure of six PAHs (anthracene, phenanthrene, pyrene, chrysene, benzo[a]pyrene, and fluoranthene), at four concentrations (100, 200, 400, and 800 ng PAH / g egg mass), on avian embryonic heart rate, heart organ mass, morphology, and mRNA expression of phase I and phase II detoxification enzymes. We exposed chicken (*Gallus gallus*) embryos to PAHs on embryonic day (ED) 3 via egg-injection. We recorded heart rate on ED 10, 14, and 18, and collected heart organ mass, morphology, and transcriptional data on ED 18. Chick embryos exhibited a decrease in ED 18 heart rate at the highest concentrations for fluoranthene, phenanthrene, chrysene, and pyrene. Additionally, we found an increase in heart mass in chicks exposed to phenanthrene, pyrene, chrysene, and fluoranthene at intermediate concentrations. Preliminary results also indicate several transcriptional responses in chicks exposed to various PAHs. Collectively, these data indicate in ovo exposure to various PAHs interferes with avian embryonic development and may contribute to reduced hatchling survival, especially if these impaired cardiac functions continue post-hatch.

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EPIGENETIC MECHANISMS HOLD THE KEY TO DEVELOPING NOVEL THERAPEUTIC TREATMENTS FOR ULCERATIVE COLITIS

Radhika Pande and Subhas Das, Oklahoma State University Center for Health Sciences

Background: Inflammatory bowel disease (IBD) includes Crohn's disease (CD) and ulcerative colitis (UC) and is associated with symptoms like abdominal pain, diarrhea, fatigue, reduced appetite, and weight loss. According to CDC, approx. 3 million Americans are reportedly diagnosed with IBD. Compared to normal individuals, IBD patients are more prone to colorectal cancer and arthritis. The causes of IBD are unknown; however, environmental, nutritional, microbiological, and genetic factors have been suggested to play a role in disease development. Nerve Growth Factor (NGF), a neurotrophic factor, is significantly elevated during several inflammatory and autoimmune diseases, including IBD and is essential for a robust inflammatory response. Studies suggest the importance of epigenetic mechanisms in chronic gastrointestinal inflammation and colorectal cancer, offering important insights into IBD's molecular basis. Although epigenetic regulators are well-explored in IBD, the regulations controlling NGF gene expression are unknown. Epigenetic modifications, including DNA methylation and covalent histone modifications, influence gene expression at the transcription level without altering the DNA sequence. We found that colon inflammation causes hypermethylation of the NGF promoter, resulting in its activation. Hypermethylation recruits proteins containing methylated DNA binding domains (MBDs), such as MeCP2. The evidence suggests that MeCP2 links DNA methylation and histone modifications to control gene expression. Aim: To understand the involvement of MeCP2 and identify novel histone modifications associated with NGF transcription. Method: TNBS-induced colitis animal model was used for this study. After inflammation, colon tissue was collected to study the DNA-protein and protein-protein interactions by Chromatin-immunoprecipitation-assay and Immunoprecipitation-assay, respectively. Results and Conclusion: Our findings show that MeCP2 and tri-methylation of histone 3 lysine 4 (H3K4me3) are elevated during the TNBS-induced inflammation compared to control animals. ChIP and pull-down assays prove that MeCP2 interacts with H3K4me3, and both are associated with the hypermethylated NGF gene promoter for the active transcription during colon inflammation.

EXAMINING THERAPEUTIC EFFECTS OF EXT-4U ON NEOVASCULARIZATION AND FIBROSIS IN AMD

Melissa Testut, Oklahoma Christian University

Henry Shin, Excitant Therapeutics

Outstanding Undergraduate Paper in Biomedical Sciences

EXT-4U is a novel small molecule that selectively activates Peroxisome Proliferator-Activated Receptor Alpha (PPAR-α). Here we show its therapeutic effects on retinal fibrosis and neovascularization in a mouse model of Age-related Macular Degeneration (AMD). To test the selectivity and potency of EXT-4U for PPAR-α agonism, we first performed a PPAR-α reporter assay. We then conducted a Cellular Thermal Shift Assay (CETSA) in ARPE19 cells to analyze the binding affinity of EXT-4U to human PPAR-α. We performed western blotting to examine the anti-fibrotic effects of EXT-4U in ARPE19 cells treated by TGF-β2 and tested the anti-angiogenic effects by conducting an ex vivo choroidal sprout assay. Finally, we conducted in vivo efficacy tests in a mouse model of laser-induced Choroidal Neovascularization (CNV). The PPAR-α reporter assay confirmed that EXT-4U is a selective and potent PPAR-α agonist, and the CETSA assay further demonstrated PPAR-α binding affinity. In ARPE19 cells treated with TGF-β2, co-treatment with EXT-4U downregulated levels of connective tissue growth factor. EXT-4U treatment also inhibited choroidal endothelial cell sprouting. Lastly, EXT-4U treatment in CNV mice decreased CNV lesion size. When considered together, these results demonstrate that EXT-4U exhibits a therapeutic effect on fibrosis and neovascularization.

HTLV-1 VIRAL PROMOTER NUCLEOSOME DYNAMICS

Landen Underwood and Alisha Howard, East Central University

Outstanding Poster

Human T-Cell Leukemia Virus Type 1, or HTLV-1, is a retrovirus infecting primarily T-cells. This viral infection is known to be the causative agent in a subset of patients into Adult T-Cell Leukemia (ATL), or if it crosses the blood-brain barrier into HTLV-1 associated myelopathy, or tropical spastic paraparesis (HAM/TSP). The virally-expressed transcription factor Tax has been found to be pivotal in the malignant transformation of infected cells. Control of viral expression by Tax from the proviral promoter varies with stage of infection. The association of the HTLV-1 viral promoter and the associated viral and host activators/co-activators within the context of the chromatin environment could provide insights into target interactions and interfaces leading to dynamic promoter control. To investigate this, a plasmid, pHTLV208-8, containing the HTLV promoter surrounded by 5S nucleosome positioning sequences was prepared. Four biotinylated oligos corresponding to complimentary regions near the 5S or promoter sites along the plasmid were designed with various lengths and sent for synthesis with a 5' biotinylation modification included. Triplex strand invasions were performed to attach each specific biotinylated oligo and pHTLV208-8. Bead binding of the triplex strand mixtures were performed using streptavidin-bound magnetic beads. Restriction digests were then used to quantitatively analyze binding success and durability of the triplex-bound plasmids. Use of the stationary bound plasmid will allow analysis of Tax chromatin positioning effects as well as pulldowns from cell lysates in the absence of non-specific end-binding proteins.

BIOHYBRID MICROSWIMMER FABRICATION AND CHARACTERIZATION

Kathy Vo, Laurel Eze, Trung Le, and Christian Santizo, University of Central Oklahoma

Outstanding Undergraduate Paper in Engineering Sciences

The long-term objective of this project is to develop a novel drug delivery method in the form of biohybrid microswimmers with the purpose of improving and accelerating patient outcomes. Traditionally, drugs are delivered through the skin, mouth, veins, etc. in order to treat diseases, improve health, and extend lives. Usually, this treatment comes with a cost in the form of side effects due to the interactions between said drugs and healthy tissues. The background of this project stems from the need to develop a better and more precise way to deliver treatments and substances into the body exactly where they are needed. The biological part of the micro-swimmer is by establishing the green algae cells, which are created through a process called cell cultures that is done in labs. The algae cells will be tested with polystyrene beads that will ultimately contain drugs, and this will identify the most effective and efficient ratio of the beads to the cells. Subsequently, to ensure the beads are attached to the algae surface, the cells will be coated in an electropositive solution expected to attract the beads even more. The guidance of these cells will be placed in an experimental setup. There is possibly a light probe that will be emitting light with an ideal wavelength for the cell's reaction. As the cells are being guided by the light probe, another high intensity light operating in the 40mA range will be used for imaging, serving as a sort of PIV system to observe the movement on a more detailed level. The idea behind this project lies in the expansion of a safer, more effective drug delivery method that will utilize the motile flagella-powered-biohybrid microswimmers by transporting drugs to the targeted areas.