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A CLOSER LOOK AT A TEA TREE OIL-SELECTED *STAPHYLOCOCCUS AUREUS* SMALL COLONY VARIANT

Nathanial J. Torres, Steven D. Hartson, Janet Rogers, Khadija A. Abdulhafid, and John E. Gustafson, Oklahoma State University

Best Graduate Paper of the Academy

Staphylococcus aureus small colony variants (SCV) are associated with chronic and recurring infections that are recalcitrant in antimicrobial therapy. SCVs demonstrate: slower growth rates; defective metabolism and electron transport; and reduced antimicrobial susceptibility. Tea tree oil (TTO) kills bacteria by denaturing proteins and disrupting membrane structure and TTO reduced-susceptibility (TTORS) *S. aureus* mutants exhibit an "unique" SCV phenotype. Similar to previously described SCVs, all TTORS SCVs investigated were less susceptible to both the cell wall antibiotics vancomycin and oxacillin. A TTORS SCV mutant (TTORS-1) harbored numerous mutations, including a mutation within acpP which encodes the acyl carrier protein (ACP) essential for fatty acid biosynthesis. Comparative proteomics revealed that TTORS-1 demonstrated increases in 39 proteins and decreases in 74 proteins compared to parent strain SH1000. In TTORS-1, the fatty acid biosynthesis proteins FabF (3-oxoacyl-synthase) and FabD (malonyl CoA-acyl carrier protein transacylase) and the bifunctional phosphopantothenoylcysteine decarboxylase/phosphopantothenate-cysteine ligase were found in greater abundance. This latter enzyme is required for the synthesis of 4'-phosphopantetheine, which when linked to ACP acts as the anchor on which fatty acid biosynthesis takes place. Furthermore, RT-PCR analysis revealed that 4 genes involved with de novo fatty acid biosynthesis as well as one phospholipid biosynthetic gene were also up-regulated in TTORS-1. *S. aureus* SCVs can result from the deletion of menB or cold shock protein cspB, and menB SCVs demonstrate a decrease in citric acid cycle activity. TTORS-1 harbored less menaquinone biosynthetic protein MenB (1,4-dihydroxy-2-naphthoyl-CoA synthase), cold shock proteins CspB and CspC, ATP synthase subunit gamma, and proteins involved with the citric acid cycle. Collectively our data indicates that fatty acid biosynthesis is altered in TTORS-1, as would be expected in an acpP mutant. We also demonstrate the reduced synthesis of certain proteins in TTORS-1 mirroring what has been observed in previously described SCV phenotypes.

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THE EFFECTS OF TEMPERATURE ON THE ATTENUATION COEFFICIENT OF ULTRASOUND

Maranda Robin Clymer, East Central University

Best Undergraduate Paper of the Academy and Outstanding Undergraduate Paper in Physical Sciences Section

Attenuation is an important property of ultrasound that needs to be known in its many different applications, such as food processing, sanitizing, extraction, and imaging in medicine. This property factors in the amount of energy lost with distance traveled (Williams, 2017). I observed the effects of temperature on the attenuation coefficient of ultrasound. Due to the diverse physiochemical properties of oils, I expected to see a clear connection between temperature and the attenuation of ultrasound within different oils. With the results, I hope to inform future research and users of ultrasound of an important factor that should be considered and noted when determining a medium's attenuation coefficient. Using an Ultrasonic Echoscope, a 1 MHz frequency transducer, and a computer with A-Scan software, I obtained different values of factors found within Beer's law. I repeated this at a range of depths and temperatures to solve for multiple attenuation coefficient values, αF. With Graphical Analysis, I plotted multiple attenuation coefficient vs temperature graphs at small temperature intervals. Once I collected all my data and composed the graphs, I observed that though there is a connection between the attenuation coefficient and temperature, there needs to be a broad range of temperatures for this to be seen. These graphs helped me achieve equations that show a relationship between the ultrasound attenuation coefficient and temperature for the mediums I used. I accomplished this by using three different oils: sunflower oil, coconut oil, and corn oil.

EVALUATION OF THE BLUE RIVER FOR PRESENCE OF *CAMPYLOBACTER JEJUNI*

Gunner Parent and April Nesbit, East Central University

Best Undergraduate Poster of the Academy

Campylobacter jejuni is a known bacterial species associated with cattle and poultry, along with other species. *C. jejuni* is known to cause campylobacteriosis, an intestinal infection that can have severe effects on young animals and humans. The Blue River is a water source for many people and livestock in Southeast Oklahoma, and the Oka' Yanahli preserve includes one mile of the Blue River near the headwaters. Prior to being a preservation, cattle occupied the land and today a chicken plant resides next to the river, and either of these activities could lead to contamination of the Blue Rive by *C jejuni*. For the safety and health humans and animals, I sampled for the presence of *C. jejuni* in the portion of the Blue River contained in the Oka' Yanahli preserve. Sediment and water samples were collected from six locations along the Blue River. Water samples were diluted using serial dilution protocols and placed on *C. jejuni*, BD *Campylobacter* Bloodfree Selective Medium, petri plates. Plates were grown at 42^{o}C for 24 hours. Eleven bacterial colonies of interest were isolated followed by gram staining and eight biochemical tests. Results were collected and deciphered using Bergey's Manual. Based on initial results, none of the eleven isolated colonies are *C. jejuni*. Future work includes testing additional colonies using standard microbial techniques and 16S bar coding studies to confirm bacteria species.

RE-GROWTH AFTER FIRE IN A CROSS-TIMBERS FOREST IN OKLAHOMA

Haylee Story, Sonya Ross, and Stanley A. Rice, Southeastern Oklahoma State University

Outstanding Undergraduate Paper in Biological Science-Botany Section

We counted the number of sprouts of woody plant species that grew after a 2011 fire near the Blue River in south central Oklahoma over the course of six years. One of the transects was in a cross timbers forest; the other one was along the Blue River. We found that some woody plant species re-sprouted quickly and maintained a relatively unchanged density of sprouts, while in other species, the number of sprouts increased over time.

TEMPERATURE REGULATES FORAGING BEHAVIOR IN THE RED HARVESTER ANT, *POGONOMYRMEX BARBATUS*

Anna Parakevopoulos, Karl Roeder, and Diane Roeder, Cameron University

Outstanding Undergraduate Paper in Biological Science-Zoology Section

All organisms require nutrients for survival, growth, and reproduction. These nutrients are acquired in varying quantity when animals forage for food. The abiotic conditions that animals experience can either constrain or provide windows of opportunity for foraging activity. Here we examine how daily fluctuations in abiotic conditions regulate foraging activity of the red harvester ant, *Pogonomyrmex barbatus*. We examine 1) colony differences in time spent foraging and distance traveled per trip, 2) the effect of temperature on travel speed, and 3) the effect of temperature on the time spent engaged in each component of a foraging trip (i.e. outbound trip, foraging duration, return trip). We tracked 20 individual foragers at each of nine colonies and recorded distance to foraging area, time spent travelling and foraging, and temperature during each trip. Ants foraged in the morning at surface temperatures ranging from 25-60ºC. Colonies foraged at different distances from the nest, which was reflected in travel time to and from the foraging area. Controlling for differences between colonies, travel speed for both outbound and return trips increased with temperature. Likewise, search time was constrained to shorter bouts. Despite increased travel speed, ants foraged in the same location throughout the day, suggesting that distance to foraging areas was not influenced by temperature. Our results highlight the importance of daily temperature cycles in regulating foraging behaviors, which may limit nutrient intake.

ENHANCING STUDENT LEARNING USING COGNITIVE SCIENCE

Shi Rui Yeoh, Tiara Travis, Paul Cook, Nesreen Alsbou, and Samuel Lawrence, University of Central Oklahoma

Outstanding Undergraduate Paper in Social Sciences Section

Our goal for this project is to study the thinking process of college students when they are learning and in the process enhance the way they think using cognitive science. We focus on the think-aloud strategy and the advantage and disadvantage of this method. The think-aloud strategy requires the learner to verbalize his or her thinking when solving a given problem. Our group contains of 6 students and 2 Professors. At the beginning of the research, our task was to review academic journals regarding to the think-aloud strategy. After that, each of us was required to design a case study which focus on the application of the think-aloud strategy to students related to our respective major. As for now, each of us has completed our preliminary case studies. The initial experiments only focused on a scale of one student and we plan to expand the scale of the experiment and hopefully help students improve the way they learn.

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MOLECULAR CHARACTERIZATION OF FOODBORNE PLANT PATHOGENS IMPORTED FROM CENTRAL AMERICA.

Matt Broge, J Grimm, C Soden, K Karki, C Biles, A Howard, and B Bruton, East Central University

Outstanding Undergraduate Paper in Microbiology Section

Plant pathogens are often carried into other countries through insects, animals, farm machinery, or plant transmission. Latent plant pathogens, such as *Diaporthe* sp., enter the surface of the melon fruit (*Cucumis melo* L. var. *cantalupensis* Naudin) early in development. The fruit is picked at maturity and then sent to market. The fruit continues to mature and at this time the pathogen quickly causes interior fruit rot often discovered by the consumer when cutting the fruit open. The purpose of this research is to investigate whether *Diaporthe* species imported on melons from Central America are the same as those already identified in melons grown in Oklahoma. Four *Diaporthe* spp. have recently been taxonomically classified that attack melon; *D. cucurbitae*, *D. melonis*, *D. sojae*, and *D. ueckerae*. Melons from Costa Rica, Honduras, and Guatemala were purchased at local grocery stores and melons were taken from fields throughout Oklahoma. The melons were washed in 10% bleach, dried and stored on a dry bench. After 4-10 days, sunken surface lesions were detected and the melons dissected using a sterile knife. Samples of the diseased tissue was placed on an agar plate containing either potato dextrose or malt extract. After 4-10 days, the fungus growing from the tissue was subcultured to another agar plate. After 7 to 14 days, the fungal pycnidia were examined microscopically for alpha and beta spores characteristic of *Diaporthe* species. Fungal hyphae was then separated from agar and DNA was extracted. Polymerase chain reactions (PCR) were performed using ITS tagged M13 Primer sequence and products were confirmed using agarose gel electrophoresis. Purified PCR products were sent to Eurofins Scientific for Sanger DNA Sequencing. *Diaporthe* spp. were isolated from melons imported from Guatemala, Costa Rica, Honduras, and from those grown in Oklahoma.

DYNAMIC RESPIRATORY PHANTOM

Amjad Barghouthi, University of Central Oklahoma

Outstanding Undergraduate Paper in Engineering Science Section

In our research we are planning to design a 3D platform and a lung phantom that has different cancerous tumor sizes. The goal is to use the phantom to detect motion artifacts in CT. We will be using motion modeling to model the respiration motion of the patients which produces image artifacts during the scanning process. These artifacts cause erroneous calculations of the volume and characterization of the tumors and critical structures in treatment planning and variations in the CT-number values and the associated densities of the associated tissues. This phantom will be made of foam substance that mimics lung tissue and gel like substance that has a density equivalent to water and normal tissues. This phantom system is compatible and safe to be used under x-rays of the cancer treatment devices. The design and reconstruction of this phantom system is still in process. This phantom moves in 3D using three mobile platforms that are driven by different stepper motors which will allow complicated motions that can simulate the lung movement. When we complete our project and research successfully we will be investigating image artifacts induced by phantom motion and develop techniques that enhance CT image quality thereby allowing radiotherapy planners to accurately calculate the volume of the tumors and reduce the uncertainty in CT numbers

MTORC1 IS NECESSARY AND SUFFICIENT TO STIMULATE GLS ACTIVITY IN OSTEOBLASTS

Joshua C. Hardage, East Central University and Duke University
Yilin Yu and **Courtney M. Karner,** Duke University

Outstanding Undergraduate Paper in Biochemisty and Biophysics Section

Osteoblasts are secretory cells whose primary function is to produce and secrete Type 1 Collagen and other proteins that comprise and mineralize the bone matrix. Metabolically, how osteoblasts generate biomass and energy to sustain matrix production is not well understood. Previously, we identified glutamine metabolism as a critical regulator of WNT-induced osteoblast differentiation and bone formation by entering the TCA cycle to alleviate the energy deficit associated with WNT-induced bone formation. WNT stimulates glutamine metabolism by activating the enzyme glutaminase (GLS) which catalyzes the first, rate limiting step in glutamine metabolism. How WNT regulates GLS activity and glutamine metabolism is unknown. Here we present data demonstrating the mammalian target of rapamycin complex 1 (mTORC1) pathway is both necessary and sufficient to stimulate GLS activity during osteoblast differentiation. We used the active site mTOR inhibitor Torin1 to inhibit all mTOR activity during osteoblast differentiation. Torin1 treatment completely eradicated both GLS activation and osteoblast differentiation in response to WNT. Conversely, disinhibition of the mTOR pathway by deletion of the Tsc2 gene in calvarial osteoblasts greatly increased GLS protein expression and activity. Moreover, pharmacological activation of mTOR with three distinct small molecules that activated the upstream kinases PI3K (PI3K activator) or AKT (SC79) or mTORC1 directly (MYH1485) was sufficient to increase GLS protein expression and activity in vitro. Mechanistically, quantitative PCR and Phos-tag western blot analyses indicated that GLS is not regulated transcriptionally rather it may be the result of direct phosphorylation by mTOR. Finally, we evaluated SC79 for efficacy in vivo. Two-month old C57Bl/6 female mice were injected intraperitoneally for 4 hours with SC79. This regimen stimulated mTORC1 activity and increased GLS protein levels in bone extracts. Collectively, our data suggest targeting mTOR activity may be a viable strategy to modulate GLS activity and stimulate osteoblast differentiation and bone formation in vivo.

UTILIZING XLSFORM AND FORM-HUB TO DIGITIZE THE DATA FOR PONTOTOC ANIMAL WELFARE SOCIETY

Billy Andrew, East Central University

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

Pontotoc Animal Welfare Society (PAWS) in Ada Oklahoma still collects data on paper. With a PetSmart grant and help form McNair Scholars Program, we have obtained equipment and developed specialized form for data entry utilizing an open source program, Form-Hub. Creating a working and efficient form will be the key in making this a viable methodology for data transfer and entry for PAWS, other humane societies and small businesses. For non-profit organizations and small businesses, it is crucial to have the least operating cost as possible. For Form-Hub to work there needs to be a server, these are expensive devices. To keep it on a small budget, ideas like using Amazon Web services and the use of a micro-server like a Raspberry PI 3 B will be explored.

EXTRACELLULAR VESICLES TARGET T-CELL FUNCTION IN B CELL CHRONIC LYMPHOCYTIC LEUKEMIA

Whitney Hall, Oklahoma Christian University
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A. Ghosh, Stephenson Cancer Center, University of Oklahoma Health Sciences Center
Outstanding Undergraduate Paper in Biomedical Science Section

B-cell chronic lymphocytic leukemia (CLL) is still incurable despite aggressive therapies. While various microenvironmental factors are known to influence CLL progression, exploring the role of extracellular vesicles (EVs) in CLL pathobiology has just begun. We now know that CLL plasma contain elevated levels of EVs including microvesicles (MVs; 0.1–1.0μm) and exosomes (Exos; 30–<100nm). While our earlier work shows the ability of CLL MVs to activate CLL bone marrow stromal cells, their interactions with T-cells remain largely undefined. Of relevance, CLL patients are also known to have T-cell dysfunction. Thus, we studied the impact of CLL EVs on T-cell function. MVs/Exos were purified from CLL plasma or used culture media of CLL B-cells and Meg-01 (megakaryocytes) cells by differential centrifugations. Levels of MVs/Exos were determined by estimating protein content. Primary T-cells from normal peripheral blood mononuclear cells and CLL B-cells from CLL patients' blood were purified using specific kits. A human T-cell line (Jurkat) was also cultured for few experiments. Fluorescent microscopic observations suggest that EVs from CLL plasma, CLL B-cells, and Meg-01 cells are able to integrate into the T-cells. Interestingly, different T-cell types show specific affinity towards MVs, Exos, or both. On the other hand, CLL B-cell derived EVs show more affinity towards T-cells than EVs from other sources. Importantly, circulating EVs from certain CLL patients inhibited normal T-cell activation in vitro. Our initial studies suggest that circulating EVs in CLL are likely to target T-cells which may contribute significantly in CLL pathogenesis.

REDEFINING HTLV AND HOST PROTEIN-PROMOTER INTERACTIONS IN MAGNETIC PROMOTER PULL-DOWN ASSAYS

Conner Anderson and Alisha Howard, East Central University

Human T-cell leukemia virus type 1 (HTLV-1) is the oldest known human retrovirus affecting over 20 million people worldwide. HTLV-1 is a causative agent of Adult T-cell leukemia/lymphoma (ATL/L) for which there is currently no known cure for. This project investigated amplification of the viral promoter utilizing different polymerase samples (Thermus aquaticus). The amplicon was also designed to attach to magnetic beads upstream of the HTLV-1 promoter region facilitating protein-DNA interaction identifications. Various polymerase samples and assorted buffers were obtained through several companies or generated in house (ECU). A plasmid, coding for Taq polymerase was transformed into BL21 (DE3) pLysS and expressed. Expression was monitored with SDS-PAGE and purified similar to established protocols. Amplification in controlled PCRs allowed comparison of reaction efficiencies. An analysis of various streptavidin coated magnetic beads was also conducted. Results indicated that Taq-Pol expressed in the lab was suitable for promoter amplification via PCR, making large volume production feasible. Results of the project also indicated that magnetic beads vary significantly in binding efficiency to the biotinylated promoter region. Based on the results, streptavidin coated magnetic beads provide the ability to isolate the promoter region of HTLV via magnetic pull-down assays. Utilizing this method will help us to understand viral-host protein-DNA and protein-protein interactions. These interactions are suspected to play an important role in the activation of the HTLV retrovirus in humans. Understanding of this process helps our comprehension, not only of viral life cycle and patient prognosis, but overall understanding of dynamic regulation in endogenous genes as well.

CULTIVATION OF FASTIDIOUS ANAEROBIC ORGANISMS FROM THE EQUINE GUT MICROBIOME USING THE ICHIP DEVICE FOR NON-TRADITIONAL CULTIVATION

Shaylin Daji, Nisha Patel, and Paul Lawson, University of Oklahoma

Cultivation is an invaluable tool in microbiology that allows for the characterization of an organism's morphological, physiological, biochemical, and chemotaxonomic traits. Currently, only a small fraction of all microorganisms have been identified and described. The Ichip diffusion device is a non-traditional cultivation method developed to recover "uncultivable" organisms in situ in an aerobic environment. In this study, a culture-dependent approach will be used to grow anaerobic fastidious organisms in situ using a modified Ichip device protocol in order to identify novel bacteria from the equine gastrointestinal tract. In the laboratory, organisms often fail to grow due to their specific growth substrates not being provided. The principle behind this approach is that organisms are encouraged to grow on the material they naturally inhabit and vital nutrients will migrate into the agar present in the Ichip device thus further increasing the probability of continued growth when transferred to a range of substrates present in agar plate growth experiments. The Ichip device will be inoculated with a diluted equine fecal sample and the Ichip will be placed in a fecal slurry grown at physiological conditions in the anaerobic chamber. Candidate novel isolates identified (below 97% 16S rRNA sequence similarity), will be subjected to a panel of morphological, physiological, biochemical, chemotaxonomic (fatty acid, polar lipids, peptidoglycan), and more in depth phylogenetic analysis. In this approach, we envision that underrepresented microbes in equine intestinal microbiome will be further characterized and studied to determine their health function in horses. Using the Ichip diffusion device, a greater range of organisms located in different phylogenetic groups will be recovered from the equine gut microbiome by providing organisms with natural growth conditions compared to traditional isolation methods.

CLONING, SEQUENCING, AND IDENTIFICATION OF UNKNOWN *SALMONELLA* OR EHEC (ENTEROHEMORRHAGIC *E. COLI*) BACTERIOPHAGE 3

Raina Hahn, Owasso High School
Riley Pritzlaff, Bixby High School
B.J. Reddig and E.L. Blewett, Oklahoma State University – Center for Health Sciences
P.K. Litt, Oklahoma State University

Bacteriophages are a common type of viruses that infect and kill bacteria. *Salmonella* and enterohemorrhagic *E. coli* [EHEC] bacterial infections are a common cause of foodborne illnesses. Bacteriophages were isolated from the environment and shown to kill both of these pathogens. Preparations of these bacteriophages can be sprayed onto food processing machinery and leafy greens in order to reduce bacterial contamination thus preventing foodborne illness. In this project we cloned DNA fragments from one of the bacteriophages, Phage 3, and sequenced the DNA. We sequenced more than 2,000 bp and used this DNA sequence data and phylogeny software to compare our phage with existing phage in GenBank. We identified Phage 3 as a Salmonella-type phage and inferred it's relationship with other bacteriophage.

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A PUTATIVE PHYTASE, CARP, IS DIFFERENTIALLY REGULATED BY MULTIPLE PROMOTERS AND PLAYS AN IMPORTANT ROLE IN CA2+ RESPONSE OF *PSEUDOMONAS AERUGINOSA*.

Michelle King and **Marianna A. Patrauchan,** Oklahoma State University
Mariette Barbier, West Virginia University

Pseudomonas aeruginosa is an opportunistic pathogen that causes severe acute and chronic infections in humans, particularly, in cystic fibrosis (CF) patients. Our group has shown that calcium (Ca2+) induces virulence and antibiotic resistance in *P. aeruginosa*. Earlier we identified a Ca2+-regulated protein, CarP, which was predicted to form a 5 bladed β-propeller structure with a phytase-like domain and a putative Ca2+ binding site in the center of the propeller. We have characterized its role in Ca2+-induced production of virulence factors: pyocyanin and pyoverdine, and cell tolerance to elevated Ca2+. To further characterize the role of CarP in Ca2+-regulated virulence and adaptation to host, we aim to identify the host factors that control the expression of carP. Based on RNA seq data analyses of carP transcription profile, we predicted two promoter regions located at -52 and +6. To study the potential role of these promoters in regulation of carP transcription, we cloned three fragments harboring P1 (-321 to -1), P2 (-212 to +100), or both P1P2 (-321 to +36) into a vector with promoterless lux operon. Overall, P1 promoter showed increased activity during late log and stationary growth phases. However, elevated Ca2+ induced its activity during early log, and decreased it during later phases. Growth at 5% CO2 reduced P1 activity and abolished the growth phase-dependent Ca2+ effect. Furthermore, we studied the role of CarP in *P. aeruginosa* pathogenicity by using Galleria mellonella and mouse virulence models. Disruption of carP reduced worm killing by 60% and decreased survival of *P. aeruginosa* in mice by 30%. These data reveal that CarP plays an important role in the pathogen's virulence and survival within a host and advance our knowledge of the molecular mechanisms of Ca2+ regulation of P. aeruginosa virulence and fitness in response to host environments with elevated levels of Ca2+.

RAISING AWARENESS FOR AN ENDANGERED SPECIES (THE SEASIDE ALDER) THROUGH PRODUCT MARKETING

Andrea Lashley and Stanley A. Rice, Southeastern Oklahoma State University

The seaside alder (Betulaceae: *Alnus maritima*) is an endangered species. One of its three populations occurs in southern Oklahoma. An endangered plant species can be protected by the Fish and Wildlife Service or rescued by planting in a botanical garden. Another way of protecting an endangered plant species is to create an economic value for its sustainable use. An extract from the twigs of the seaside alder, which can be sustainably harvested, has strong antibiotic properties. The extract, when incorporated into a lotion, can create a clear zone of dead bacteria on an agar plate. This demonstrated antibiotic activity can help to sell the product, some of the revenues from which can be used for conservation of the alder.

IMPORTED SPECIES OF PATHOGENIC *FUSARIUM* SPECIES FROM CENTRAL AMERICA DIFFER FROM *FUSARIUM* SPECIES IN OKLAHOMA

Cierra Soden, Matt Broge, Alisha Howard, Benny Burton, and Charles Biles, East Central University

Plant pathogenic *Fusarium* causes disease on a large range of food crops around the world. This project is investigating the various *Fusarium* isolates that are being brought into the United States from Central America on cantaloupes. Symptoms that occur before harvest include a green margin around the area of infection, large fissions in the netted epidermal tissues, along with the infected lesion area turning tan to brown. White mycelium can occur on the surface when stored at high humidity and warm temperatures. Lesions that develop postharvest and without the external preharvest symptoms, also develop interior spongy, white lesions. Melons (*Cucumis melo* L. var. *cantalupensis* Naudin) imported from Mexico were purchased from a local grocery store, surface disinfected with bleach and stored on disinfected table tops for 7 days. The melons were dissected with a sterile knife and small infected fruit tissue pieces were placed on Potato Dextrose Agar (PDA). On PDA, the colonies appeared peach colored. Microscopic examination indicated that the isolates were *Fusarium* spp. They were placed in 15% glycerol and stored at -70°C until molecular analysis could be conducted. The isolates stored at -70°C were thawed and 50 µl of the spore suspension transfer to a PDA plate. A small portion of the hyphae was removed from the Petri dish and used for DNA extraction. ITS primers were used to isolate DNA sequences from the different isolates. The DNA analysis confirmed that they were *Fusarium* species. GenBank blast search indicated that the isolates from Mexico were a 100% match with Fusarium sp. ALO-IIHR. Costa Rica isolates were either *F. proliferatum* var. *proliferatum* or *F. subglutinans*. Oklahoma isolates were *Fusarum solani*. The *F. proliferatum* and *F. subglutinans* have not been reported as pathogens on cantaloupe. This is the first report of *Fusarium* Fruit Rot in Costa Rica and Mexico.

DESIGN AND SYNTHESIS OF COLLYBOLIDE PROBES FOR DEVELOPING NON-ADDICTIVE PAINKILLERS

Rhonda H. Weigand, Redlands Community College
Nicholas P. Massaro and Indrajeet Sharma, University of Oklahoma

Opiates, such as morphine are prescribed and used by millions of patients each year for the treatment of moderate to severe pain. However, opioid analgesics cause addiction and subsequent abuse that affects the health, social, and economic environment of all societies. Studies suggest that selective kappa-opioid receptor (kOR) agonists biased towards G-protein signaling could be novel therapeutics for treating pain with reduced side effects. In the quest for biased kOR ligands, we have identified collybolide a non-nitrogenous sesquiterpene natural product from the mushroom *Collybia maculata*. Deciphering the structural requirements essential for kOR selectivity through collybolide probes, is the first step in developing selective- and biased-kOR ligands. Therefore, we have developed a novel three components coupling approach for the efficient synthesis of diverse biocores of collybolides. All of the starting materials required for the three components coupling have been synthesized at gram scale. During the process, various synthetic and analytical skills including the Schlenk techniques, low- and high-temperature reactions, column chromatography, thin-layer chromatography (TLC), High-Pressure Liquid Chromatography (HPLC), as well as Infrared (IR), nuclear magnetic resonance (NMR) and Mass spectroscopy were applied. The resulting analogues will be submitted for the High-throughput screening at the NIMH Psychoactive Drug Screening Program against 50 CNS receptors to find new hits. Identified high-affinity collybolide probes will be advanced for in vivo use for the development of potential non-addictive painkillers.

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USING ULTRASOUND TO ANALYZE CALIBRATED ABSORBERS

Karen A. Williams, East Central University

Two sets of lead absorbers seemed to produce different results when used to attenuate gamma rays. In an attempt to determine if the absorbers were different or there was other error, I used ultrasound to examine them to determine if the absorbers were different. Examination of the velocity of sound determined if the absorbers were different. My findings showed there was a 332 m/s difference between the average velocities of the two lead absorber kits. The square lead absorbers have some other metal (Al) on the back and their velocity appears slightly higher as expected. Since the mass absorption coefficient of these absorbers was calibrated at the manufacturer, my use of a one-point attenuation coefficient determination was used to examine the relationship between the ultrasound attenuation coefficient and the mass absorption coefficient for x-rays. I was surprised to find a moderately strong correlation between these two quantities even with the one-point attenuation errors inherit in the method. The ultrasound attenuation at 1MHz in lead data appears to be linearly correlated with the mass attenuation coefficient. The slope = 54,140 (dB/cmMHz)/(cm^2/mg), r = .953 for round lead; while the slope = 11,300 (dB/cmMHz)/(cm^2/mg), r = .995 for square lead. This finding was only with five and four absorbers, respectively. The smaller slope for the aluminum-backed lead graph was logical as aluminum is not as good a gamma attenuator as lead is. The sound attenuation versus the mass attenuation for aluminum absorbers also exhibited a linear relationship (slope = 7,062 (dB/cmMHz)/(cm^2/mg), r = .906). More data from calibrated materials should be examined before there can be confidence that the sound attenuation coefficient is strongly linearly correlated to the mass absorption coefficient.

HIGH TEMPERATURE SYNTHESIS OF TITANITE

Austin Walker and Dwight L. Myers, East Central University

Titanite (sphene) is a mineral which commonly forms where calcium, silicon, and titanium are all present together. Since titanium oxide is present in high temperature applications in turbomachinery, titanite is one possible reaction product when calcium and silicon bearing minerals are ingested into a gas turbine. A study of the reaction of calcium carbonate with silicon dioxide (quartz) and titanium dioxide (rutile) is described in this study. Titanite is observed to form on heating for 24 hour intervals at temperatures of approximately 1300°C and above. Reaction progress over multiple heating cycles shows increasing amounts of titanite by X-ray diffraction. Calcium titanate (perovskite) is observed to form at these temperatures as well. The significance of these reactions with regard to corrosion in gas turbines will be discussed.

COMPUTATIONAL INVESTIGATIONS OF BROMINE OXIDES

Daniel McInnes and Aljan Ranjit. East Central University.

Structural isomers of bromine oxides with the formulas BrO_2, Br_2O, and Br_2O_2 have been characterized at the HF/6-31G level of theory. This work expands on a previous investigation of the analogous iodine oxides. An understanding of the properties and reactivity of halogen oxides is important in atmospheric chemistry, among other areas. How these species act as intermediates in the ozone depletion process is of particular interest. Methods of making, storing and analyzing reactive compounds have improved over the years; as a result, halogen oxides can be synthesized, their properties can be studied, and their environmental fate can be determined.