

INBRE F06 Poster Abstracts

Display and Awards

The undergraduate student who will represent the group, as it was identified by the contributing author, is noted with an asterisk. The poster abstracts are printed as they were received. However, some scientific symbols were scrambled during electronic transmission. Corrections were made where possible.

Biological Sciences

B1. Cave Crickets as Vectors for Dictyostelids in Caves. Alicia E. Tuggle*, Christy A. Melhart, Michael E. Slay, and Steven L. Stephenson, University of Arkansas.

Abstract

Cellular slime molds (or dictyostelids) are microscopic organisms. There are approximately 100 described species, and they have been assigned to one of three genera: *Dictyostelium*, *Polysphondylium*, and *Acytostelium*. Dictyostelids are currently being investigated in cave habitats in Arkansas. However, these organisms are essentially microscopic throughout their entire life cycle. In order for them to be studied, they must be grown under controlled laboratory conditions. This study was carried to see if the spores of dictyostelids are associated with crickets found in the cave. Cave crickets were captured alive and rinsed in a water/wetting agent solution in a small sterile plastic tube. The rinsed, live crickets were then placed in a container to collect any fecal matter they might deposit. The tubes with the water/wetting agent solution as well as the fecal matter left in the container were plated out on hay-infusion agar and these plates examined for dictyostelids. Four species of dictyostelids were recovered from the rinse wash and from the fecal matter, which indicates that the cave crickets can serve as vectors to transport dictyostelid spores within the cave habitat. Since the crickets can forage outside the cave, it is possible that they also introduce spores to cave habitats from outside sources.

B2. Ecology of Myxomycetes from Cocos Island. Carlos Rojas* and Steven L. Stephenson, University of Arkansas.

Abstract

Cocos Island is a small oceanic island located approximately 500 km north of the Galapagos Archipelago in the Pacific Ocean. Very few studies of its terrestrial biota have ever been carried out. During a visit to the island in April 2005, the ecology of Myxomycetes was investigated. Six study sites along an elevational transect that extended from the northern coast of the island at Bahía Chatham to the highest peak at Cerro Yglesias were selected. Substrate samples were collected at each site and studied during 2005 and 2006 using the moist chamber culture technique. A total of 36 species, all of them known from the same latitudes on mainland Costa Rica were recorded. The diversity of myxomycetes decreased with elevation and the taxonomic diversity index resemble that of tundra and polar zones suggesting that the ecology of insular myxomycetes is different to that of the continent. Communities seemed to show differences that can be associated with elevation. However, the role of microhabitat preferences is proposed to play an important role in determining species composition. Molecular analysis is needed to understand the genetic relatedness of these species to their counterparts on the mainland. This process should begin in the near future.

B3. Glycoconjugate-enhanced Phagocytosis of *B. cereus* Spores Using *Dictyostelium discoideum* as a Model. Elizabeth Burton*, Sai Desikan, John Bush, Pierre Alusta, and Olga Tarasenko, University of Arkansas at Little Rock.

Abstract

Phagocytosis plays an important role in a variety of cell functions ranging from nutrition in amoeba to innate and adaptive immunity in mammals. Recent studies have shown that *Dictyostelium discoideum* has proven to be a useful system in phagocytosis of several human pathogens, including *Legionella pneumophila*,

Display

Poster and vendor set up begins at 10 a.m. Friday. Posters will be on display until 5 p.m. The poster session will take place from 3:30 p.m. to 5:00 p.m. in Alltel Ballroom in the Arkansas Union. Poster authors are expected to attend the poster session. All posters should be removed by 5:45 p.m. Friday.

Awards

Prizes will be awarded during the banquet to the top posters in the undergraduate category in each discipline – biology, chemistry and physics.

Judging Rules

Each poster will be judged by three judges. The judges will again be selected from various institutions. To avoid conflict of interest, no judge will evaluate a poster from his/her own institution.

Three awards, first, second, and third will be given in each of the three disciplines, physics, chemistry and biochemistry, and biology.

Only posters with undergraduate participation, and where the presenter is an undergraduate, will qualify for awards.

The person who will receive the award on behalf of the group should be identified by an asterisk on the by-line. No institution may win more than one award in any discipline. If two or more posters from one institution are among the top scorers, only the one with the higher score will be selected for an award.

Each poster will be judged in three areas on a 1-10 point scale (10 best): Technical merit, appearance, and how well the presenter knows and is able to explain his/her research. Thus there will be 30 points possible. An average poster would get 5 on each category and 10 would be truly exceptional.

Mycobacterium avium, *Mycobacterium marinum*, *Pseudomonas aeruginosa*, *Cryptococcus neoformans*, and *Entamoeba histolytica*. Our goal was to understand whether glycoconjugates affect phagocytosis and contribute to the destruction of bacterial spores using *Dictyostelium* as a model. We have employed phagocytosis, direct microscopic counts, fluorescence microscopy, and colony forming unit (CFU) count. Our results have shown that glycoconjugates influence adherence, ingestion, and phagocytosis of glycoconjugate-coated spores (GCSs). As many as 10-20 GCSs per *Dictyostelium* were ingested. Direct microscopic counts do not allow differentiation between viable and nonviable spores. To overcome these limitations, we employed CFU as an irrefutable indication of destruction efficiency. We disrupted spore-fed *Dictyostelium* with detergent in order to release entrapped spores for viability studies. Resulting supernatants were serially diluted and plated onto Petri dishes with Tryptic Soy Agar. Plates were incubated at 37°C for 14-16 hours and then CFU counted. Results verify that glycoconjugates facilitate phagocytosis and the termination of spore viability.

B4. Decontamination Using Glycol-conjugates. Samea Lone, University of Arkansas at Little Rock.

B5. Caloric Restriction Increases the Alkaline-sensitivity of ERG6 Delta Cells. Joseph W. Watkins*, Maria F. Bermudez, and Fusheng Tang, University of Arkansas at Little Rock.

Abstract

Ergosterol, like its mammalian counterpart cholesterol, is a major component of the plasma membrane and intracellular membranes of the budding yeast *Saccharomyces cerevisiae*. In this study, we analyzed how ergosterol contributes to the growth of yeast cells. Yeast cells normally grow on a mild acidic environment. When the environmental pH is buffered to pH 7.4, selected mutants such as cells missing Sur4p, which is required for the synthesis of very long chain fatty acids, will lose their ability to grow. Deletion of the ERG6 gene, whose product is required for the synthesis of ergosterol, does not inhibit the growth on pH 7.4 media with normal concentration of glucose. However, as the glucose concentration decreases, the sensitivity of erg6 cells to pH 7.4 increases. These observations suggest that ergosterol is a key component in for the growth on caloric restricted media. Since caloric restriction is an established method to extend life span, ergosterol may contribute to life span extension.

B6. Caloric Restriction Generates Higher Demand for Vacuole-vacuole Fusion. Maria F. Bermudez*, Joseph W. Watkins, and Fusheng Tang, University of Arkansas at Little Rock.

Abstract

Vacuole in the yeast *Saccharomyces cerevisiae* is an intracellular organelle that maintains the homeostasis of ions, pH and nutrients for the cell. It also degrades damaged proteins and organelles. All these functions are essential for cell viability and life span extension as well.

Vacuole-vacuole fusion is a key step involved in multiple vacuolar functions and therefore may be required for life span extension. We analyzed the effect of caloric restriction, a life-span extending treatment for a variety of organisms, on vacuole-vacuole fusion and discovered that caloric restriction generates highly fragmented vacuoles in cells missing the ERG6 gene. Adjusting the initial pH to 3.5 of caloric restricted media promotes fusion. This discovery provides a new field for exploring how caloric restriction extends the life span.

B7. Arkansas Myxomycetes, Adam W. Rollins* and Steven L. Stephenson, University of Arkansas.

Abstract

Myxomycetes are phagotrophic protists that resemble fungi. They feed on bacteria, fungi, and organic materials. Myxomycetes have been documented to occur worldwide wherever plants are present. They are very common in nature and it is believed that they play an important role in nutrient cycling as members of the detritus food chain. Over the past two years members of the lab for Eumycetozoa studies at the University of Arkansas have been collecting and documenting the occurrence of these organisms in Arkansas. Myxomycetes are quite diverse in the state of Arkansas and can be found growing in many microhabitats including, leaf litter, bark of living trees, and dead decaying wood.

B8. Use of Whole Cell MALDI to Screen Peptide Markers in Avian Phagocytic Cells. Lakshmi Kannan, Narayan C. Rath, Rohana Liyanage, and Jackson O. Lay, Jr., University of Arkansas.

Abstract

Low molecular weight proteins and peptides play important roles in the physiology of cells and tissues. Identification of such cell associated factors can provide better understanding of their functional physiology. Based on the concept that whole cell matrix assisted laser desorption/ionization time-of-flight (MALDI-TOF) may provide opportunity to identify differentiation or transformation related peptides and biomarkers, we compared phagocytic cells of chicken immune system, monocytes and granulocytes, as models. The MALDI profile obtained showed a significant peak corresponding to mass 4963 and 3915 in chicken monocytes and granulocytes respectively. Pursuing to identify these peptides, we purified 4963 from chicken macrophage cell lines and 3915 from bone marrow cells using reverse phase high pressure liquid chromatography. Peptide mass fingerprinting yielded 4963 to be thymosin β_4 , a G-actin sequestering peptide, with extracellular angiogenic and anti-inflammatory efficacy whereas 3915 appeared to be a cationic antimicrobial peptide (AMP). Thymosin beta was shown to be synthesized in the macrophages and was N-terminally blocked resisting Edman degradation whereas granulocyte AMP could be partially sequenced by Edman degradation. These results show that MALDI-TOF may be a suitable technique in identifying differentiation-related peptide biomarkers that may not be resolved by 2-D gel electrophoresis.

B9. Ajulemic Acid and Resveratrol Suppress Markers of Microglial Activation in Cultured and Primary Cells: Potential New Therapies for Multiple Sclerosis. Brooke Stroope^{1*} and Andrea Wyatt^{1*}, Randall D. Wight,¹ Cameron A. Tull,¹ Janet A. Chavis,² Paul D. Drew,² and Lori L. Hensley², Ouachita Baptist University¹ and University of Arkansas for Medical Sciences².

Abstract

Multiple sclerosis (MS) is a neurodegenerative disease characterized by an autoimmune attack against myelin sheaths in the central nervous system (CNS), resulting in unpredictable and varied debilitations such as temporary blindness, loss of balance, muscle spasticity, incontinence, pain, chronic fatigue, and even paralysis. This study explored the effects of ajulemic acid and resveratrol on microglial activation as a measure of the inflammatory response. Results from enzyme-linked immunosorbent assays (ELISA) demonstrated that lipopolysaccharide (LPS) stimulates markers of activation, including nitric oxide (NO), tumor necrosis factor-alpha (TNF- α), interleukin-12 p40 (IL-12 p40), and interleukin-6 (IL-6), in HAP1 cultured microg-

lia and that ajulemic acid and resveratrol repress these effects. In mouse primary cells, ELISAs also revealed that ajulemic acid and resveratrol suppress NO and interleukin-1 beta (IL-1 β ;) (#946;). These results compare favorably with mitoxantrone, an FDA-approved, cardio toxic drug used to treat secondary-progressive forms of MS. NIH Grant Number P20 RR-16460 from the IDeA Networks of Biomedical Research Excellence (INBRE) Program of the National Center for Research Resources supported the project.

B10. Microorganisms Contributing to Biofouling in Tap Filters. LaQuasha Rosson* and Olga Tarasenko, University of Arkansas at Little Rock.

Abstract

Public water supplies and purification systems are facing a major challenge related to biofilm formation or biofouling. The aims of this study were: A) identification of microbial population/s contributing to biofouling, B) determining the Genus and/or species. The identification of bacterial populations involves isolation of each layer of Pür™ tap water filters, culturing, analyzing colonial and cell morphologies, Gram and endospore staining, biochemical tests, identification using Bergey's Manual of Systematic Bacteriology and Bergey's Manual of Determinative Bacteriology. Our results have shown that every filter layer was highly populated by microorganisms. Species, namely *Neisseria mucos*., *Sporosarcina halophila*, *Flavobacterium balustinum*, *Rhizobacter moraxella*, *Branhamella catrrhalis*, *Kingella denitrificans*, *Halomonas elomgata*, *Bordetella pertussis*, and *Morococcus cerebrus* were identified in Pür™ tap water filters. Identified microorganisms can be used as reference in further research with emphasis in drinking water purification, as well development of the new anti-biofouling agents.

B11. Specific Cytokines Are Synthesized and Released by Sympathetic Neurons in Cell Culture. Jonathan Treece,* Swati Mishra and Malathi Srivatsan, Arkansas State University.

Abstract

Increasing evidence indicates the immune system and nervous system interact extensively. Peripheral sympathetic neurons innervate lymphoid tissue and express receptors for cytokines. This prompted us to investigate if superior cervical sympathetic ganglion(SCG) neurons synthesize and release specific cytokines. SCG neurons from postnatal day-1 Sprague Dawley rat pups were isolated and maintained in cell culture in serum free Neurobasal medium with B-27 supplement and NGF-2.5S(50ng/ml). Repeated pre-platings and adding uridine mix to culture medium eliminated non-neuronal cells. After 48 hours, culture medium was removed, and cell lysates were obtained using Pearce lysis buffer. Cytokines were detected and quantified by using the Bio-Rad Bio-Plex Suspension Array System. The Bio-Plex Rat Cytokine 9-Plex A Panel consisting of the cytokine specific beads and detection antibodies was used to bind and detect respective cytokines. SCG cell lysate contained IL-1 β >IL-4>TNF- α >GM-CSF and the culture medium contained IL-1 β >TNF- α >IL-4>GM-CSF. Three-fourth of the IL-1 β , TNF- α , and half of GM-CSF synthesized in the neurons appeared to have been released into the culture medium. This shows that in cell culture, postnatal SCG neurons of rat actively synthesize selective cytokines and release significant amounts into the medium. Further, exposure to 0.1 μ M nicotine for 24 hours appears to up regulate IL-10 and down regulate IL-1 β in SCG neurons. We thank the funding support of NIH/NIDA grant #1R15DA19971; by NIH/NCRR grant #P20RR-16460 from the IDeA Networks of Biomedical Research Excellence(INBRE) Program.

B12. Development of Bioluminescent Gene Reporter System for *Candida albicans*. Tamara Thomas*, Kristin E. Cano, and David S. McNabb, University of Arkansas.

Abstract

Candida albicans, the most frequently encountered fungal pathogen in humans, is a primary cause of systemic infections in immunocompromised individuals. The recent increase in *Candida* infections, coupled with the limited arsenal of effective drug therapies, has lead to the need for the discovery of new drug targets. We have developed a series of gene reporter plasmids utilizing the bioluminescent *Renilla luciferase* gene derived from the sea pansy, *Renilla reniformis*, in order to evaluate the genes involved in virulence and pathogenesis. We have constructed a total of six different reporter plasmids containing three selectable markers (URA3, HIS1, and ARG4), and a large restriction site polylinker. We have collected data demonstrating the optimum conditions for cell lysis, assaying activity, the reliability of the assay at different growth stages, and the in vivo half life of the luciferase protein, using the *C. albicans* MET3 promoter. Our data has demonstrated that the assay can be completed in less than five minutes and yields data that reflects MET3 promoter activity. Our current goal is to exploit this reporter assay system to identify the regulatory elements of an uncharacterized promoter, CYC1, of *C. albicans* to probe the regulatory mechanisms involved in the expression of genes used during respiration.

B13. Characterization of 2D Micropatterned Neuron Monolayers. JA Goss^{1*}, Lauren Chin², and Gunther Du Hoffman², Harding University¹ and Harvard University².

Current neuron cultures are lacking structure reproducibility, which limits their usefulness as an inducible trauma model. In order to create a consistent, accurate model of neural networks, we have demonstrated the ability to micropattern neurons onto extracellular matrix proteins in highly specific patterns using soft photolithography in conjunction with microcontact printing. This facilitates future research on mechanical and chemical mechanisms in the brain. Furthermore, the techniques involved in constructing two dimensional tissues can be readily implemented into three dimensional models, which would not only model tissue function more accurately, but would also provide a closer step to clinical treatments for injured tissue

B14. Effects of Atmospheric Pressure on the Survival of Photosynthetic Microorganisms During Simulations of Ecopoiesis. Jaime Warrington^{1*}, Carl Rector¹, Paul Todd², and David J. Thomas¹, Lyon College¹ and SHOT, Inc.²

Abstract

Three cyanobacteria (*Anabaena* sp., *Plectonema boryanum* and *Chroococcidiopsis* CCME171) and an alga (*Chlorella ellipsoidea*) were grown under simulated martian ecopoiesis conditions. A xenon arc lamp with a solar filter provided simulated martian sunlight, and temperature cycled diurnally from -80°C to 26°C. A Mars-like atmosphere of 100% CO₂ was provided at 25, 100, 300, 500 and 1000 mbar. The cyanobacteria and alga were inoculated into JSC Mars-1 soil simulant and exposed to each atmospheric pressure for five weeks. Survival and growth were determined via extractable chlorophyll a and total esterase (fluorescein diacetate hydrolysis) activity. Maximum survival occurred at 100-300 mbar. At 25, 500 and 1000 mbar, esterase activity was near zero, and extractable chlorophyll a was less than 10% of control samples. Overall, the cyanobacteria survived better than the alga. Low survival at 25 mbar was probably due to desiccation. Low survival

at 500 and 1000 mbar may have been due to CO₂ toxicity. (This research is funded by the NASA Institute for Advanced Concepts.)

B15. The Roles of Antioxidant Enzymes in Ultraviolet Radiation Damage Resistance. Desiree Parish^{1*}, Michelle Eubanks¹, Lynn Rothschild², and David J. Thomas¹, Lyon College¹ and NASA Ames Research Center².

Abstract

Antioxidant mutants of *Synechococcus* strain PCC7942 were used to study how ultraviolet light causes oxidative damage to DNA, and the mitigating effects, if any, of the antioxidant system. Liquid BG-11 cultures of wild-type, sodB-, katG-, and tplA- strains were placed in sterile UV transparent bags, and then put into a temperature controlled water bath of 25°C. Half of the collected specimens were placed into a UV shielded water bath, and the other half were fully exposed to natural sunlight. Growth was measured as apparent absorbance at 720 nm three times a day at morning, noon, and early evening. At the same times, measurements of PAR, UVA, and UVB were made. Subsamples were then frozen and stored for later DNA analysis. Results of in-progress research will be presented.

B16. 2-Methoxyestradiol Mediated Relaxation Response in Coronary Artery by Activation of K⁺ Channels. Paige Henry*, Dawn Hughes, and Brent J.F. Hill, University of Central Arkansas.

Abstract

The concentration of plasma 17 β -estradiol (i.e. estrogen) significantly decreases in women at menopause. The decrease in 17 β -estradiol has been clinically linked to the increase in coronary artery disease, which is the leading cause of death for women. It has also been shown that 17 β -estradiol is linked to breast cancer development. Because the metabolites of 17 β -estradiol, such as 2-methoxyestradiol (2-MeOH) do not cause tumor development, the aim of our study is to demonstrate the mechanism(s) associated with the ability of 2-methoxyestradiol to cause relaxation of coronary arteries. Our results suggest that 2-MeOH acts independently of estrogen receptors because the selective estrogen antagonist, ICI182780, has no effect on the 2-MeOH mediated relaxation response. Based upon this finding, we hypothesize that 2-MeOH may mediate its relaxation response, in part, by its activation of K⁺ channels which would ultimately decrease the opening of voltage-gated Ca²⁺ channels resulting in less vascular constriction.

B17. Estrogen Attenuates Vascular Tone by Decreasing L-type Ca²⁺ Channel Expression and Function. Sean Necessary^{1*}, Brent J.F. Hill¹, and Nancy Rusch², University of Central Arkansas¹ and University of Arkansas for Medical Sciences².

Abstract

Coronary artery disease (CAD), is the leading cause of death for women. Although incidences of CAD in premenopausal women remain low as compared to age-matched men, after menopause the rate at which new cases of CAD develop in women dramatically increases due to the loss of estrogen production by the ovaries. One of the protective effects of estrogen against the development of CAD in women before menopause is the ability of estrogen to regulate vascular tone. It is believed that estrogen affects vascular tone by regulating the influx of calcium into the cells. The aim of this study is to determine how estrogen regulates L-type Ca²⁺ channel expression and function in coronary arteries. Preliminary results using Western blots have found that estrogen (48 hr incubation) mediates a decrease in the α_1c subunit of the L-type Ca²⁺ channel. We have just begun experiments to evaluate if estrogen also attenuates the constrictive ability of the L-type Ca²⁺ channel specific agonist, BayK8644. We predict that the decrease in L-type

Ca²⁺ channel expression will correlate with an attenuated constrictive response due to calcium influx.

B18. Generation of a Transgenic Chicken Expressing Lambda CRE Recombinase. Phillip Cleves* and Douglas Rhoads, University of Arkansas.

Abstract

The goal of this project is to use a defective retrovirus construct to generate a transgenic chicken expressing the CRE recombinase gene. These CRE-chickens will be useful in subsequent crosses for studies of stem cell development and development of the testis and ovary. The CRE gene encodes a bacterial gene for recombining a specific sequence, LOX. The CRE gene has been used in animal and plant cells to catalyze specific recombination between DNA sequences. To generate the CRE transgenic chicken, I will use Polymerase Chain Reaction (PCR) to amplify the CRE gene from a plasmid clone. The PCR fragment will be cloned into pMI β to fuse the CRE gene to a chicken actin promoter. The promoter-CRE fusion will then be subcloned into the retroviral backbone of plasmid pFB. The recombinant will then be packaged by co-transfection along with a packaging plasmid into human 293T cells. This will result in defective retroviral particles produced from the pFB construct. The packaged viruses will be injected into the subgerminal cavity of one day old chicken embryos in ovo. Eggs will be incubated to hatch and the chicks will be wing-banded, and bled for DNA isolation. DNA's will be screened using PCR to detect the CRE gene. PCR positive chicks will be further screened using antibodies for CRE protein to test for protein expression.

B19. Effects of Prenatal Steroids on the Scalenus Muscle of Guinea Pigs (*Cavia porcellus*). Alissa C. Hellie* and Jennifer L. Dearolf, Hendrix College.

Abstract

Women at risk for preterm deliveries may be treated with glucocorticoids in order to decrease the risk of respiratory distress syndrome in their infants. These chemicals are known to accelerate fetal lung maturity. However, the effects of prenatal exposure to glucocorticoids on the development of ventilatory muscles are unknown. Because of findings in adult and juvenile rodents and fetal sheep, we hypothesize that prenatal glucocorticoid treatment will lead to smaller muscle fibers and fewer type IIB fibers in the guinea pig scalenus. To test these hypotheses, we will inject pregnant guinea pigs at 70% gestation with betamethasone (0.5 mg/kg) or sterile water. Twenty-four hours after the second injection, we will euthanize the females and fetuses and collect muscle samples. Histochemical techniques will be used to determine the fiber-type profiles of the scalenus muscles of treated and untreated fetuses, and the diameters of the muscle fibers will be measured. If the scalenus muscle of treated fetuses demonstrates the hypothesized characteristics, it may have a decreased ability to produce force and a slower contraction speed than untreated muscles. These functional problems would lead to a weakened ventilatory system.

B20. FRGY1 is a Regulator of Wee1 Translation. Robert Frank^{1*}, Andrew Dunham¹, Robert Gregerson¹, and Angus MacNicol², Lyon College¹ and University of Arkansas for Medical Sciences².

Abstract

Wee1 is an important cell cycle regulator. During maturation of vertebrate oocytes, the inactive Wee1 mRNA becoming polyadenylated in the oocyte cytoplasm and translated into protein. The appropriate timing of Wee1 mRNA activation is essential for proper cell cycle control. The Frgy1 protein was found to be a possible

regulator of Wee1 mRNA polyadenylation and translation. In addition, protein binding partners have been discovered for Frgy1 using a bacterial two hybrid screen.

B21. Is Calmodulin Involved in Meiotic Cell Cycle Progression? Neil McCarthy* and Khaled Machaca, Lyon College.

Abstract

Calcium plays an important role in many major biochemical processes in the cell cycle. Calcium is a well known messenger in mitosis, however, its role in meiosis is still of ongoing debate. Using *Xenopus* oocytes, recent research has shed light on this role and has found its importance in the cell cycle machinery as well as the completion of meiosis 1. When cytoplasmic calcium is inhibited (or in low concentrations) oocytes mature at a much faster rate. This evidence supports the fact that Ca is a negative regulator of the initiation process in maturation, before the MAPK-MPF cascade leading to germinal vesicle breakdown(GVBD). However, this hurried progression comes at a price because low concentrations of Calcium affect the formation of spindle structures and polar bodies in the first meiosis division. The purpose of this study was to find the mediator of calcium and through which biological processes Calcium affects this progression. Calmodulin (CaM), a Ca-binding protein, is an obvious choice for this mediator, while past studies have also found that CaM affects the initiation of the oocyte maturation. When CaM is in low concentrations, GVBD is increased in rate. However, CaM's role in meiosis 1 is still unknown and the purpose of this study. Using chromosomal and polar body staining methods, in tandem with GVBD time courses, CaM's involvement in this cycle will be addressed.

B22. Testing the Oxygen Paradox with Antioxidant-deficient Cyanobacteria. Michelle Eubanks*, John Boling, Marie Crowell, Tiffany McSpadden, Carl Rector, Christy L. Schuchardt, CaSandra J. Spurlock, Jaime Warrington, and David J. Thomas, Lyon College.

Abstract

The light reactions of oxygenic photosynthesis produce reactive oxygen species (ROS) that can damage cellular components and lead to cell death. Thus, the co-evolution of an antioxidant system was necessary for the survival of photosynthetic organisms. This project investigated the sequence of antioxidant system evolution in cyanobacteria. The first organisms that possessed antioxidants would have been able to live closer to the water's surface, and would have been pre-adapted for dealing with photosynthetically produced ROS. We tested this hypotheses by growing wild type and mutant cyanobacteria (*Synechococcus* PCC7942 *sodB*—FeSOD deletion) under primordial atmospheres (2.5% CO₂ in N₂). When grown in air, the *sodB*- strain had a lower growth rate than the wild type. However, when the two strains are grown in 2.5% CO₂ in N₂, there is no difference in the growth rates, indicating that the presence or absence of the iron superoxide dismutase has no effect under these conditions. Our results support the hypothesis that oxygenic photosynthesis evolved before superoxide dismutases and provided the selection pressure for them. Additional research with other antioxidant mutants, currently in progress, will be presented. (This research was supported by grants from the Arkansas Space Grant Consortium.)

B23. Phagocytosis using D/M models. Sai Prasad Desikan, University of Arkansas at Little Rock.

B24. Characterizing the Role Of Neurogenin1 and its Downstream Effectors in Nociceptive Neuron Development.

Ariane Christie*, Richard Murray, Hendrix College.

Abstract

In the nervous system, pain is sensed by nociceptive neurons residing in the dorsal root ganglia (DRG). These neurons derive from migrating neural crest cells, but little else is known about their development. It has been reported that most nociceptive neurons are missing in the DRGs of *ngn1* null embryos (Ma et al., 1999 *Genes Dev.* 13:1717) suggesting that this gene is required for their formation. Based on these observations, we are attempting to identify genes that act downstream of *ngn1* by comparing gene expression in heterozygote and *ngn1* null DRGs through microarray analysis. Results to date using mRNA isolated from E12.5 DRGs revealed several genes that were over- or under-represented in mRNA from heterozygote embryos relative to mRNA from the null *ngn1* embryos. In situ hybridization experiments designed to confirm these results did not show the expected differences in their expression pattern. Further examination of the *ngn1* null phenotype revealed that the loss of nociceptive neurons was not as dramatic as previously reported. We are currently performing additional experiments to further characterize the requirement for *ngn1* in nociceptive neuron development in order to obtain more accurate microarray data.. (Supported by NIH P20 RR-16460 from the INBRE program of NCRR.)

B25. Characterization of Dorsal Root Ganglion Specific Elements in the Neurogenin1 Promoter. Brian Koss*, Richard Murray, Hendrix College.

Abstract

In the mammalian nervous system, pain is sensed by nociceptive neurons that reside in the dorsal root ganglia (DRG). An important factor in their development is the transcription factor neurogenin1 (*ngn1*); in *ngn1* knockout mice almost all nociceptive neurons are missing. This suggests that genes regulating *ngn1* expression regulate the determination and/or differentiation of nociceptive neurons. Our research focuses on characterizing *ngn1* promoter elements required for DRG-specific expression. A 2.7-kb fragment upstream of the neurogenin1 gene is able to drive expression of a reporter gene in DRGs in vivo, but this promoter is sensitive to site of integration effects since only 25% of founder embryos express in this tissue (Murray et al., 2000 *Dev. Dyn.* 218:189). We will combine the 2.7-kb fragment with an upstream 7.5-kb enhancer, which has been shown to direct expression with high efficiency although not in the DRGs (Gowan et al., 2001 *Neuron* 31:219). We will test the efficiency of this new construct by generating transgenic mice and analyzing the pattern of expression of the reporter gene. This research will provide a better understanding of the regulation of *ngn1* expression by identifying DRG-specific regulatory sequences. (Supported by NIH P20 RR-16460 from the INBRE program of NCRR.)

B26. Selectivity and Specificity of Glycoconjugates for Sensing Bacterial Spores in Food Supply. Paul Bobryshev*, Olga Tarasenko, University of Arkansas at Little Rock.

Abstract

This research project is designed to study the selectivity and binding abilities of glycoconjugates with the bacterial spores. Being able to find out and test the pattern and specificity of glycoconjugates selectivity I will be able to determine the presence of spores in the food products of liquid and fluid forms. Performing it successfully my method can be used by FDA customs for detection and prevention of food borne pathogens and potential bio terror attacks. Due to specificity of the sugars binding they will be classified under a cer-

tain corresponding bar code for quicker and more convenient use.

B27. Testing the Oxygen Paradox with Antioxidant-Deficient Cyanobacteria. Michelle Eubanks*, John Boling, Marie Crowell, Tiffany McSpadden, Carl Rector, Christy L. Schuchardt, CaSandra J. Spurlock, Jaime Warrington and David J. Thomas, Lyon College

Abstract

The light reactions of oxygenic photosynthesis produce reactive oxygen species (ROS) that can damage cellular components and lead to cell death. Thus, the co-evolution of an antioxidant system was necessary for the survival of photosynthetic organisms. This project investigated the sequence of antioxidant system evolution in cyanobacteria. The first organisms that possessed antioxidants would have been able to live closer to the water's surface, and would have been pre-adapted for dealing with photosynthetically produced ROS. We tested this hypotheses by growing wild type and mutant cyanobacteria (*Synechococcus* PCC7942 *sodB*—FeSOD deletion) under primordial atmospheres (2.5% CO₂ in N₂). When grown in air, the *sodB*- strain had a lower growth rate than the wild type. However, when the two strains are grown in 2.5% CO₂ in N₂, there is no difference in the growth rates, indicating that the presence or absence of the iron superoxide dismutase has no effect under these conditions. Our results support the hypothesis that oxygenic photosynthesis evolved before superoxide dismutases and provided the selection pressure for them. Additional research with other antioxidant mutants, currently in progress, will be presented. (This research was supported by grants from the Arkansas Space Grant Consortium.)

Chemistry and Biochemistry

C1. Synthesis of Biologically Active Simple Analogs of Sclerophytin-A. John Faver*, David Bateman, and Matt McIntosh, University of Arkansas.

Abstract

Sclerophytin-A is a natural product that exhibits potent growth-inhibiting effects against leukemia cells in vitro. Due to its complex chemical structure, its total synthesis involves many separate chemical steps. It would be necessary to have a more efficient method of producing Sclerophytin-A in order to provide for more medical research and to accelerate the process of its development as a drug. Rather than improving its synthesis, this project examines the possibility of developing other molecules that may have the same activity. These will be relatively simple molecules resembling the molecule of interest that can be synthesized efficiently in a few steps. The various structural analogs of Sclerophytin-A will be synthesized and then assayed for their inhibition of leukemia cell growth. It is hypothesized that these compounds of similar structure will exhibit similar activity in biological systems. Data from these biological assays may provide insight into what chemical groups and three-dimensional structures are important in the biological functioning of this family of compounds, which will then be used in the planning of future analog syntheses.

C2. Adsorption and Photochemical Studies of Organic Compounds Over Mixed Oxide Semiconductor Nanomaterials. D. K. Paul¹, D. Cormode¹, M. Singh¹, K. K. Adulapuram¹, and K.J. Klabunde², Pittsburg State University¹ and Kansas State University².

Abstract

The photocatalytic oxidation of acetaldehyde over high surface area TiO₂-SiO₂ powder has been studied using in situ transmission FTIR spectroscopy. It has been found that acetaldehyde adsorbs on

the surface through H-bonding with surface hydroxyl groups. A fraction of the adsorbed aldehyde undergoes aldol condensation during warm-up followed by dehydration forming unsaturated aldehyde. In presence of UV light exposure, the acetaldehyde undergoes oxidation forming partially oxygenated compounds and some CO₂(g). The infrared assignments for surface intermediates have been used to explore the reaction mechanisms of the photochemical reaction.

C3. Novel Isoforms of a Heterogeneous Nuclear Ribonucleoprotein C-like Protein-hRALY (p542). Edward Penner* and Michelle McCullough, Pittsburg State University.

Abstract

Previous structural and functional studies conducted in our laboratory suggest that hRaly is a heterogeneous nuclear ribonucleoprotein (hnRNP) of the C type. There are two hnRNP C isoforms that are designated as C1 (291 amino acids) and C2 (303 amino acids). hnRNP C2 differs from C1 by the presence of a 12 amino acid insert in its primary sequence that results from alternative splicing. Interestingly, hRaly has two comparable isoforms, variant 1 (306 amino acids), that differs from variant 2 (290 amino acids) by the presence of a 16 amino acid insert that is inserted at the same position relative to the 12 amino acid insert found in the primary sequence of hnRNP C2. To further investigate alternatively spliced forms of hRaly, specific primers derived from the protein's primary sequence were used to synthesize hRaly specific cDNAs in a reverse transcription-coupled PCR reaction. The resulting cDNAs were "shotgun cloned" into pET28a and transformed into *Escherichia coli* strain DH5 alpha;. Sequence analysis of the resulting recombinant vectors identified a total of five different hRaly isoforms. In addition to cDNAs corresponding to variants 1 and 2, three novel isoforms were discovered, and these have been designated as hRaly variants 3-5. An alignment of the primary sequence of the 306 amino acid isoform of hRaly identified 7 exons and 6 introns in the genomic sequence of the hRALY gene. All of the newly identified variants can be accounted for by exon exclusion events, indicating that they did not result as an artifact of the cloning process. hRaly variant 3 excludes exon 6 and is 233 amino acids in length. Excluding exons 4-6 and 2-6 generates hRaly variants 4 and 5 that code for 230 and 94 amino acid proteins, respectively. The alternative splicing event that gives rise to variant 5 defines an eighth exon that is totally divergent from the primary sequence of hnRNP C or hRaly. The unique carboxy terminal sequence found in this isoform was used in a homology data base search to identify other proteins with a similar sequence. Interestingly, this region shares homology with the dog hRaly homologue. Furthermore, variants 4 and 5 are missing an extensive internal region that corresponds to a nuclear retention signal, as well as an oligomerization domain. These observations suggest that the oligomeric state, as well as the cellular location of these proteins, are different than that of hRaly variants 1 and 2 or the hnRNP C proteins.

C4. Free Radical Frontal Polymerization Using Microencapsulated Reaction Components. Alissa Ferrari* and Nathan Williams, University of the Ozarks.

Abstract

Two components of a free-radical front polymerization system, cumene hydroperoxide (CHP) (initiator) and 1,6-hexanediol diacrylate (HDDA) (monomer), were microencapsulated through formation of a polyurea shell via interfacial polymerization. These CHP-core microcapsules were then tested at different concentrations in polymeric systems to determine the minimum amount of microencapsulated initiator needed to begin frontal polymerization of encapsulated HDDA. The systems, containing varying concentrations of microencapsulated CHP, were run in small vials and front velocities

were measured for the reactions. Investigations into the mechanical properties of the polymers formed and into the pot lives of these polymerization systems were made as well.

C5. Studies of Photocatalytic Activity of Cr- and Al-incorporated MCM-41: An *in situ* Transmission FT-IR Study. Chih-ang Chang¹, Hisanori Kajiwara¹, S. Sinharoy¹, A. Paul¹, D. K. Paul¹, and K.J. Klabunde², Pittsburg State University¹ and Kansas State University².

Abstract

MCM-41 material possesses a porous system consisting of hexagonally arranged channels with diameters varying from 15 to 100 Å. It has attracted the attention of scientists due to its elevated specific surface area, high thermal and hydrothermal stability, possibility of controlling its pore size and its hydrophobicity and acidity. These characteristics have made MCM-41 a promising material as catalyst and/or support and to be used in industrial processes of adsorption, ion exchange and environmental control. In this study Cr- and Al- have been incorporated to examine its behavior toward adsorption and photochemical oxidation of acetaldehyde. In presence of UV or visible light exposure, the acetaldehyde undergoes oxidation forming partially oxygenated compounds and some CO_{2(g)}. The infrared assignments for surface intermediates have been used to explore the reaction mechanisms of the photochemical reaction.

C6. Peptide-Lipid Interactions of N-terminal Acylated and Trp Methylated Lactoferricin Peptides Determined by Solid-State ²H and ³¹P NMR. Melisa Dougan^{1*} and Denise Greathouse², Arkansas Tech University¹ and University of Arkansas².

Abstract

Many strains of bacteria are becoming resistant to conventional antibiotics. Antimicrobial peptides (AMP's) can be classified as natural antibiotics and are being investigated as a potential new category of antibiotic. Gaining an understanding of their mechanisms of action is critical. AMP's are an integral part of most organisms innate immunity and are the first line of defense against bacterial and fungal infections. Not only do peptides assist in antimicrobial activity but they have also been found to play an active role with inflammatory cells.

Lactoferrin is one of the major iron binding proteins produced by mammals that can cause deprivation of nutrients that bacteria need for metabolism, thereby reducing bacterial growth. A 25 amino acid fragment removed from lactoferrin by pepsin, lactoferricin, has antimicrobial activity against Gram negative and Gram positive bacteria, fungi, and protozoa.³ A fragment consisting of only six amino acids (Lfb-6) also has antimicrobial activity (ref) Lfb-6 contains three Arginine (Arg) and two Tryptophan (Trp) residues, which are required for the antimicrobial activity. Previous studies have shown that peptides with Arg and Trp residues have stronger binding abilities (Schibli, 2002). Most AMP's carry a positive charge which allows them to be selectively attracted to the negatively charged phospholipid headgroups of bacterial cellular membranes². The Trp residues then interact with the interfacial region of the bilayer causing a membrane perturbation. The mechanism, by which this happens, however, is not completely understood. Previous studies in this lab have shown that methylation of one of the two Trp residues increases slightly the antimicrobial activity of Lfb-6. More recent studies have shown that amino acylation of methylated Lfb with 2, 4, or 6 carbon fatty acids increases membrane perturbation in a chain-length dependent manner. The purpose of this research is to continue these studies by examining the effect of C4 amino acylation of methyl-Trp Lfb-6. Additionally, the effects of salts and buffer

on sample preparation and peptide/lipid interactions will be investigated. Finally, the antimicrobial activity of the acylated methyl-Trp Lfb-6 peptide will be measured.

C7. Emission Spectroscopy of Hydroxyl Radicals in the 306 nm to 324 nm Region of the Electromagnetic Spectrum. Kellen Harkness*, Harding University.

Abstract

A special emission spectrograph was obtained to specifically measure the well-known hydroxyl radical emission spectrum found in most combustion processes involving hydrocarbons and oxygen. Spectra obtained were those of the optical emission of a mini-scale hybrid rocket that used gaseous oxygen as the oxidant. Calculations were employed to model the measured spectra by theoretical models that would make it possible to estimate the temperature of the plume as well as the number density of hydroxyl radicals present.

C8. Sourcing ¹⁴C Content in Mexico City Black Carbon Aerosol. Amanda MacMillan* and Karen Steelman, University of Central Arkansas.

Abstract

Atmospheric aerosols were measured to determine the source of radioactivity in black carbon in Mexico City. Atmospheric aerosols contribute to global climate change, destruction of the ozone layer, and pose serious health problems to humans. Over 50 aerosol samples were collected on quartz-fiber filters at El Centro Nacional de Investigación y Capacitación Ambiental in Mexico City during April 2003. Collection occurred on the rooftop of the main laboratory building using cascade impactors and high-volume air samplers. Plasma oxidation was used to convert organic materials to a mixture of carbon dioxide and water. Accelerator mass spectrometry was used to measure the radiocarbon content of the collected carbon dioxide in order to determine the percent composition of the aerosol samples from fossil fuel combustion or modern biomass. Radiocarbon levels showed a 70% modern biogenic to fossil ratio. Potential biogenic sources may include: fires in the Yacatan; oxidation of monoterpenes and sesquiterpenes emitted from a nearby fruit-drying facility; and inter-city trash burning.

C9. The Translocation of NS3 Helicase from the Hepatitis C Virus (HCV). Clint Langston* and Dennis L. Matlock, Harding University.

Abstract

Hepatitis C Virus (HCV) infects over 170 million persons worldwide. It is the leading cause of liver disease in the U.S. and is responsible for most liver transplants. Current treatments for HCV are deficient. By characterizing how the virus replicates, hopefully we can find new targets to help control HCV. Non-structural protein 3 (NS3) is a protein that is involved in the viral replication process of HCV. NS3h is a domain located on NS3 that possesses helicase activity. Our specific goal will be to characterize the mechanism of NS3 binding, unwinding, and translocation along a nucleic acid substrate. The characterization of this mechanism will be approached by using a sensitive, real-time fluorescence method that has been accurately shown to measure the translocation of DNA-dependent ATPase (Dda) helicase along a nucleic acid substrate.

C10. Analysis of Transmembrane Peptide Anchored Antimicrobial Lactoferricin Peptides by NMR Spectroscopy and Antimicrobial Assay. Rachel Ellis* and Denise Greathouse, University of Arkansas.

Abstract

The effects of attaching an α -helical transmembrane peptide (TM) to the carboxy and amino ends of lactoferricin (LfB) have been investigated. Lactoferricin is a 25 residue peptide that is cleaved from lactoferrin by pepsin proteolysis. A six residue peptide with the sequence Arg-Arg-Trp-Gln-Trp-Arg-Amide has been shown to retain antimicrobial activity. The peptide is attracted selectively to microbial membranes by the positively charged arginine residues. The tryptophan residues then interact peripherally at the membrane interface. The exact mechanism in which these peptides exert their bactericidal effects is not well understood. Analysis by solid-state NMR requires that the peptides all orient in the same manner; however the small size and peripheral binding of LfB peptides makes obtaining well-oriented samples difficult. To improve stability and enhance orientation at the membrane surface the length of the LfB peptide was increased by synthesizing the peptide with a model α -helical transmembrane (TM) peptide at either the carboxy or amino end. The single Gln in the LfB sequence was replaced with deuterated-Ala. The dynamics of the membrane anchored LfB-TM peptides in oriented bilayers were studied by solid state ^2H NMR and their effect on lipid phase by ^{31}P NMR. Their antimicrobial activity was compared to native LfB.

C11. Synthesis of Coumarin Derivatives for Possible Use as Soybean Seed Treatment. Jacob C. Laas*, Robert P. Pavlis, Nancy L. Brooker, and Yuri V. Kuzmichev, Pittsburg State University.

Abstract

Soybean seedlings are subject to attack by several types of fungi and are most susceptible to fungal infection at germination and in the early growth stages of development. Sesamol (3,4-(methylenedioxy)phenol) is known to be a moderately effective seed treatment that provides some seedling protection against early season fungal diseases. In this work, a variety of coumarin derivatives were produced for screening as potential anti-fungal agents because of their similarity in shape to sesamol. Most of the compounds that were produced were derived from 4-hydroxy- and 7-hydroxy-coumarin. The general syntheses and activities of each compound will be presented.

C12. Elevated Foliar Vitamin C Content Confers Plants Tolerance to Stresses. Katherine A. Lisko^{1*}, Scott Simeon¹, Javier Martinez-Quintana¹, Berangre Jullian², Martha Vaughan², Boris I Chevone², Craig L Nessler² and Argelia Lorence¹, Arkansas Biosciences Institute, Arkansas State University¹ and VA Tech².

Abstract

Arabidopsis thaliana is a member of the Brassicaceae family, and a model plant for plant science worldwide due to its small size, prolific seed production, easy transformation potential, availability of genetic resources, and fully sequenced genome. There are four pathways leading to vitamin C (ascorbate, AsA) formation in plants: D-mannose/L-galactose, L-gulonate, myo-inositol, and D-galacturonate. Surprisingly, the last four steps of the inositol pathway are not only present in plants, but also in most mammals. Myo-inositol oxygenase (MIOX) and L-gulonolactone oxidase (GLOase) are enzymes involved in the inositol pathway to AsA. Our group has shown that plants over-expressing MIOX and GLOase have significantly higher levels of AsA in leaves (Radzio et al., 2003; Lorence et al., 2004). In preliminary experiments, we have observed salt

tolerance in our MIOX and GLOase over-expressers. We propose that plants with elevated AsA content are tolerant to other types of stresses, such as cold temperature, methyl viologen, and hydrogen peroxide, among others. This response is likely due to the power of vitamin C to counteract the action of reactive oxygen species. MIOX and GLOase over-expressers are being grown under the stresses cited above and their AsA foliar level is being measured via an HPLC-based method and compared to the one of wild type plants. Growth indicators such as shoot length, dry biomass, photosynthetic activity, and reduction in membrane damage will be analyzed in all plant lines. We expect to see enhanced growth and performance in plants with higher vitamin C foliar content.

C13. Open Path Near-Infrared Absorption Spectroscopy of Oxygen. Josh Eichhorn*, Harding University.

Abstract

The low-pressure, low-temperature absorption spectrum of oxygen and some of its isotopes were measured by near-infrared diode laser absorption spectroscopy as part of a project to develop sensors for unmanned space missions. The measurements were carried out in a specially constructed Mars Atmosphere Simulation Chamber. Other measurements were made in the field over a path of one hundred meters. The signal to noise ratio was determined and the ability to measure oxygen isotopes was evaluated.

C14. The Detection of Sugars By Electrogenerated Chemiluminescence with Ruthenium(II) Tris-Bipyridyl at Gold and Glassy Carbon Electrodes in a Flow-Stop Thin Layer Cell System. Jacob Beveridge* and Norman E. Schmidt, Harding University.

Abstract

The electrochemiluminescence (ECL) of Ru(bpy)₃²⁺ was studied in the presence of sugars at gold (Au) and glassy carbon (GC) working electrodes having a surface area of 7.068 mm². In an oxidative-reduction mechanism similar to that of Ru(bpy)₃²⁺-Tripropylamine (TPA), a sugar reacts with Ru(bpy)₃²⁺ whose excited state (Ru(bpy)₃^{2+*}) emits light at 610nm. Using cyclic voltametry in a flow-stop thin layer cell analysis system an ECL signal is observed from analyte solution containing Ru(bpy)₃²⁺, Triton-X, buffer, and a sugar. The sugars studied include: fructose, glucose, galactose, and sucrose. Results show a proportional response, at both Au and GC electrodes, of increasing ECL with increasing sugar concentration giving ~ 1 millimolar limit of detection (LOD) on average.

C15. Harding University USLP Program. Sarah Christensen*, Harding University.

Abstract

Harding University is a participant in the NASA sponsored University Student Launch Program (USLP) Program. USLP is sponsored by the University of Alabama Space Grant Consortium. It requires an eight month commitment to successfully design, construct, test, launch and recover a reusable rocket and science payload. It involves diverse aspects such as: scheduling, purchasing, performing calculations, financing the project, coordinating logistics, arranging press coverage and documenting impact made on education through reports and design interviews. The Harding University Leadership Team of 10 students and two faculty members has been formed and a successful proposal to USLP has been made. A web page is in place and work has begun on National Association of Rocketry (NAR) certification. The contest will end in April with all participating universities launching their rockets and submitting their final reports.

C16. Patterning Strategy For Immobilization of Capture Antibodies For Immunoassays. Megan Easterly*, Harding University.

Abstract

A procedure for micro-spotting immunoassay components using mouse IgG as a model system in a sandwich-type assay has been investigated for electrochemical detection. Sandwich assays were performed using self-assembled monolayers of mercaptoundecanol to covalently attach to the capture antibody via carbodiimide coupling. Solutions of 24 µg/mL primary antibody (Rat anti-mouse IgG), 5 µg/mL mouse IgG (Chromo-pure mouse IgG), 5 µg/mL alkaline phosphatase labeled secondary antibody (Rat anti-mouse IgG) with 2% or 10% bovine serum albumin for blocking were used. Electrochemical detection was accomplished using a CH Instrument electrochemical workstation model 650 potentiostat with a picoampere booster and Faraday cage (CH Instruments, Inc, Austin, TX) controlled by a PC used in the cyclic voltammetry (CV) mode. Micro-spotting was accomplished using a MicroGrid II from Genomic Solutions (robotic ink jet technology). The MicroGrid was able to accomplish uniform spotting of approximately 0.12 mm in diameter and, assuming a perfect sphere, approximately 0.26 pL in volume, with a 0.2 mm pitch (from center to center of spots). The 10% bovine serum albumin proved to be effective in providing reproducibility of the assay.

C17. Measurement of Methane Gas in Different Environmental Sites. Cortney Owen*, Harding University.

Abstract

Methane gas samples from a variety of locations were collected and measured by gas chromatography-mass spectrometry, GC/MS, infrared and diode laser absorption techniques in order to test the feasibility of carrying out remote sensing of methane on other solar system bodies. A special open path near infrared diode laser spectrometer was built and tested during this study. It featured a high resolution tilt and pan mechanism and fiber optic cables to allow spectroscopic measurements to be made over wide areas and distances.

C18. Developing a *C. elegans*-based Bioassay for Estrogenic Activity. Katie McLean*, Justin Holt, Ashley Turensky, Allyn Dodd, Tim Lindblom, and Barry Gehm, Lyon College.

Abstract

Assays of estrogenic or anti-estrogenic activity are performed for a variety of purposes, including development of new pharmaceuticals, testing chemical products and environmental pollutants for endocrine-disrupting effects, and research on the mechanism of estrogen receptor (ER) action. Several different kinds of assay are already in use, based on different model systems, including vertebrate animals, cultured human/mammalian cells, and transgenic yeast (expressing human ER and estrogen responsive reporter genes). Each of these has advantages and disadvantages; the yeast system is least expensive but the effects of some ligands (e.g. tamoxifen) do not match those in humans, possibly due to the great evolutionary distance between yeast and mammals. We propose to develop a new bioassay based on *C. elegans*, which we hypothesize will share many of the advantages of the yeast-based assay but produce more physiologically relevant results. Design of the genetic vectors for expression of human ER and estrogen-responsive reporter genes will be discussed, and preliminary results with transgenic animals will be presented.

C19. Synthesis and Direct Fluorination of Dendritic Monomers. Lindsay Read*, Daniel Hall, and Kyle Felling, University of Central Arkansas.

Abstract

Dendrimers are highly branched molecules consisting of a central core from which regular repeat units emanate to form a globular, monodisperse macromolecule. Fluorinated dendrimers are a class of molecules, which have very unique properties compared to normal dendrimers because of the strong electron-withdrawing influence of the fluorine atoms. They have considerable potential applications as optoelectronic materials, surfactants, solvents, and drug delivery agents. Direct fluorination, a process in which elemental fluorine is used to replace hydrogen atoms in organic/inorganic compounds with fluorine atoms, has many advantages for commercial and large-scale production of fluorocarbons with high yields. In this study, the perfluorinated analogues of polyether, sulfur-containing and poly(propylene imine) dendrimer frameworks are produced using the Exfluor-Lagow direct fluorination technique. Subsequent characterization is also discussed.

C20. Peptide Mimics as Nanosensors. Tamara Binyon*, Ashley Evans, Rebekah Castleberry and Nick Gleason, University of Central Arkansas.

Abstract

Peptide mimicry is being used as a strategy for developing an opiate nanosensor. The amino acids implicated in the binding of opiates in the rat μ -opioid receptor are adjacent Asp(147)-Tyr(148) and Trp(318)-His(319) residues. Our strategy is to build a parallel combinatorial oligopeptide library, in which the 170 amino acid sequence that connects the four binding amino acids (in the native protein) is truncated to four residues. The library members will be screened for binding by exposure to a colored opiate derivative and looking for visible color changes in the library members. The status of this project will be reported.

C21. Interaction of p107 with Regulatory Proteins During 3T3-L1 Preadipocyte Differentiation. Remy Ngwanyam, Grant Jackson, Sarah Hart, and Timothy Hayes, Ouachita Baptist University.

Abstract

p107 and p130 are members of the Retinoblastoma (Rb) protein family. Quiescent 3T3L1 cells express p130 but little p107. After stimulation to differentiate the level of p130 declines and p107 rises dramatically. Interference with the increase in p107 expression blocks differentiation and proliferation. The goal of this study is to determine the mechanism of p107 action in 3T3-L1 differentiation.

- Gel filtration chromatography shows that p107 is present on day 1 of differentiation in large complexes.
- We have analyzed microarray data for the expression of proteins known to interact with the Rb family. This excluded several candidates for interaction with p107 and highlighted 15 likely candidates, including transcription factors, HDACs, cdk2 and cyclins.
- p107 is complexed with E2Fs as shown by EMSA and antibody supershift.
- E2F4 co-precipitates with p107 while E2F3, E2F5, C/EBP β and MCM7 do not.
- E2F4 also co-precipitates with p130 while E2F3 and E2F5 do not.

Since the increase in p107 is critical for differentiation, proteins that interact with p107 but not p130 may be the link between p107 and its effect on differentiation. This work was supported by NIH Grant P20 RR-16460 from the BRIN Program of NCRR.

C22. Screening of Arabidopsis Thaliana Knockout Lines Looking For Genes Encoding Glucuronolactonase, The Third Enzyme in the Myo-Inositol Pathway to Ascorbate. Gwendolyn Wilson*, Arkansas State University, Jeannette Uwase, Scott Simeon, Javier Martinez-Quintana, Argelia Lorence, Arkansas Biosciences Institute.

Abstract

Vitamin C (ascorbic acid, AsA) is one of the most abundant antioxidants in plants and animals. There are four known pathways in which plants synthesize AsA: myo-inositol, L-gulose, L-galactose, and D-galacturonate. The inositol route involves four enzymes. Genes encoding those four enzymes have been found in animals, but are yet to be discovered in plants, with the exception of myo-inositol oxygenase and glucuronate reductase. Therefore, bioinformatic analyses have been conducted to identify the third enzyme among candidate genes. These genes were identified out of 28,607 in the Arabidopsis thaliana genome by comparing them to glucuronolactonases from rat and two bacteria. Eighteen genes were selected as they shared conserved amino acid regions with the homologs from rat and bacteria. The corresponding knockout lines were ordered from the Arabidopsis Biological Resource Center (ABRC). ABRC holds a large collection of Arabidopsis mutants in which individual genes are interrupted by a T-DNA. The putative glucuronolactonase knockouts were grown in selective media along with wild type and GUS over-expressers as controls. After 5 weeks of growth, rosette leaves were collected and the foliar AsA level was measured via spectrophotometric- and HPLC-based methods. Four mutant lines have been analyzed up to date, two of which have showed low AsA foliar level. Our hypothesis is that mutants with low AsA foliar content contain the gene we are looking for. These two mutants are prime subjects for further studies to confirm the participation of those genes/enzymes in vitamin C formation.

C23. Analysis of Ancient Peyote by Alkaloid Extraction and Gas Chromatography. Bethany Glover*, Kim Morrison, Karen Steelman, University of Central Arkansas, Martin Terry, Sul Ross University.

Abstract

Peyote use has been a part of Native American culture for 6000 calendar years, according to radiocarbon dating done by our laboratory. Artifacts labeled as peyote in the Witte Museum collection appear to be modified due to the presence of woody tissue. A high mescaline content would identify the artifacts as containing peyote. We used three different extraction protocols to determine the method detection limit for alkaloids from modern peyote. Standards were used to construct a calibration curve to quantitate mescaline levels using gas chromatography / mass spectrometry. Once isolation procedures are perfected for the smallest viable sample size, peyote from the only two archaeological sites where the cactus has been found will be analyzed.

C24. The Effects of Finished Drinking Water Components on the Electrochemical Immunoassay Detection of Cryptosporidium parvum in Water. Jana Gertsch*, Jana Gertsch & Zoraida P. Aguilar University of Arkansas and Vegrandis LLC.

Abstract

Cryptosporidiosis, caused by the protozoan *Cryptosporidium parvum* is a debilitating disease that causes extensive diarrhea which

can ultimately result in death in immunocompromised individuals and small children. *C. parvum* oocysts cannot be eliminated by primary water treatment processes such as filtration and chlorination because the oocysts are very small and are very resistant. A need and an interest for faster, more accurate, and less expensive techniques for the detection of *C. parvum* have generated research toward the development of an electrochemical enzyme linked immunosorbant assay (ELISA). Microcavity chips fabricated from gold-coated silicon wafer chips have been devised for the electrochemical immunoassay detection of *C. parvum*. The assay involves the capture of the oocysts on 1cm x 1cm gold-coated silicon wafer chips using antibodies to sandwich the analyte. Electrochemical detection was performed inside a 50 µm-diameter cavity embedded with electrodes along the wall and base. An antibody-enzyme conjugate (2° Ab) captures the oocysts and reacts with a para-aminophenyl phosphate (PAPP) solution to produce an electrochemically active compound, para-aminophenol (PAP). A cyclic voltammetry scan results in a cyclic voltammogram (CV) which directly correlates to the concentration of *C. parvum* oocysts present. This electrochemical method allows for rapid detection of very low concentrations of *C. parvum* oocysts.

In working toward automated and self-contained assay platforms, the possibility of interference by certain finished drinking water contaminants must be addressed. Solutions of each contaminant is prepared and then spiked with oocysts in order to determine the effects of each contaminant on the assay.

Physics

P1. Temperature Dependence of Macromolecule Diffusion by Light Scattering. Thomas G. Akin* and Surendra P. Singh, University of Arkansas.

Abstract

Macro-molecules suspended in a liquid medium undergo constant Brownian motion due to random impulses imparted by liquid molecules. This diffusive motion is reflected in the intensity fluctuations of laser light scattered by macromolecules. We use measurements of time dependence intensity correlations of scattered light to extract macro-molecule size as well as study the temperature dependence of diffusive motion on temperature. Supported by NSF through REU and Arkansas Biological Institute.

P2. Investigation of Cellular Ageing Using Optical Raman Tweezers. Hannah DeBerg* and Gregory Salamo, University of Arkansas.

Abstract

Optical Raman tweezers offer a unique opportunity to investigate life processes and identify organisms at the cellular level. Optical Raman tweezers combine laser tweezers and Raman spectroscopy techniques by using a single laser beam to both optically trap and scatter light off a sample. The scattered light can then be collected to yield the Raman spectrum of the sample. The Raman spectrum of a molecule acts as a fingerprint, uniquely identifying it. Through the use of optical trapping to immobilize the sample, only a single cell or molecule is necessary for precise measurements of the Raman spectrum. This makes it possible to study single cell behavior as opposed to the behavior of the statistical average over a distribution of cells. This capability, therefore, makes allows us to investigate cell division and cell ageing by examining the Raman spectra of single cells. The investigation of cell ageing and the

division of cells, in turn, has the potential to offer insights into the ageing process.

P3. Investigation of the Optical Properties of Laguerre-Gaussian Beams.

Matthew Burch* and Surendra Singh, University of Arkansas.

Abstract

The goal of this project is to first produce high quality Hermite-Gaussian mode laser beams from a He:Ne laser source by inserting a pair of perpendicular fibers in the laser cavity. These Hermite-Gaussian modes will then be converted into Laguerre-Gaussian mode laser beams through a Gouy phase shift in an astigmatic arrangement of lenses called a $\pi/2$ converter. Wavefronts of Laguerre-Gaussian beams will then be reconstructed by observing their interference with a plane wave. The method used in this project may prove useful for producing high quality Laguerre-Gaussian beams for practical applications in microscopy, biophysics, and fundamental studies of polarization of laser modes. A CCD camera will be used to image the intensity profile of the different laser modes and interference patterns. The results of these experimental observations will then be analyzed using MATLAB to find the difference compared to theoretical predictions for the behavior of Hermite-Gaussian and Laguerre-Gaussian beams. In this manner the quality of the various modes produced can be quantified.

P4. Transverse Profile Properties of Lasers in Ince-Gaussian Modes.

Adam Goldstein* and Reeta Vyas, University of Arkansas.

Abstract

Two well-known sets of transverse profiles of laser modes are Hermite-Gaussian modes and Laguerre-Gaussian modes. Hermite-Gaussian modes follow a rectangular symmetry as the mode parameters are changed and are a superposition of the fundamental Gaussian beam and the Hermite polynomial set. Similarly, Laguerre-Gaussian modes follow a cylindrical symmetry as the parameters are changed and are a superposition of the fundamental Gaussian beam and the Laguerre polynomial set. Recently, there has been a discovery of a third set of modes, based on the orthogonal Ince polynomials. Ince-Gaussian modes exhibit symmetry in an elliptic cylindrical system, and it can in fact be shown the both Hermite-Gaussian and Laguerre-Gaussian modes are only special cases of the Ince-Gaussian modes as certain parameters tend toward zero or infinity. By using this fact, any output profile can be described by a superposition of allowable Ince-Gaussian modes in the laser's optical cavity.

By solving the paraxial wave equation in an elliptic cylindrical system, it is possible to produce the equation for Ince-Gaussian modes. From this, it is possible to graphically produce the field and intensity profiles and prove the relationships and transitions between Ince-, Hermite-, and Laguerre-Gaussian modes.

P5. A Sensitive Raman Spectrometer.

Stephen Wagner*, Harding University.

Abstract

A sensitive Raman Spectrometer has been constructed using a diode laser for the excitation source. The design incorporates a novel reflection system that improves the signal to noise ratio an order of magnitude. The sensitive and range of the instrument is illustrated by measuring the Raman spectra of several common laboratory reagents.

Arkansas INBRE

The Arkansas IDeA Network of Biomedical Research Excellence (Arkansas INBRE) is funded by a grant from the National Center for Research Resources (NCRR), under the Institutional Development Award (IDeA) Program of the National Institutes of Health (NIH). The IDeA program was established for the purpose of broadening the geographic distribution of NIH funding for biomedical and behavioral research. Currently NCRR supports INBRE programs in 23 states and Puerto Rico.

The Arkansas INBRE builds on the successful Arkansas Biomedical Research Infrastructure Network (BRIN) program that was established in 2001 under a grant from NCRR. The Arkansas BRIN established a statewide network that links Arkansas institutions of higher education to establish a statewide infrastructure in support of a growing effort to build a biomedical research capacity in Arkansas.

