

MISSISSIPPI
ACADEMY OF SCIENCES



SIXTY-FOURTH ANNUAL MEETING

February 24 & 25, 2000

BILOXI, MISSISSIPPI

President Casino Broadwater Tower
2060 Beach Boulevard

Hosted by

Mississippi Institutions of Higher Learning



Journal of the Mississippi
Academy of Sciences

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Editorial policy is located on the inside front cover. *Information for contributors* is located on the inside back cover. Manuscripts and inquiries about publication and information about advertising should be sent to the editor: Kenneth J. Curry, University of Southern Mississippi, Post Office Box 5018, Hattiesburg, MS 39406-5018; 601-266-4930 (voice & fax); kenneth.curry@usm.edu.

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SCHEDULE

WEDNESDAY, FEBRUARY 23, 2000

<u>TIME</u>	<u>EVENT</u>	<u>LOCATION</u>
3:30 PM to 7:00 PM	Registration	Hotel Lobby
4:00 PM to 6:00 PM	Board of Directors Meeting	Mary Mahoney's Old French House

THURSDAY, FEBRUARY 24, 2000

<u>TIME</u>	<u>EVENT</u>	<u>LOCATION</u>
8:00 AM to 5:00 PM	Registration	Island Bar
8:00 AM to 4:30 PM	Divisional Programs	See Pages 10–101
9:00 AM to 7:00 PM	Exhibits	Crystal and Topaz Halls
9:00 AM to 11:00 AM	NASA's Commercial Remote Sensing Program (symposium)	Caprice Room
5:00 PM	2000 Dodgen Lecture & Presentation of Awards; lecture will be given by Dr. David Orr	Gulf Hall
6:00 PM to 7:00 PM	Hospitality Hour	Crystal and Topaz Halls
6:30 PM	MAMP Executive Meeting	Gulf Hall
7:00 PM	IMAGE Student Meeting	Gulf Hall

FRIDAY, FEBRUARY 25, 2000

<u>TIME</u>	<u>EVENT</u>	<u>LOCATION</u>
7:15 AM	Past-Presidents' Breakfast	Largo's Restaurant
8:15 AM to 8:45 AM	MAS Business Meeting	Emerald Room
8:00 AM to 2:00 PM	Registration	Island Bar
8:00 AM to 5:00 PM	Divisional Programs	See Pages 10–101
9:00 AM to 1:00 PM	Exhibits	Crystal and Topaz Halls
9:00 AM to 11:00 AM	Communicating Science through the News Media (symposium)	Caprice Room
9:00 AM to 11:00 AM	Meet the Statistician (complimentary consulting)	Pre-Assembly Area
12:00 PM	Mississippi Association of Biologists Luncheon	Atlantic Room

The Mississippi Academy of Sciences would like to offer a special thanks to **Mississippi Chemical**, **Howard Computers**, and the **Waterways Experiment Station** for supporting the efforts of the Academy to promote scientific research in our state.



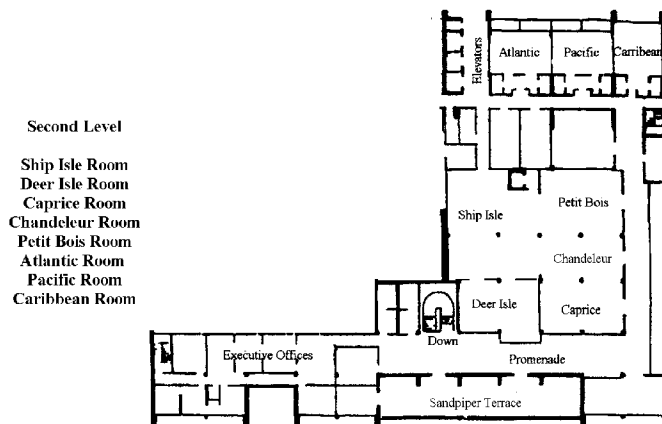
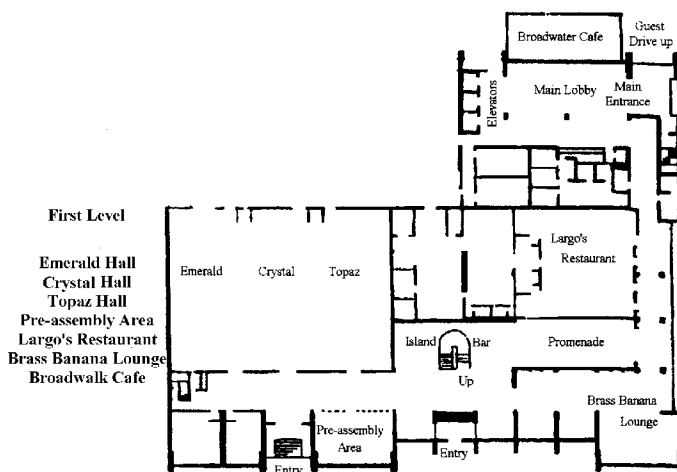
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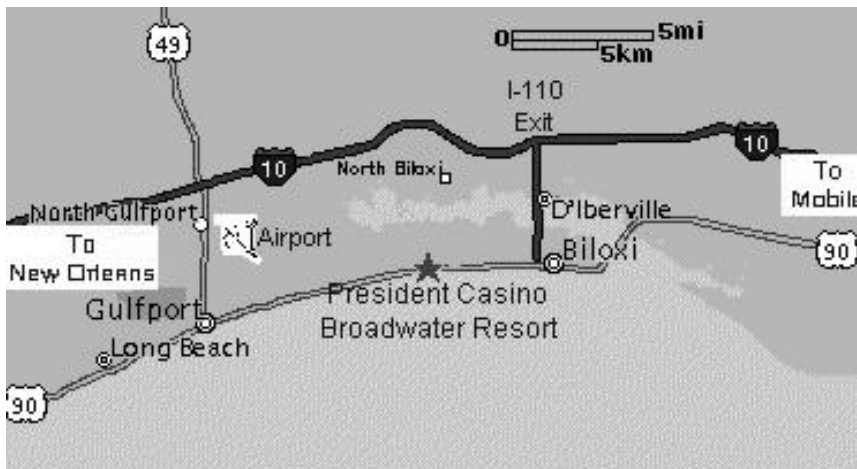
MISSISSIPPI ACADEMY OF SCIENCES MEETING OVERVIEW

	Island Bar	Emerald	Topaz/Crystal	Deer Isle	Caprice	Chandelier	Petit Bois	Caribbean	Pacific	Atlantic	Ship Isle	Gulf Hall
THURSDAY MORNING	Registration	Chemistry and Chemical Engineering	Exhibits	Agriculture and Plant Science	Social Sciences Psychology and Behavioral Neuroscience	Physics and Engineering	Cellular, Molecular and Developmental Biology	Mathematics, Computer Science and Statistics	Geology and Geography	Science Education	Marine and Atmospheric Science	Health Sciences
	Registration	Chemistry and Chemical Engineering	Exhibits	Agriculture and Plant Science	Special Symposium NASA's Commercial Remote Sensing Symposium	Physics and Engineering	Cellular, Molecular and Developmental Biology	Mathematics, Computer Science and Statistics Miss. Chap. Amer. Stat. Assoc. Business Meeting	Geology and Geography	Science Education	Marine and Atmospheric Science	Health Sciences
THURSDAY AFTERNOON	Registration	Chemistry and Chemical Engineering	Exhibits	Agriculture and Plant Science	Special Symposium NASA's Commercial Remote Sensing Symposium	Physics and Engineering	Cellular, Molecular and Developmental Biology	Mathematics, Computer Science and Statistics Miss. Chap. Amer. Stat. Assoc. Business Meeting	Geology and Geography	Science Education	Marine and Atmospheric Science	Health Sciences
	Registration	Chemistry and Chemical Engineering	Exhibits	Agriculture and Plant Science	Special Symposium NASA's Commercial Remote Sensing Symposium	Physics and Engineering	Cellular, Molecular and Developmental Biology	Mathematics, Computer Science and Statistics Miss. Chap. Amer. Stat. Assoc. Business Meeting	Geology and Geography	Science Education	Marine and Atmospheric Science	Health Sciences
THURSDAY EVENING			Hospitality Hour (follows Dodgen Lecture)									Dodgen Lecture and Awards Presentations
FRIDAY MORNING	Registration	MAS General Business Meeting	Exhibits	History and Philosophy of Science	Special Symposium Communicating Science through the News Media	Physics and Engineering	Cellular, Molecular and Developmental Biology	Zoology and Entomology	Geology and Geography	Science Education	Marine and Atmospheric Science	Health Sciences
	Pre-Assembly Area "Meet the Statistician" Special Workshop	Chemistry and Chemical Engineering										
FRIDAY AFTERNOON	Registration	Chemistry and Chemical Engineering	Exhibits	History and Philosophy of Science						Mississippi Association of Biologists Luncheon		

President Casino Broadwater Tower



Gulf Hall is located in the small building across the parking lot from the Main Entrance of the Broadwater Hotel





Environmental Issues

Dodgen Lecture—2000

David Orr

Professor of Environmental Studies

David W. Orr was born in Des Moines, Iowa and was raised in New Wilmington, Pennsylvania. He holds a B.A. from Westminster College (1965), a M.A. from Michigan State University (1966), and a Ph.D. in International Relations from the University of Pennsylvania (1973). He and his wife have two sons. David Orr is currently Professor and Chair of the Environmental Studies Program at Oberlin College.

He is perhaps best known as an environmental educator and for his pioneering work on environmental literacy and campus ecology. His present work is focused on ecological design. During the past three years he spearheaded the effort to design and build a \$7 million Environmental Studies Center at Oberlin College.

He was awarded a National Conservation Achievement Award by the National Wildlife Federation in 1993, a Lyndhurst Prize in 1992 awarded by the Lyndhurst Foundation “to recognize the educational, cultural, and charitable activities of particular individuals of exceptional talent, character, and moral vision,” the Benton Box Award from Clemson University for his work in Environmental Education (1995), and an Honorary Doctorate in

Humane Letters from Arkansas College in May, 1990. He has been a distinguished scholar in residence at Ball State University (1995) and Westminster College in Salt Lake City (1996).

David Orr is the author of *Earth in Mind* (1994) and *Ecological Literacy* (1992) and over 100 published articles. He is also the co-editor of *The Campus and Environmental Responsibility* with David Eagan (Jossey-Bass, 1992), and *The Global Predicament* co-edited with Marvin Soroos (University of North Carolina Press, 1979). He is presently working on a book on that project and another on the larger topic of ecological design.

Dr. Orr is the Education Editor for *Conservation Biology*, a member of the editorial advisory board of *Orion Nature Quarterly*. He is a Trustee of the Compton Foundation (CA) and the JED Fund and the Educational Foundation of America. He is a member of: the Education Visiting Committee of the New England Aquarium in Boston, the Board of the Center for Ecoliteracy Berkeley, the Center for Respect of Life and Environment in Washington, D.C., Urban Ecology (Berkeley), and the School for Field Studies.

The Dodgen lecture is named in honor of Charles L. Dodgen, University of Mississippi Medical Center. Dodgen joined the Academy in 1959. He became executive officer in 1972, a post he held until his death in 1980.

Education Members

Organizations that assist the Mississippi Academy of Sciences in its efforts to promote science in Mississippi

Alcorn State University	MSU Agricultural & Forestry Expt. Station
Belhaven College	Mississippi University for Women
Delta State University	Pearl River Community College
Mississippi-Alabama Sea Grant Consortium	University of Mississippi
Mississippi Delta Community College	University of Mississippi Medical Center
Mississippi Gulf Coast Community College	University of Southern Mississippi
Mississippi State University	

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**AGRICULTURE AND
PLANT SCIENCE**

Chair: James O. Garner, Mississippi State University
Vicechair: Franklin O. Chukwuma, Alcorn State
University

THURSDAY MORNING

Deer Isle

9:05 Introduction

James O. Garner, Jr., Mississippi State University, Mississippi State, MS 39762

9:15 RESPONSE OF LEAF AND CANOPY SPECTRAL REFLECTANCE TO DROUGHT AND FUNGAL STRESS IN SOYBEAN

Judge Brown*, Raj Bahadur, and Abdullah Faruque, Mississippi Valley State University, Itta Bena, MS 38941

Plants of two soybean varieties, traditional DP3588 and high tech. 92B71-Roundup ready, were grown in greenhouse and in the field at Stoneville, MS and East Lansing, MI for primarily drought stress studies. The objective of this study funded by National Aeronautics Space Administration (NASA) at Stennis Space Center was to record the spectral reflectance differences of leaf and canopy stress caused by drought and white mold disease. Plant physiological measurements of leaf water content, leaf water potential and other growth and development data were correlated with the percentage of spectral reflectance of leaf and canopy. Neural network and other statistical techniques were used to analyze plant and soil water relations and the reflectance data acquired with the spectroradiometer. Students were trained in conducting experiments, collecting and analyzing the data. Results of three levels of fungal infection and two levels of drought stress in leaf and canopy are presented. Incorporating this technology in satellites, economic crops could be monitored world wide for signs of damaging drought stress, which could lead to more reliable predictions of crop yields and remove weather-driven volatility from grain commodity markets. Further research for refining the techniques of predicting by remote sensing crop-damaging effects of drought and possibly irrigating can be economically beneficial.

9:30 LEAD ACCUMULATION OVER TIME IN TWO WEED SPECIES, *SESBANIA EXALTATA* (RAF.) AND *IPOMOEA LACUNOSA* L. IN

HYDROPONIC CULTURE

Susmita Ghosh*, Amelya Hardaway, Jennifer N. Ntoni, Aladin Siddig, and Charles Rhyne, Jackson State University, Jackson, MS 39217

The time of exposure to can be an important factor affecting the accumulation in different plant parts. A modified hydroponic growing system was used to suspend two weed species, *Sesbania exaltata* (Raf.) and *Ipomoea lacunosa* L. in aqueous solutions of either Hoagland's nutrient solution or 500 mg/L of $Pb(NO_3)_2$ in the laboratory. Plants were harvested and separated into shoots and roots at the end of 7, 14, 21, 29, and 35 days of growing. Heights and dry weights were recorded after each harvesting. In case of *Sesbania exaltata* (Raf.), Pb accumulation in shoots was 1398 (.1%) and 1399 (.1%) mg/kg with root accumulations of 18401 (1.8%) and 7231 (.7%) mg/kg at the end of 7 and 14 days respectively. In case of *Ipomoea lacunosa* L., shoot Pb accumulations after 7 and 14 days were 1635 (.2%) and 1778 (.2%) mg/kg respectively. Accumulation by roots of the plants was deduced at the end of 14 days (5445 mg/kg) compared to the accumulation (9067 kg) at the end of 7 days. Translocation of Pb to the shoots showed an in with time in both species. Further data will be provided at the time of presentation.

9:45 A COMPARATIVE ANALYSIS OF WEEDING COST UNDER DIFFERENT MULCHING PRACTICES IN TOMATO CULTIVATION

Kat M. Lee*, Liang C. Huam, and Akpan Idung, Alcorn State University, Alcorn State, MS 39096

Black plastic and sweet potato intercrop plots were compared to unmulch plots in a study to determine weeding cost in tomato cultivation. Weed numbers and weeding time spent under each medium were recorded. Weed control was most effective under plastic mulching, followed distantly behind by intercrop and unmulch. Weed numbers and hand weeding time were related to ground surface cover and physical crowding, and shading from competing growth of mulching medium and main crop. Weeding cost by manual labor was almost the same under intercrop and unmulch, and lowest under plastic medium. Analysis of enterprise budgets indicate labor cost constituted about one-half to three-fourth of total variable cost whereas hand weeding labor cost constituted about one-thirtieth of that under plastic to almost one-half under intercrop mulching and unmulch. Analysis of partial budgets indicated a positive net change from switching intercrop mulching and unmulch to plastic mulching medium while a negative net change was evident if hand labor weeding cost was excluded in the budgets. Under a small farm situation, the difference in net income change is primarily due to reductions in weeding cost since labor can be provided by

the operator.

10:00 ROOTING OF PECAN CUTTINGS BY GIRDLING AND BANDING

Frank B. Matta, Mississippi State University, Mississippi State, MS 39762

Nine-year old bearing grafted pecan trees were used in this study. Varieties propagated were 'Choctaw,' 'Kiowa,' 'Cheyenne,' 'Shoshoni,' and 'Pawnee.' Main limbs producing one-year old wood were girdled. Current seasons shoots originating from one-year old wood on girdled limbs were banded at the base with one-half inch wide electrical tape. Cuttings were harvested five weeks after banding, immersed in Captan®, placed in propagation flats filled with rooting media, and placed in a greenhouse under intermittent mist for rooting. Rooting was cultivar dependent with 'Pawnee' having a greater percentage rooting regardless of treatment. Girdling and banding increased rooting of 'Cheyenne.' 'Choctaw' responded the least to girdling and banding and banding alone.

10:15 PHYTOEXTRACTION OF CADMIUM FROM SOLUTION BY *CYMOPOGON FLEXUOSUS* L., A PRELIMINARY STUDY

Susmita Ghosh*, Amelya Hardaway, Jennifer N. Ntoni, and Charles Rhyne, Jackson State University, Jackson, MS 39217

Phytoextraction, or removing certain metals or organic compounds from contaminated soil or water and concentrating them in the harvestable parts is a natural process carried out by few plants. Our research objective is based on surveying and identifying wide-ranging plant species as potential hyperaccumulators. A modified hydroponic growing system was used to suspend plants in aqueous solutions of either Hoagland's nutrient solution or varying concentrations of Cd(NO₃)₂. Plants were exposed to Cd concentrations of 50, 100 and 200 mg/L. After four weeks of exposure, plants were harvested and separated into shoots and roots to analyze the accumulations of Cd. Accumulation of Cd in shoots of 50 mg/L test concentration was 3373 (.3%), mg/kg the highest among shoots and, 16289 (1.6%) mg/kg, of Cd in roots of 200 mg/L test concentration was the highest among roots. Dry weights of the plants in different test concentrations were also recorded. The high Cd accumulation by *Cymbopogon flexuosus* L. suggests that this plant may be used to clean up Cd-contaminated sites using the phytoextraction process.

10:30 Break

10:45 THE RELATIONSHIP BETWEEN FATTY ACID CONTENT AND PECAN COLD

HARDINESS

Jeb Cade* and Frank B. Matta, Mississippi State University, Mississippi State, MS 39762

Seasonal fatty acid changes in total lipids of 'Jackson' and 'Owens' pecan from September to March were determined. The predominant fatty acids were linolenic (18:3), linolenic (18:2), oleic (18:1), stearic (18:0), and palmitic (16:0). In both cultivars, total saturated fatty acid content was negatively correlated with cold hardiness and negatively correlated with total unsaturated fatty acid content. Total unsaturated fatty acid content was positively correlated with cold hardiness. In 'Owens' 16:0 was significantly correlated with cold hardiness and total saturated fatty acid content.

11:00 AIR TEMPERATURE INFLUENCES THE EFFECT OF GROWTH REGULATORS ON COLD HARDINESS OF BLUEBERRY

Girish K. Panicker*, Frank B. Matta, and Patrick D. Gerard, Mississippi State University, MS 39762

A two-year study was conducted on rabbiteye var 'Tifblue' flower flushes to determine the effect of three concentrations of abscisic acid (ABA) and paclobutrazol on cold hardiness of floral parts. Two types of flower flushes were identified in 'Tifblue.' Differential thermal analysis (DTA), electrolyte leakage (EL), tetrazolium stain test and oxidative browning test were conducted on floral parts to determine the critical freezing temperatures. Floral parts frozen to -40°C produced only one exotherm confirming that rabbiteye floral parts do not supercool. Both growth regulators induced hardiness in all floral parts at second flush, and induced hardiness only in certain floral parts at first flush. Floral parts in April were more prone to freezing injury than floral parts in March. Ovaries were the hardest followed by calyx, stamens, style and corolla. Air temperature had profound influence on cold hardiness as determined by DTA and the viability tests.

11:15 ALLEVIATION OF CHILLING INJURY IN SWEET POTATO (*IPOMOEA BATATA* L.) BY GLK-8903

Ibrahim Makhadmeh* and James O. Garner, Jr., Mississippi State University, Mississippi State, MS 39762

Twelve-day old rooted stem cuttings of 'Travis' sweet potato plants were foliar sprayed with 1% GLK-8903. Twenty four hours after treatment the plants were chilled (5°C day/night, 12 hr. of night). Non-chilled plants were kept at 25°C day/night in another growth chamber. After 24 hrs leaves of the untreated control were injured, as characterized by leaf wilting, whereas leaves of the GLK-8903 treated plants retained turgid. The GLK-8903 protection mechanism was assessed by examine several

physiological response. No differences in diffusive resistance, transpiration rate and chlorophyll content were detected between treated and non-treated plants. The decline in relative water content (RWQ) and chlorophyll fluorescence ratio Fv/Fm caused by chilling exposure to 5°C were minimized by the application of GLK-8903. RWC of treated plants increased from 78% to 90% under chilling. Treated plants had 0.215 Fv/Fm compared with non-treated 0.165. Electrolyte leakage, an indication of membrane injury was reduced from 20.9 to 9.7 with the GLK-8903 treatment. The activity of peroxidase was increased by GLK-8903 application. Malondialdehyde (MDA), a product of lipid peroxidation was increased in untreated plants under chilling exposure. Under non-chilling conditions, there were no differences between treated and non-treated plants.

11:30 PHYSIOLOGICAL EVALUATION OF CHILLING TOLERANCE

Ehiorobo Izekor* and James O. Garner, Jr., Mississippi State University, Mississippi State, MS 39762

Four chilling tolerant sweet potato genotypes were physiologically evaluated for similarities in traits relating to tolerance to chilling injury. Chilling decreased transpiration rate (TR) and increased diffusive resistance among the genotypes tested. Electrolyte leakage (EL) was increased by 61% and peroxidase activity was also increased by 75% following 5°C chilling for 24 hours. Genotype effect on chilling temperature was supported by chilling-genotype interaction for chlorophyll fluorescence yield. Genotype 108MS3 had 0.38 chlorophyll fluorescence ratio (Fv/Fm) compared to genotype 105MS1 with 0.16 Fv/Fm when chilled. There was no difference among genotype in percent fatty acid composition before and after chilling among the chilling tolerance genotypes tested. However, more than 70% of the fatty acid composition of the glycolipid fraction of the total lipid was linoleic (18:2) and linolenic (18:3). Genotype effect was also recorded for percent leaf shrinkage of the anatomy. The largest shrinkages due to water loss among the genotypes were observed in the palisade layer (40%) and epidermal layer (49%). Total leaf shrinkage, stomata density, diffusive resistance and transpiration rate may have interacted with leaf water content and specific leaf weight with respect to water loss of the leaf under chilling condition.

11:45 FIELD EVALUATION OF *ECHINACEA* SPECIES

Patrick E. Igbokwe*, Muhammad Rizvi, Liang C. Huam, Magid Dagher, and LaShunda L. Anderson, Alcorn State University, Alcorn State, MS 39096

A field study was conducted in the summer of

1999 to determine the adaptation, growth potential and mineral composition of *Echinacea angustifolia*, *E. dallida*, and *E. duffurea*. The study was conducted on a Memphis silt loam soil at Alcorn Experiment Station. A randomized complete block experiment design, with four replications of each species was used. Each species was planted into beds 6.1 m long and 1.5 m wide at a within-row spacing of 0.3 m and a between-row spacing of 0.3 m. Fertilizer (N-P-K) application was based on recommendation after sod test. Other production practices were uniformly applied to all plots. Plant survival was greatest for *E. purpurea* and lowest for *E. angustifolia*. Canopy width, canopy height, flower formation and growth were also greatest for *E. purpurea* and lowest for *E. angustifolia*.

THURSDAY AFTERNOON

Deer Isle

1:00 Divisional Poster Session

PHYTOREMEDIATION OF TRINITROTOLUENE (TNT) USING SPINACH (*SPINACIA SPINOSA*) FILTRATE

Lovell Agwarambo¹, Steven L. Larson², Willie W. Craft, Jr.^{1*}, and Charlie A. Cheney¹, ¹Tougaloo College, Tougaloo, MS 39174 and ²U.S. Army Corps of Engineers, Waterways Experiment, Vicksburg, MS 39180-6199

Trinitrotoluene (TNT) and its degradation products pose a treat to our environment due to their toxic and mutagenic nature. This explosive is known to contaminate surface and groundwater, especially near munition sites, that may later be used for irrigation of food crops. The spinach green (*Spinacia spinosa*) was made into a puree, filtered to remove any insoluble solid particles, and added to a 100 ppm solution of TNT. High-performance liquid chromatography was then utilized to test the degradation of TNT using the spinach. Analysis showed that over a period of 32 hours the spinach significantly reduced the concentration of TNT even after the removal of all insoluble solid particles. This result suggests that the degradation of TNT by the spinach was enzymatic rather than adsorption. Acknowledgements: (a) This project was funded by the U.S. Army Corps of Engineers (b) We thank the WES Environmental Chemistry Branch Management for providing us with the research facility, supplies, and office space.

THE SCRAMBLE FOR PLANT MATERIALS BY SOLVENTS: IMPLICATIONS ON TNT REMEDIATION

Lovell Agwarambo^{1*}, Steven L. Larson², Chris Foote², Lynn Escalon², and Waleska Perez³, ¹Tougaloo College, Tougaloo MS 39174; ²U.S. Army Corps of Engineers,

Waterways Experiment, Vicksburg, MS 39180-6199; and ³University of Puerto Rico, Mayaguez, Puerto Rico

Phytoremediation research has concentrated on the aqueous matrix since the technology will be used for water, sludge, or soil treatment. No study has been conducted to examine the partitioning of the plant materials between organic and aqueous matrices. This study examines the reaction of TNT with the organic and aqueous extracts and the un-extractable marcs of mustard green and spinach using 100% hexane, 100% acetone, and 50/50 hexane-acetone as solvents, respectively. A fresh and un-extracted spinach juice was filtered and treated with TNT as a control experiment. The marcs degraded TNT at varying rates but removed TNT faster than the aqueous layer after organic solvent extraction. The mustard green marc from the hexaneacetone extraction removed TNT faster than the corresponding spinach marc. The marcs from the 100% hexane extraction removed TNT equally but faster than the other reactions. The spinach aqueous layer from the hexane-acetone extraction removed TNT faster than that of the corresponding mustard green. The fresh but filtered spinach juice removed TNT faster than all the marcs and extracts except the pure and fresh marc. These results suggest that: (a) there may be more than one plant component and reaction involved in phyto removal, degradation, or transformation of TNT; (b) hexane does not extract all the plant components that degrade TNT (c) removal of TNT is not due to adsorption by the plant material. Support for this project was provided by the United States Corp of Engineers & MSEIP.

PHYTOREMEDIATION OF TNT BY SEVEN TERRESTRIAL PLANTS

Lovell Agwarambo^{1*}, Steven L. Larson², Victor Medina³, and Waleska Perez⁴, ¹Tougaloo College, Tougaloo, MS 391742; ²U.S. Army Corps of Engineers, Waterways Experiment, Vicksburg, MS 39180-6199; ³University of Puerto Rico, Mayaguez, Puerto Rico; and ⁴Washington State University, Tri Cities, Richland WA 99352

Phytoremediation, a nascent technology is the use of plants to remove contaminants from various media. This technology is economically attractive and environmentally friendly and acceptable. Much research has focussed on munitions remediation using microbes and aquatic plants. This study investigates the use of terrestrial plants as a viable alternative to solving the enormous munitions pollution. Terrestrial plants are bulkier and more abundant. The seven plants were chosen at random; various TNT solutions were treated with each plant, respectively. It was observed that in some cases, there were no detectable levels of TNT after four hours. Some of the plants were selected for reaction with RDX. The results of these investigations

will be discussed and shared. Support for this project was provided by the United States Corps of Engineers & MSEIP.

ADSORPTION AND DESORPTION OF METOLACHLOR IN A LOESSIAL SOIL

F.O. Chukwuma* and A.B. Johnson, Alcorn State University, Alcorn State, MS 39096

The key step in designing management practices that will reduce surface and groundwater pollution is understanding the sorption and desorption of herbicides in soils: Therefore, the objective of this study was to determine the influence of varied equilibrium time on the overall sorption and desorption of metolachlor by a Loring silt loam soil (Fine-silty, mixed, thermic Typic Fragiudalfs). Soil samples were collected from Ap (0–15 cm) horizon, air dried, sieved (< 2 mm) and selected physico-chemical properties determined. Sorption isotherms were obtained by placing 3 g of soil in 25 ml corex glass centrifuge tubes with Teflon-lined caps. Fifteen ml of metolachlor of different concentrations (0, 2, 4, 10, 16, 20 mg L⁻¹) were added in triplicate to each tube for five equilibrium times (1, 24, 48, 72 and 96 h). After each equilibrium time, the suspensions were centrifuged and 7 ml from each sample was filtered and solution concentration analyzed for metolachlor using HPLC. Desorption was measured after sorption using the highest concentration for each equilibrium time. Seven ml of background solution (0.01 M CaCl₂) was added to each sample, vortexed and was shaken accordingly. This procedure was repeated 5 times and the supernatant analyzed as above for metolachlor. Adsorption-desorption isotherms were then fit to the logarithmic form of the Freundlich equation.

PHYTOEXTRACTION OF LEAD FROM CONTAMINATED SOILS: ROLE OF A SYNTHETIC CHELATE

G. Miller*, M.F.T. Begonia, G.B. Begonia, C. Burks*, J. Owens, and M. Johnson, Jackson State University, Jackson, MS 39217

Previous hydroponic studies indicated that coffee-weed or hemp *Sesbania* (*Sesbania exaltata* Raf.) can accumulate substantial amounts of lead (Pb) in its shoots. To further evaluate the effectiveness of *S. exaltata* as a phytoextraction species, a study was conducted to determine whether a synthetic chelate, ethylenediamine-tetraacetic acid (EDTA), can enhance the shoot uptake of Pb from a contaminated soil. Seeds of hemp *Sesbania* were planted in 1.8 L plastic pots containing planting mix:top soil (2:1, v:v) amended with aqueous solutions of Pb and EDTA. Experimental units were arranged in a 4 Pb x 5 EDTA factorial in RCB with 5 replications. Results showed

that shoot and root dry biomass of hemp *Sesbania* were not significantly affected by the various Pb/EDTA treatments. Pb uptake in the shoot increased with increasing levels of soil-applied Pb but was not enhanced by EDTA. Pb accumulation in the roots was only increased at the two highest levels of soil-applied Pb in combination with 5 mM EDTA. The concentrations of Pb remaining in the soil after harvest were directly proportional to the levels of soil - applied Pb but were not affected by chelate amendments.

EVALUATION OF DIFFERENT TRELLIS SYSTEMS FOR CHINESE MELON (*MOMORDICA CHARANTIAL.*) PRODUCTION

O.P. Vadhwala^{1*}, C.R. Reddy¹, and James Spiers², ¹Alcorn State University, Alcorn State, MS 39096 and ²USDA Small Fruit Research Station, Poplarville, MS 39470

Chinese melon (*Momordica charantia* L.) yield as influenced by four trellis systems was evaluated. Chinese melon seeds of cultivar Durga an Indian variety were used for this study and planted on June 2, 1999. Chinese melon plants grown without trellis (control) were the least productive. Maximum yield was obtained with V-shaped trellis system followed by vertical and semi-vertical trellis systems. Harvesting was more convenient with all trellis systems as compared to control where the plants were allowed to trail and spread on the ground. First harvest date was July 23, 1999 (50 days after transplanting) and final harvest date was October 25, 1999 (144 days after transplanting).

RESPONSES OF INDIAN MUSTARD TO SOIL CADMIUM AND LEAD POLLUTION

K. Shumaker, M.S. Zaman*, V. Boyd, and Alice M. Powell, Alcorn State University, Alcorn State, MS 39096

Cadmium (Cd) and lead (Pb) are ubiquitous pollutants in the biosphere. Studies in our laboratory indicate that *Brassica juncea* (Indian mustard) plants can tolerate high concentrations of Cd and Pb in soil. In this study, we evaluated the comparative biotoxic effects of Cd and Pb on *B. juncea*. Plants were grown on Memphis silt loam soil, polluted with various concentrations of Cd or Pb. Data were analyzed for biomass production and chlorophyll synthesis. Results indicate that there was a dose related inhibition of plant biomass, chlorophyll concentration, and chlorophyll content in several Cd and Pb treated plant groups. Results also indicate that these inhibitions were greater in the Cd treated plants than in the Pb treated groups, suggesting that either Cd is more toxic to plant tissue than the Pb, or Cd is more mobile in soil/plant tissue than the Pb, therefore, capable of exerting a more toxic effect. Acknowledgements: The study was supported by a grant from NIH/NIGMS/MBRS (# 5-S06-GM55356-03).

The authors acknowledge Dr. Susmita Ghosh, Department of Biology, Jackson State University, for her assistance.

EVALUATION OF DIFFERENT PLANT SPECIES FOR PHYTOEXTRACTION OF CADMIUM FROM CONTAMINATED SOILS

K. Seals*, M.F.T. Begonia, G.B. Begonia, G. Miller, V. Payne*, and M. Brown, Jackson State University, Jackson, MS 39217

The success of phytoextraction as a phytoremediation strategy for clean up of metal-contaminated soils depends on the selection of suitable species that not only produce large biomass but also accumulate and tolerate toxic metals. An experiment was therefore conducted at a Jackson State University laboratory equipped with high intensity (1000 W; PAR, 800 $\mu\text{mol photons M}^{-2} \text{S}^{-1}$) metal halide lamps. Five plant species were evaluated for their tolerance and uptake of cadmium when grown on cadmium-contaminated media. Seeds of selected species [morningglory (*Ipomoea lacunosa* L.), coffeeweed (*Sesbania exaltata* Raf.), wheat (*Triticum aestivum* L.), rape (*Brassica napus* L.), turnip (*Brassica campestris rapifera* L.)] were planted in 150 cm^3 plastic super cells containing sand. Each super cell with emerged seedlings was irrigated alternately with 10 ml of either nutrient solution or aqueous cadmium test solution every three days until harvest. Three super cells each containing two or five plants constituted a treatment replicate. Treatments were arranged in a completely randomized design (CRD) with three replications. Generally, shoot and root dry biomass of the test species decreased with increasing concentration of applied cadmium, although cadmium tolerance varied among test species. Wheat and rape showed the greatest and least tolerance to cadmium, respectively. The relative uptake of cadmium by the shoots and roots of each test species will be explained in relation to the species' tolerance to cadmium.

2:00 Divisional Talks Resume

2:00 PESTICIDE RESIDUES IN LEGUMINOUS PLANTS: ASSIMILATION OR DEPOSITION?

Detria Smith*, Joseph M. Wahome, and William C. Mahone, Mississippi Valley State University, Itta Bena, MS 38941

The presence of pesticide residues on bean and pea plants was quantified using High Performance Liquid Chromatography (HPLC). The plants were grown in replicates under different environmental conditions and sprayed with a phosphate based pesticide at regular time intervals. The amount of pesticide residues in plants depended on the growth stage and inter-spraying intervals.

These data are discussed in light of environmental contamination of food chains.

2:15 APPLICATIONS OF IMAGE ANALYSIS IN PLANT PATHOLOGY

Kenneth J. Curry and Reena Shetty*, University of Southern Mississippi, Hattiesburg, MS 39406-5018

Frequently, disease symptoms in plants are assessed by subjective evaluation which may be a tedious and time consuming process. Image analysis promises an alternative to the traditional method that can be rapid and precise. With image analysis a computer assesses and quantifies disease symptoms in terms of color patterns and areas. We are using the Bioquant™ image analysis software package. We have analyzed anthracnose leaf spots and found that the lesions are easily distinguished from the healthy leaf tissue. Variation in the color is the basis for quantification. With this software, a relatively large number of samples can be quantified in a short period of time. Image analysis is not restricted to leaves but can be extended to quantifying the disease symptoms in whole fruits and grains. If the infected grains are darker or lighter in color than the healthy ones, they can be easily distinguished and quantified in terms of color pattern and number. This could be useful in a variety of ways in the agricultural industry. Despite the advantages, there are certain limitations to image analysis. Since quality and uniformity of lighting is important in comparative quantification, it is imperative that the sample be viewed under controlled lighting conditions and this puts a limit to its use in the field where the lighting conditions are variable.

2:30 A PRELIMINARY STUDY OF THE FUNGUS *CERCOSPORELLA RUBI* IN BLACKBERRY (*RUBUS* SP.)

Melinda R. Lyman^{1*}, Kenneth J. Curry¹, and Barbara J. Smith², ¹University of Southern Mississippi, Hattiesburg, MS 39406-5018 and ²Agricultural Research Service, Small Fruits Research, Poplarville, MS 39470-2005

Symptoms of infection by this fungus include rosetted vegetative buds and elongated floral buds that are reddish in color. When the floral bud is fully mature, the sepals and petals open exposing infected pistils and stamens. *Cercospora rubi* sporulates at this time and apparently infects neighboring primocanes. Infected flowers abort and infected primocanes continue to grow without any symptoms. During the early stages of floral bud development, *C. rubi* occupies the tight crevices among stamens and pistils. My observations confirm Plakidas' (1937) report that this fungus becomes enclosed in the carpel during ovule development while never penetrating

host tissue. Samples have been collected from vegetative and floral buds at various stages of development and embedded in paraffin and plastic. Paraffin sections of infected floral buds have yielded no information to date as to the presence of *C. rubi*. However, plastic embedded floral buds on both light and electron microscopic levels have shown presence of *C. rubi* nestled within tight crevices among pistils and stamens and within closing ovules. In addition, mycelium of this fungus grows in a matrix of unknown composition which appears granular at the ultrastructural level. Mycelium of *C. rubi* is evident in floral buds as small as 1mm in diameter. At the ultrastructural level, host cells have no apparent symptoms of stress although the fungal matrix adheres to the cuticle of host tissues. Mycelium has not been observed in vegetative buds at this time. Additional observations will be made as the season progresses and as vegetative buds show evidence of infection.

2:45 ULTRASTRUCTURAL LOCALIZATION OF CHITIN IN FUNGUS *COLLETOTRICHUM ACUTATUM* IN STRAWBERRY USING WHEAT GERM AGGLUTININ (LECTIN)

Jana B. Avant^{1*}, Kenneth J. Curry¹, and Barbara J. Smith², ¹University of Southern Mississippi, Hattiesburg, MS 39406-5018 and ²Agricultural Research Service, Small Fruits Research, Poplarville, MS 39470-2005

Understanding the details of molecular interactions between plant pathogens and their host has been greatly assisted by the development of techniques to localize and visualize molecules *in planta* using lectins, antibodies, and enzymes associated with gold, fluorescent, and other labels. The lectin, wheat germ agglutinin, has been used successfully in studies on chitin distribution in fungal walls. Wheat germ agglutinin has a binding site for a glucosamine molecule of at least two or three residues and requiring an uncharged substituent in the 2-position (which is the structure of chitin). Chitin is a substrate for plant chitinases and is known to elicit host defense responses. 'Chandler' cultivar of strawberry was inoculated with *Colletotrichum acutatum* and observed for lesion development. Appropriate tissue was fixed, resin embedded, and sectioned for electron microscopy. Chitin was visualized using wheat germ agglutinin conjugated with colloidal gold. The gold probe indicated the distribution of chitin within the mature fungal walls *C. acutatum*. Several fungi are known to modify or mask chitin in certain penetration structures presumably to avoid detection from the host or to avoid the effects of host chitinases. Studying the distribution of chitin fungal invasion is a necessary part of understanding the intrinsic host-pathogen relationship. We intend to use this technique

to determine the distribution of chitin within walls of the invasion structures of *C. acutatum*.

3:00 ANTHRACNOSE DISEASE IN STRAWBERRY (*FRAGARIA X ANANASSA*) CAUSED BY *COLLETOTRICHUM ACUTATUM* AND *COLLETOTRICHUM FRAGARIAE*: AN ULTRA-STRUCTURAL STUDY

Maritza Abril^{1*}, Kenneth J. Curry¹, and Barbara J. Smith²,
¹University of Southern Mississippi, Hattiesburg, MS 39406-5018 and ²Agricultural Research Service, Small Fruits Research, Poplarville, MS 39470-2005

Colletotrichum acutatum is found worldwide on a number of strawberry hosts, and is increasing in importance as the cause of strawberry petiole, stolon, crown, and root infections. *Colletotrichum fragariae* is often associated with anthracnose crown rot in strawberry and seems to be restricted to the southeastern United States, while *C. acutatum* is usually the causal agent of anthracnose fruit rot. These pathogens infect strawberry petioles and stolons and cause the dark sunken lesions typical of anthracnose. We inoculated petioles and stolons by misting with conidial suspensions (1.5×10^6 spores/ml) of *C. acutatum* and *C. fragariae* and incubating at 28°C and 32°C respectively and 100% RH. We observed at the light as well as the ultrastructural level the ontogeny of the infection process by both pathogens on the 'Chandler' strawberry cultivar. Following cuticular penetration via an appressorium, subsequent steps of invasion by both *C. acutatum* and *C. fragariae* involve growth within the cuticle and within the cell walls of epidermal, subepidermal, and subtending cells. Both fungi have a necrotrophic nature, but occasionally they are seen penetrating living cells. Acervuli (the reproductive structures) are formed once the cortical tissue has experienced moderate disruption and begins with the development of a stroma in the tips of the epidermal cells. The acervuli develop under the cuticle of the host and erupt through the cuticle to produce conidia. Invasion of the vascular tissue apparently occurs after acervulus maturation and remains minimal.

3:15 Break

3:30 POTENTIAL NUTRACEUTICALS FROM SOUTHEASTERN FRUITS AND PROCESSES TO OBTAIN THEM

Juan L. Silva^{1*}, Aurora E. Nuñez², Diane K. Tidwell³, Miranda Reed¹, and S.X. Ma⁴, ¹Mississippi State University, Mississippi State, MS 39762; ²Universidad De Oriente, Maturin, Venezuela; ³University of Mississippi, Oxford, MS 38655; and ⁴Minute Maid Corporation,

Orlando, FL 32802

Nutraceuticals are substances that are found in foods and contribute to human health through disease prevention, curing, or health maintenance. These could range from food concentrates to extracts, usually from plant materials. One sector is the antioxidants used to "neutralize" free radicals in our body and thus prevent cancer and other diseases. One group of these are the phytochemicals, a group of minor chemicals found in plants that may or may not have health benefits. One sector within these are the phytoestrogens and another the polyphenols. Amongst the first are isoflavones, resveratrol and ellagic acid, whereas catechins and oligomeric proanthocyanidins make-up the latter. Phytoestrogens bind to the body much as estrogen does. Resveratrol has been found in grapes, seeds, juice, wine, and other products but is also found in blueberries. It is also associated with decreased risk of coronary heart disease. Southern grapes (muscadines - *Vitis rotundifolia*) and blueberries (rabbiteye - *Vaccinium ascei*) have thicker skin than their Northern or European counterparts. Data has shown that these fruits and their seeds contain elevated amounts of resveratrol and phenolics, and that muscadines also contain ellagic acid. Processes to concentrate and extract these compounds include dehydration and milling of the seeds and skins and liquid-liquid extraction from spent materials. Products such as wine, by-products from puree and skin, and others have also been developed. These products, from muscadines and rabbiteye blueberries contain as much as twice to five times as much resveratrol and other phenolics than their counterparts.

3:45 SURVIVAL OF *ESCHERICHIA COLI* DURING THE MANUFACTURE AND STORAGE OF CHEESE CURDS UNDER MODIFIED ATMOSPHERE PACKAGING

Eric A. Johnson^{1*}, Kathleen Glass¹, and Kendra J. Thornton², ¹University of Wisconsin-Madison and ²Mississippi State University, Mississippi State, MS 39762

The objective of this study was to compare the survival of *Escherichia coli* O157:H7 during the manufacture of Cheddar cheese curd packaged under ambient air, 100% CO₂, 100 N₂, or 60% CO₂/40% N₂ mixture and stored at 21.1, 12.8, and 4.2°C (70, 55, and 40°F). The *E. coli* strain F5854 was obtained from cheese associated with the 1998 Wisconsin cheese curd outbreak. Pasteurized, non-homogenized whole milk was obtained from the University of Wisconsin-Madison Dairy Plant. Cheese curds were produced using standard cheese make procedures. F5854 was added at the beginning of processing. The curds were salted to approximately 1.5% and weighed into 20 g portions and placed in either sterile

vacuum bags or stomacher bags. Samples from each gas and ambient air were incubated. Sampling was performed on Day 0, 1, 2, and 3 for all temperatures. 21.1°C were discontinued because obvious spoilage would occur. In addition, sampling was performed on day 4, 7, 10, 14, 21, and 28 for 12.8°C and 4.2°C. No significant difference was noted among gases and ambient air in 21°C curds. However, there were significant differences in the 4°C and 12°C curds.

4:00 USE OF HIGH INTENSITY PULSED-LIGHT ON CHANNEL CATFISH FILLETS

Juan L. Silva*, José E. Figueroa, and Abdulaziz Shuwaish, Mississippi State University, Mississippi State, MS 39762

Processing of this fish grew from 2.7 million kg in 1970 to 68.2 million kg in 1984 to 256 million kg in 1998. Fresh fish fillets account for about 20% of total product sales with 18% more in other fresh products. Consumer demand coupled with longer distribution channels place demands on the quality/shelf-life and safety of this product. New and improved technologies can help in per capita consumption of channel catfish (*Ictalurus punctatus*) has risen over 0.46 kg per capita in 1998 meeting these demands. One such technology is pulsed-light, short-duration, high intensity light with wavelengths from UV to the IR region. This technology has very little heat production but is effective against spoilage and pathogenic bacteria. This enhances the shelf-life and safety of prepackaged catfish products held at refrigeration temperatures. Freshly processed channel catfish fillets were exposed to the PureBright® light, 20,000X more intense than sunlight with wavelengths of 200–300 nm. The doses ranged between 0.25 and 0.50 J/cm², with 2 and 4 pulses for each dose. The prepackaged fish were treated one day after processed and evaluated for 13 d at 4°C. Psychrotrophs (PPC) increased from 3.2 to 6.0 CFU/g by day 9 for control versus 11–12 days for treated fillets. Surface color and texture (firmness) were not different between the treatments. Oxidation nor gaping were different between treatment or time. This technology may enhance shelf-life of catfish fillets by 3–4 days kept at 4°C.

4:15 Divisional Business Meeting

CELLULAR, MOLECULAR AND DEVELOPMENTAL BIOLOGY

Chair: David Carson, Mississippi University for Women

Vicechair: Peter Butko, University of Southern Mississippi

THURSDAY MORNING

Petit Bois

8:45 Introduction

David Carson, Mississippi University for Women, Columbus, MS 39701

9:00 SUPPRESSORS OF THE *ASPERGILLUS NIDULANS* *NIMX2* MUTATION AFFECT SEPTATION, BRANCHING, DEVELOPMENT, AND NUCLEAR DIVISION

Brett Carter*, Robert Carter, Peyton Hays, Angela Payne, Melanie Schrader, Chad Young, and Sarah Lea McGuire, Millsaps College, Jackson, MS 39210

The p34^{cdc2} kinase is believed to trigger mitotic entry in all eukaryotes. In the filamentous fungus *Aspergillus nidulans*, the functional p34^{cdc2} homolog, *nimX^{cdc2}*, is required for both the G1/S and G2/M transitions. To identify proteins that interact with *nimX^{cdc2}*, we generated extragenic suppressors of the heat-sensitive *nimX2* mutation. Four strains containing clonable extragenic suppressor mutations have been isolated. The suppressor genes were designated *snxA-snxD* (for suppressor of *nimX*). The *snxA1* mutation halts the cell cycle in G1 at 20°C, producing abnormal nuclei. *snxA* maps to chromosome II and is not allelic with any other *Aspergillus* cell cycle genes located on chromosome II. *snxB1* leads to a hyperbranching, hyperseptate phenotype, and preliminary evidence suggests that this maps to chromosome I or VI. *snxC1* maps to chromosome I and affects septation and conidiophore structure, leading to sparse conidiation. The conidiophores contain septae (absent in wild type) and many have abnormal developmental structures such as hyphae growing from metulae. *snxD1* is similar to *snxB1* in that it also is hyperseptate and hyperbranching; preliminary evidence suggests that it maps to chromosome VII or VIII. Further analysis and cloning of these *nimX^{cdc2}* suppressors will lead to a better understanding of cell cycle regulation in *Aspergillus nidulans* and of how the cell cycle relates to development, branching and septation.

9:15 POLYSACCHARIDE CAPSULE OF GROUP B *STREPTOCOCCUS* IS NOT THE ANTIGENIC TARGET FOR THE PROTECTIVE NATURAL IgM IN MICE

Angela H. Adams* and Peter Butko, University of Southern Mississippi, Hattiesburg, MS 39406

It was previously found that normal mouse serum contains natural IgM antibody which is protective against

infection by group B *Streptococcus* (*Streptococcus agalactiae*, GBS). The long-term objective of this work is to identify the molecular target for this IgM. The bacterial surface exhibits three types of molecules: capsular polysaccharide, surface proteins, and the cell wall peptidoglycan. The capsule, being the most conspicuous among the surface structures, was chosen first to be tested for IgM binding. Three strains with varying degrees of encapsulation were used in this study: a highly encapsulated strain M781; strain COH1 with medium encapsulation; and an acapsular mutant strain COH1-13. An enzyme-linked immunosorbent assay (ELISA) performed on the suspension of GBS with normal mouse serum was used to detect bound IgM. The amount of bound IgM was found to vary inversely with the amount of capsule expressed by the bacteria. It is concluded that the polysaccharide capsule is not the target for murine natural IgM, but rather it attenuates binding of the antibody to its target molecule, which may be a protein or peptidoglycan.

9:30 SURFACE ASSEMBLY OF AN AMPHIPATHIC FUNGAL HYDROPHOBIN AND AN ASSOCIATED POLYSACCHARIDE

Paul Stroud*, Gregory G. Martin, Gordon C. Cannon, and Charles L. McCormick, University of Southern Mississippi, Hattiesburg, MS 39406-5043

The hydrophobin protein, Sc3p, is excreted into the growth medium by the wood-rotting fungus *Schizophyllum commune* when grown as a monokaryon in liquid culture. Co-excreted into the growth medium with Sc3p is a high molecular weight polysaccharide, schizophyllan. Sc3p has many properties including the ability to self assemble at both hydrophilic surfaces such as mica and hydrophobic surfaces such as Teflon, rendering them hydrophobic and hydrophilic respectively after surface coverage. Interactions of Sc3p with schizophyllan have been shown to be necessary for stable hydrophilic surface coverage but is still unclear in the specific role schizophyllan plays in self assembly at the surfaces as well as the stability of the Sc3p in solution. An elucidation of the structure function relationship of the Sc3p for binding hydrophobic and hydrophilic surfaces has been undertaken, as well as the elucidation of the role the polysaccharide, schizophyllan, plays in binding these surfaces.

9:45 Invited Speaker

CLONING AND CHARACTERIZING THE CALICHEAMICIN SELF-RESISTANCE GENE IN *MICROMONOSPORA ECHINOSPORA*

Ross E. Whitwam^{1*}, Joachim Ahlert², Theodore. R. Holman³, Mark Ruppen³, and Jon S. Thorson², ¹Mississippi

University for Women, Columbus, MS 39701; ²Memorial Sloan-Kettering Cancer Center, New York, NY 10021; and ³Wyeth-Ayerst Research Division of American Home Products, Pearl River, NY 10965

Calicheamicin (CLM) is a DNA-binding and -cleaving enediyne antibiotic produced by the soil Actinomycete *Micromonospora echinospora* ssp. *calichensis*. While the oxidative mechanism by which CLM cleaves DNA is well understood, nothing is known of how *M. echinospora* synthesizes this architecturally complex compound or of how *M. echinospora* controls its reactive nature and toxic effects. Screening a cosmid library from *M. echinospora* revealed a clone resistant to high levels of CLM. Subcloning and screening localized CLM resistance to a single gene we have labeled *calC*. Expression, purification, and preliminary characterization of the corresponding protein as a maltose-binding protein fusion product reveals that CalC is a non-heme iron metalloprotein that can function *in vitro* to inhibit CLM-induced DNA cleavage.

10:15 Break

10:30 Divisional Poster Session

THE ECOLOGY AND MICROBIAL FLORA OF THE CARABID BEETLES

Monroe Parker* and Alfred Mikell, Alcorn State University, Alcorn State, MS 39096 and University of Mississippi, University, MS 38677

Ecology is the study of the relationship of organisms and their environments. In this research we examined three genera from the Carabid Family: the *Brachinus*, the Tiger Beetle, and the *Chalaenius*. These insects live near streams and rivers. Beetles eat mites and insect larvae. The Genus *Brachinus* is known as the Bombardier Beetle. When these small insects feel threatened, they release hydroquinone and hydrogen peroxide from a pair of glands in the tip of its abdomen. An inhibitor is also added to this mixture to keep the chemicals from exploding inside the beetle. When released all these chemicals are in the form of a gas. This mixture is very caustic from the number of reactive oxygen species generating during the course of this reaction. The focus of the study is to compare the bacteria found inside the intestinal flora of these beetles with the bacteria found on their surfaces. This comparison is necessary to determine if isolates from the Bombardier's spray are different and adapted to this extreme environment. Also, the anaerobic process and the effects of oxidative stress on these amazing creatures were examined. Oxidative stress can cause damage to a certain molecule or the entire organism. It

causes damage by reactive oxygen species. Once biochemical adaptations are established, they may well give us insights into coping with oxidative stress.

THE EFFECTS OF HEAVY METALS ON HYPER-THERMOPHILIC ARCHAEA

Patrick D. Williams^{1*}, Rafael Montalvo², and Paul Blum²,
¹Alcorn State University, Alcorn State, MS 39096-7500 and
²University of Nebraska-Lincoln, Lincoln, Nebraska 68588

Little is known about the effects of heavy metals on hyperthermophiles, specifically hyperthermophilic Archaea. This project is to compare two strains of *S. solfataricus* (98/2 and a natural isolate named CoSo 3) and a mutant. The mutant is a derivative of 98/2 with a 15 kb deletion. Inside the deletion is a putative heavy metal resistance gene. Studying the effects of cadmium and mercury toxicity will determine if the gene conveys resistance towards these two heavy metals. This experiment will also determine if these putative mercury and cadmium genes can be used as selectable markers on future genetic systems in *S. solfataricus*.

THE MEDICAL CONTRIBUTIONS OF THE BOMBARDIER BEETLE

Fameeka S. Jenkins* and Alfred Mikell, Alcorn State University, Alcorn State, MS 39096 and University of Mississippi, Oxford, MS 38677

Bombardier beetles are named for the explosive, caustic chemicals ejected from their abdomen. These chemicals represent a biochemically complex defense mechanism. The research explored the physiological aspects of the beetle's chemical defense mechanisms. The goal was to analyze the presence of bacteria in the abdomen of the Bombardier beetle. The hypothesis was that there may be an undiscovered species of bacteria that would lead to an advancement in medical knowledge. The discovery was hoped to provide further understanding of DNA agents and cancer mutations. Procedures in starting this process included the dissection of the beetle's abdominal-final glands and applications of sensitive techniques designed to detect the presence of bacteria. The determination of oxidative stress along with the tolerance level of heat were to be observed. Several trials were performed to compare the results and obtain conclusive data. Through the data obtained, the medical implications of the beetle's defense mechanism were to be determined.

EXPRESSION OF MUTANT P67 IN *E. COLI*

Quatrissa Douglas^{1*}, Rekha Datta², and Bansidhar Datta²,
¹Alcorn State University, Alcorn State, MS 39096 and
²University of Nebraska, Lincoln, NE 68588

The initiation of protein synthesis in mammals is

largely regulated at the level of phosphorylation of eukaryotic initiation factor-2 (eIF2). When phosphorylated by eIF2 kinases, it is inactive in protein synthesis initiation. P67, a cellular glycoprotein, protects eIF2 from phosphorylation by its kinases. Understanding the interaction between p67 and eIF2 will help to elucidate the detail mechanism of protection of eIF2 from phosphorylation. We introduced mutations at the putative active site of p67 and subcloned the mutant gene into an *E. coli* expression vector. Later, we wanted to isolate the mutant p67 protein and to study the interaction between eIF2 and p67 *in vitro*.

THE EFFECT OF MET-ENKEPHALIN AND RELATED PEPTIDES ON INTERLEUKIN-2 (IL-2) PRODUCTION

Corey Montgomery*, Natalia Gordonov, and Robert C. Sizemore, Alcorn State University, Alcorn State, MS 39096

This project will determine the effect of met-enkephalin, Tyr-Gly-Gly (YGG) and Tyr-Gly (YG) on the *in vitro* production of the cytokine, IL-2. Murine splenocytes placed in serum-free medium will be stimulated with concanavalin A with or without phorbol 12-myristate 13-acetate (PMA). Various concentrations of met-enkephalin, or the first two (YG) or three (YGG) amino acids of the enkephalins, will then be added to determine if the immune parameter (IL-2 production) is enhanced or suppressed. The amount of IL-2 in the tissue cultures will be measured by Enzyme-Linked Immunosorbent Assay (ELISA). These studies will help elucidate the relationship between the central nervous system and the immune system by examining the importance of endogenous peptides on the regulation of immune responses. Supported by NIH grant # 3 SO6 GM55356-02S1.

CLONING AND EXPRESSION OF TWO COTTON FIBER cDNAs ENCODING MYB-TYPE PROTEINS

Chuan-Yu Hsu^{1*}, Roy G. Creech¹, Johnnie N. Jenkins², and Din-Pow Ma¹,
¹Mississippi State University and
²USDA/ARS Crop Science Research Laboratory, Mississippi State, MS 39762

Plant MYB-type proteins contain DNA-binding domains which regulate both general and specific gene transcription. Two cotton cDNA clones (GhMYB1 and GhMYB2), which encoded MYB-like proteins, have been isolated from 15 DPA (days post anthesis) fiber mRNAs by using 5' and 3' RACEs (rapid amplification of cDNA ends). The derived amino acid sequences from these two full-length fiber *myb* cDNAs show that the basic N-terminal DNA-binding domains of cotton fiber MYBs are highly homologous to other plant MYB-type proteins. Based on the comparison of cDNA and genomic sequences, each of the two *myb* genes contains two introns located in the coding region of the gene. The expression patterns of these

two myb genes were studied by Northern blotting analysis using total RNA from different cotton tissues. The GhMYB1 and GhMYB2 cDNAs were cloned into an expression vector, pET-32b(+), and the expressed His-MYB fusion proteins were purified and used for DNA-binding studies.

CHARACTERIZATION OF AJUBA, A NOVEL LIM PROTEIN, BY PROTEIN-PROTEIN INTERACTION SCREENING

Dayle Houston^{1*}, Henry Outlaw¹, and Gregory D. Longmore², ¹Delta State University, Cleveland, MS 38733 and ²Washington University, ST. Louis, MO 63130

Ajuba is novel group 3 LIM protein along with zyxin, paxillin, trip6 and others. It is 55 kDa in size and is characterized by a proline-rich pre-LIM region containing two potential SH3 recognition sites, and three tandemly arranged LIM domains located at the c-terminus. So far, it has been determined that ajuba functions to stimulate MAP kinase activity, interact with Grb2 in a serum-dependent manner, and promote meiotic maturation in *Xenopus* oocytes. Its stimulation of MAP kinase activity is of interest because it occurs in serum-starved cells, indication that molecules besides Grb2 may aid in this function. Enhancement of MAP kinase activity has also been shown to be the mechanism by which ajuba promotes meiotic maturation. Ajuba has been found in tissues of adult mouse skin, nervous system, and genitourinary tract and all mouse embryonic germ layers. My work has been directed toward using the yeast two-hybrid selection system to screen a 9-day mouse embryo cDNA library for molecules that interact with ajuba. Though the screening is still in progress, two positive interactions have been identified: myosin Va and profilin.

BACTERIAL MOTILITY AND THE GENERAL SECRETORY PATHWAY

Yang Ruifeng*, Steven E. Passmore, and Donna L. Marykwas, University of Southern Mississippi, Hattiesburg, MS 39406

The bacterial motor protein FliM interacts with the General Secretory Pathway protein GspE in a two-hybrid screen for protein-protein interactions. FliM is required for flagellum assembly, but the role of the General Secretory Pathway in *Escherichia coli* is not known. To test the role of GspE in bacterial motility, the gene coding for GspE was deleted from *E. coli*. A mutant in which the gspE gene bore a large insertion was nonmotile, but when the insertion was resolved by homologous recombination to yield a deletion within gspE, this deletion mutant turned out to be motile. This suggests one possibility, that the insertion mutant could be polar, turning off the expression of genes

downstream of gspE in the same operon, and that one of these downstream genes is required for motility. However, there are two other chromosomal gene products in *E. coli* that are highly similar to GspE. This suggests a second possibility, that one of these GspE homologues (not GspE itself) is actually the one involved in motility, or a third possibility, that GspE and its homologues share redundant functions. To test these possibilities, we are constructing mutations (transposon insertions) within each of these three genes and in the neighboring genes of their respective operons. If the single gene knockouts all swim, we will construct each double mutant and the triple mutant and test their motility.

REPRODUCTIVE EFFECTS OF ESTROGENIC AND ANTIESTROGENIC CHEMICALS ON SHEEPSHEAD MINNOWS

Arthur Karels* and Marius Brouwer, University of Southern Mississippi, Institute of Marine Sciences Ocean Springs, MS 39566-7000

Accumulating scientific data suggests that many man-made chemicals, such as alkylphenols/PCBs, have potential to adversely affect the endocrine system of humans/wildlife. Some of these compounds have estrogenic/antiestrogenic effects, collectively they are called endocrine disrupting chemicals (EDCs). These compounds can activate genes of the reproductive system, such as endogenous vitellogenin (a precursor to egg yolk protein), by activating the estrogen receptor (ER). Since little is known about effects of environmental estrogens/antiestrogens on reproductive fitness of estuarine/marine fish, we exposed adult lab-reared male sheepshead minnows (*Cyprinodon variegatus*) to estrogenic 4-tert-octylphenol (OP) and females to antiestrogenic cadmium (Cd) in aquaria to examine 1) fecundity of F₀ generation, 2) embryonic development/egg hatching/survival rate of F₁ generation fry, 3) vitellogenin levels in male/female blood sera to determine correlation to adverse changes in reproductive function and 4) gonadal development. A similar 3 week field exposure was set up using cages near an outfall of a sewage treatment plant. Initial results appear to show that higher levels of exposure adversely affect fecundity. Vitellogenin/histological analysis are underway. In addition to reproductive studies, we have isolated an ER cDNA fragment from total RNA of gravid female fish livers, which will be used for cloning of complete ER cDNA for future bioassay development. Sequence of partial ER cDNA shows homology to related fish.

FUNCTION OF PROTEIN KINASE (PKB) GENE IN *DICTYOSTELIUM DISCOIDEUM*

Kesi L. Gaskin* and Alice M. Powell, Alcorn State University, Alcorn State, MS 39096

Dictyostelium discoideum (Dd) is a eukaryotic organism with a relatively simple life cycle that comprises a vegetative growth phase and a differentiation phase. Chemotaxis provides a means for microorganisms to respond to environmental gradients of potential nutrients and toxins. Usually, this phenomenon results in motility towards or away from substances. In this experiment, a small population assay was used to determine the effects of cAMP and folic acid on the chemotactic movement of Dd. Three different cell lines of *Dictyostelium discoideum* was used in this assay: AX-3 (wild-type), 2D2 (knockout), and Car1-/Car3-. Car1-/Car3- cells was used as the control. The cells were exposed to folic acid and cAMP for zero, ten, and twenty minute time intervals. With a concentration of one micrometer for cAMP and 100 micrometers for folic acid, we determined that the AX-3 cells and the 2D2 cells did not show very much movement towards the stimulus. However, due to the way the cells were set after each time limit, it was hard to tell which cells moved the greatest distance or if they moved at all.

THE EFFECT OF HEAT ON THE HEAT SHOCK RESPONSE OF INDUCED WOUNDS IN RATS

April Watson*, Leroy Johnson, and Alice M. Powell, Alcorn State University, Alcorn State, MS 39096

This study was to determine the effect of heat stress on the healing rate of induced wounds in rats. All wounds were superficial with uniformed lengths and depths. The outcomes of this study show an increased wound healing rate and a higher quality of wound heal. Animal studies (Riberro et al., 1995) have shown that the response is attributable to the elicitation of the "housekeeping" heat shock proteins. This research was an effort to examine the possible change in the total protein profiles using SDS-PAGE in heat treated animals. The increased or sudden appearance of new bands indicated possible heat shock protein response to the particular stress. Rat tissues were minced with sterile surgical blades and incubated in lysis buffer for thirty minutes on ice. The proteins were stored at -20°C and used as needed. Rats heat treated show an increase in the expressed profile of a total protein extract run on polyacrylamide gel electrophoresis. These proteins may not be chaperonins, but there is a correlation to the expression of these proteins and induction by heat stress.

THURSDAY AFTERNOON

Petit Bois

1:45 SIGNALING PATHWAYS INVOLVED IN SCATTER FACTOR-MEDIATED C-MET INDUCTION IN HUMAN GLIOBLASTOMA CELLS

Claretha Nichols^{1*}, Srikanth Ranganathan², Roger Abou-ader², and John Laterra², ¹University of Southern Mississippi, Hattiesburg, MS 39406-5043 and ²Johns Hopkins University School of Medicine, Baltimore, MD 21205

Scatter Factor (SF) is a multifunctional growth factor that exerts its action through its only receptor, the tyrosine kinase c-met. SF and c-met play a role in tumorigenesis and malignant progression of a wide variety of tumors, including human glioblastomas. SF and c-met expression in human gliomas correlate with tumor grade. Over-expression of SF in glioblastomas increases their malignancy, whereas; knock-down of SF/c-met expression inhibits glioblastoma growth in vivo and in vitro. C-met in glioblastomas is induced by SF. Parts of the signaling pathway involved in c-met induction by SF have previously been characterized by our lab. This study shows that Ras and AP-1 are also involved in the signaling pathway of c-met induction by SF.

2:00 DETERMINATION OF cDNA SEQUENCES OF TWO CADMIUM-INDUCIBLE AND ONE COPPER-SPECIFIC METALLOTHIONEIN IN THE BLUE CRAB, *CALLINECTES SAPIDUS*, AND THEIR POTENTIAL AS BIOINDICATORS OF TOXIC TRACE METALS

Rachel A. Syring*, Thea Hoexum-Brouwer, and Marius Brouwer, University of Southern Mississippi, Gulf Coast Research Laboratory, Ocean Springs, MS 39564

Copper is an essential metal which has the potential to be toxic, like cadmium and mercury, when occurring in excess. The blue crab, *Callinectes sapidus*, has two cadmium-inducible (CdMT-I and CdMT-II) and two copper-inducible (CuMT-I and CuMT-II) metallothionein (MT) isoforms comprising a mechanism of defense against metal-mediated oxidative damage. CdMT-I and CuMT-I are the same protein containing different metals, while CuMT-II is a unique, copperspecific isoform. The objective of this project was to determine the complementary DNA (cDNA) sequences of CdMT-I/CuMT-I, CdMT-II, and CuMT-II. The cDNA was isolated from hepatopancreas tissue of cadmium and copper exposed blue crabs using degenerate gene specific primers synthesized from the N-terminal amino acid sequence. The cDNA was PCR amplified using 3' Rapid Amplification of cDNA Ends (RACE), cloned, and sequenced. Upon 3' determination, reverse and complementary gene specific primers were synthesized and the 5' end was PCR amplified using 5'

RACE, cloned, and sequenced. The 3' and 5' sequences were combined to obtain the complete cDNA sequences. Alignment of the cDNA species indicates that each isoform is encoded by a distinct gene. CuMT-II appears to have evolved prior to the CdMTs in view of its greater similarity to molluscan MTs rather than other crustacean MTs.

2:15 EXPRESSION OF GLUTAMINYL CYCLASE IN *DROSOPHILA MELANOGASTER* SCHNEIDER 2 CELLS

Rachell E. Booth*, Eric Williams, and Robert C. Bateman, Jr., University of Southern Mississippi, Hattiesburg, MS 39406

Glutaminyl cyclase converts an N-terminal glutamine to pyroglutamic acid to biologically activate many proteins and peptides. It has previously been expressed in several *Escherichia coli* systems; however, production of the protein is not sufficient enough for x-ray crystallization studies. A *Drosophila* Expression System (DES) was used for the expression of glutaminyl cyclase (QC). PCR primers were designed to amplify the QC coding region including the signal sequence. Following analysis by gel electrophoresis, the PCR product was cloned into the pMT/V5-His-TOPO vector. The insert and flanking vector regions were sequenced for confirmation. This vector was then transformed into *Drosophila* Schneider 2 (S2) cells. After induction of the metallothionein promoter with copper sulfate, the protein will be purified from the cells using anion-exchange chromatography. Finally, a stable cell line will be generated from cotransfection of this QC expression vector and a selection vector, pCoHYGRO. The cell line will produce the milligram amounts of protein needed for x-ray crystallization studies.

2:30 FUNDAMENTAL MECHANISMS OF JANUS KINASE ACTIVATION AND INACTIVATION

Roy J. Duhe, University of Mississippi Medical Center, Jackson, MS 39216

Janus protein-tyrosine kinases (JAKs) serve as essential early mediators of cytokine-initiated signal transduction. Precise control of the amplitude and duration of JAK catalytic activity is crucial for regulating normal physiological responses; hyper- or hypo-activation of JAKs can result in leukemias or in immunosuppressive disorders, respectively. I will describe the research I conducted at the National Cancer Institute—Frederick Cancer Research and Development Center to elucidate two independent mechanisms of JAK regulation. My lab will continue to investigate the molecular foundations of both the autoinhibitory and the redox-regulated mechanisms of controlling JAK activity. Ongoing efforts to improve the speed and quantitative accuracy of assays for JAK activity

may not only help to better define the role of JAK dysregulation in disease etiology, but also help to rapidly screen candidate drugs for disease therapy.

2:45 Break

3:00 ISOLATION AND CHARACTERIZATION OF A COTTON FIBER cDNA ENCODING A AUX/IAA PROTEIN

Shaohua Yu^{1*}, Johnnie N. Jenkins², Roy G. Creech¹, and Din-Pow Ma¹, ¹Mississippi State University, and ²USDA/ARS, Crop Science Research Laboratory, Mississippi State, MS 39762

Auxin is an important phytohormone which controls cotton fiber development and differentiation. The auxin-inducible Aux/IAA gene family, a group of early auxin-response genes, have been shown to be essential in auxin signaling. Based on the conserved peptide sequences of AUX/IAA proteins, QVVGWP and WMLVGDVPW, two sets of oligonucleotides were synthesized and used as PCR primers to amplify cDNAs synthesized from 15 DPA (days postanthesis) fiber mRNAs. The amplified PCR products (~350 bp) were cloned into the pGEM-T easy vector and sequenced. Sequencing data verified that these PCR products are cDNAs encoding parts of AUX/IAA proteins. Additional primers based on the partial IAA cDNA sequences were then synthesized and used in 5' and 3' RACEs (rapid amplification of cDNA ends) to clone the full length cDNAs. The derived amino acid sequence from a full-length IAA cDNA revealed the encoded AUX/IAA protein consists of four highly conserved domains (domains I, II, III, and IV). Domain III contains an amphipathic $\alpha\alpha\alpha$ -fold, found in α -ribbon DNA-binding domains of prokaryotic repressor proteins.

3:15 CLONING OF THE cDNA FOR THE 68 KDA DNA BINDING PROTEIN OF *GLYCINE MAX* CHLOROPLAST NUCLEOIDS

Mignon A. Keaton*, Cecilia Chi-Ham, Gordon C. Cannon, and Sabine Heinhorst, University of Southern Mississippi, Hattiesburg, MS 39406

Chloroplast DNA (ctDNA) is compacted by association with various proteins into structures called nucleoids. Nucleoid structure varies during development from proplastids into mature chloroplasts, suggesting that it plays a role in the regulation of DNA replication and transcription of ctDNA. Identifying the function of the proteins that are associated with nucleoids may lead to a better understanding of these processes. Previously, a 68 kDa protein had been isolated from chloroplast nucleoids of *Glycine max* that shows DNA compaction in vitro. The N-terminal 15 amino acids showed homology with several

ferredoxin sulfite reductases of higher plants. These enzymes reduce sulfite possibly for sulfur assimilation in cysteine biosynthesis. This sequence was used to design degenerate primers for reverse transcription of soybean RNA and PCR amplification of the cDNA. A complete cDNA clone will provide insights into structure, function, expression patterns and possible post-translational modifications of the protein, and will allow creation of antisense and over expressing transgenic *Arabidopsis* lines.

3:30 CLONING AND CHARACTERIZATION OF CANINE-LIVER UDP-GLUCURONOSYL TRANSFERASES

Bernita M. Finley* and Christopher King, Alcorn State University, Alcorn State, MS 39096 and Merck Pharmaceuticals, Rahway, NJ 08817

Dog liver microsomes contain UDP-glucuronosyl transferases which are important in detoxifying many endogenous and exogenous compounds such as morphine, bilirubin, and estradiol. Studies were designed to isolate and clone a UGT-specific gene from canine liver, using an antibody and/or an oligonucleotide probe. Many positive plaques were seen, and they are being isolated. Secondly, another study was done to reveal substrates involved in glucuronidation in dog liver microsomes. Using glucuronidation assays, a significant amount of morphine and estradiol glucuronide was seen. UGT assays reveal that dog liver microsomes metabolizes morphine to morphine-3-O glucuronide as well as morphine-6-O glucuronide to most potent form of morphine. Lastly, western analysis show that UGT1A1, -2B7, and -1A6 are UGT like isoform may be present in dog liver microsomes. These studies suggest that dog have similar UGT-isoforms to rat and human.

3:45 ISOLATION OF AN INSULIN-LIKE GROWTH FACTOR-I (IGF-I) COMPLEMENTARY DNA FROM CHANNEL CATFISH (*ICTALURUS PUNCTATUS*)

L.A. Clay^{1,2*}, G.C. Waldbieser², and S.Y. Wang¹, ¹University of Southern Mississippi, Hattiesburg, MS 39406 and ²U.S. Department of Agriculture-ARS, Stoneville, MS 38776

Insulin-like growth factor-I (IGF-I), previously known as somatomedin C, has been shown to be essential for normal development and growth in several species. This gene encodes a single chain 70-residue basic peptide with 3 intra-chain disulfide bridges. IGF-I is produced in the liver, brain and other tissues, and is considered to be the principal mediator of growth hormone action on growth and development. In order to better understand the endocrine regulation of growth in catfish, we have cloned and sequenced a 516 bp IGF-I cDNA in channel catfish.

We constructed degenerate primers based upon mammalian and fish IGF-I amino acid sequence and used this information to amplify channel catfish IGF-I via 3'- and 5'-Rapid Amplification of cDNA Ends (RACE). Several clones were obtained from total RNA from adult liver and brain. A partial open reading frame in the cDNA encoded 109 amino acids of channel catfish IGF-I which shared 91% identity with the common carp amino acid sequence. Results from this study will be utilized to determine tissue- and developmental stage-specific levels of expression in channel catfish in order to assess the role of IGF-I in catfish growth.

4:00 TRANSFECTION STUDIES WITH A CANDIDATE HUMAN IMIDAZOLINE RECEPTOR cDNA

Michael Chen*, Mary Elise Lutrick, He Zhu, James Baldwin, Victor Stuckey, and John Piletz, University of Mississippi Medical Center, Jackson, MS 39216

Imidazoline receptors (IR) are involved in blood pressure and stress responses from brain nuclei. We have previously cloned a candidate IR₁ cDNA by screening from a human hippocampal cDNA expression library with two IR-selective antisera (*J. Autonomic Nervous System*, 72: 98-110, 1998; *DNA and Cell Biology*, submitted). That cDNA, designated imidazoline receptor antisera-selected (*iras-1*) cDNA, contains 5,131 bp and is predicted to encode a 167 kDal protein. Transfection of *iras-1* cDNA into CHO (Chinese hamster ovary) cells results in a three-fold increase in the B_{max} of [¹²⁵I]-*p*-iodoclonidine for I₁ sites; with a high-affinity component revealed only in transfected CHO cells for the I₁ ligands, moxonidine and rilmenidine. In PC-12 (phaeochromocytoma) cells, over 80 stably-transfected subclones were screened both by Western blotting and PCR, and six of these showed at least a two-fold increase in I₁ B_{max} values. Transfected CHO and PC-12 cells showed a 167 kDal band as well as smaller bands (~85 kDal) on Western blots. On the other hand, transient transfections into COS-7 and Sf9 cells failed to result in an increase in I₁ binding sites, even though there was an abundance of the ~167 kDal protein made. To determine if there is any possible interaction between I₁ sites and alpha_{2A} adrenergic sites, CHO cells stably transfected with the human alpha_{2A} adrenergic receptor cDNA were transiently transfected with *iras-1*. These cells produced both alpha_{2A} and I₁ receptors (immunologically) with the appropriate binding sites observed, and the results provide support for studies aimed at characterizing the pharmacological and functional interactions between alpha₂-adrenergic and I₁ receptors. Supported by NIMH grant NM49248-06 and grants from Eli Lilly and Solvay Pharmaceutical

Companies.

FRIDAY MORNING

Petit Bois

9:00 **UVA LIGHT-INDUCED FORMATION OF DNA COVALENT ADDUCTS AND DNA SINGLE STRANDED CLEAVAGE BY 1-HYDROXY-PYRENE**

Shiming Dong*, Laketa Halloway, Huey-Min Hwang, Xiaochun Shi, and Hongtao Yu*, Jackson State University, Jackson, MS 39217

This research examines the light-induced damages to DNA by 1-hydroxypyrene (HOP). HOP is often found in the urine of human or animals exposed to polycyclic aromatic hydrocarbons (PAHs) and it is an important biomarker for studying PAH exposure. It has shown that HOP is both acute toxic and genotoxic. In this research we found that upon UVA light irradiation, HOP causes DNA single strand cleavages and forms HOP-DNA covalent adducts. The UVA light-induced cleavage of the supercoiled plasmid ϕ X 174 DNA is dependent upon both HOP concentration and UVA dosage. Longer irradiation time or higher HOP concentration induces more DNA cleavage. The DNA cleavage results done in the presence of reactive oxygen species scavengers indicate that superoxide free radical and singlet oxygen are both likely involved in causing DNA cleavages. The photocleavage is inhibited by the presence of an excited singlet state quencher, KI, indicating that it is an excited state reaction. Along with light-induced DNA cleavage, HOP also forms DNA covalent adducts efficiently while being degraded. Light-induced degradation of 20 mM HOP follows a first order reaction kinetics in 10% methanolic buffer (10 mM phosphate) solution in the absence or presence of 100 mM ct-DNA, with degradation half-lives of 20 min or 27 min, respectively. The longer degradation half-life in the presence of DNA is due to the formation of HOP-DNA covalent adduct which is light stable. The formation of the HOP-DNA covalent adduct is evidenced by comparing the UV-Vis spectra of the irradiated HOP/DNA solution before and after dialysis. While HOP from a non-irradiated solution containing HOP and DNA diffuses freely out of the dialysis membrane, the HOP from the irradiated sample remained in the membrane, indicating that the HOP is covalently bound to DNA that cannot diffuse out of the membrane. Acknowledgements: This research is supported by the National Institutes of Health through generous grants: NIH-RCMI 1G12RR12459-01 and NIH-MBRS S06GM08047.

9:15 **ISOLATION OF A CATALYTIC RNA CAPABLE OF COENZYME SYNTHESIS**

Wally Bugg* and Faqing Huang, University of Southern Mississippi, Hattiesburg, MS 39406-5043

Coenzymes, such as coenzyme A (CoA), nicotinamide adenine dinucleotide (NAD), and flavin adenine dinucleotide (FAD), play important roles in the metabolism of modern organisms. These coenzymes have the same biosynthetic pathways and the same functions among drastically different organisms, from bacteria to humans. Therefore, they must have been present in the last common ancestor. The presence of a ribonucleotide adenosine in these chemically complex coenzymes suggests that they might have arisen in a pre-protein world the so-called RNA world. In order to demonstrate the ability of RNA to catalyze the synthesis of coenzymes from their precursors, catalytic RNA is being isolated by powerful *in vitro* selection/amplification techniques from a pool of random RNA sequences. After 12 rounds of selection/amplification, the resulting RNA has been shown to synthesize a variety of RNA-linked molecular structures, including coenzymes NAD and FAD. The demonstration of RNA catalysts to synthesize coenzymes strongly supports that coenzymes are ancient molecules, which might have existed before the first protein was made.

9:30 **CHARACTERIZATION OF A COENZYME-SYNTHESIZING RIBOZYME**

Shannon Williams* and Faqing Huang, University of Southern Mississippi, Hattiesburg, MS 39406-5043

Coenzymes are essential molecules for cell functioning. For example, the three most common coenzymes, coenzymes A (CoA), nicotinamide adenine dinucleotide (NAD), and flavin adenine dinucleotide (FAD), participate in numerous biochemical reactions. To understand the origin and evolution of these coenzymes, we have isolated, by *in vitro* selection and amplification techniques, RNA catalysts that synthesize the coenzymes from their corresponding precursors. The RNA has been cloned and sequenced. The RNA-synthesized coenzyme product has been identified by enzymatic digestion, chromatography, and mass spectroscopy. In order to understand the RNA activity, structure characterization of the isolated RNA is being carried out. Further studies of the kinetics are also being investigated. Reaction rates under different conditions, such as pH, temperature, metal ion concentrations, and substrate concentrations are being measured in order to understand the nature of RNA-catalyzed synthesis of coenzymes.

9:45 **ESSENTIAL RESIDUES IN GLUTAMINYL CYCLASE**

Stephanie A. Misquitta*, Jeffrey Temple, Robert C. Bateman, Jr., University of Southern Mississippi, Hattiesburg, MS 39406-5043

Glutaminyl cyclase catalyses the conversion of N-terminal glutamine to pyroglutamic acid in certain peptide hormones, and neurotransmitters. In order to understand the mechanism of enzyme action, it is necessary to determine the residues involved in catalysis. DEPC inactivation of the recombinant enzyme showed that histidine is an important residue for catalysis. Sequence alignment showed eleven histidine residues that are conserved. The histidines at positions 140, 307, 319 and 330 were mutated. Kinetic studies indicate that the K_m and V_{max} for His307 and His319 are similar. The K_m of these two mutants is higher than that for the native human enzyme, indicating that these residues are important for substrate binding. The K_m for His330 was lower, indicating that His 330 does not play such an important role in substrate binding while the His140 was totally inactive indicating that it is an important residue for catalysis.

10:00 Break

10:15 SOYBEAN CHLOROPLAST NUCLEOID PROTEINS AND THEIR INTERACTIONS WITH DNA

Cecilia Chi-Ham*, Gordon C. Cannon, and Sabine Heinrich, University of Southern Mississippi, Hattiesburg, MS 39406-5043

Chloroplast DNA is organized by DNA-binding proteins into complexes called nucleoids. Plastid nucleoid structure and protein composition vary during the development of proplastids to chloroplasts, suggesting that genome packaging may play a crucial role in the regulation of replication, transcription, and recombination. In an effort to understand the role plastid nucleoid proteins play in determining nucleoid structure and its effect on gene expression and development of the organelle, we have purified several nucleoid proteins. One plastid nucleoid protein (DCP68) can associate with DNA into a form that does not support DNA replication *in vitro*. The amino terminal sequence of the purified DCP68 shows homology to ferredoxin-dependent sulfite reductases from *Arabidopsis thaliana*, *Zea mays*, and *Nicotiana tabacum*. We are currently studying the interaction of DCP68 with DNA and with other nucleoid proteins in order to obtain a better understanding of the role this protein plays in determining nucleoid structure and function.

10:30 SELF-ASSEMBLY OF THE SC3 HYDROPHOBIN PROTEIN

J. Shawn Goodwin*, Charles L. McCormick, and Gordon C. Cannon, University of Southern Mississippi, Hattiesburg, MS 39406-5043

The Sc3 hydrophobin protein from *Schizophyllum commune* self-assembles in an aqueous environment to form vesicles with hydrophobic interior and hydrophilic exterior surfaces. We are studying the protein's ability to entrap a hydrophobic material from an aqueous environment into stable vesicles and the mechanism by which this occurs. Utilizing a radiolabeled ^{14}C -hexadecane sequestration assay, we are able to quantify the amount of hydrophobic material that can be removed from an aqueous environment by hydrophobin. Epifluorescence microscopy studies using Nile Red, calcein, and Marina Blue confirm that hydrophobic molecules are within Sc3 hydrophobin protein vesicles. Insight into the mechanism of hydrophobin protein self-assembly can be determined using circular dichroism and fluorescence spectroscopy.

10:45 STRUCTURAL CHARACTERIZATION OF A SELF-CAPPING RNA CATALYST

Ping Zhang* and Faqing Huang, University of Southern Mississippi, Hattiesburg, MS 39406-5043

A previously isolated RNA catalyst, named Iso6, has multiple catalytic functions, such as RNA capping, phosphoryl coupling, pyrophosphatase, decapping, and cap-exchange activities. Among the known ribozymes, Iso6 RNA possesses many unique properties, such as multifunction, specific GTP binding site, Ca^{2+} as the metal cofactor, and binding multiple small-molecule substrates and building larger products from them, etc. These unusual properties of Iso6 RNA coupled with its biological and evolutionary relevance, well established reaction center at its 5 alpha phosphate, makes it an excellent model system to study RNA structure-function relationship and mechanism of RNA catalysis. We are currently investigating the structural elements of the RNA that are essential for its functions. By using substrate-linked probes, such as EDTA and photo-crosslinking reagents, we hope to define the RNA sequence that constitutes the substrate binding site as well as the metal ion binding site. The results will enhance our understanding of RNA-substrate-metal ion interactions and RNA catalysis in general.

11:00 Divisional Business Meeting and Presentation of Awards

**CHEMISTRY AND
CHEMICAL ENGINEERING**

Chair: Ken S. Lee, Jackson State University
Vicechair: Lovell E. Agwaramgbo, Tougaloo College

THURSDAY MORNING

Emerald Room

9:00 THE INVESTIGATION OF SODIUM L-ACYL-N-GLUTAMATE / CATIONIC CELLULOSE INTERACTION

Naoya Yamato^{1*}, Rebecca Boudreaux², and Robert Y. Lochhead², ¹AminoScience Laboratories Ajinomoto Co., Inc., Kanagawa 210-8681 Japan and ²University of Southern Mississippi Hattiesburg, MS 39406

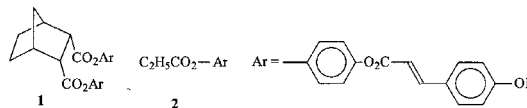
The interaction of Cationic Cellulose with anionic surfactants has been well documented. The objective of this study was to investigate the interaction of Cationic Cellulose with sodium L-Acyl-N-Glutamate. Phase diagrams were constructed to examine the interactions in the concentrated surfactant regime. The Cationic Cellulose reduced the range of the clear composition and this is attributed to the crystallization of the surfactant due to osmotic competition for water. Phase diagrams were prepared at low concentration, in the region of the surfactant's cmc. A complex precipitated in the vicinity of the cmc but redissolved at higher surfactant concentrations. Surface tension measurement indicates that below a certain surfactant concentration, no binding to polymer occurs, but at a critical concentration there is an exceptional uptake of surfactant by polymer, followed by plateau region.

9:15 SOLVENT EFFECTS ON THE PHOTOPHYSICS OF MODEL ARYL CINNAMATE CHROMOPHORES

Rabih O. Al-Kaysi* and David Creed, University of Southern Mississippi, Hattiesburg MS 39406-5043

Several compounds were synthesized to model the aggregation properties of liquid crystalline polymers in which aryl cinnamates act as both chromophores and mesogens. Model compounds such as 1 have two aryl cinnamate chromophores attached to a rigid norbornane skeleton. The orientation of these chromophores with respect to one another can be determined or estimated. Model compound 2 is a reference chromophore for 1. The UV-VIS spectrum of compound 2 in hexane has a $\epsilon_{\max} = 289$ nm. Addition of 1 % ethanol shifts the ϵ_{\max} to 312 nm. This behavior suggests aggregation of 2, through hydrogen bonding, which perturbs the UV-VIS spectrum. Addition of

ethanol presumably disrupts hydrogen bonded dimers. We were not able to obtain the spectrum of compound 1 in hexane due to its very low solubility. It has $\epsilon_{\max} = 310$ nm in chloroform and 318 nm in ethanol.



9:30 THE EFFECTS OF GRAVITY ON POLYMERIC FOAMS PRODUCED THROUGH FREE-RADICAL FRONTAL POLYMERIZATION: RESULTS FROM THE NASA REDUCED GRAVITY STUDENT FLIGHT OPPORTUNITIES PROGRAM

William J. Ainsworth*, Vinh V. Nguyen, James R. Warren, Paulin N. Wahjudi, Monique Kendrick, Felicia Stewart, and John A. Pojman, University of Southern Mississippi, Hattiesburg, MS 39406

Through the use of frontal polymerization, a new process has been developed for the production of polymeric foams. The addition of a low-boiling point blowing agent to a frontal polymerization system at constant pressure results in the production of a polymeric foam. This process utilizes the thermal energy produced by the forming polymer to cause the blowing agent to be vaporized behind the front to produce bubbles, which become trapped in the forming polymer. To investigate the effects of gravity on polymeric foams produced through this method, experiments were performed aboard the NASA KC-135A reduced gravity aircraft. Changes in foam density, front velocity, bubble size, and bubble distribution were examined and compared to the results from ground based experiments.

9:45 PHASE BEHAVIOR OF HYDROPHOBICALLY MODIFIED POLYELECTROLYTE/SURFACTANT SYSTEMS

Rebecca Boudreaux*, Stacey V. Maggio, and Robert Y. Lochhead, University of Southern Mississippi, Hattiesburg, MS 39406

The properties of polymer-surfactant solutions are governed by a fine balance between hydrophobic, hydrophilic, and ionic interactions. It is expected that the control of the hydrophobic and ionic character of a given system will allow for the precise control of desired liquid crystalline phase behavior. This research is aimed at the control of hydrophobic and ionic character through the use of hydrophobically modified polyvinylamine (HMPVAm) which allows for the precise control of hydrophobic content and charge density. By controlling ratios of hydrophobic content and charge density, it is expected that the fine-

tuning of desired liquid crystalline phases can be achieved. Binary phase diagrams were constructed for three polymer systems: unmodified polyvinylamine, HMPVAm-0.4%, and HMPVAm-0.8%. An induced hexagonal phase in dodecyltrimethyl ammonium bromide (DTAB) was observed for all of the polymer systems as polymer concentration increased. The hexagonal phase appeared at lower surfactant concentrations as the pH increased in the presence of unmodified polyvinylamine. It is proposed that the induced phase behavior is due to an osmotic competition for solvent rather than direct polymer-surfactant interactions. The control of liquid crystalline phase behavior is achieved in this study by altering pH, degree of hydrophobic modification, and surfactant concentration.

10:00 THE EFFECTIVE INTERFACIAL TENSION IN MISCIBLE FLUIDS

Vitaly Volpert¹, Thierry Dumont¹, Yuri A. Chekanov², Jonathan Masere², and John A. Pojman², ¹Université Lyon I, 69622, Villeurbanne Cedex, France and ²University of Southern Mississippi, Hattiesburg, MS 39406

Using the concept of the Korteweg stresses induced by concentration and temperature gradients, we show with numerical simulations that convection should occur in miscible systems with sharp but non-uniform concentration gradients, analogous to Surface-Tension Induced Convection in immiscible fluid layers. We attempted to observe such convection in low *g* caused by radial concentration gradients in propagating fronts of benzyl acrylate and hexyl acrylate polymerization but found that the variations in the acceleration were too large. However, studying model systems of glycerin in water showed that on the time scale of seconds, miscible and immiscible fluids are indistinguishable.

10:15 Break

10:30 INFLUENCE OF THE TYPE OF HYDROPHOBE ON THE ASSOCIATION BEHAVIOR OF HYDROPHOBICALLY MODIFIED CATIONIC POLYMER

Nad'a Spišáková*, Robert Y. Lochhead, and Stacey V. Maggio, University of Southern Mississippi, Hattiesburg, MS 39406

A complex association behavior of hydrophobically modified polyvinylamine was investigated. Understanding of the behavior of a model synthetic polymer can be very useful in applying to more complicated biological systems, where self-association is very common. The polyvinylamines modified to different degree with bulky and linear-alkyl chain hydrophobes were synthesized.

The synthetic route comprised the synthesis of polyvinylformamide, the hydrolysis to polyvinylamine and finally the hydrophobic modification of polyvinylamine. The polymers were characterized via NMR and static light scattering. Their behavior in water was studied by means of pyrene fluorescence spectrometry and rheology. It was shown that at 0.8 mol % of hydrophobes on the polymer backbone, the linear hydrophobes caused strong intermolecular associations, due to which the viscosity of the solutions rose substantially. The effect of bulky hydrophobes differed in extent compared to linear hydrophobe. The formation of micelles in each case was proved by the changes in the pyrene emission spectrum-finger print region. The influence of the net charge on the solution behavior by variation of the pH is also shown.

10:45 PHOTOCHEMISTRY AND PHOTOPHYSICS OF A SIDE-CHAIN LIQUID CRYSTALLINE POLYMER

Alline P. Somlai* and David Creed, University of Southern Mississippi, Hattiesburg, MS 39406

A *trans*-4,4'-dialkoxystilbene containing liquid crystalline polymer having nematic and smectic phases has been irradiated as an "as cast" film, as an annealed film, and in solution. The occurrence of 2+2 photocycloaddition of the stilbene moiety upon irradiation of the films at 313 nm is seen by the decrease in the stilbene absorption above 300 nm and the appearance of a cycloadduct absorption band at 280 nm. Some stilbene-like absorption is regenerated when the 313 nm irradiated 'as cast' film is subsequently irradiated at 254 nm. This apparent photoreversibility is not observed with the annealed film. In solution, irradiation of the polymer at 366 nm and 313 nm induces 2+2 cycloadduct formation. It is necessary to perform all experiments under N₂ to avoid formation of other photoproducts. The fluorescence quantum yield of the polymer was estimated using the standard, *trans*-stilbene, with a literature value of 0.05. The polymer and standard have roughly the same quantum yield in CHCl₃.

11:00 PREPARATION OF POLYMER MATERIALS VIA FRONTAL POLYMERIZATION

Yuri A. Chekanov*, and John A. Pojman, University of Southern Mississippi, Hattiesburg, MS 39406

Frontal polymerization is a self-sustaining process in which a localized reaction zone or front propagates through a monomer converting it to the polymer. High exothermicity of the polymerization reaction and Arrhenius dependence for the polymerization rate are the most important requirements for a monomer to support a front. The formation of polymer material was accomplished by ascending frontal polymerization in a cylindrical reactor. It

was realized by continuous fed of liquid monomer on the top of the front. This approach offers an excellent opportunity to create any type of gradient in the polymer by simply changing the composition of the monomer feedstream. A range of surface velocities supporting front can exist for the ascending mode, which we call its dynamic range. The dynamic range for tri(ethylene glycol) dimethacrylate cured with tricaprilmethylammonium persulfate initiator was determined experimentally. Polymer samples with hyperbolic gradient of dye were prepared by the method developed as promising materials for optical limiters.

11:15 FLUORESCENCE STUDY OF ASSOCIATION BEHAVIOR OF HYDROPHOBICALLY MODIFIED CATIONIC POLYMER IN WATER

David A. Presken*, Robert Y. Lochhead, Nad'a Spišáková, and Stacey V. Maggio, University of Southern Mississippi, Hattiesburg, MS 39406

Association behavior of polymers can be influenced by many factors. The knowledge of Their relationship gives us valuable tool for designing industrial applications. Fluorescence technique was used to characterize the association behavior of hydrophobically modified polyvinylamine. This molecule is a model for self-associating behavior based on charge-charge repulsion and hydrophobic interaction. The polyvinylamine bearing 0.8 mol% of bulky hydrophobe was studied. Its behavior is compared to polyvinylamine hydrophobically modified with C12 linear alkyl chain, which was reported previously. The polymers were characterized via NMR and static light scattering. The formation of micelles in each case was proved by the changes in the pyrene emission spectrum-finger print region. As pyrene experiences hydrophobic environment, its ratio of the peak intensity at ca. 373 nm and at ca. 383 nm decreases. At 0.8 mol% of hydrophobes on the polymer backbone, the linear hydrophobes caused strong intermolecular associations, which could be seen on the high apparent viscosity of the solutions. However, fluorescence technique cannot estimate the portion of inter vs. intramolecular associations. The influence of the net charge on the micelle formation by variation of the pH is documented.

11:30 INVESTIGATIONS OF EXPANDING SPHERICAL FRONTS

John A. Pojman and Marcus Molden*, University of Southern Mississippi, Hattiesburg, MS 39406

The expansion of spherical fronts of a frontal polymerization system in which spin modes migrate around the front as it propagates is under investigation. Frontal polymerization involves the conversion of a monomer into

polymer via a localized reaction zone that propagates. For this study, reaction solutions consisting of dimethylsulfoxide (DMSO), pentaerythritol triacrylate (PET3A) monomer, and ammonium persulfate as initiator were used. The purpose of this study is to determine the behavior of fronts as they propagate from the center of a sphere outwards. To prevent sedimentation of the polymer during the reaction, Cab-O-Sil, ultra-fine silica gel, has to be added to the reaction solution to make it more viscous. Photoinitiation, a less invasive approach than thermal initiation, is used. A photoinitiator, Irgacure 184, is injected at the desired initiation site and by shining UV light, initiation of the reaction is achieved.

11:45 Divisional Business Meeting

THURSDAY AFTERNOON

Emerald Room

2:00 PLATINUM (II) VS. PALLADIUM (II): A DFT STUDY OF INTERACTION WITH GUANINE
Glake A. Hill, Jr.*, Alexander Pelmenschikov, and Jerzy Leszczynski, Jackson State University, Jackson, MS 39217

Cisplatin (cis-[Pt(NH₃)₂]²⁺) is one of the most widely used antitumor drugs. Although it has been studied in great detail, the mechanism of its antitumor activity is not yet completely understood. Our goal was to compare the binding properties of Cis-[Pt(NH₃)₂]²⁺ and Cis [Pd(NH₃)₂]²⁺ with respect to DNA bases. Using molecular models (structures 1 and 2) we have found that the two metals, and their subsequent compounds, are close in binding properties and induce analogous conformation changes in DNA. Our results allow for the conclusion that similar metals can act as adequate and maybe superior substitute for platinum.

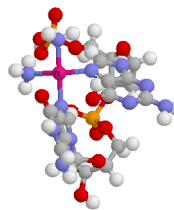


Figure 1

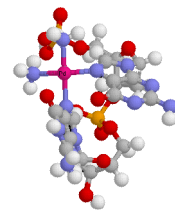


Figure 2

Platinum with Bound DNA

Palladium with Bound DNA

2:15 ANOMALIES IN THE LIQUID CHROMATOGRAPHY OF AMINES USING SULFATED BETA-CYCLODEXTRIN AS A CHIRAL SELECTOR

J.C. Strawbridge*, Kenneth McMurtrey, and J.G. McCoy, University of Southern Mississippi, Hattiesburg, MS 39406

Racemic DOPA, salsolinol (SAL), 1-carboxysalsolinol (1-CSAL), and cis-3-carboxysalsolinol (3-CSAL) were chromatographed using a conventional C18 reversed phase LC column. The mobile phases used included aqueous solutions with and without the chiral selector sulfated β -cyclodextrin (S- β -CD) and the ion pairing agent sodium heptyl sulfate (SHS). Analyses were conducted at temperatures from 0°C to 35°C to determine changes in enthalpies and entropies of retention. S- β -CD appears to be an excellent chiral selector for all of the studied enantiomers, except those of 1-CSAL, which separates slightly only at 0°C. During these mobile phase and temperature dependence studies anomalies were present. Van't Hoff plots of $\ln(k')$ vs. $1/T$ are linear between 0°C and 13°C, and again between 17°C and 35°C. Between 13°C and 17°C, a dramatic change in slope occurs. Enthalpy and entropy changes appear to be roughly constant irrespective of which mobile phase is used, and are taken to indicate conformational changes in the column's packing material. When using mobile phases containing SHS, a triplet peak was obtained for L-3-CSAL at 5°C. No other compounds, even D-3-CSAL, exhibited this behavior.

2:30 SEQUESTERING METAL IONS ONTO TIRE DERIVED PARTICLES

Eric R. Smith* and David L. Wertz, University of Southern Mississippi, Hattiesburg, MS 39406

Tire derived particles [tdp] from the WOMBAT process were mixed with samples of six aqueous solutions containing different dissolved metal ions. After one week, the tdp samples were collected from the solutions by gravity filtration and dried. X-ray fluorescence spectroscopy was run on each of the samples to determine its components. The purpose of the experiment is to determine if the tdp sequesters metal ions from the solutions. The X-ray spectrum shows a K-alpha and K-Beta peak for a metal ion such as copper if it is present in the sample. Attempts to remove the sequestered ions from the tdp by washing with water have been undertaken.

2:45 X-RAY CHARACTERIZATION OF POTENTIALLY AUXETIC LIQUID CRYSTALLINE ELASTOMERS

Chad J. Booth* and A.C. Griffin, University of Southern Mississippi, Hattiesburg, MS 39406-5043

While almost all known materials expand laterally when stretched, auxetic materials are those that contract laterally when stretched. The liquid crystalline (LC) materials examined in this study are composed of both terminally and laterally attached (transverse) rigid rods.

These laterally attached rods rotate when stretched potentially causing an auxetic effect. Wide angle x-ray scattering (WAXS) is an excellent method to probe the interchain distance change upon stretching. Previously we have shown in similar linear LC systems that contain a transverse rod that upon stretching there is an increase in interchain distance. On the contrary, the elastomeric systems discussed in this paper seem to support Warner and Terentjev's theory of soft elasticity in that, there is no change in interchain distance even to 400% extension. We wish to thank the NSF (DMR-9420843) for support of this work.

3:00 Break

3:15 ELECTRODEPOSITION OF COPPER/NICKEL ALLOYS AND OXIDES FROM THE TETRA-NUCLEAR $(Y_4-O)\{N,N\text{-DIETHYLNICOTINAMIDE}\}_4Cu_{4-x}(Ni(H_2O))_xCl_6$ ($x = 0-4$) COMPLEXES. SURFACE AND ELECTROCHEMICAL CHARACTERIZATION

Bizuneh Workie, Jackson State University, Jackson, MS 39211

Potentiostatic hydrodynamic electrodeposition at a Pt electrode form the heterotetranuclear complexes $(Y_4-O)(denc)_4Cu_{4-x}(Ni(H_2O))_xCl_6$ ($denc = N,N$ -diethylnicotinamide and $x = 0-4$) in 0.20 M tetrabutylammonium hexafluorophosphate/dimethyl sulfoxide results in a well adhering, continuous and microscopically rough surfaces. The potential necessary for the deposition is essentially the same for all complexes. Energy dispersive x-ray (EDS) study of the deposited films shows that the CuNi atomic ratio is the same as the metal stoichiometry of the complexes. X-ray diffraction (XRD) analysis reveals that the films deposited from the $(Y_4-O)(denc)_4Cu_{4-x}(Ni(H_2O))_xCl_6$ ($x = 1-4$) are composed of Cu/Ni alloys. The Ni alloy composition determined by the XRD increases from about 12% for the $(Y_4-O)(denc)_4Cu_3Ni(H_2O)$ to about 62% for $(Y_4-O)(denc)_4(Ni(H_2O))_4$. Particle size study of the Cu/Ni alloys using XRD indicates that increasing the nickel content of the deposit leads to a deposition of finer grain alloys.

3:30 RESOLUTION OF THE ENANTIOMERS OF MAMMALIAN ALKALOIDS USING CHIRAL HPLC WITH SULFATED β -CYCLODEXTRIN AS A MOBILE PHASE ADDITIVE

Kenneth McMurtrey*, J.C. Strawbridge, T.M. Coleman, and J.G. McCoy, University of Southern Mississippi, Hattiesburg, MS 39406

The mammalian alkaloids salsolinol (SAL), tetrahydropapaveroline (THP), and tetrahydroxy-berbine

(THB) are implicated as possible agents in the etiology of alcoholism or its symptoms. To develop methods to determine stereochemistry of the substances in intact animals we have investigated the use of HPLC with sulfated α -cyclodextrin as a chiral selector in the mobile phase. Enantiomers of SAL, THP, and THB are well separated with selectivity (α) values of as much as 1.6 and measured resolution (R_s) of 5.5. In contrast, the enantiomers of their methoxy analogs, salsolidine, tetrahyropapaverine, and xylopine, respectively, resist separation. Apparently the hydroxyls present in the mammalian alkaloids and absent in their methoxyl analogs play a role in binding to the chiral selector.

3:45 COMPARISONS OF WAVELENGTH DISPERSIVE X-RAY SPECTRA FROM MODEL COMPOUNDS DESIGNED TO SIMULATE SCRAP TIRES AND WOMBAT TIRE-DERIVED PARTICLES

Ashley D. Trahan* and David L. Wertz, University of Southern Mississippi, Hattiesburg, MS 39406

Model compounds of various solid-state metal salts were prepared by thoroughly mixing the metal salt with graphite. The samples were prepared by mass percent and ranged from 1-5% analyte by mass, which corresponds to the abundance range of each analyte in tires. A wavelength dispersive x-ray fluorescence (WDXRF) spectrum of each mixture was obtained using a Rigaku x-ray spectrometer and an end-centered rhodium x-ray tube for excitation. The linearity of the relationship between peak intensity and analyte abundance has been explored for each of the analytes, and then this linearity has been used to measure the abundance of that analyte in the various scrap tire products being produced in the Wertz laboratory.

4:00 AUTODETACHMENT SPECTROSCOPY AND DYNAMICS OF VIBRATIONALLY EXCITED DIPOLE BOUND STATES OF H_2CCC^-

K. Yokoyama^{1*}, G.W. Leach², and W.C. Lineberger³, ¹Jackson State University, Jackson, MS 39217; ²Simon Fraser University, British Columbia, Canada V5A 1S6; and ³University of Colorado, Boulder, CO 80309

The direct observation of the rotational fine structure levels of a vibrationally excited negative ion dipole-bound state is reported. Autodetachment resonances of H_2CCC^- were observed for the $^2A_1-^2B_1$ transition in one quanta of ν_6 , ν_4 , and ν_2 and two quanta of ν_6 vibrational modes of the DBS. Rotational assignments for both the electronic ground state and an electronic excited state, the *dipole-bound state* (DBS) were performed. Based on an electron affinity of $14469 \pm 64 \text{ cm}^{-1}$, the binding energy of the electron in the DBS is $170 \pm 50 \text{ cm}^{-1}$. The vibrational

frequencies for ν_2 , ν_4 , and ν_6 of the DBS are directly determined to be $1965(1) \text{ cm}^{-1}$, $1117(1) \text{ cm}^{-1}$, and $221.447(2) \text{ cm}^{-1}$, respectively. The observed autodetachment resonances contain information about the detachment dynamics via the observed linewidths, and the departing weakly bound electron is best regarded as a function of the neutral core vibrational motions. The detachment rate varies by an order of magnitude, depending on the type of normal mode excitation. In particular, motions along the dipole moment axis significantly enhance autodetachment, indicating that the dipole-bound state is unstable with respect to neutral core motion which modulates the absolute value of the dipole.

4:15 Divisional Poster Session

GC/MS ANALYSIS OF BOLL WEEVIL CUTICULAR WAX

Edwin Tullos^{1*}, Jason Corbitt¹, Marcus Steele¹, Dennis Elmore², and Joe Mulrooney², ¹Delta State University, Cleveland, MS 38733 and ²United States Department of Agriculture-Agricultural Research Services, Stoneville, MS 38776

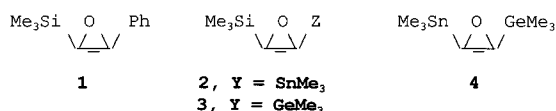
The boll worm is the most damaging predator to cotton crops in the Mississippi Delta. The cuticle of the parent boll weevil is covered by a surface wax which represents a major barrier to pesticide transport across the insect/atmosphere interface. Since the surface wax has such a significant influence on the penetrability of pesticides, it is important that the composition of this wax is known. In our study, cuticular wax was extracted from the surface of laboratory-grown boll weevils by washing them with HPLC grade chloroform. A 0.2- mg wax sample was reacted with hexamethyldisilazine in hexane. A Hewlett-Packard Model 5890 gas chromatograph with a 5971 mass selective detector equipped with a Hewlett Packard 7673A autosampler and interfaced with an HP ChemStation was used in all analyses. This procedure produces a surprisingly detailed analysis of unfractionated cuticular wax. The primary constituents are fatty acids and saturated and unsaturated hydrocarbons.

RING-OPENING REACTIONS OF SILYL, STANNYL, & GERMYL EPOXIDES

Lovell Agwarambo¹, Jerzy Leszczynski², Ilya Yanov², and Eucharía Agwarambo^{1,2*}, ¹Tougaloo College, Tougaloo, MS 39174 and ²Jackson State University, Jackson, MS 39217

Theoretical calculations were done on compounds 1-4 in order to evaluate and compare the influence of silicon, tin, and germanium in directing ring-opening reactions of epoxides. Epoxide 1 serves as a control with

both experimental and theoretical data. Epoxides 2-4 are very toxic for experimental work, therefore, theoretical calculations became the most viable method to study them. Since tin and germanium are more electropositive than silicon, their electron-withdrawing ability or inductive effect will be greater than that of silicon. Therefore, if epoxide opening is due to inductive effect, then epoxides 2 & 3 will undergo ring-opening at the position α to tin and germanium, respectively. However, if ring-opening is controlled by chelation, then the silicon which is smaller will chelate better with oxygen than tin or germanium, leading to ring-opening α to the silicon. Epoxide 4 compares the stannyl and germlyl groups in directing the ring-opening of the epoxide. The results of these investigations will be presented. Funds for this project was provided by the NSF-CREST Grant. We thank Glake Hill, Jr. for his suggestions.



SOLVENT EFFECTS ON THE PHOTOOXIDATION OF 2-METHYL-2-BUTENOIC ACID

Jason A. Payne* and Kristina L. Stensaas, Millsaps College, Jackson, MS 39210-0001

The solvent effects on the mechanism of the photooxidation of 2-methyl-2-butenic acid with singlet oxygen ($^1\text{O}_2$) will be described. Deuterated benzene, methanol, and mixtures of methanol/water were investigated for possible stabilization of the proposed peroxide intermediate due to polarity. These photooxidations were carried out in an NMR tube and the products were monitored using ^1H NMR. The results indicate that the same products are formed regardless of the solvent utilized.

AB INITIO POST-HARTREE—FOCK STUDY ON THE ENERGETICS OF NUCLEIC ACID BASES PROTONATION AND THEIR PROTON AFFINITIES

Yevgeniy Podolyan*, Leonid Gorb, and Jerzy Leszczynski, Jackson State University, Jackson, MS 39217-0510

Protonation of nucleic acid bases (B) is very important in many biochemical processes, i.e. enzymatic reactions, stabilization of triplex structures, *etc.*, and also due to the fact that protonation can cause mutations in the DNA via mispairing of complimentary bases. All geometry optimizations were performed with the standard 6-31+G(d,p) basis set at MP2 level of theory. The single point calculations were performed at the MP4(SDTQ)/6-31+G(d,p)//MP2/6-31+G(d,p), MP4(SDQ)/6-31+G(d,p)//MP2/6-31+G(d,p) and MP2/6-

31++G(d,p)//MP2/6-31+G(d,p) levels of theory. Gas-phase proton affinities were calculated as the negative of enthalpy of the process $\text{B} + \text{H}^+ \Rightarrow \text{BH}^+$. In this study we performed the most systematic investigations of the relative stabilities of different protonated forms of all nucleic acid bases. The values of proton affinities have also been calculated and compared to the experimental values. For the first time the values of proton affinities were calculated taking into account the contributions of rare tautomers of cytosine and guanine and their protonated forms. The results of the calculations on the energetics of protonated bases are in very good agreement with the experimental data. The study of proton affinities has indicated that the inclusion of rare tautomers for cytosine and guanine in the study is very important for good consistence with experimental results.

PHOTODEGRADATION OF METHYL ORANGE INDUCED BY TITANIUM DIOXIDE (TiO_2)

Regina Thomas^{1*}, Tywanda Jefferson¹, Nodja Adams², and Ken S. Lee¹, ¹Jackson State University, Jackson, MS 39217 and ²Hinds Community College, Raymond, MS 39154

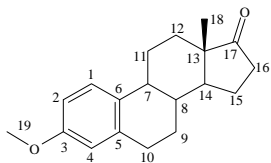
Photodegradation of methyl orange in an aqueous solution was monitored by measuring the UV absorption of the solution. Methyl orange was dissolved in water and titanium dioxide was added into the solution. Then it was irradiated by Ultraviolet Visible light. A small portion of the solution was withdrawn every 10 minutes for measuring UV absorption at 462 nm. Absorption was gradually decreased as irradiation continued. The rate law of photodegradation of methyl orange is the first order for the concentration of the methyl orange and its rate constant at room temperature is $6.54 \times 10^{-3} \text{ sec}^{-1}$. When we saturated the solution with N_2 gas, its reaction rate constant decreased to $3.82 \times 10^{-3} \text{ sec}^{-1}$. However, when the solution was saturated with air by bubbling, the rate constant of photodegradation increased to $1.12 \times 10^{-2} \text{ sec}^{-1}$.

STRUCTURE DETERMINATION OF 3-METHOXY-ESTRONE BY NMR SPECTROSCOPIES

Demetrice Davis* and Ken S. Lee, Jackson State University, Jackson, MS 39217

3-Methoxyestrone was prepared as a starting compound by converting 3-hydroxy group in basic methanol solution. It was reacted with bromoacetic ester and zinc (Reformatski Reaction) in order to add the ester group on the 17th carbon. Since the proton NMR spectrum of 3-methoxyestrone has a multiplet at 2.9 ppm with two hydrogen in integration, it was unclear for us to assign it whether the alpha hydrogen on 16th carbon or the benzylic hydrogen on 10th carbon. We had conducted thorough NMR studies: ^1H COSY, ^{13}C decoupled, DEPT135, HCCOSY,

and HCCOLOC, to assign every hydrogen and carbons. In conclusion, the spectra confirmed that a multiplet peak at 2.9 ppm is representing the benzylic hydrogen of 10th carbon. Peaks representing alpha hydrogen at 16th carbon is at 2.2 and 2.5 ppm. The carbons at 10th and 16th are at 29.6 and 35.8 ppm, respectively. Hydrogen and carbon at 7th carbon are at 2.3 and 43.9 ppm.



DFT AND MP2 QUANTUM MECHANICAL STUDY ON MOLECULAR STRUCTURE AND STABILITIES OF CARBOHYDRAZIDE AND ITS MONO AND DIMETHYL DERIVATIVES

Issac Orton, Aminatu Issaka*, Ali Jabalameli, Ramaiyer Venkatraman, Andrzej Nowek, and Richard H. Sullivan, Jackson State University, Jackson, MS 39217

DFT (Becke3LYP) and MP2 correlated levels of theory were applied to study of molecular structure and stabilities of carbohydrazide [(NH₂NH)₂CO] and its methyl [NH₂NHNH₂NCH₃CO] and dimethyl [(NH₂NCH₃)₂CO] derivatives. Double-dzeta 6-3-1 G(d,p) basis set were used. Potential energy surface search revealed ten minimum energy forms (rotamers) for unsubstituted and dimethyl and eleven for monosubstituted carbohydrazide. Their relative stabilities vary depending on the number and type of intramolecular hydrogen bonds [NH...O and NH...N] present. The relative energies of rotamers range between 0 to 16 kcal/mol. The predicted values at DFT and MP2 levels are similar and differ (DFT values are larger) by less than 10 percent.

CONVERTING WASTE WOMBAT FLUID TO AMMONIUM NITRATE WHILE EXTRACTING THE ZINC FROM THE WOMBAT FLUID

Marty Hartzog* and David L. Wertz, University of Southern Mississippi, Hattiesburg, MS 39406

The WOMBAT process uses nitric acid to oxidize various components in tires while converting the tires into several final products – steel, fibers, and tire-derived particles. After repeated processing, the oxidizing power of the nitric acid is sufficiently reduced so that the WOMBAT reactions cease to occur. At this point, the depleted nitric acid, which contains large amounts of aquozinc complexes and large amounts of solvated sulfate, has been reacted with solid ammonium carbonate to produce the reaction: NH₄⁺ (aq) + NO₃⁻ (aq) ⇒ NH₄NO₃(s) after removing the water from the beaker containing the reaction products. The

carbonate ion is being used to precipitate the zinc from the solution by the reaction: Zn⁺²(aq) + CO₃⁻²(aq) ⇒ ZnCO₃(s) because the solubility product constant for zinc carbonate is small.

CARBON MONOXIDE—INTERHALOGEN MOLECULAR COMPLEXES. THE HIGH-LEVEL QUANTUM MECHANICAL COMPLEMENTARIES STUDY

Ali Jabalameli*, Issac Orton, Aminatu Issaka, Ramaiyer Venkatraman, Andrzej Nowek, and Richard H. Sullivan, Jackson State University, Jackson, MS 39214

Molecular complexes of OC and ClF and BrCl has been observed and characterized by microwave spectroscopy as linear species. Quantum mechanical high-level (MP2, MP4, coupled-cluster theory) computational methods predict a variety linear and nonlinear isomeric forms of the titled systems.

AB INITIO QUANTUM MECHANICAL STUDY ON MOLECULAR STRUCTURE OF BH₂X AND BHX₂ (X = F, Cl)

Aminatu Issaka*, Issac Orton, Ali Jabalameli, Ramaiyer Venkatraman, Andrzej Nowek, and Richard H. Sullivan, Jackson State University, Jackson, MS 39217

The microwave spectrum of BH₂X (X = F, Cl) has been recorded an intermediate in the reaction between diborane (B₂H₆) and boron halides BX₃ in gas phase. Also, an existence of BHF₂ and BHCl₂ Was suggested. In our study, we report results of molecular structure predictions of these species. DFT (Becke3LYP) and MP2 levels of theory were applied. Double-dzeta and triple-dzeta quality basis sets augmented with polarization functions 6-31G(d,p) and 6-311G(df,pd) were used. Overall good agreement of calculated rotational constants, bond lengths, and bond angles with experimental data (where available) was obtained.

SYNTHESIS, STRUCTURE AND SPECTROSCOPY OF TERNARY COPPER(II) COMPLEXES INVOLVING L-PROLINE AND L-OH PROLINE AND AROMATIC DIAMINES

Kiwana T. Thomas¹, Ramaiyer Venkatraman^{1*}, Jeffery D.Zubkowski¹ and Edward J.Valente², ¹Jackson State University, Jackson, MS 39217 and ²Mississippi College, Clinton, MS 39058

Structures and spectroscopic properties have been determined for the ternary Cu(II) complexes containing L-proline and L-OH proline and 4,7 dimethylphenanthroline and bipyridyl. The absorption spectra of the 1:1:1 systems exhibited a single d-d peak at around 600–610 nm (pH 6–8) and the band centered at ca. 300–320 nm due to charge

transfer interaction between proline ring and diamines were observed in the near ultraviolet region. The complexes with L-proline and L-OH proline, [Cu(Ophen)(L-pro)(H₂O)] NO₃ (1), [Cu(Ophen 4,7diMe)(L-pro)(H₂O)] NO₃ (2), [Cu(Ophen)(L-OHpro)(H₂O)] NO₃ (3), [Cu(bpy)(L-OHpro)(H₂O)] NO₃ (4), and [Cu(Ophen 4,7diMe)(L-OHpro)(H₂O)]NO₃ (5) were isolated as crystals and the structures were determined by the X-ray diffraction method. Complex 1 crystallizes in the monoclinic space group, P2(1)/n, with unit cell of dimensions a = 7.1732(2) Å, b = 21.296(10) Å, c = 12.293(6) Å, β = 92.19(4)°. Complex 2 crystallizes in triclinic space group, P1, with unit cell a = 7.053(3) Å, b = 11.081(5) Å, c = 12.835(7) Å, α = 86.31(4)°, β = 88.66(4)°, γ = 82.18(3)°. Complex 3 crystallizes in orthorhombic space group, P2(1)2(1)2(1), with a unit cell dimension a = 6.781(2) Å, b = 13.258(4) Å, c = 20.170(7) Å. Complex 4 is monoclinic, P2(1), with a = 10.399(5) Å, b = 6.923(5) Å, c = 11.991(8) Å, β = 96.23(5)°. Complex 5 is monoclinic P2(1) with a = 11.445(2), b = 6.931(2), c = 12.937(3), β = 100.05(2). The copper (II) ion in each complex is in a five coordinate, slightly distorted square pyramid geometry. The proline α -CH and NH lie on the same side as coordinated water and the Cu-OH₂ distance [\sim 2.382 Å] in which α -CH and NH lie below the pyramid base away from coordinated water. Additionally, copper is coordinated weakly by carboxyl oxygen from neighboring inequivalent complex trans to shorter Cu-OH₂, and the shorter C=O...Cu distance [\sim 3.102 Å] opposite to the longer Cu-OH₂. Uncoordinated nitrates are hydrogen bonded to coordinated and uncoordinated waters.

AN AB INITIO QUANTUM CHEMICAL STUDY ON XANTHOPTERIN

M.K. Shuklal¹, Ramaiyer Venkatraman^{2*}, and Jerzy Leszczynski², ¹Banaras Hindu University, Varanasi-221005, India and ²Jackson State University, Jackson, MS 39217

Xanthopterin is a classical butterfly pigment found in nature. Also, human beings suffering from cancer exhibit elevated urinary levels of xanthopterin. In the present work, HF and DFT theoretical calculations applying standard 6-31++G(d,p) basis set have been carried out to investigate the tautomeric properties of the molecule. The transition states corresponding to the intramolecular proton transfer from oxo to the hydroxy form have also been studied.

REFORMATE GAS CLEAN-UP

Lois A. Zook, Delta State University, Cleveland, MS 38733

Awareness of the effects of greenhouse gases on the global climate, and the subsequent environmental legislation to reduce these gases, has resulted in a rekindled

interest in hydrogen energy technologies. A fuel cell is an electrochemical device that converts hydrogen and oxygen into electrical energy. The proton-exchange membrane (PEM) fuel cell has been suggested as a potential replacement for the internal combustion engine because it is clean, energy efficient, and fuel flexible. The hydrogen gas can be stored on board or produced as needed from liquid fuels such as methanol, ethanol, or gasoline. Liquid fuels are more attractive to consumers, but the reformation reactions to produce hydrogen gas from liquid fuels produce by-products that can poison the fuel cell catalyst sites. One strategy to clean-up these reformat streams via partial oxidation will be presented.

BOUND STATES OF HOCl AND DOCl

Joseph A. Bentley*, and B. Ramachandran, Delta State University, Cleveland, Mississippi 38733 and Louisiana Tech University, Ruston, Louisiana 71272

We report vibrational energies for the HOCl and DOCl molecules in the gas phase, calculated from ab initio and scaled ab initio potential surfaces. The ab initio calculations were performed at the CASSCF/MR-CISD levels of theory, using the highly polarized correlation consistent augmented Valence Triple Zeta (cc-pAVTZ) basis sets of Dunning. The multireference analog of the Davidson correction was used to approximate the effect of higher excitations (MR-CISD+Q). The Scaled External Correlation (SEC) method of Brown and Truhlar was used to extract additional dynamical correlation energy from both the MR-CISD (CI/SEC) and MR-CISD+Q (CI+Q/SEC) energies. The CI, CI+Q, CI/SEC, and the CI+Q/SEC energies up to 20,000 cm⁻¹ above the HOCl minimum were fitted to polynomial expansions and the spectroscopic parameters evaluated in each case. These results are compared to those from the calculations of Koput and Peterson using significantly larger basis sets [*Chem. Phys. Lett.* 283 (1998) 139], the "complete basis set limit" results of Skokov et al. [*J. Chem. Phys.* 109 (1998) 2662], and to available experimental results. It is seen that applying the SEC scaling to CI or CI+Q energies obtained using a moderate basis set (cc-pAVTZ) is a viable alternative to the use of extremely large basis sets.

DECREASED ANTIBODY CATALYTIC ACTIVITY ELICITED BY FLEXIBLE TRANSITION STATE ANALOG HAPTENS

Eric D. Helms^{1*}, Amy L. Odenbaugh², and Brent L. Iverson³, ¹Delta State University, Cleveland, MS 38733; ²Duke University, Durham, NC 27708; and ³University of Texas at Austin, Austin, TX 78712

An aspect of catalytic antibody research that receives little attention in the literature involves those

haptens systems that fail to elicit antibody catalysts despite a high affinity immune response and hapten designs that resemble those known to elicit catalysts. We found that six haptens of differing flexibility, in the form of three pairs of enantiomers, failed to induce any catalytic activity in rabbit polyclonal antibodies. This lack of catalytic activity occurred despite high affinity and stereoselective immune responses against each of the haptens. Enantiomeric pairs are ideal for use in systematic hapten structure-activity studies, because the two enantiomers have identical physical properties in achiral environments. Nevertheless, the stereoselectivity inherent in the immune response generally leads to two *different* immunological solutions to recognition, one for each enantiomer. The surprising lack of observed catalytic activity with the enantiomeric haptens led to the investigation of a series of five benzyl phosphate haptens. Three different animal systems were investigated; New Zealand white rabbits, inbred BALB/cJ mice and outbred ICR mice. The elicited polyclonal antibodies displayed catalytic activity that was significantly weaker in terms of the level of observed catalytic activity, as well as frequency of elicited catalysts, compared to a more rigid phenyl phosphate hapten. In addition, the affinities of the polyclonal antibodies were significantly higher in the rabbits compared to the mice, yet the catalytic activity was generally higher in the murine systems. In two cases, polyclonal catalytic activity was only observed in mice, not the rabbits. Mechanistic studies indicated that there was not a change in rate-limiting step for hydrolysis of the benzyl substrates compared to the phenyl substrate systems. Thus, it appears as though the increased flexibility of the benzyl systems, not a change in mechanism, is responsible for their decreased ability to elicit antibody catalysts. Taken together, our results indicate that hapten flexibility should be avoided when designing transition state analogs for use in eliciting highly active antibody catalysts.

PROBING THE FUNCTION OF RNA-BINDING SITES OF TRANSCRIPTION FACTOR RHO BY ALKYLATION OF CYSTEINE RESIDUES

Larrious E. Collins^{1*}, Brandt R. Burgess², and John P. Richardson², ¹Alcorn State University, Alcorn State, MS 39096 and ²Indiana University, Bloomington, IN 47405

To understand more about mechanism of action of a protein factor from bacteria called Rho that causes termination of transcription at the end of genes and at regulatory sites. My experiments are to explore the role of two residues in the function of Rho. One residue, which is normally a serine residue at position 82, is in the primary RNA-binding sites. The second residue is normally a serine at position 325. I have functional mutational derivatives of Rho in which these residues are changed to cysteine

residues. I made derivatives of these proteins in which their cysteine residues have been modified with iodoacetamide, iodoacetic acid, and assayed for poly (C)-dependent ATP hydrolysis. Also, a form of Rho with no cysteine residue will be used as a control group for both residues. With the 82C Rho, the modification causes very little change in the activities compared to the 0C Rho, indicating that it is insensitive to modification with iodoacetamide and iodoacetic acid. Unlike the 82C, there is a difference in the modification of 325C. The results show that the modification causes a great change in the activity when compared to the 0C Rho. Therefore the results indicate that the 325C Rho is very sensitive to modification with iodoacetic acid, but not as sensitive to modification with iodoacetamide. Since the modification with iodoacetic acid puts a negative charge on the modified residue, these inhibited results indicate that the function of Rho is inhibited by the presence of a negative charge at residue 325. My conclusion is that the backbone of the RNA, which has a negative charge, does not come in close proximity with residue 82 but does come in close proximity to residue 325.

DESIGN, SYNTHESIS, AND EVALUATION OF B/C/D-RING ANALOGS OF THE FUNGAL METABOLITE OF K-16 AS POTENTIAL COMPLEMENT INHIBITORS

Jared Gilmore*, Tori Hill, and Robert Sindelar, Alcorn State University, Alcorn State, MS 39096; NIH NHLBI STIMS Cardiovascular Biomedical Research Program; and University of Mississippi, University, MS 38677

The complement system, a component of innate immune response in all vertebrates, is extremely important to host defense against infectious pathogens. It also serves to initiate the inflammatory response and directly kill and promote the phagocytosis of invading microorganisms. Because of the importance and vital roles of the complement system, a slight disturbance may cause a number of pathological conditions. This list includes infectious diseases, stroke, wound healing, autoimmune disease, rejection after xenotransplantation, and others. Since undesired activation of the complement system is common in these condition, understanding how this system is controlled and what causes it to misbehave has attracted in tense inters from both academic researchers and industry researchers seeking to develop effective complement inhibitors with therapeutic benefit. Funding: NIH.

THEORETICAL EVALUATIONS OF INERT GAS ATOMS IN MOLECULAR CAGES

Billy R. Booth^{1*}, Willard Collier², Charles U. Pittman, Jr.², and Svein Saebo², ¹Alcorn State University, Alcorn State, MS 39096 and ²Mississippi State University, Mississippi

State, MS 39762

Structures have been optimized for [4]-prismane (cubane), [5]-prismane, [6]-prismane, and pentaasterane using several levels of theory. Then a proton or a noble gas atom was placed in the center of these cages, and the resulting endohedral complex was re-optimized. Ab initio calculations at the Hartree-Fock and Density Functional levels of theory with various basis sets were employed. The strain energy induced upon enclosing a noble gas atom was calculated by subtracting the total energy of the cage plus the isolated noble gas atom from the energy of the endohedral complex. Inserting a Helium atom introduced strain energies of 26.89 kcal/mol, 6.82 kcal/mol, 4.19 kcal/mol per Carbon-Carbon bond in the endohedral complexes of respectively at the B3LYP/6-311 g(d,p) level of theory. In conclusion, derivatives of the prismanes having CH₂ links between the top and bottom ring carbons have larger internal volumes, allowing larger inert gas atoms to be inserted. Thus, pentaasterane was predicted to exist with Helium, Neon, Argon, and Krypton inserted into the cage. Steric strain increased as the size of the endohedral atoms increased.

CHARACTERIZATION OF SEB BASED IMMUNO-ASSAY SYSTEM

Tommie Pittman^{1*}, Giri Gokulrangan², Samadhi Vitharana², and George Wilson², ¹Alcorn State University, Alcorn State, MS 39096 and ²University of Kansas, Lawrence, Kansas 66045

An ELISA based immunoassay has been developed for characterizing a toxic analyte Staphylococcal enterotoxin B (SEB). SEB is a 29 kDa protein with infectious properties and has a potential of being used as a biological warfare agent. Rapid detection and quantitation of SEB is of significant interest from a bioanalytical and commercial perspective. A titration immunoassay was designed and performed to determine the avidity of a polyclonal rabbit (Rb) anti-SEB antibody for SEB. Affinity purification of the polyclonal anti-SEB IgG sample was performed using a reatigel 6X agarose column. An apparent K_f, the thermodynamic formation constant, was determined to be about 10⁸ M⁻¹ for an anti-SEB antiserum sample. Avidity of the affinity purified anti-SEB IgG sample was also calculated and found to be 10⁹ M⁻¹.

ANTIBODY IMMOBILIZATION TO HIGH-PERFORMANCE LIQUID CHROMATOGRAPHIC SUPPORTS: CHARACTERIZATION OF MAXIMUM ANTIBODY LOADING

Arniee Jackson*, William Clarke, and David S. Hage, Alcorn State University, Alcorn State, MS 39096 and University of Nebraska, Lincoln, NE 68588-0304

This study examines the maximum extent of antibody immobilization that can be obtained on several HPLC-grade supports by Fab fragments as the model ligands. The pore size of the silica support varied in size and type. Three methods were used in this experiment. The first is the CDI method. It is achieved by coupling aldehyde groups on the support to amine or thiol groups in the protein. Six samples were analyzed using the CDI method. The pore sizes ranged from 50 Å to 4000 Å. The second method is schiff base. The schiff base method couples the protein to the aldehyde groups on the silica surface through the amine group contained in the protein. Three samples were analyzed using the schiff base method. The pore size ranged from 100 Å–4000 Å. The third method is tresyl chloride. The tresyl chloride method is site specific for sulfhydryl groups produced during the digestion of IgG with papain. Three samples were analyzed using the tresyl method. The pore sizes ranged from 500 Å–4000 Å. The conditions used in this study involved using an IgG concentration of 20.0 mg/ml in order to ensure enough protein present for at least monolayer coverage of the support silica particles.

A NOVEL ROUTE TO BISANOMERIC SPIROKETALS

Kesmic Jackson* and Keith Mead, Alcorn State University, Alcorn State, MS 39096 and Mississippi State University, Mississippi State, MS 39762

Spiroketal is a compound which occurs in nature and is known for its strong antitumor activity. The purpose of this experiment is to synthesize a bisanomeric spiroketal with exclusive equatorial substitution on the C2 and C8 carbons. It is believed that this substitution can be accomplished by protecting the axial site on the C2 carbon using a benzoyl group that would be bonded to the C8 carbon.

ANALYSIS OF THE CAFFEINE CONTENTS OF COMMERCIAL BRANDS OF INSTANT COFFEE

Abul B. Kazi, William C. Mahone, and Jermel Harris*, Mississippi Valley State University, Itta Bena, MS 38941

Caffeine is a stimulant of the central nervous system and is present in coffee, tea, cola drinks, cocoa, chocolate, wake-up pills and some headache and cold medicines. While low to moderate consumption of caffeine may have some beneficial health effects, taken in large doses, it can cause adverse health effects such as headaches, nervousness, rapid heartbeats, and convulsions. In this study we have developed a simple and convenient method based on ultraviolet spectrophotometric analysis for the quantitative measurement of caffeine in samples of commercial brands of instant coffee.

INCORPORATION OF 7-AZAINDOLE INTO DNA AND STUDY OF ITS FLUORESCENCE PROPERTIES

Ke Wang, Sandra Stringfellow*, Kanyetta Wilson, and Hongtao Yu, Jackson State University, Jackson, MS 39217

Incorporation of various modified DNA bases in place of a natural base of duplex DNA has been used in many research areas. Such "bases" as nonhydrogen bonding benzene, naphthalene, and indole analogues, as well as modified natural nucleic acid bases have been used for studying various biological events, nucleic acid structure and dynamics, and even for using them as potential anticancer/antibacterial drugs. For this reason we conducted the synthesis shown below. The overall yield for the 4-step synthesis was 28. The structures of all compounds were confirmed by proton and/or phosphorous NMR and high resolution mass spectrometry. Compound 4 is successfully used to incorporate 7-azaindoles into DNA on an automated DNA synthesizer. DNA melting studies is used to compare the stability of DNA oligomers containing 7-azaindoles and native DNA duplexes. Fluorescence emission intensity of 7-azaindoles in the nucleoside is 23 times enhanced than it is free in solution. The fluorescence of 7-azaindoles in duplex and single stranded DNA is greatly quenched. This research is supported by an NIH-MBRS grant #S06GM08047.

FRIDAY MORNING

Emerald Room

9:00 THE MECHANISM OF DECOMPOSITION OF DIBENZYL TRISULFIDE 1-OXIDE

Arnold S. Brownell* and Kristina L. Stensaas, Millsaps College, Jackson, MS 39210-0001

The oxidation of dibenzyl trisulfide utilizing *meta*-chloroperoxybenzoic acid will be discussed. The initial product, dibenzyl trisulfide 1-oxide, readily decomposed at room temperature to produce a mixture of dibenzyl tetrasulfide and dibenzyl 1,1-dioxide disulfide. The decomposition reaction was monitored by following the benzylic protons in the ¹H NMR spectrum. The mechanism of the decomposition of the 1-oxide will be discussed.

9:15 SYNTHESIS AND CHARACTERIZATION OF POLYAMPHOLYTES

Stephen Ray Jones* and Robert Y. Lochhead, University of Southern Mississippi, Hattiesburg, MS 39406

It is the objective of this research to develop polyampholyte materials and compare their solution properties with their polyelectrolyte counterparts as functions of both pH and ionic strength. Polyelectrolytes have large hydrodynamic volumes (thus large intrinsic

viscosities) in deionized water; increasing salt concentrations collapse the chains. Polyampholytes tend to have collapsed conformations in deionized water due to electrostatic attractions; their conformations generally expand with increasing ionic strength of the solution. However, solubility and solution behavior of polyampholytes depends greatly on both the net charge and the charge distribution along the polymer chain. Polyampholytes generally become insoluble in deionized water as the cation to anion ratio approaches one. Target polyampholytes of interest are copolymers and terpolymers of diallyldimethylammonium chloride (DADMAC), acrylic acid (AA), and acrylamide (AAM). Polyampholyte microstructure has been studied by ¹³C-NMR, ¹H-NMR, and FTIR. Solubility behavior was examined using Hoy solubility parameters.

9:30 SYNTHESIS OF IONIC LIQUID-POLYMER ELECTROLYTE COMPOSITE MATERIALS BY FRONTAL POLYMERIZATION

Timothy F. Bourne*, Jonathan Masere, Yuri A. Chekanov, and John A. Pojman, University of Southern Mississippi, Hattiesburg, MS 39406

Potentially highly conductive composites of polymers were synthesized by frontal polymerization. By utilizing the process of frontal polymerization, polymer composites with high salt percentages were synthesized while preventing macroscopic phase separation. The traditional process of batch polymerization was also employed to compare multiple properties of polymeric composites made. Ionic liquid salts were used in place of organic plasticizers for acrylate polymer matrices. Using a solution of ammonium persulfate in dimethyl sulfoxide as an initiator, self-sustaining polymerization fronts were realized at high salt:polymer ratios. Differential scanning calorimetry (DSC) studies show that the acrylate matrices exhibit neither glass transition behavior nor crystallinity of the polymer-salt composites as the composition of the salt additives increases.

9:45 POLYAMPHOLYTE ADSORPTION ONTO MONTMORILLONITE CLAY

Camille T. Haynes* and Robert Y. Lochhead, University of Southern Mississippi, Hattiesburg, MS 39406-0076

The objective of this project is to determine the mechanisms of interaction of model polyampholytes with montmorillonite clay as a function of solution pH and ionic strength. Polyampholytes used in these studies contain three types of monomers. Acrylamide will be used as an anionic spacer, 2-vinylpyridine as the cationic units and acrylic acid as the anionic units. The terpolymers are synthesized utilizing solution free radical polymerization.

Monomer incorporation is determined by monitoring characteristic peaks in ^1H and ^{13}C NMR spectra. Differences in ionic incorporation affect the solution properties of resultant polyampholytes. Electrostatic interactions between the clay surface and the charged units of the polyampholyte are an important driving force for adsorption. Interactions are affected by many factors, including pH and salt concentration of the solution and charge density of the polyampholyte. The interactions of ampholytic terpolymers are studied at differing solution pH and ionic strength. The polymer/clay colloidal systems are studied by adsorption isotherms, IR spectroscopy and gated decoupling ^{13}C NMR. This allows determination of the amount of polyampholyte adsorbed, which moieties are involved in adsorption, and the conformation of the adsorbed chains.

We would like to acknowledge Southern Clay Products for project funding.

10:00 A STUDY OF THE INTERACTIONS OF HYDROPHOBICALLY MODIFIED POLY-VINYLAMINE WITH DODECYLTRIMETHYL-AMMONIUM BROMIDE BY SURFACE TENSION MEASUREMENTS

Jennifer L. Smith*, T. Susanne Smith, Stacey V. Maggio, and Robert Y. Lochhead, University of Southern Mississippi, Hattiesburg, MS 39406

The polymer-surfactant interactions of hydrophobically modified Polyvinylamine (HMPVAm) with Dodecyltrimethylammonium bromide (DTAB) in dilute solution have been studied using surface tension measurements. HMPVAm is a cationic polyelectrolyte and DTAB is a cationic surfactant. The interactions were studied as a function of hydrophobe length, concentration, and pH. The two hydrophobes are heptyloxybenzoic acid and propoxybenzoic acid. 0.8% of the amine units on Polyvinylamine (PVAm) are altered by one of the hydrophobes. The polymer concentrations studied are 2.5 g/L and 10 g/L. The pHs studied are 3, 7, and 10. Neither of the HMPVAm's are surface active due to strong self-association of the polymers. The critical micelle concentration (CMC) of DTAB increases in the presence of HMPVAm at all pH ranges and all concentrations. The surface tension measurements show that a non-surface active complex of surfactant absorbed onto polymer is formed when HMPVAm and DTAB are in solution. The different hydrophobes causes variations in the of the polymer/surfactant system, while increases in pH decrease the polymer/surfactant interactions. Similar trends are seen for both concentrations, and therefore concentration does not have a noticeable effect.

10:15 Break

10:30 ISOTHERMAL FRONTAL POLYMERIZATION: EXPERIMENTS AND THEORY OF METHYL METHACRYLATE SYSTEMS

Lydia L. Lewis^{1*}, Cynthia A. Spade², Paulin N. Wahjudi¹, John A. Pojman¹, and Vladimir A. Volpert², ¹University of Southern Mississippi, Hattiesburg, MS 39402 and ²Northwestern University, Evanston, IL 60201

Isothermal frontal Polymerization (IFP) is a process which converts monomer to polymer through a localized propagating reaction zone. IFP propagation occurs due to the diffusive supply of species into a preformed swollen polymer region where the Trommsdorf effect is significant. The Trommsdorf effect accelerates the polymerization rate in the gel region over that in the bulk region, and the diffusion of the species from the bulk fuels the reaction. Even though IFP is used commercially to produce gradient materials, little has been published on the factors that promote and limit front propagation. We have examined the effects of the system temperature and the type and concentration of the initiator on the velocity and the distance traveled by the front. We have also examined the effects of the viscosity of the preformed gel region on the front propagation. We have observed in methyl methacrylate polymerizations, both experimentally and theoretically, that higher system temperatures or faster-decomposing initiators yield fronts that travel faster but for a shorter amount of time. We have also observed that preswelled polymers of 20% or higher (weight of MMA as solvent/weight of PMMA) support propagation.

10:45 VISCOSITY STUDIES OF HYDROPHOBICALLY MODIFIED POLYVINYLAMINE AND DODECYLTRIMETHYLAMMONIUM BROMIDE SOLUTIONS

T. Susanne Smith*, Jennifer L. Smith, Stacey V. Maggio, and Robert Y. Lochhead, University of Southern Mississippi, Hattiesburg, MS 39406

This study was conducted to determine the interactions of hydrophobically modified polyvinylamine with surfactant dodecyltrimethylammonium bromide through increases or decreases in viscosities. The type of hydrophobe, as well as the pH of the systems and the concentration of the surfactant was varied. The polyvinylamine was modified to a percent modification of 0.8% using propoxybenzoic acid and heptylbenzoic acid as the hydrophobes. The pHs of 3, 7, and 10 were studied. The charge on the polymer chain decreases as the pH increases, leading to a decrease in viscosity. Upon the addition of the dodecyltrimethyl ammonium bromide, the viscosity of the

solution increased at a pH of 3, but increased less with higher pH. This is believed to occur because of the formation of mixed micelles in the solution. As the pH and surfactant concentration increased the polymer assumes a more collapsed conformation, which results in the decrease in viscosity and perhaps the formation of unimolecular micelles where the hydrophobes are inside, limiting surfactant interactions.

11:00 TWO-DIMENSIONAL FRONTS

John A. Pojman and Monique Kendrick*, University of Southern Mississippi, Hattiesburg, MS 39406

Snells Law was investigated using frontal polymerization in two-dimensional space. Frontal polymerization is the conversion of monomer to polymer through a high energy source such as heat. The use of frontal polymerization in a two-dimensional system requires a sustainable front to travel in both x- and y-directions. A system consisting of dimethyl sulfoxide (DMSO) and 1,6-hexanediol diacrylate (HDDA) with diethyl phthalate (DEP) and $(\text{NH}_4)_2\text{S}_2\text{O}_8$ as the thermal initiator was used and by varying the initiator concentration, different velocities were obtained. In a petri dish, two reaction mixtures with different initiator concentrations were placed one in each half of the dish. To prevent mixing, via diffusion, Cab-O-Sil (super-fine silica gel) was used as a viscosifier. The reaction was ignited at the center and the subsequent front velocities and the curvatures in each of the two media monitored. By using the different velocities and curvatures, it was demonstrated that frontal polymerization can conform with Snells Law.

11:15 RHEOLOGICAL BEHAVIOR OF HYDROPHOBICALLY MODIFIED CATIONIC POLYMER IN WATER

Derek Dorman*, Nad'a Spišáková, Robert Y. Lochhead, and Stacey V. Maggio, University of Southern Mississippi Hattiesburg, MS 39406

Self-association phenomenon is employed in number of industrial applications and has been paid wide scientific attention. The factors that influence the solution behavior of the self -associating polymer are numerous and the matter is very complex. The tendency towards intermolecular associations of hydrophobically modified polyvinylamine was studied by means of rheology in the low shear region. The polyvinylamine bearing 0.8 mol% of bulky hydrophobe was characterized via NMR and static light scattering. Its behavior is compared to polyvinylamine hydrophobically modified with C12 linear alkyl chain to 0.8 mol%, which was reported previously. At 0.8 mol% of hydrophobes on the polymer backbone, the linear hydrophobes caused strong intermolecular associations, due to

which the viscosity of the solutions increased. The bulky substituent shows fewer tendencies towards intermolecular interactions. The influence of the net charge on the micelle formation by variation of the pH is documented. At high pH, the polyelectrolyte chain adopts more collapsed conformation. This influence is superposed by the hydrophobic interaction of different type of hydrophobe.

11:30 OPTICAL GRADIENT MATERIALS PRODUCED VIA LOW-TEMPERATURE ISOTHERMAL FRONTAL POLYMERIZATION

Jonathan Masere* and John A. Pojman, University of Southern Mississippi, Hattiesburg, MS 39406

Using a newly developed low-temperature polymerization technique, polymethyl methacrylate (PMMA) matrices doped with organic laser dyes and organic optical limiters were successfully prepared. This technique affords less tenuous temperature conditions than had been used before. Optical dyes and a thermally unstable initiator were dissolved in methyl methacrylate (MMA) solution and fed into a PMMA tube yielding radial gradients in the process. On the other hand, an axial dye gradient was observed when MMA was overlaid and polymerization effected from a dye-doped PMMA seed. In either case, polymerization reactions were observed as a result of interfacial-gel polymerization with the subsequent formation of spatial gradient distribution of the optical dye dopants. Low temperatures are desirable to eliminate thermal and photothermal degradation of temperature-sensitive dyes during the polymerization. The preparation of longer polymer rods with organic optical limiter dye gradient materials can also be realized with the use of low-temperature polymerization.

11:45 AN INVESTIGATION OF ISOTHERMAL FRONTAL POLYMERIZATION WITH A WATER SOLUBLE MONOMER

Paulin N. Wahjudi* and John A. Pojman, University of Southern Mississippi, Hattiesburg, MS 39406

We investigated water-soluble polymers to determine if they would exhibit isothermal frontal polymerization and to determine their behavior. Isothermal frontal polymerization is a method of converting monomer into polymer through a localized propagating reaction zone utilizing the gel effect. Experiments were carried out with a system consisting of water-soluble monomer, water as solvent, and initiator. Systems using the monomers of methacrylic acid and 2-hydroxyethyl methacrylate were investigated by varying the ratio of the monomer to water, varying the concentration of the initiator, and varying the temperature.

FRIDAY AFTERNOON

Emerald Room

2:00 USE OF FENTON'S REAGENT FOR THE REMEDIATION OF WATERS CONTAMINATED WITH MOTOR OIL

Abul B. Kazi, William C. Mahone, and Shirley Turner*, Mississippi Valley State University, Itta Bena, MS 38941

Motor oil is a complex mixture of hydrocarbons with other additives. Improper disposal of used motor oil and accidental release during transportation can contaminate surface and ground waters. Waters contaminated with motor oil can pose serious threat to human health and aquatic lives, because many of the components are suspected carcinogens and are resistant to biodegradation, particularly in anaerobic ground water environment. In this study we are investigating the effectiveness of Fenton's reagent, a combination of hydrogen peroxide and ferrous iron for chemical remediation of water contaminated with motor oil. Preliminary results indicate that Fenton's reagent can be an effective tool for the removal of motor oil components from contaminated waters. Determination of the efficiency of the Fenton's degradation is based on a variety of analytical techniques, including gas chromatographic analysis and measurement of the reduction of chemical oxygen demand (COD). Optimization of the effects of reaction parameters such as concentrations of hydrogen peroxide and ferrous iron, reaction pH, and reaction time is being studied.

2:15 COMPLEXATION OF TETRACYCLINE WITH METAL ION

Wedad R. Hussein* and Christopher G. Walker, Jackson State University, Jackson, MS 39217

The tetracyclines, a group of broad-spectrum antibiotics are effective against aerobic and anaerobic, Gram positive and Gram negative bacteria. Tetracycline, although not the first to be discovered, is considered the parent of the group for nomenclature purposes. Tetracyclines have a common skeleton made of four fused six membered rings, (A, B, C, & D). One of these rings, the D, is aromatic. From its chemical structure and the presence of 4-acidic protons, tetracycline should be capable of forming complexes with metal ions. It has been suggested that metal chelation plays a role in the tetracycline antibiotic action. Three models have been suggested for the metal ion-tetracycline complex based on the potential coordination site. From computational calculations, we found that one of the three models is the most likely complex to be formed. Potentiometric titration of tetracycline with metal ions in the pH range 8–10 was

performed to determine the stability of the complex.

2:30 AN ANALYSIS OF SALT BRIDGE FUNCTION IN SECONDARY ELECTROCHEMICAL CELLS

William C. Mahone, T. Parker, and S. Green*, Mississippi Valley State University, Itta Bena, MS 38941

It has long been known that in order for an electrochemical cell to function an ion exchange mechanism called a salt bridge must be incorporated into the design. The salt bridge is necessary to preserve cell neutrality. Without an ion exchange mechanism, the half cells become polarized and the power output drops to zero. By the use of multiple salt bridges of identical configuration we are investigating the kinetic aspects of salt bridge configuration. These investigations have provided interesting insights into ion transport processes associated with cell power output.

2:45 SYNERGISTIC EFFECTS USING THE MACROCYCLIC ANTIBIOTICS VANCOMYCIN AND RISTOCETIN A IN CAPILLARY ELECTROPHORESIS

Brad Farris*, Kellie Woodling, and Timothy J. Ward, Millsaps College, Jackson, MS 39210

Capillary electrophoresis (CE) is a powerful tool for chiral separations. Recently the macrocyclic antibiotics have been shown to be a powerful class of chiral selectors in capillary electrophoresis (CE). The macrocyclic antibiotics contain the types of functional groups and spatial arrangement that provide multiple enantioselective interactions. The glycopeptide antibiotics have been the most useful of the macrocyclic antibiotics. In this work, a mixture of the macrocyclic glycopeptide antibiotics were used as a chiral selector in a countercurrent CE process. Some of the solutes analyzed showed enantioselectivity only with ristocetin A, and some of the solutes had greater enantioselectivity with vancomycin. Using a mixture of vancomycin/ ristocetin A provided greater enantioselectivity than either chiral selector alone. Interestingly, it was found this effect was greatest for those solutes which exhibited better enantioselectivity with vancomycin than ristocetin A. Those solutes that showed greater enantioselectivity with ristocetin A did not show as great an enhancement when vancomycin was added to the mixture.

3:00 ELECTROCHEMICAL DEPOSITION OF HEAVY METALS FROM COMPLEXES IN AQUEOUS SOLUTIONS

William C. Mahone, Abul B. Kazi, and N. Powell*, Mississippi Valley State University, Itta Bena, MS 38941

In this investigation we look at the effect of complexation on the aqueous solubility of heavy metal salts in solution. Because complexes mask the metal it reduces the activity of the metal in solution. Therefore more salt must dissolve to satisfy the solubility product limitations. Subsequently we look at the reduction of heavy metals in solution by electro deposition. Upon conclusion we will make recommendations about the feasibility of the deposition process for general remediation of heavy metals in contaminated waste water.

GEOLOGY AND GEOGRAPHY

Chair: James Harris, Millsaps College

Vicechair: Terry Panhorst, University of Mississippi

THURSDAY MORNING

Pacific Room

8:30 GEOLOGY IN MISSISSIPPI BEFORE 1850

Earl M. Manning and Michael B.E. Bograd*, Tulane University, New Orleans, LA 70118 and Mississippi Office of Geology, Jackson, MS 39289

A good deal had been learned of the geology of Mississippi by the time its geological survey was started in 1850. Although no detailed state geologic map had been made, the Mississippi part of Maclure's early U.S. geologic maps showed the connection of southern Mississippi to the Coastal Plain, and showed a northward lobe of that region (later the Mississippi Embayment) in the western part. The westward dip of most northern beds had been demonstrated, and the loess had been identified and described (though as fluvial, not eolian). The geology of several areas of the state was well known, and a few geologic sections (notably at Natchez and Vicksburg) and fossil faunas (notably the Natchez Pleistocene, Vicksburg Oligocene, and Jackson Eocene) had been reported, and many new species had been described from Mississippi. Five geologic time periods had been identified: Carboniferous (now Mississippian), Cretaceous, "lower Eocene" (now late Eocene Jackson Group), "upper Eocene" (now early Oligocene Vicksburg Group), and post-Tertiary (then "archaic alluvium," now late Pleistocene). The quality of soils for farming had been intensively studied, and several geologic resources (building stone, clays, lignite) had been utilized. Over eighty papers, starting in 1803, had been published on Mississippi geology by 1851, and several reports on the subject had been presented at national geological meetings.

8:45 THE USE OF HISTORICAL AERIAL IMAGERY TO ASSESS THE GEOMORPHIC EFFECTS OF GRAVEL MINING ON THE BOUIE RIVER, HATTIESBURG, MISSISSIPPI

Rachel P. Ingram* and David M. Patrick, University of Southern Mississippi, Hattiesburg, MS 39406

During the last several decades in-channel gravel mining has been conducted along a stretch of the Bouie River upstream of its confluence with the Leaf River and downstream of its confluence with Okatoma Creek. Field observations of the channels upstream from the Bouie River mines and several miles along Okatoma Creek have indicated some degradation which could be attributable to mining; however, the degradation appears rather minor when compared to other streams in the region along which in-channel mining has been conducted. Historical, panchromatic aerial imagery for the years 1958, 1964, 1980, 1985, 1991, and 1996 were examined to determine whether there was any evidence for channel instability during this time frame. The results of this examination revealed that, besides local increases in river width throughout the mined area on the Bouie, the planform of these rivers appeared to have changed very little over the years. The explanation for the apparent lack of change may be found in the lithology of the upstream channels which are incised into the Hattiesburg Formation (Miocene). This sandy, clayey silt would appear to possess sufficient cohesive strength to withstand the erosion effects of presumed higher upstream velocities. Indeed, the present channels of the Bouie River and Okatoma Creek do exhibit relatively stable appearing knickpoints cut into the Hattiesburg Formation forming a "rock-lined" channel. If, on the other hand, these channels had consisted of alluvial fill, the erosion would probably have been more extensive.

9:00 STRATIGRAPHIC AND SEDIMENT STUDIES IN NORTHERN GULF COASTAL PLAIN STREAM VALLEYS (PEARL AND AMITE RIVER TERRACE SEQUENCES) IN LOUISIANA AND MISSISSIPPI

Ervin G. Otvos and Wade E. Howat*, Gulf Coast Research Laboratory, University of Southern Mississippi, Ocean Springs, MS 39566-7000

Recently started TL (thermoluminescence) dating of pre-Prairie and Prairie coast-parallel alluvial terraces as well as the Pearl and Amite River intermediate ("Deweyville") terraces provided some preliminary insight into the complex late Quaternary coastal plain development stages, valley incision, successive development of approximately three nested valley surfaces, as well as estuarine/delta growth in the Pearl estuary. Ongoing studies are also aimed at establishing depositional facies, their ages and landward

extent of brackish facies during the late Holocene transgression/ regression. Among some early results, the TL-dates are helping in making age-distinctions between late Pliocene Citronelle, Pleistocene pre-Prairie "Big Ridge"/Montgomery (?) and Prairie coast-parallel alluvial surfaces and underlying shallow deposits. Paleoclimatological studies of extensive late Pleistocene-early Holocene dunes revealed corresponding Late Quaternary dry climate phases in SE Louisiana and NW Florida. Several postdate the full-glacial (ca. 22–17 ka BP) spruce forest development north of Baton Rouge, LA.

9:15 MODEL AND COMPARISON OF THE MERIDIAN SAND "INCISED VALLEY FILL" TO OTHER PUBLISHED PALEOVALLEY ANALOGUES

Stephen L. Ingram, Sr., Mississippi Office of Geology, Jackson, MS 39289

The Meridian Sand is characterized as a Lowstand Systems Tract (LST) incised valley fill (ivf). Along the outcrop belt, a mappable system of paleovalleys is present, which exhibit the high erosional relief associated with headland construction. Two distinct lobes (paracycles) are evident on geophysical logs along the outcrop, an upper transgressive marine lobe and a lower fluvial-estuarine lobe. Paleovalleys typically exhibit a "fining-up" stacking pattern of coarser-grained sands and/or conglomerate at base (lower lobe), to finer-grained sands at top (upper lobe). In extreme updip limits of a few paleovalleys, a rare, shallow fluvial facies may be found. This shallow facies is comprised of wedge-shaped lenses of clay and sand, and has been interpreted as a coastal-nearshore deposit. Sands and clays of the Tallahatta Fm., Basic City Shale Member (inner-shelf) overlie the Meridian Sand. From the above geological characteristics, a model for the Meridian paleovalleys was constructed. This model illustrates incision and headland construction, back-filling, and eventual drowning of the Meridian's paleovalleys (LST ivf). LST ivf models of Feldman et al. (Pennsylvanian age Tonganoxie Paleovalley, 1995), Nichol et al. (Holocene age Lake Calcasieu, 1996), and Allen et al. (Holocene age Giuronde Estuary, 1993), compare favorably to the Meridian model. Common features of these paleovalleys include well-defined incision and a fining-upward cycle capped by fine-grained facies.

9:30 LOWER TERTIARY (CRETACEOUS CHALK TO COOK MOUNTAIN LIMESTONE) CORRELATIONS IN THE SUBSURFACE OF SOUTHERN MISSISSIPPI

David T. Dockery III, Mississippi Office of Geology, Jackson, MS 39289

Correlations of oil exploration geophysical logs in southern Mississippi, including cross sections A-A' from Horn Island north to Wayne County, B-B' from Greene County west to Walthall County, and C-C' from Walthall County west to Wilkinson County, were made using the top of the Cretaceous chalk (base of section) and the base of the Cook Mountain Limestone (top) as datums of undisputed correlation. Within the Wilcox Group of this section are several transgressive sand and high-stand shale sequences of regional extent. From top to bottom these include: (1) an unnamed shale and the underlying 4,600' Sand of the upper Hatchetigbee Formation, (2) the basal Hatchetigbee shale and the underlying Bashi Formation, (3) the Big Shale and the underlying Blake Sand at the top of the Nanafalia Formation (Grampian Hills Member), and (4) the Baker Shale and the underlying and sometimes limey McKittrick Sand of the middle Nanafalia Formation (*Ostrea thirsae* Beds). The McKittrick Sand correlates to a limestone in southeastern Mississippi that is identified as the Salt Mountain Limestone on many petroleum logs. The Blake Sand correlates to a sandstone in southeastern Mississippi that lies 250 feet above the Salt Mountain Limestone but mimics the log character of the Salt Mountain on some resistivity curves, making a mis-correlation of this unit possible.

9:45 FEARN SPRINGS AND BETHEDEN FORMATIONS: INCORPORATION INTO RECENT PALEOCENE STRATIGRAPHY AND SURFACE MAPPING

David E. Thompson, Mississippi Office of Geology, Jackson, MS 39289

F.F. Mellen first coined the stratigraphic names Fearn Springs and Betheden in 1939 while working on his Winston County Mineral Resources, Bulletin 38. Mellen considered these units to be distinct formations in the lower Wilcox and upper Midway, respectively. The Fearn Springs of Mellen consists of purplish, silty sands and clays, lignite, and is known for its quality ceramic clays. Mellen's Betheden consists of bauxite, kaolin, clay, and lignite. Subsequent authors and mappers have had differing opinions as to the stratigraphic position and/or relevance of these units. F.S. MacNeil, for instance, considered the deposits to be intraformational and recommended that the name Fearn Springs be made to include both units, and that the name Betheden be abandoned. Recent surface mapping and drilling activities associated with STATEMAP considered these units in relation to the classic Alabama Midway/Wilcox stratigraphy. Mellen's Fearn Springs Formation was found to be equivalent to the Coal Bluff Member of the Naheola Formation based on geophysical log correlation and palynology ranges. Mellen's Betheden

Formation, at the type locality, was found to be equivalent to the Oak Hill Member of the Naheola Formation. Therefore, both units are currently recognized as belonging to the Naheola Formation of Midway age. Geologic maps for the 7.5-min. quadrangle sheets of Fearn Springs and Betheden have been completed and recognize this stratigraphic assignment.

10:00 Break

10:15 CLASSIFICATION OF HAND SPECIMENS DURING AN UNDERGRADUATE PETROLOGY LABORATORY EXAM: EVIDENCE OF STUDENT FATIGUE

Terry Panhorst, University of Mississippi, University, MS 38677

Hand specimen rock classification is an important skill for undergraduates in geoscience curriculums. Students at University of Mississippi take a sophomore-level introductory petrology class. Emphasis during the laboratory portion is on rock classification using over 200 hand specimens and standard classification schemes. The laboratory final exam requires students to classify 39 new specimens presented in a particular sequence. Students have two minutes to examine a rock specimen before passing it and receiving the next specimen. Since 15 to 20 students are taking the exam at the same time, specimens are viewed in order but each student starts with a different first sample. Over the last four years 83 students have taken this exam, all using the same set of rocks arranged in the same sequence. Results of their performance indicate that igneous rocks are more difficult to correctly identify in hand specimen than either metamorphic or sedimentary rocks. At the beginning of the exam students tend to make more incorrect identifications regardless of where in the sequence they begin. As the exam proceeds their performance on average improves. After about 40 minutes there is a significant increase in the average number of incorrect identifications, regardless of where in the sequence the students are at that point. This increase in incorrect identifications appears to be independent of rock type and is interpreted to represent student fatigue.

10:30 ESTABLISHING FIELD-RESEARCH LEARNING OPPORTUNITIES IN GEOLOGY: MILLSAPS' CASE HISTORY, YELLOWSTONE TO THE YUCATAN

Ed L. Schrader, Millsaps College, Jackson, MS 39210

Over the past four years, Millsaps College has successfully established field-based undergraduate research courses in the Yucatan Peninsula and Yellowstone National Park. While focussing on earth and natural sciences, these

courses are multi-purposed, multi-disciplinary and involve students from a broad spectrum of departmental majors at all academic levels from Freshmen to Seniors. To date 40 students have studied in the Yucatan and over 60 students have participated in research in Yellowstone Park during the development phases of the courses. Both courses are designed to incorporate three interlocking educational segments during the summer term. In the Yucatecan course, the three learning modules are: 1) Cultural and archaeological setting of the Maya civilization; 2) Botany and ecology of interior old growth forests of the Yucatan, and; 3) Impact of development and tourism on the Great Mayan Coral Reef, from Cancun to Belize. In the Yellowstone course, the modules are; 1) Contamination and geochemistry of Soda Butte Creek and related Yellowstone watersheds; 2) Carnivore ecosystems of Yellowstone Park, and; 3) Geological and seismic setting for the next volcanic episode at Yellowstone. All modules are extensively field oriented with readings assigned each evening and in the semester prior to the field experience. Scientific and curricular results of the programs are now being disseminated through appropriate professional venues.

10:45 SEASONAL GEOCHEMICAL RECONNAISSANCE OF SODA BUTTE WARM SPRINGS IN YELLOWSTONE NATIONAL PARK

Keri E. Walker* and Ed L. Schrader, Millsaps College, Jackson MS 29210

Between fall of 1997 and fall 1999, sampling was accomplished at the site of Soda Butte Warm Springs in northeastern Yellowstone National Park. Water, rock and sediment samples were taken directly from the warm spring vent on the travertine mound name "Soda Butte" as well as from several springs surrounding the travertine deposit. The chemistry of this system is relevant for describing the relatively unstudied geothermal activity in this area, the most northeasterly of the park. The geochemical signature of the warm spring is elevated calcium and magnesium content, reducing oxidation-reduction conditions, very low dissolved oxygen and slightly acidic pH values. The overall chemistry of this warm spring is congruent to that of Mammoth Hot Springs about 45 miles to the west and significantly divergent from the Heart Lake, Shoshone, Upper Midway, Lower and Norris Geyser Basins to the southeast.

11:00 GEOARCHAEOLOGY OF THE ELMALI PLAIN, SOUTHWESTERN TURKEY

Stanley J. Galicki, Millsaps College, Jackson, MS 39210

This geological research supports a joint archaeological excavation conducted by the Associated

Colleges of the South and Bilkent University in Ankara, Turkey. The mound at Hacimusalar, inhabited from the Neolithic to Late Roman Age, lies in the center of the Elmali Plain. The primary objective is to develop a paleogeographic interpretation of the Elmali Plain that is contemporaneous with the occupation of the mound at Hacimusalar. The Elmali Plain is a terminal basin located in the Taurus Mountains in southwestern Turkey. Two shallow lakes were present on the northern and southern margins of the Plain until the mid-1970's when they were drained to increase land under cultivation. Initial samples taken on reconnaissance of the Plain indicated the presence of both fresh and saltwater microfossil assemblages. The freshwater assemblage is dominated by ostracodes that are common in Holocene lacustrine sediments. Utilizing the paleontology, topography, and stratigraphic information obtained from 10-5 m holes drilled on the Plain a paleogeographic reconstruction has been formulated.

11:15 EFFECTS OF CULVERTS ON MISSISSIPPI'S RENOURISHED BEACHES

Keil Schmid, Mississippi Office of Geology, Jackson MS 39289

Culverts, which drain local roads and coastal developments, are striking features along the renourished beaches in Mississippi, especially in Harrison County. Their important function is offset by their stark contrast and inadvertent hardening of the shoreline. Hardened shorelines generally override natural sedimentation and create very localized erosion and accretion trends, which can cause management problems. Development growth, which reduces the amount of permeable area, adjacent to the coast will likely increase the number of culverts along the beach. A closer inspection of the culverts and the shoreline patterns shows how different construction variables affect shoreline evolution. In some cases the culverts effectively act like groins, whereas others seemingly have little impact on sediment transport. Global Position System (GPS) surveys coupled with Geographic Information System (GIS) analysis of the culverts and shoreline patterns in two test areas have been used to investigate the roles of several construction variables on beach evolution. Shoreline deviation and temporal change near culverts were compared with construction variables including pipe diameter, culvert spacing, double vs. single culverts and culvert length. Results suggest that culvert diameter is the most important factor in determining shoreline response. This indicates that sediment movement is driven by high energy, low frequency events that are able to transport sediment over the tops of small culverts but not large ones. Future studies of the entire beach system may establish the longer-term effect of culverts on erosion

patterns.

THURSDAY AFTERNOON

Pacific Room

1:30 Divisional Poster Session

MISSISSIPPI COUNTY OIL AND GAS PRODUCTION INDEX MAP PROJECT

Stephen D. Champlin, Mississippi Office of Geology, Jackson, MS 39289

Of Mississippi's 82 counties, 45 currently have or have had oil and gas production from approximately 900 fields with an estimated 2625 pools. The Energy Section of the Mississippi Office of Geology is currently working on a project to construct, on a county by county level, digital oil and gas production index maps. Each county map will show the location of oil and gas fields in that county and, by using a color-coded geologic column, show the producing formations for each of those fields. The software program used is AutoCad Map on a 450 MHZ Pentium III PC. The finished product will be published by the Office of Geology as a series of Open-File Reports and will be made available to the public in a color plotted paper hard copy with a scale of 1:126,720 (1 inch equal 2 miles). The digital county maps will also be used on the Office of Geology Web site as an interactive link to the office's oil and gas databases. Each field will be linked to its own Web page where the user can choose to view field and/or well data. Data will include available field and pool production data, scanned images such as scout tickets, mud logs, well logs, core data, or any other information the office may have available. The final product of the project will be a statewide color-coded production index map.

1:45 Divisional Talks Resume

1:45 STRATIGRAPHY OF THE MISSISSIPPI VALLEY GAS #1 TERRY BELL, WASHINGTON COUNTY, MISSISSIPPI

Stephen L. Ingram, Sr., and Danny W. Harrelson*, Mississippi Office of Geology, Jackson, MS 39289 and U.S. Army Engineering Research and Development Center, Vicksburg, MS 39180

The Mississippi Valley Gas, #1 Terry Bell was drilled as a natural gas storage test hole. The well, in Section 18, Township 17 North, Range 9 West, Washington County, Mississippi, reached a total depth of 5,156 feet in May 1964. It is situated along the northern edge of the Monroe-Sharkey Uplift in an area of known igneous activity. Locally, the well site lies within the

southern limits of the Desha Basin, a Mesozoic-age igneous province as defined by Harrelson (1985) and Coleman (1991). Earlier work by Harrelson and Bicker (1979) identified several igneous intervals in the well, but a detailed stratigraphic analysis was not undertaken. In 1999, nine cores from the Terry Bell were examined and correlated as Eagle Mills (Triassic synrift red beds), Smackover, Haynesville and possibly Norphlet (Jurassic age post rift sediments) unconformably overlain by Late Cretaceous Eutaw (basin fill sediments) through Holocene deposits. Gravity and magnetic maps indicate anomalies south of the Terry Bell well which are interpreted as clusters of east-west trending volcanic activity. Seismic data from Jurick (1989) indicates a "synrift basin" associated with Triassic rifting in the vicinity of the Monroe-Sharkey uplift. This combination of rifting and subsequent igneous activity (intrusive and extrusive) is suggested as an explanation for the complex stratigraphy found in the Terry Bell test hole and northwestern Mississippi.

2:00 POROSITY LOSS, FLUID FLOW, AND MASS TRANSFER IN OOID GRAINSTONE RESERVOIRS OF THE SMACKOVER FORMATION, MISSISSIPPI

Ezat Heydari, Mississippi Office of Geology, Jackson, MS 39289

The effects of burial diagenesis have been studied on porosity evolution of the Upper Jurassic Smackover Formation ooid grainstones, buried to a depth of over 6 km at Black Creek Field, Mississippi. The study demonstrates that the combined effects of mechanical compaction, grain-to-grain pressure solution, and cementation have reduced their intergranular porosity to 0%, suggesting that porosity reduction has gone to completion. The study shows that from the original 40% porosity, 13 porosity units were lost by mechanical compaction, 15 porosity units were reduced by intergranular pressure solution, and 12 porosity units were destroyed by cementation. Grain-to-grain pressure solution resulted in 28% vertical shortening, generating sufficient calcium carbonate to precipitate the observed carbonate cements in this grainstone reservoir. Fine-grainstone samples at the top of the reservoir experienced high degrees of intergranular pressure solution and contain only small amounts of cement. They acted as sources for abundant cements in coarse-grained ooid grainstones in the middle and basal parts of the reservoir. Mass transfer of pressure solution-generated calcium carbonate from the top of the unit to precipitation sites in the middle and basal parts of the reservoir could have occurred by the non-Rayleigh type convection cell.

2:15 USING MICROBIAL SURFACE SURVEYS TO DETECT HYDROCARBON ACCUMULATIONS AT DEPTHS OF 14,000 FEET

Jack S. Moody, Mississippi Office of Geology, Jackson, MS 39289

The Mississippi Office of Geology is investigating the ability of surface hydrocarbon detection techniques to predict the presence of hydrocarbons at depth for wildcat wells. This program will ultimately create a database from which the statistical value of using this technology will be analyzed. Prospect WC-MS-2 was sampled using a pre-designed sample grid. Two different microbial techniques were used to predict the outcome of the well. The samples were collected by the Office of Geology using GPS navigation to sample sites. The collected samples were received by the labs within 48 hours of collection. Geo-Microbial Technologies, Inc. of Ochelata, OK, predicted the well would have noncommercial quantities of hydrocarbons. The Mississippi State University technique developed by Dr. Lewis Brown predicted that hydrocarbons would be present. The well was drilled to 14,190 feet and there was enough gas present for the company to spend considerable money trying to complete the well. After a great deal of effort, the well was classified as "noncommercial" and was plugged and abandoned. Both microbial techniques made the correct prediction of hydrocarbons being present. The results suggest that microseepage is occurring in a nearly vertical path from 14,000 feet to the surface.

2:30 ASSOCIATED NORM IN MISSISSIPPI OIL & GAS OPERATIONS

Rick L. Ericksen^{1*}, Charles T. Swann², and John C. Matthews³, ¹Mississippi Office of Geology, Jackson, MS 39289; ²Mississippi Mineral Resources Institute, University, MS 38677; and ³Research Institute of Pharmaceutical Sciences, University, MS 38677

There is a lack of data concerning the concentrations and isotopic compositions of uranium, thorium, and radium in the produced formation fluids (brines), precipitates, and sludges generated with the operation of oil and gas wells in Mississippi. These radioactive elements when contained in the formation fluids are referred to as NORM, an acronym for naturally occurring radioactive materials, or TENORM when they are technologically enhanced during oil and gas production activities resulting in the formation of scale (precipitates) and sludges. Sampling has recovered brines from 61 oil and gas fields in the Mississippi Interior Salt Basin, the Black Warrior Basin, and the Wilcox trend in southwestern Mississippi. Scale and sludge samples have been collected

at several localities. Published studies have indicated that the main contributor to NORM in oil and gas production is radium. Preliminary results indicate the isotopic ratio of ^{226}Ra to ^{228}Ra ranges from 2.9 to over 252 in the brines. The chemical composition of the scale and sludge analyzed consists of varying concentrations of the barium and strontium end members of the barite to celestite solid solution series. The NORM/TENORM database being developed should allow informed decisions to be made concerning this issue. The authors acknowledge the support of this work by the U.S. Department of Energy, John Ford Project Manager, under Grant No. DE-FG26-97BC15035.

2:45 CHARACTERIZATION OF LEACHABILITY OF RADIOACTIVE SCALE AND SLUDGE

Shuanglian Li^{1*}, Rick L. Ericksen², Charles T. Swann¹, and John C. Matthews¹, ¹University of Mississippi, University, MS 38677 and ²Mississippi Department of Environmental Quality, Jackson, MS 39289-1307

In 1 year, *e.g.* 1998, Mississippi produced $>36 \times 10^9$ L of formation waters (brines) associated with hydrocarbon production. These brines generally contain high concentrations of dissolved minerals and salts. Through condensation and precipitation reactions sediment particles composed, in part, of BaSO_4 and SrSO_4 with co-precipitated radioactive radium form deposits (scales and sludges) on and in the production and storage equipment. The Mississippi State Oil and Gas Board is considering proposals to allow disposal of these radioactive scales and sludges, also known as naturally occurring radioactive material (NORM) by land spreading under their Rule 68. We have investigated the leachability of radioactivity from 1) a weathered, non-oily scale sample collected from the surface of the ground, 2) an unweathered, non-oily scale sample collected from a section of production piping, 3) an oily sludge sample collected from a NORM storage site, and 4) a radioactive sandy soil sample from a site not associated with oil and gas operations, all from MS. Each sample was tested for leaching of radioactivity under artificial rainwater conditions alone and after mixing and incubation for 2 weeks with 4 representative types of MS top soil. Extractable radioactivity from the samples was low ($\sim 0.1\%$ of the total). After incubation with the top soils extractable radioactivity was still low, but increased to $\sim 1\%$ of the total. We found no correlation between soil type and extractability. We conclude that land spreading of these materials may increase solubilization and possibly mobilization of radioactivity. The implications of these findings for environmental and human health at this time are not clear.

3:00 HIGH RESOLUTION INDUCTIVELY COUPLED PLASMA-MASS SPECTROMETER (HR-ICP-MS): A POWERFUL TECHNIQUE FOR ULTRA-TRACE ELEMENTAL AND ISOTOPE RATIO ANALYSES

Zhongxing Chen* and Alan M. Shiller, University of Southern Mississippi, Stennis Space Center, MS 39529

Since its commercial introduction in the early 1980s, inductively coupled plasma mass spectrometry (ICP-MS) has been widely used as a multi-element analytical technique for trace elemental determinations and isotope ratio measurements in various disciplines. However, limited sensitivity and low mass resolution of traditional quadrupole ICP-MS cannot meet two growing analytical demands, *i.e.*, lower detection limits and resolution of interferences. Recently installed at University of Southern Mississippi (USM, Stennis Space Center), the new Finnigan MAT high resolution magnetic sector ELEMENT2 inductively coupled plasma mass spectrometry (HR-ICP-MS) opens a door for USM and regional researchers to perform ultra-trace elemental and isotopic analyses. With sensitivity higher than 1.0 billion counts per second (cps) per ppm and dark noise less than 0.2 cps, elemental concentrations down to ppt (even ppq for some elements) levels can be measured. The determination of elements such as Fe, V, As, and Se has been problematic with conventional quadrupole ICP-MS because of the limited mass spectral resolution of that instrument. However, the high resolution capability of our HR-ICP-MS allows most of these elements to be distinguished from the interfering masses. In this study, we present the performance of our HR-ICP-MS and its application to ultra-trace elemental concentration determinations and isotope ratio measurements in marine, geological, environmental, biological, and nuclear samples.

3:15 Break

3:30 REMOTE SENSING CHARACTERIZATION OF SOILS AND SENSITIVE HABITATS, CAMP SHELBY TRAINING SITE, MISSISSIPPI

Julie M. Ford*, Christopher P. Cameron, and David M. Patrick, University of Southern Mississippi, Hattiesburg, MS 39406-5044

Airborne Terrestrial Applications Sensor (ATLAS) imagery and HyMap hyperspectral imagery, as well as ground hyperspectral data, are being used to supplement and enhance on-going studies at Camp Shelby. Specific project objectives include: identification of wetland classes, and verification or refinement of a previously established hydrogeomorphic model; refinement of a previously developed, working geologic map; determination

of the effectiveness of remote sensing imagery in identifying and predicting erosion susceptibility; detection of change at selected wetland and erosion locations; and incorporation of the data sets produced into the existing Geographic Information System (GIS). Analysis of the airborne imagery is aided by the use of a hyperspectral field-portable spectrometer that collects high-resolution ground data of soils and vegetation. False color imagery in the VNIR and SWIR highlights soils and vegetation spectral characteristics specific to wetlands, pitcher plant bogs, mid-slope clay-silts, and upland soils and sediments. These spectral signatures facilitate rapid and precise delineation of wetlands and bogs in a geo-referenced framework. Thermal emission sensitivity to changes in mineralogy and soil-sediment water content are seen best in the TIR data. The latter is particularly useful, along with the false color imagery, in detailed mapping of the sandy and graveliferous sediment and soil in some upland areas.

3:45 THE RELATIONSHIPS BETWEEN LITHOSTRATIGRAPHY AND SENSITIVE HABITATS, CAMP SHELBY TRAINING SITE, FORREST AND PERRY COUNTIES, MISSISSIPPI

Suzanne A. Boyd* and David M. Patrick, University of Southern Mississippi, Hattiesburg, MS 39406

An updated and enhanced geologic map for Camp Shelby Training Site consists of three map units: Undifferentiated Quaternary Alluvium and Terrace, Upland Complex (Citronelle), and Hattiesburg Formation. This GIS map layer combined with population data layers, illustrates the relationship between exposed lithostratigraphic units and sensitive habitats. The outcrop pattern of the exposed stratigraphic units which controls the distribution of these habitats, is in turn controlled by a broad, asymmetrical, south-sloping and arcuate cuesta. Generally, the crest of the cuesta is capped by coarse clastics of the Upland Complex, and the flanks are composed of fine clastics of the Hattiesburg Formation and its equivalents. This general outcrop pattern changes abruptly along the eastern side of the training site directly above Cypress Creek Dome where there is a widening and broadening of the Hattiesburg outcrop pattern. The outcrop patterns of the Hattiesburg above Cypress Creek Dome correlate with the habitat for the Camp Shelby burrowing Crawfish (*Fallicambarus gordonii*). The contact between the Hattiesburg Formation and Upland Complex appears to define the habitat of the Louisiana quillwort (*Isoetes louisianensis*). The sandy hills along the crest of the cuesta (Upland Complex) are the habitat for the gopher tortoise (*Gopherus polyphemus*) and red cockaded woodpecker (*Picoides borealis*).

4:00 STREAM GAUGING—A COMPONENT OF WETLANDS MITIGATION, CAMP SHELBY TRAINING SITE, MISSISSIPPI

David M. Patrick^{1*}, David L. Derrick², and David D. Abraham², ¹University of Southern Mississippi, Hattiesburg, MS 39406 and ²U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS 39180

The planned construction, in 2000, of the G.V. "Sonny" Montgomery Range, a multi-purpose tank and helicopter gunnery range, has required a number of mitigation actions in order to protect wetlands and other sensitive habitats within and outside the range construction area. Since the range will occupy the headwaters of three intermittent streams along which there are wetlands and Louisiana quillwort habitats, mitigation actions were taken to ensure that: a) the pre-construction discharge of these streams was maintained during and after construction, and b) there was no significant change in turbidity or sediment discharge attributable to construction. During the summer of 1998, in order to address these issues, three stream gauges were installed along these tributaries. Two gauges are located directly downstream of the construction area, and one further downstream near a quillwort colony. The three gauges are battery operated, they record every 20 minutes, and each measures water depth (stage), water temperature, and conductivity calibrated to sediment load. During the last 15 months of pre-construction, base line monitoring, the stage data demonstrated the degree to which these streams are intermittent, sediment load and temperature were found to correlate with stage, and there were no indications of human-induced sedimentation in these streams. Such sedimentation would be apparent if turbidity increased without an increase in stage. These data will be used for comparison with construction and post-construction data to identify the effects of construction and, if any detrimental effects are discovered, to take corrective action.

4:15 Divisional Business Meeting

FRIDAY MORNING

Pacific Room

8:30 ADVICE TO ASPIRING EARTH SCIENCE EDITORS

Michael B.E. Bograd, Mississippi Office of Geology, Jackson, MS 39289

All professional scientists do a lot of editing, through writing or preparing manuscripts for publication, submitting reports to clients, peer review of manuscripts and proposals, supervising theses, or simply grading

papers. The work of an editor is important—a reader will consciously or unconsciously judge the quality of the science by the quality of the writing. As editor for my agency, I know that the credibility and reputation of the Office of Geology as a competent scientific organization will be judged by what appears in print under our banner. Poor writing will fail to get the scientific message across. The most difficult part of editing is marking what is missing, not just correcting obvious errors in the manuscript. Many scientists do not appreciate the value of the editor's work. The editor must deal with all personalities from pig-headed to sensitive, while proving that the product will be improved with editing and that the editor is sincere in trying to help. Those considering a career in earth science editing should get a degree in the field; a degree is usually required for most job applications, and the editor must edit for scientific content as well as for grammar and spelling. Editors can obtain help through professional organizations such as the Association of Earth Science Editors.

8:45 WOODSON RIDGE, LAFAYETTE COUNTY:
POSSIBLE EXTENSION OF REELFOOT
TECTONICS INTO NORTHERN MISSISSIPPI

Stephen L. Ingram, Sr.* and Charles T. Swann, Mississippi Office of Geology, Jackson, MS 39289 and Mississippi Mineral Resources Institute, University, MS 38677

Woodson Ridge is located 6 miles northeast of Oxford, Mississippi in Lafayette County. Attaya identified the ridge as a structural feature in 1951. Recent geological investigation corroborates a structural interpretation for Woodson Ridge, indicating a link to regional tectonics associated with the Reelfoot Rift. Those geologic aspects which define Woodson Ridge are: 1) an anomalous broad surface topography reflected as the ridge crest; 2) a lower Claiborne-age fault along the southwest flank; 3) stratigraphic onlap of the Lower Claiborne (Meridian Sand) and Middle Wilcox (basal Tusahoma Fm.) onto structurally high Lower Wilcox and Midway deposits; 4) a northwest-trending, 6 mile left lateral, 90 degree offset of the Meridian Sand outcrop on the northeast flank; 5) structural contours mapped on the Meridian Sand, which are on-trend with Paleozoic-age Black Warrior Basin faults mapped 15 miles southeast, in the subsurface of Pontotoc County; and 6) NW-NE-trending geomorphic anomalies (rectangular stream valleys) associated with Sardis Lake. The above geologic evidence, supported by similar tectono-stratigraphic relations expressed in the Reelfoot Rift (Van Arsdale et al., 1995; Kingsburry & Parks, 1993; Spitz & Schumm, 1996; Cox, 1988; Ingram, 1999), could suggest that Reelfoot tectonics extend over 60 miles into northern Mississippi.

9:00 EVALUATION OF SEISMIC ANISOTROPY IN
QUATERNARY SEDIMENTS OF THE
CENTRAL NEW MADRID SEISMIC ZONE

Brant W. Cole* and James B. Harris, Millsaps College, Jackson, MS 39210

Determining the extent and location of surface/near-surface structural deformation in the New Madrid seismic zone (NMSZ) is very important for evaluating earthquake hazards. A preliminary shallow shear-wave splitting experiment, located near the crest of the Lake County uplift (LCU) in the central NMSZ, shows the presence of near-surface azimuthal anisotropy believed to be associated with neotectonic deformation. Based on the orientations of the polarized shear-waves, two complementary explanations for the azimuthal anisotropy are; (1) pore spaces/fractures/faults aligned in response to near-surface tensional stress produced by uplift of the LCU, and (2) faults/fractures oriented parallel to the Kentucky Bend scarp, a recently identified surface deformation feature believed to be associated with contemporary seismicity in the central NMSZ. This research will further explore the relationship between shear-wave splitting and near-surface structural deformation utilizing multicomponent downhole and surface reflection data to investigate shallow deformation associated with the Reelfoot/Kentucky Bend/New Madrid scarp complex. In addition to increased seismic resolution by the use of shear-wave methods in unconsolidated, water-saturated sediments, measurement of near-surface directional polarizations, produced by shear-wave splitting, may provide valuable information for identifying neotectonic deformation, evaluating associated earthquake hazards, and guiding future paleoseismologic investigations.

9:15 A HYDROGEOLOGICAL AND GEOPHYSICAL
STUDY OF AN UNCONFINED AQUIFER ON
MILLSAPS COLLEGE CAMPUS, JACKSON,
MISSISSIPPI

Jaime E. Miles*, Stanley J. Galicki, and James B. Harris, Millsaps College, Jackson, MS 39210

This study integrated hydrogeological and geophysical techniques to investigate an area of soil slumping on the campus of Millsaps College in Jackson, MS. High water saturation in the zone of slump formation, believed to be related to local geology and hydrology, has prevented traditional landscape maintenance in the area. The hydrogeologic techniques used in the study included head monitoring in two wells, slug tests, and sediment analysis. The geophysical techniques included seismic reflection/ refraction, and ground penetrating radar tests. The data sets were integrated to produce a model of the near-surface (<10 m deep) geology and hydrology. The

model suggests the presence of a perched aquifer in the pre-loess terrace sediments that locally overlie the weathered Yazoo Clay. Additionally, a channel (or channel system) may have developed on top of the Yazoo Clay promoting the preferential movement of water into the slump. Data gathered as part of this study will be used in the design and development of a managed wetland area to be constructed in the future.

HEALTH SCIENCES

Chair: Zelma Cason, University of Mississippi
Medical Center
Vicechair: Aaron D. Puckett, University of
Mississippi Medical Center

THURSDAY MORNING

Gulf Hall

8:30 Introduction

Zelma Cason, University of Mississippi Medical Center,
Jackson, MS 39216

8:40 CYTOPATHOLOGICAL ANALYSIS OF THE
TISSUE-IMPLANT REACTION FOLLOWING
SURGICAL IMPLANTATION OF UHMW-
POLYETHYLENE INTO ADULT MALE RATS

Kenneth Butler*, A.D. Puckett, Hamed Benghuzzi, and
Audrey Tsao, University of Mississippi Medical Center,
Jackson, MS 39216

It is well demonstrated in the literature that polyethylene materials used in orthopedic and dental applications are highly compatible and non-immunogenic with host tissues. However, recent studies in our laboratory have demonstrated the need for further study of these devices *in vivo* to further elucidate the mechanisms involved in biocompatibility. The purpose of this investigation was to study the tissue-implant response resulting from the implantation of ultra-high molecular weight polyethylene (PE) at 90 days post-implantation. In this investigation, implants of PE coated with RGE, RGD, Poly-L-Lysine, and Saline were implanted into 15 adult male rats subcutaneously (S/C) and intraperitoneally (I/P). At 90 days post-implantation, the animals were euthanized and the PE devices, the fibrous tissue, and vital organs were harvested. Evaluation of routinely stained sections (5 μ m, Hematoxylin & Eosin) of the fibrous tissue capsule surrounding the PE revealed the following: 1) all the devices had fibrous connective tissue capsules of slightly

varying degrees of thickness present at the time of sacrifice, 2) the thickness of the fibrous tissue capsule was dependent on the site of implantation and type of coating, 3) the thickness of the fibrous tissue capsules around the subcutaneous devices differed markedly than those retrieved from the peritoneal cavity, and 4) there were statistically significant differences (ANOVA, $p < 0.05$) in the numbers and types of cellular components with respect to implantation site and type of coating. The number of macrophages, neutrophils, fibroblasts, degree of vascularity, and thickness of the fibrous tissue matrix was found to be statistically different between the subcutaneously implanted PE groups. The presence of collagen was found to be statistically different when comparing the S/C and I/P fibrous tissue surrounding PE.

8:55 DETECTION OF REMOTE EXOGENOUS
HER2/NEU ANTIBODIES IN RAT SALIVA

W.R. McReynolds*, J.T. Brinkley, Hamed Benghuzzi,
Michelle Tucci, X. Dai, L.G. Bigler, and Charles F. Streck-
fus, University of Mississippi Medical Center, Jackson, MS

In recent years, there has been an increased interest in saliva as a diagnostic tool. Diagnosis of many diseases, including gastric cancer and immunodeficiency, has been made using saliva. The purpose of this study was to determine whether Her2/*neu* antibody, made in response to certain carcinomas of the breast, could be detected in saliva when experimentally placed at a remote site. This study was conducted using two male HSD rats, each weighing between 300 g and 500 g. One experimental animal received 200 microliters, and the other, 500 microliters, of encapsulated c-erbB-2 monoclonal antibody (Signet, Dedham, MA) intraperitoneally. Prior to capsule placement, baseline serum and saliva samples were taken. Samples were also taken 20, 68, 140, 188, 308 and 356 hours post-placement. Saliva flow was induced by administration of ophthalmic pilocarpine prior to sampling. All samples were kept at -20 degrees Celsius. Antibody detection was performed using the ELISA technique. The subject receiving the higher antibody concentration showed a markedly greater saliva level of the antibody than the other (peak 24.158 hnu/ml vs. 7.95 hnu/ml at 308 hours post-injection). These results seem to indicate that Her2/*neu* antibody saliva levels may serve as a useful, non-invasive method in the early detection of some breast cancers. Supported by NIH/NIDCR grant IR55DE/OD12414.

9:10 THE PATHOPHYSIOLOGICAL RESPONSES
ASSOCIATED WITH SUSTAINED DELIVERY
OF DHEA AND DIOSGENIN IN OVARIECT-
OMIZED RATS

Aaron Scott*, Kent Kihyet Higdon, Hamed Benghuzzi, Michelle Tucci, Zelma Cason, Barry England, James L. Hughes, and Audrey Tsao, University of Mississippi Medical Center, Jackson, MS 39216

Numerous studies have shown that dehydroepiandrosterone (DHEA) exhibits a host of benefits at the vital and reproductive organ levels. However, the use of naturally occurring DHEA is hindered by its inability to survive the first metabolic process of the liver. One possible alternative means that deserves consideration is the administration of DHEA's precursor, namely, Diosgenin (DG). The specific objectives of this investigation are: 1) to deliver DHEA and DG at sustained levels by Tri-Calcium Phosphate Lysine (TCPL) drug delivery systems using ovariectomized (OVX) adult rats as a model, and 2) to evaluate the biochemical and histopathological changes associated with the sustained delivery system. A total of 14 adult female rats were used, and further divided into 4 groups. Group 1 animals served as an intact control group while each rat in Groups 2, 3, and 4 were ovariectomized (sham, n=3), OVX + DHEA, OVX + DG, respectively. Surgical aseptic techniques were employed according to standard procedures. Malondialdehyde (MDA) and hormonal levels were measured from serum, collected semi-weekly, during the entire investigation (for 33 days). A routine of H & E staining conducted for histopathological evaluation on the reproductive and vital organs. Pap Smears were collected daily for 33 days to ensure the endometrial changes associated with DHEA and DG treatment. Results of this investigation demonstrated: 1) OVX resulted in a decrease in total body weight, and the use of DHEA and DG returned the body weight to normal levels compared to intact control, 2) TCPL delivered DHEA and DG at a sustained level during the 33 day phase, 3) the ease of MDA levels is as follows: DG > DHEA = OVX > control, 4) no significant changes were observed in total wet weights, as well as, the morphology of the spleen, kidney, adrenal, heart, liver, and lung tissues, 5) OVX resulted in an atrophy and non-keratinization trend in the reproductive tissues, and sustained delivery of DHEA and DG showed no remarkable change in these tissues, 6) the use of sustained delivery of DHEA and DG resulted in a significantly higher weights of uteri compared to the OVX group. In conclusion, this study provided more information regarding the interrelationship between DHEA and DG, and the physiological responses encountered when they are administered continuously using adult OVX rats as a model.

9:25 PHYSICAL PROPERTIES COMPARISONS FOR NEW APACKABLE@ DENTAL RESTORATIVES

W.B. Jenkins* and A.D. Puckett, University of Mississippi Medical Center, Jackson, MS 39216

The objective of this study was to determine the polymerization shrinkage and coefficient of thermal expansion (CTE) for the recently introduced packable composites, Surefil (Dentsply/Caulk, Milford DE) and Prodigy (Kerr Sybron, Orange, CA.). The polymerization shrinkage was measured from the change in composite density produced by light curing a 0.3 gram disc having a diameter of approximately 15mm and a thickness of <2 mm. The mass of the cured sample was also measured in air and water. The formula, $(1 - \text{specific gravity of uncured composite} / \text{specific gravity of cured composite } H_2O) * 100$, was used to calculate shrinkage. Additional samples were prepared for Thermal Mechanical Analysis (TMA) to determine the CTE of the composites. The CTE was measured using a Mettler TMA at a rate of 2°C/minute over the temperature range of 30°C - 50°C. The CTE for Prodigy was 43.55 ppm/K and Surefil's CTE was 38.15 ppm/K. The polymerization shrinkage determined at 22°C was 2.23% and 1.72% for Prodigy and Surefil respectfully. These new restorative materials may behave more like amalgam during placement but their shrinkage and expansion properties are not significantly different than conventional hybrid composites.

9:40 INTERVENTIONAL MRI GUIDED STEREOTACTIC ASPIRATION OF ACUTE/SUBACUTE INTRACEREBRAL HEMATOMAS

Donnie Tyler, University of Mississippi Medical Center, Jackson, MS 39216

Surgical Interventions for hypertensive intracerebral hematomas are still controversial. Many believe only hyperacute intervention is of any real utility. The majority of present interventions require a formal craniotomy with standard neurosurgical techniques. There are, though, a few reports on CT guided stereotactic aspiration of these hematomas with favorable results. We report of ten patients treated with frameless fiduciless stereotactic means using an intraoperative MRI scanner (GE 0.5T Signa SP). These patients were initially diagnosed with hypertensive ICH and operated on within 1 to 34 days post hemorrhage. The actual operating time averaged less than 120 minutes, including intraoperative imaging. Clot volumes ranges from 2.5-75 cc with a mean of 31 cc. There were two thalamic hematomas and eight basal ganglial hematomas. Three patients had intraventricular hematoma extension and all three as well as an additional patient required extra ventricular drainage. However, no patients required permanent post hemorrhage ventriculo-peritoneal shunt. Aspiration was successful in all cases to 70-90% of clot removal; two cases utilized intrahematoma t-PA infusion

with subsequent 80-90% clot removal. There were no complications or rehemorrhages. All patients showed some form of improvement that included either improved blood pressure control, speech or cognitive abilities. We conclude that using an intraoperative MRI scanner to perform frameless, fiduciless stereotactic aspiration of acute/subacute ICH is a safe and potentially effective means of treating intracerebral hematomas.

9:55 THE EFFECTS OF CIRCADIAN RHYTHM ON SALIVARY C-ERBB-2 LEVELS IN HEALTHY INDIVIDUALS

A.N. McArthur*, W.J. Cox, X. Dai, L.G. Bigler, T.M. Dellinger, and Charles F. Streckfus, University of Mississippi Medical Center, Jackson, MS 39216

C-erbB-2, commonly known as Her2/*neu*, is a prognostic marker used in the diagnosis of malignant tumors in breast cancer patients. The purpose of this study is to evaluate the effects of circadian rhythm on the protein c-erbB-2 salivary secretions in both males and females. C-erbB-2 protein levels in saliva were determined using enzyme-linked immunosorbent assay in two separate groups. The two groups consisted of 10 healthy males with the ages ranging from 22 to 45 (mean 26.3) and 10 healthy females with the ages ranging from 19 to 62 (mean 37.4). Saliva specimens were collected 3 times daily for 5 consecutive days. Each specimen was collected during a 5 minute stimulation period. Using the subjects' baseline values as a control, serial assessments were compared to the control using a one way analysis of variance. The data indicated that there were no statistical differences for salivary c-erbB-2 levels throughout the circadian cycle. The data also indicated that gender had no effect on the salivary c-erbB-2 levels (mean of males 15.06 hnu/mL; mean of females 15.03 hnu/mL). This study suggest that the secretion of oncogene c-erbB-2 is not affected by circadian rhythm.

10:10 Break

10:25 A RETROSPECTIVE STUDY OF ORAL DISORDERS AMONG PATIENTS WITH HYPOTHYROIDISM IN A DENTAL SCHOOL PATIENT POPULATION

P. Steven Arnold*, Horace E. Combs, Jason S. Grissom, Brian C. Talley, Sigurds O. Krolls, J. Perry McGinnis, Jr., and Charles F. Streckfus, University of Mississippi Medical Center, Jackson, MS 39216

One thousand and twelve patients comprising a lower to middle income class were evaluated for dental treatment in 1999 at the UMC School of Dentistry. The cohort with hypothyroidism was comprised of 46

individuals or 5% of the total patient population and comprised of 5 males (11%) and 32 females (70%) Caucasians and 1 male (2%) and 8 female (17%) African-Americans. Results of oral examinations revealed that 50% of the cohort had evidence of periodontal disease. Seventeen percent of those exhibiting hypothyroidism had class V carious lesions and 24% had class 11 lesions. Of those patients with hypothyroidism, 27% had missing teeth, 28% had loose teeth and 30% open contacts. Of the total non-hypothyroidism population studied, 51% presented with evidence of periodontal disease. In addition, the control group exhibited 15% class V carious lesions and 30% presented with class 11 lesions. The control group presented with 29% missing teeth, 23% loose teeth and 24% open contacts. This study suggests that caries and periodontal disease in a hypothyroid patient are no more prevalent than in a patient presenting without a hypothyroid disorder.

10:40 DEVELOPMENT OF A NOVEL SUSTAINED DELIVERY SYSTEM FOR ANTI-CANCER AGENT IN TISSUE CULTURE SETTING

Kent Kihyet Higdon*, Aaron Scott, Hamed Benghuzzi, Michelle Tucci, and James L. Hughes, University of Mississippi Medical Center, Jackson, MS 39216

The specific objectives of this investigation were: (1) to develop a ceramic delivery system for the purpose of releasing sustained levels of IP6 + I in a tissue culture setting; and (2) to assess the proliferation and viability of HTB 122 Intraductal Breast Cancer (IBC) cells exposed to sustained levels of IP6 + I compared to conventional means of drug delivery. The Tricalcium Phosphate – Lysine (TCPL) capsules were fabricated according to standard laboratory procedure. A total of 40 mg of IP6 + I was loaded into each capsule (n=12) and sterilized by gas sterilization (24 hours). The experimental design consisted of four groups: Groups 1-4 were consisted of media + cells (50,000 cells / well); media + cells + 10 µg (IP6 + I) daily; media + cells + sham capsule; of media + cells + TCPL loaded with IP6 + I, respectively. At the end of 24, 48, and 72 hours, the cells were terminated, and the supernatant was removed for biochemical analysis. Total cell counts, protein content, and MDA levels were conducted by following standard laboratory protocols. Data obtained from this investigation suggest the following: (1) TCPL delivery systems can be utilized in the tissue culture setting to deliver IP6 + I in a sustained manner for 72 hours; (2) the use of IP6 + I at the physiological dose did not induce any significant change in the biochemical marker (MDA); and (3) regardless of route of administration, treatment with IP6 + I resulted in a decrease in total protein content compared to the sham capsules and control groups.

10:55 ADVANCES IN CURING OF DENTAL RESTORATIVE MATERIALS

S.B. Roberts*, A.D. Puckett, C.C. Inman, and J.G. Fitchie, University of Mississippi Medical Center, Jackson, MS 39216

The purpose of this study was compare the degree of conversion and mechanical properties obtained for a hybrid composite cured by a plasma-arc light curing unit on two available settings to a conventional halogen light curing unit. The hybrid composite APH (Caulk Dentsply, Milford, NH) was cured by three methods: A) Apollo 95E plasma-arc light for 3 seconds B) Apollo 95E on "step-cure" mode (2 seconds at 50% full power, followed by 4 seconds at full power) C) Demetron Optilux 401 light for 40 seconds. Five standard diametral tensile specimens (d = 6 mm and t = 3 mm) were prepared for each experimental group using a stainless steel mold and glass cover slips. Immediately after curing the hardness measurements for both top and bottom surfaces were recorded using a Shore D durometer (Pacific Transducers Corp, Los Angeles, CA). After 1 hour at room temperature, diametral tensile strengths (DTS) were determined using a Sintech 2/G mechanical testing system at a load rate of 1 cm/min. Another series of samples were prepared, cured, and stored in DI H₂O for 24 hr @ 37°C before repeating the mechanical analysis. A series of samples were also cured, crushed and extracted with chloroform to evaluate the residual monomer using gel permeation chromatography (GPC). The results from this study suggest that the three curing methods are not equal.

11:10 PHYSICIAN TECHNOLOGY PREFERENCES: EVOLUTION DURING TRAINING AND TECHNOLOGIC CHANGE

Kendall P. Brown*, and W.B. Lushbaugh, University of Mississippi Medical Center, Jackson, MS 39216

Given the expected convergence of local area network (LAN) technology and hand-held computers within hospital practice, a survey of 4th year medical students was performed, to evaluate how attitudes and preferences towards this evolving technology have been formed, and what subsets of users practicing physicians might be divided into. The results further elucidate the gap between physician preferences and the process by which default technologies become standards. For example, the institutional process by which technologies are chosen and become standards are opaque relative to the clear process evidenced by these survey results, even in this first approximation of the physician preference-determining process. Portable hand-held devices were preferred. This cohort chose optimal device ergonomics. A majority of respondents desired to delegate responsibility for

maintenance of interface standards, as well as software and hardware maintenance. Wide bandwidth was preferred, by > implication, given a desire for real-time access to network databases. Transmission range and data security issues were not fully resolved, and warrant further investigation. Respondents chose a stable interface, and a high level of inter-device data transfer transparency. LAN designs are consistent with this need, and further research needs to be conducted to verify which LAN software schemes are most adaptable to physician tool designs.

11:25 USING PROCRIT TO MINIMIZE ANEMIA SIDE-EFFECTS OF CHEMOTHERAPY

Renetta King^{1*}, Richard Mansour² and Howard Wold², ¹University of Southern Mississippi, Hattiesburg, MS 39406-5043 and ²Freedman Clinic of Internal Medicine, Alexandria, LA 71303

In addition to killing cancer cells, chemotherapy also destroys erythrocytes, thereby causing anemia. Anemia results when there is not enough oxygen released in the cells or when levels of hemoglobin are low. Normally the hormone, Erythropoietin would stimulate the production of red blood cells, but during chemotherapy the levels of Erythropoietin are not high enough to recover such a great loss of erythrocytes. Procrit or epoetin alpha is a replacement for human Erythropoietin. Cancer patients usually receive an injection of Procrit three times a week, a dose that is based on the regimen of Procrit administration for renal failure. However, a 16 week study in 500 clinics found that Procrit could be administered once a week to cancer patients and produce the same results as compared to three doses a week. Overall, there were a 3.0 g/dL mean increase in hemoglobin levels as well as improved patient-reported quality of life parameters. These results have been published and presented to FDA for approval of once weekly dosing of Procrit.

11:40 THE EFFECT OF THE PHYTOCHEMICALS Fisetin AND Luteolin on MCF-7 Breast Cancer Cell Growth

William J. Steelman*, Kedra L. Martin, and Nancy Eddy Hopkins, Millsaps College, Jackson, MS 39210

Recent research and media attention has focused on the estrogenic and the cancer chemopreventative effects of phytochemical isoflavonoids such as genistein and daidzein in soybased foods as well as the cancer chemopreventative effects of the flavanoids such as catechin and epicatechin found in tea. Women such as those in Thailand and Japan who eat diets rich in plant foods have a decreased risk of breast cancer. Many other flavanoids and isoflavonoids are found in plant foods. Using a modified E-screen (Wang, et al., Carcinogenesis

17:271–275, 1996), we have evaluated the effects two phytochemicals, fisetin and luteolin, on MCF-7 cell growth of in the presence and absence of 17- β estradiol (E2). These tetrahydroxyflavone isomers produced similar growth effects in this system. Both fisetin and luteolin increased cell growth in a dose depend manner in the absence of E2 but inhibited cell growth in a dose depended manner in the presence of E2. Studies are underway to evaluate the effects of other phytochemicals with similiar structures and to elucidate the mechanism of these effects.

THURSDAY AFTERNOON

Gulf Hall

1:30 DEVELOPMENT OF A CACO-2 COLON CANCER CELL ASSAY TO EVALUATE CHEMOPREVENTATIVE PHYTOCHEMICALS

Alexa N. Ivancac*, Kedra L. Martin, and Nancy Eddy Hopkins, Millsaps College, Jackson, MS 39210

The Caco-2 colon cancer cell line is well characterized and is a useful model for many tissue culture models. This line will undergo early differentiation and expresses many markers and receptors in culture that are expressed in normal colon epithelium. Recently, these cells were reported to express estrogen receptor in serum-free media. Phytochemicals such as the catechins found in green tea and flavanoids and isoflavanoids found in soybean foods have been shown to be chemopreventative in several colon cancer animal models. These same chemicals have been shown to decrease the risk of breast cancer. In order to study these phytochemicals, we have developed an assay using 2.5% dextran-charcoal stripped serum to evaluate the effect of phytochemicals on estrogen -induced Caco-2 cell growth. We have found that 1 μ M 17- β estradiol will give a 2- to 2.5-fold increase in cell growth. Studies are underway to determine the effects of phytochemicals in this system.

1:45 PSPA FAMILY TYPING OF CLINICAL ISOLATES OF *STREPTOCOCCUS PNEUMONIAE*

LaTonya B. Washington*, LaShandra Johnston, and Larry S. McDaniel, University of Mississippi Medical Center, Jackson, MS 39216

Streptococcus pneumoniae is an important human pathogen worldwide for which a more effective vaccine is needed. There has been considerable interest in pneumococcal protein antigens as potential vaccine components. One of the most well characterized pneumococcal proteins is pneumococcal surface protein A

(PspA). PspA has been shown to play a role in pneumococcal virulence and can elicit protective immune responses against pneumococcal infection in a mouse model. Despite being a serologically variable protein, PspA is able to elicit cross-protection against different variants. Sequence analysis has defined 7 clades that can be placed into 4 PspA families. Rabbit antiserum is available that reacts specifically with family 1 and family 2 PspA. Most clinical isolates have been typed using the rabbit antiserum as family 1 or 2. We examined 167 pneumococcal isolates collected over a four year period from the University of Mississippi Medical Center Clinical Laboratory. We found that 81/167 (48.5%) were family 1, 76/167 (45.5%) were family 2, 2/167 (1.2%) were both, and 8/167 (4.8%) were neither. Our results are in agreement with those reported for pneumococcal clinical isolates from other geographic locations. If PspA is to be used as a pneumococcal vaccine, it is important to identify, and continue to monitor, the relatedness of pneumococcal clinical isolates.

2:00 EFFECT OF EPHEDRINE ANALOGS AND ISOMERS ON HUMAN α_2 - AND α_2 -ADRENOCEPTORS EXPRESSED IN CHINESE HAMSTER OVARY CELLS

Yolande Davis^{1*}, Shilpa G. Lalchandani², and Dennis Feller², ¹Mississippi University for Women, Columbus, MS 39701 and ²University of Mississippi, Oxford, MS 38655

Ephedrine and its alkaloids are used for the treatment of asthma, nasal congestion and obesity. Ephedrine, with two chiral centers exist as four isomers which exhibit direct and indirect affects on both α - and β -adrenergic receptors (AR). Our main goal was to study the binding affinity and selectivity of ephedrine isomers and its analogs on human α_2 - and α_2 -adrenergic receptor subtypes expressed in Chinese hamster ovary cells (CHO). Radioligand binding assay was performed on racemic ephedrine, its hydroxyl and methyl substituents and also on four isomers of ephedrine. The binding data showed that the addition of 4-hydroxy and N-methyl substituents reduced the binding affinity of ephedrine on the α -adrenergic subtypes. Also among the isomers the 1R, 2S and the 1R, 2R ephedrine isomers showed greater binding than the 1S, 2R and the 1S, 2S isomers, indicating the importance of the 1R hydroxyl substituent for α -adrenoceptor binding.

2:15 DETERMINATION OF TAMOXIFEN AND ITS METABOLITES IN FETAL TISSUE USING CAPILLARY ELECTROPHORESIS (CE) CHROMATOGRAPHY

K.L. Alford^{1*}, Henry Outlaw¹, P.J. Schupp², J.M. Sanders², and M.L. Cunningham², ¹Delta State University, Cleveland,

MS 38733 and ²Laboratory of Pharmacology and Chemistry, NISHS, Research Triangle Park, NC 27709

Tamoxifen (TAM), an antiestrogen, has been approved for use by women with increased risk of developing hormone-dependent breast cancer. However, little data exist describing potential TAM-induced fetal toxicity to women of child-bearing age. Transplacental exposure of TAM has been linked to reproductive tract toxicity in female offspring of CD-1 mice. In support of the National Toxicology Program's characterization of reproductive and developmental effects of AM, this work describes a CE-based analytical technique for the detection of TAM and two of its major metabolites, N-desmethyltamoxifen (DMT), and 4-hydroxytamoxifen (4-HT) in mouse fetal tissue. The present technique was developed and validated following 98:2 hexane/isoamyl alcohol extraction of TAM, DMT, and 4HT from spiked fetal tissue homogenates. Optimum resolution of TAM, DMT, and 4-HT was obtained on a 57 cm x 50 μ m capillary using a nonaqueous buffer system of 1:1 methanol/acetonitrile containing 50 mM ammonium acetate and 1.5% acetic acid. 4-Dimethylaminopyridine was used as an internal standard. Temperature and voltage were optimized at 40°C and 15 kV, respectively. This CE-based analytical technique was used to analyze for the presence of TAM, DMT, and 4-HT in TAM-treated CD-1 mice. All three compounds were detected at 2, 4, 8, and 12 hr post-dosing in fetal tissue collected at gestation day 16 from mice receiving a single dose of 100 mg TAM/hg. Results of the present study demonstrate transplacental transport of TAM-derived material to fetuses of TAM-treated dams. Further, this work presents a sensitive new methods for the detection of TAM and two major metabolites in fetal rodent tissues.

2:30 TRANSFECTION STUDIES WITH A CANDIDATE HUMAN IMIDAZOLINE RECEPTOR cDNA

Michael Chen*, Mary Elise Lutrick, He Zhu, James Baldwin, Victor Stuckey, and John Piletz, University of Mississippi Medical Center, Jackson, MS 39216

Imidazoline receptors (IR) are involved in blood pressure and stress responses from brain nuclei. We have previously cloned a candidate IR₁ cDNA by screening from a human hippocampal cDNA expression library with two IR-selective antisera (*J. Autonomic Nervous System*, 72, 98-110, 1998; *DNA and Cell Biology*, submitted). That cDNA, designated imidazoline receptor antisera-selected (*iras-1*) cDNA, contains 5,131 bp and is predicted to encode a 167 kDal protein. Transfection of *iras-1* cDNA into CHO (Chinese hamster ovary) cells results in a three-fold increase in the B_{max} of [¹²⁵I]-*p*-iodoclonidine for I₁ sites;

with a high-affinity component revealed only in transfected CHO cells for the I₁ ligands, moxonidine and rilmenidine. In PC-12 (phaeochromocytoma) cells, over 80 stably-transfected subclones were screened both by Western blotting and PCR, and six of these showed at least a two-fold increase in I₁ B_{max} values. Transfected CHO and PC-12 cells showed a 167 kDal band as well as smaller bands (~85 kDal) on Western blots. On the other hand, transient transfections into COS-7 and Sf9 cells failed to result in an increase in I₁ binding sites, even though there was an abundance of the ~167 kDal protein made. To determine if there is any possible interaction between I₁ sites and alpha_{2A} adrenergic sites, CHO cells stably transfected with the human alpha_{2A} adrenergic receptor cDNA were transiently transfected with *iras-1*. These cells produced both alpha_{2A} and I₁ receptors (immunologically) with the appropriate binding sites observed, and the results provide support for studies aimed at characterizing the pharmacological and functional interactions between alpha₂-adrenergic and I₁ receptors. Supported by NIMH grant MH49248-06 and grants from Eli Lilly and Solvay Pharmaceutical Companies.

2:45 Break

3:00 Divisional Poster Session

GROWTH HORMONE (GH) AFFECTS A-549 LUNG CELLS INDIRECTLY THROUGH IGF-1

Robert Triplett*, Bobby Thomas, Joseph A. Cameron, Leon Anderson, Michelle Tucci, and Hamed Benghuzzi, University of Mississippi Medical Center, Jackson, MS 39216 and Jackson State University, Jackson, MS 39216

In reviewing the literature, lung cell proliferation and differentiation is controlled by a complex interaction of endocrine and autocrine growth factors, mechanical forces and developmental regulators. In the present study, we have examined the regulation of GH and IGF-1 in A549 cells to gain more insights into the role of growth factors might have in neoplastic lung growth. The specific objectives of this investigation were: (i) to study the effect that IGF-1 and GH might have directly or indirectly on the proliferation of A549 cells in culture, and (ii) to evaluate the role of IGF-1 and GH on the cellular membrane integrity (MDA levels) of A-549 cells. A549 cells were grown in 15-ml glass tubes in Ham's F-12 medium. The cells were then incubated with IGF-1 (26 pg/ml) or GH (48 pg/ml) for either 24 or 48 hours. At the end of each phase, the media was removed and saved in a 1.5 ml microcentrifuge tube for MDA analysis. The cells were washed twice with 5 ml of phosphate buffered saline. The cells were detached from the side of the tube, and collected

into a volume of 1 ml of phosphate buffered saline for cell counts and protein analysis. At the time of termination, the cells were evaluated morphologically, trypsinized, and cell numbers were calculated using a hemacytometer. Results obtained from this investigation suggest that: (I) IGF-1 stimulated the A549 at concentration of 26 pg/μl at both 24 and 48 hours without causing cellular damage, (II) GH at concentration of 48 pg/μl was unable to stimulate cell proliferation at either 24 or 48 hrs, and (III) supernatant MDA levels were increased in the growth hormone treated cells in comparison to the IGF-1 and media treated cells. Overall conclusion obtained from this study reveals that GH regulates the proliferation of A549 cells indirectly through IGF-1.

INFLUENCE OF LEAD ON NITRIC OXIDE IN THE LIVER AND KIDNEY OF NEONATAL RATS

Regina L. Bell, S.L.N. Reddy, Sharonda Swilley, Vanessa Hinton*, S. Rajanna, and B. Rajanna, Alcorn State University, Alcorn State, MS 39096

Nitric Oxide (NO) is implicated in the control of short and long term regulation of arterial pressures in the liver and kidney. We have earlier reported hepatic and renal toxicity of lead (Pb). The purpose of this study is to determine the effects of Pb on the production of NO measured as nitrate and nitrite (NO_x) in the liver and kidney of the rats. Pregnant Sprague Dawley rats in their 5th day of gestation were orally treated with 0.1% and 0.2% PbAcetate. Treatments of mothers were continued until 21 post natal days (PND). The pups were sacrificed at 5, 10, 15, 20, and 25 PND. The liver and kidney were excised. The NO_x levels were estimated by the chemiluminescent method using Sievers 280 Nitric Oxide Analyzer. 0.1% and 0.2% PbAcetate significantly reduced NO_x levels in both the liver and kidney at PND 5,10,15, and 20. At PND 25, NO_x reductions by PbAcetate at both doses were not significant. These results suggest that Pb play a significant role in reducing the NO production in the liver and kidney of neonatal rats. These studies have been extended to include PND 35, 40, and 60. Supported by NIH/MBRS #GM 55356).

TRANSFER OF IMMUNITY TO *TRYPANOSOMA LEWISI* FROM INFECTED MOTHERS TO THE OFFSPRING IN RATS

Kristi McGillivray*, Daila Morgan, John Rentrop, and Kristi Tucker, Belhaven College, Jackson, MS 39202

Trypanosoma lewisi is a cosmopolitan blood parasite of rats, which is non-pathogenic in humans. Another species causes African sleeping sickness in humans and is the fifth leading cause of death from parasites in the world. It is known that humans receive

immunity from the mother's milk through breast-feeding. It has been shown that suckling rats can also receive immunity from their mother. In this study a group of mothers (I) were inoculated with *T. lewisi* before giving birth to determine if they will develop immunity to the parasite and transfer that immunity to their offspring. Another attempt was made to determine if immunity was passed trans-placentally. A cross fostering method was used: the I mothers gave birth and then their offspring were switched to nurse from a non-infected (NI) mother. This would determine if immunity was passed trans-placentally. The offspring from the NI mother nursed from an I mother, which would determine if immunity to the mother's milk was the result of infection prior to giving birth. It was observed that the levels of trypanosomes in the offspring that nursed from the I mother were almost zero. This demonstrated that the immunity passed in the milk was sufficient to halt the infection. Immunity to the trypanosomes passing trans-placentally resulted in an infection lower than the control group. Another aspect of this study was an *in vitro* use of antibodies derived from rat's milk against live trypanosomes. The results were inconclusive after twenty minutes because none of the trypanosomes were killed.

CYTOHISTOLOGIC CORRELATION IN PATIENTS WITH CLINICAL SYMPTOMS OF POSTMENOPAUSAL BLEEDING

Stephanie D. Webster*, Zelma Cason, and Hamed Benghuzzi, University of Mississippi Medical Center, Jackson, MS 39216

Today, the life expectancy for women is longer; therefore, many will likely experience the postmenopausal period (termination of fertility and menstrual bleeding). Uterine bleeding after this period could be attributed to several pathologic conditions. The specific objective of this project was to evaluate the cytohistologic findings in women with postmenopausal bleeding (PMB) and to determine the presence of any significant pathologic lesions. Cytohistologic correlations from 66 patients attained in 1993 from the University of Mississippi Medical Center were evaluated. The population evaluated were divided into three groups: (control group 1) dysfunctional uterine bleeding (DUB), (control group 2) postmenopausal (PMP), and (test group 3) the group of women with postmenopausal bleeding. The DUB and PMP age-matched controls (n=12, mean age 51 ± 5 and 57 ± 5 years) were randomly selected, and correlated with the actual group being tested (54 PMB, mean age 57 years). The distribution among the 54 PMB women evaluated were 69% (37/54) black, and 31% (17/54) white. The DUB and PMP control groups consisted of 50% (6/12) black and 50% (6/12)

white, respectively. Histopathological confirmation (62/66-94%) revealed 47/66 as negative, 5/66 as endometrial hyperplasia and 10/66 as squamous cell carcinoma or adenocarcinoma. A significant lesion with endometrial pathology was found in 23% of the patients. These findings suggest that the majority of women in this study with clinical symptoms of postmenopausal bleeding were negative for malignancies. While these results lean more towards a normal cytologic evaluation, postmenopausal bleeding should not be taken lightly. Post menopausal bleeding could represent signs of more serious lesions such as squamous cell carcinoma or endometrial adenocarcinoma if not detected and managed early.

THE EFFECT OF TCPL DENSITY ON THE RELEASE PROFILES OF HYDROPHOBIC AND HYDROPHILIC COMPOUNDS

Krashod Byrd* and Hamed Benghuzzi, Jackson State University, Jackson, MS 39216 and University of Mississippi Medical Center, Jackson, MS 39216

Several studies have shown that Tri-Calcium Phosphate Lysine Drug Delivery Systems (TCPL) are capable of releasing various organic compounds at a sustained manner. The fabrication of these devices is a very complex and the manipulation of one of various procedures can alter the release profile. The compression of the TCPL material into the capsules is an instrumental factor when studying the release profile. The objectives of this investigation were: 1) to study the interrelationship between the release profiles of devices that had been cold pressed to a density of 1.53 ± 0.15 (Low density, TCPL-LD) and $1.98 \pm 0.7 \text{ gm/cm}^3$ (High density, TCPL-HD), and 2) to evaluate the role of the change in density that might have on the release of hydrophobic and hydrophilic compounds in an *in vitro* environment. A total of 16 serum bottles were used and later subdivided into four groups (n=4). Groups I and II contained TCPL-HD and TCPL-LD capsules each loaded with 20 mg of progesterone (P). Groups III & IV contained TCPL-HD and TCPL-LD capsules that were loaded with 20 mg of Bovine Serum Albumin (BSA). Each serum bottle in groups III and IV was filled with a 100 ml of the experimental buffer (phosphate buffer saline, pH 7.4) and 10 μl of sodium azide (antibacterial agent). Serum bottles in groups I and II were filled with a buffer of 50% alcohol (wt/vol). Samples were withdrawn at various time intervals (168 hours) and analyzed by using standard spectrophotometer techniques and Jandel Sigmastat Statistical program. Results of this investigation suggest that: 1) TCPL-HD and TCPL-LD devices were capable of releasing P and BSA at a sustained levels, 2) regardless of the loaded drugs, the release profiles from TCPL-LD devices was found to be significantly higher ($p < 0.05$) than

the release profiles of P and BSA from TCPL-HD, and 3) physiochemical characteristics of the drug to be delivered are instrumental in regulating the rate of release and duration or availability of an effective and safe dose (BSA > P).

BIOMECHANICAL EVALUATION OF SUTURE BONE ANCHORS: IMPROVING ORTHOPEDIC SURGICAL REPAIR OF TENDONS TOM OFF BONE

Philip Eichhorn^{1*}, Douglas Parsell², and Thom Tarquinio², ¹Jackson Preparatory School and ²University of Mississippi Medical Center, Jackson, MS 39216

Bone anchors are tiny metal screws with a central hole in the outer end for connecting sutures from torn off tendons or ligaments being reattached to bone (heel, shoulder) in orthopaedic surgery. Repair strength is critical. This study evaluates failures of suture-anchor combinations as a function of anchor design and orientation during use. Four commercially available bone anchors were evaluated using heavy suture (#2 Ethibond). Sutures, n = 232, (looped through the eyelets of anchors inserted into high-density polyethylene, UHMWPE, that simulates bone) were pulled at three angles of orientation using four different anchors of each type, pulled five times in each orientation. Using a computerized screw-type load frame, pull was applied rapidly to simulate a patient's traumatic fall. Two of four brands showed significant variation among samples. Also, suture failure strength varied significantly as a function of pull angle. Sutures in Fastin and SuperQuick anchors at 90° and 90°/90° broke easily. Suture strength in the Mainstay anchor highly depended on eyelet orientation: weak at 90°, but strongest of all tested at 90°/90°. Suture in the Pebax anchor had good strength at both orientations. Significant differences were shown among these bone anchor types. Most sutures are used at 90° and 90°/90° in anchors in surgery. Therefore, the Pebax anchor and, particularly, the Mainstay used at 90°/90° have the greatest repair strength. Application of these results can improve orthopedic surgical repairs needing bone anchors. Future work towards more orientationally robust bone anchor designs is warranted.

CYTOLOGICAL ASSESSMENT OF BENIGN AND MALIGNANT DENSE HYPERCHROMATIC GROUPS IN CERVICOVAGINAL SMEARS

Marlene Harris*, Zelma Cason, and Hamed Benghuzzi, University of Mississippi Medical Center, Jackson, MS 39216

Dense hyperchromatic cell groups are considered one common diagnostic problem in cytopathological evaluations. This morphological feature represented by cluster of cells with scant cytoplasm and dark nuclei.

Cytologic evaluations may result in high false-positive or false negative rates in cervicovaginal smears, due to overcalling benign groups as malignant and malignant groups as benign. The key is to differentiate among the dense groups and to appropriately classify the lesions based on strict morphologic criteria. The objective of this study was to evaluate the cytomorphology of benign and malignant dense hyperchromatic groups in cervicovaginal smears at the University of Mississippi Medical Center. Six types of dense hyperchromatic groups were selected (sixty cervicovaginal smears) to represent all of the entities. The cases were divided into; group 1, atrophic pattern (n=10), group 2, endocervical cells (n=10), group 3, endometrial cells (n=10), group 4, high-grade squamous lesions (HSIL) (n=10), group 5, invasive squamous cell carcinoma (n=10), and group 6, endometrial adenocarcinoma (n=10). Light microscopy was used to evaluate the background, arrangement, and chromatin pattern. ImagePro® computer software (x40 magnification) was used to measure and evaluate the nuclear area, ratio, density, and shape. Data obtained from this investigation suggest the followings: (I) there were no significant difference can be observed in the total areas among all groups, (ii) nuclear density of the cells have shown to be higher in HSIL, invasive squamous and adenocarcinoma cases, and (iii) evaluation of cellular shape in groups 1, 2, 3, 4, and 5 demonstrated round to oval, predominate round, oval to irregular, round to oval, round to irregular, and round to oval, respectively. In conclusion, cytomorphometric analysis can be utilized as an ideal diagnostic tool in differentiating between the ambiguous or suspicious groups of dense hyperchromatic cells. Ultimately, this diagnostic tool can minimize the high false-positive and false-negative rates resulting in better cytologic evaluations and patient prognosis.

NEUROTOXIC EFFECTS OF LEAD ON NITRIC OXIDE IN THE DEVELOPING RAT BRAIN

Regina L. Bell*, Sharonda Swilley, S.L.N. Reddy, S. Rajanna, and B. Rajanna, Alcorn State University, Alcorn State, MS 39096

Nitric Oxide (NO) is a free radical gas synthesized by Nitric Oxide Synthase (NOS) during the conversion of L-arginine to L-citrulline. Lead (Pb) is an environmental toxicant that affects neuronal functioning. NO, a neuronal messenger, has a short half-life and converts immediately to nitrite and nitrate. The present study is designed to determine the effects of Pb on NO production in four regions of the developing rat brain: the cerebellum, the hippocampus, the frontal cortex, and the brain stem. Pregnant Sprague Dawley rats in their 5th day of gestation were treated with 0.1 % PbAcetate and 0.2% PbAcetate, and control groups received 0.1% NaAcetate. All

treatments were administered through deionized, distilled drinking water. Treatments were continued during pregnancy and until 21 postnatal days (PND). The pups were sacrificed at PND 5, 10, 15, 20, 25, 30, 45, and 60. Whole brain tissues were excised and separated into the cerebellum, hippocampus, frontal cortex and brain stem. The nitrite and nitrate (NOx) were measured by the chemiluminescent method using Sievers Nitric Oxide Analyzer (280). In the cerebellum, at PND 25, 0.1% and 0.2% Pb reduced NOx levels by 428% and 328%, respectively. In the hippocampus, both doses of Pb reduced NOx levels at all PND except PND 15. In the brain stem, there were significant reductions in NOx at PND 20 and 25. Both doses of Pb reduced NOx in the frontal cortex at PND 10, 15, 20, and 25. These results suggest that Pb alter NO production in the rat brain leading to neuronal dysfunction. These studies have been extended to include rat brain tissues of PND 30, 45, and 60. (Supported by NIH/NIGMS/MBRS #GM 55356).

THE ROLE OF GLUCOCORTICOIDS ON HUMAN PULMONARY ADENOCARCINOMA (A549 CELLS) IN CULTURE

Kimberly Cornelius*, LaShunda Thompson, Hamed Benghuzzi, Michelle Tucci, and James L. Hughes, University of Mississippi Medical Center, Jackson, MS 39216

A549 cell line, a transformed cultured cell line derived from a human pulmonary adenocarcinoma. They are distinguished from the cell lines by having morphologic and biochemical features of the pulmonary alveolar type II cells. Steroid hormones have been used to treat several pulmonary medical complications. The mechanism of action of such steroids is still unclear. The specific objective of this investigation is to study the effect of various concentrations of cortisol that might have on the viability and proliferation rate of A549 cells in culture. The cells were incubated in the presence of 0, 1, or 20 µg/ml cortisol, and the cell number, morphology and cell damaged (MDA) were measured at 24, 48 and 96 hours after cortisol administration. Data obtained from this study demonstrated that the protein content of the cells at 24 hours showed a significant increase ($p < 0.05$) in both the 1 and 20 µg/ml cortisol treated cells. No significant change in protein content at 48 and 96 hours phases between experimental and control groups. Cortisol treatment did not induce any significant changes in cell number, viability and markers of cell membrane at all three phases. In contrast, morphological evaluation showed, regardless of the dose, that there were an increase in cell volume with condensed chromatin in cortisol treated cells. This phenomenon could possibly explain the increase observed in cell protein content. A549 cells act as pulmonary alveolar type II cells,

which are capable of secreting surfactant. Corticosteroids have been used in neonates to reduce the incidence of respiratory distress syndrome, and the increase in cell volume may indicate cellular activation and increased surfactant secretions. The results of this study suggest that cortisol at concentrations of 1 and 20 $\mu\text{g}/\text{ml}$ are capable of increasing cellular protein concentration after 24 hours without causing membrane damage (MDA levels) or changes in cell viability (morphology).

RESTORATION OF THE ENDOMETRIAL FUNCTION BY MEANS OF SUSTAINED DELIVERY OF ES AND ES + P IN OVARIECTOMIZED RATS

Zelma Cason^{1*}, Hamed Benghuzzi¹, Michelle Tucci¹, Aaron Scott¹, and Barry England², ¹University of Mississippi Medical Center, Jackson, MS 39216 and ²University of Michigan Medical Center, Ann Arbor, MI

Previous studies conducted in our laboratories have documented that tricalcium phosphate lysine (TCPL) delivery system can be utilized to deliver estrogen (ES) and combination of estrogen with progesterone (ES + P) at a sustained levels for long duration in intact rats. The specific aim of this investigation was an attempt to reverse the endometrial changes resulted from post-ovariectomy by exogenously delivering sustained levels of ES and ES + P. A total of 13 adult female rats were used in this study. The animals were randomly divided into four different groups: groups 1, 2 and 3 were ovariectomized (OVX), OVX plus ES (20 mg loaded TCPL), and OVX plus E (TCPL, 20 mg) plus P (TCPL, 60 mg) treatment. Group 4 animals served as intact control group. Blood samples were collected biweekly for 33 days. Vaginal smears were taken and screened daily during the entire investigation. Histopathological evaluations were conducted on all reproductive as well as vital organs (H & E). Data obtained from this investigation suggest the following: (I) OVX resulted in an increase in total body weight, however ES and ES plus P maintained the body weights at prior ovariectomy level, (II) sustained delivery of ES resulted in maturation of vaginal epithelium and the smears exhibited the estrus at the end of 72 hours post implantation and continued this trend for the duration of the study, (III) ES + P treatment induced no estrus and the epithelial changes resembled the OVX group, and (IV) ES and ES + P treatment resulted in a significant different ($p < 0.05$) in MDA levels compared to OVX and intact control groups. Results of this investigation conclude that sustained delivery of ES and ES + P by TCPL can be utilized to maintain the normal function of the reproductive organs and could serve as an efficient and safe therapy in estrogen deficient patients.

EFFECTS OF THE POLYCHLORINATED BIPHENYL (AROCLOR-1254) ON PRIMARY RABBIT KIDNEY (PRK) CELLS

Annette Davis^{*}, Michelle Tucci, James L. Hughes, Hamed Benghuzzi, and Leon Anderson, University of Mississippi Medical Center, Jackson, MS 39216

The cytotoxicity of a commercial PCB mixture, Aroclor-1254, was assessed on cultured kidney epithelial cells. Studies using this cell line can be useful to determine the effect of Aroclor-1254 on kidney function such as filtration, excretion, and absorption processes. In PCB exposed and unexposed cells, the following biochemical parameters were measured: cell viability, protein synthesis, and lipid peroxidation. The results show that Aroclor-1254 at concentrations exceeding 0.1mM (but not at lower concentrations) causes irreversible damage to cultured kidney epithelial cells. In cells exposed to concentrations of 10 μg of PCBs, there was decreased in cell number at 24 and 48 hour phases compared to untreated and cells treated with lower doses of Aroclor-1254. Cellular protein concentration confirmed the results of cell number. The decrease in both cell number and protein concentration at both 24 and 48 indicated either cell death due to severe injury or interference with cell ability to divide in culture. In order to determine the integrity of the cell, the levels of MDA were determined at both time points. The results obtained from the MDA assay indicate no significant differences in the levels between the treatment groups and vehicle control, suggesting disruption of the cell's ability to divide rather than an indicator of cell death. However, cell morphology evaluation indicated changes in cell structure at concentrations greater than 0.1 $\mu\text{g}/\mu\text{l}$ as compared to cells treated with media or vehicle alone. In conclusion, Aroclor-1254 at concentrations of 1 and 10 $\mu\text{g}/\mu\text{l}$ caused disruption of the cells ability to divide possibly by causing changes within the cellular DNA resulting in the cell being held within G_1 of the cell cycle. Cells exposed to concentrations greater than 0.1 $\mu\text{g}/\text{ml}$ showed alterations in cell morphology as compared to untreated cells.

THE EFFECT OF ALDOSTERONE AND CORTISOL ON THE VIABILITY AND PROLIFERATION OF RHESUS MONKEY KIDNEY EPITHELIAL CELLS IN CULTURE

Mi Jung^{*}, Hamed Benghuzzi, Michelle Tucci, and Zelma Cason, University of Mississippi Medical Center, Jackson, MS 39216

Primary cultures of Rhesus Monkey renal tubular epithelial cells were used to study the effect of two adrenal hormones, aldosterone and cortisol, on cell proliferation and viability as well as cell morphology at 24, 48 and 72 hours after steroid hormone treatments. Proliferation was studied by comparing cells grown in serum; with cells

grown in the presence of either 1mg or 20mg cortisol or aldosterone for 24, 48 or 72 hours in culture. In addition to cell counts cellular protein and MDA levels were determined at each phase. Proliferation was assessed by determining cell number (population doublings), and the results show that cells treated with cortisol caused a slight increase in cell number at both 24 and 48 hours, where as cells treated with low dose aldosterone had slight effects on cell doubling. Supernatant levels of MDA in cortisol treated cells were significantly higher than cells treated with aldosterone or media alone. At 72 hours the cells treated with both the low and high dose of either cortisol or aldosterone showed the highest levels of supernatant MDA. Morphological evaluation of aldosterone treated cells revealed changes in size and shape as early as 24 hours after treatment. The changes observed included vacuolation, irregular spindle shapes, lack of cell aggregates and occasional pyknosis. Cortisol treatment caused the appearance of vesicular nuclei, columnar shape cells, shriveling, and predominant pyknosis. The results from this experiment show that the proximal tubule epithelial cells retain a number of functional characteristics and that they represent an excellent model for studies of normal and abnormal biology of the renal proximal tubule epithelium.

THE EFFECTS OF AMYLOID β -PROTEINS ON PROSTAGLANDIN E2 PRODUCTION IN RAT MICROGLIA

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The hallmarks of Alzheimer's disease include senile plaques that contain amyloid β -proteins (A β), neuritic tangles, loss of neurons and gliosis which involves microglia and astrocytes. Microglia are immune cells of the central nervous system. Many activated microglia are found near the senile plaques. In this study, we investigated the regulation of prostaglandin E2 (PGE2) production by A β ₁₋₄₀ and A β ₁₋₄₂ in adult rat microglia after exposure to bacterial lipopolysaccharide (LPS) (a classical inducer of microglia). Rat microglia were cultured from cortex of adult rat brain and were used within seven days of culture. We tested the effects of both A β ₁₋₄₀ and A β ₁₋₄₂ on PGE2 production in rat microglia with or without exposure to LPS. PGE2 was assayed by commercial enzyme-linked immunoassay kit. The results showed that both A β ₁₋₄₀ and A β ₁₋₄₂ alone didn't increase the production of PGE2 compared with the controls. LPS significantly increased PGE2 production. Interestingly, we found that A β ₁₋₄₀ increased PGE2 production induced by LPS, whereas A β ₁₋₄₂ decreased the PGE2 production induced by LPS. We also tested expression of cyclooxygenase-2 (prostaglandin synthase)

which rises rapidly in response to inflammatory stimuli. In each condition the level of expression of cyclooxygenase-2 was consistent with the production of PGE2. The results suggest that A β ₁₋₄₀ and A β ₁₋₄₂ have opposite effects on the production of PGE2 induced by LPS.

THE EFFECTS OF GROWTH HORMONE AND INSULIN-LIKE GROWTH FACTOR ON THE PROLIFERATION RATES OF RAW 264.7 MACROPHAGES

Jayson R. Smith*, Michelle Tucci, James L. Hughes, and Hamed Benghuzzi, University of Mississippi Medical Center, Jackson, MS 39216

It is well documented that growth hormone (GH) functions to regulate both cell growth and cell number and is considered the master hormone because it affects almost every cell of the body. Growth hormone stimulates the liver to secrete insulin-like growth factor, which is also capable of binding insulin as well as insulin-like binding receptors on the cell surface. It is possible that GH cellular effects are mediated by insulin-like growth factor (IGF) rather than GH itself. In this study, RAW 264.7 cells were challenged with high dose GH (48 ng/ μ l), low dose GH (4.8 ng/ μ l), high dose IGF-1 (26 ng/ μ l) or low doses IGF-1 (6.3 ng/ μ l) for 24, 48, 72, and 96 hours. Cell number, cell protein, concentration, cell damage, and cellular morphology were measured at each time point and compared to untreated RAW 264.7 cells. The results show significant increases in cell number for cells treated with low doses of GH and IGF-1 at 24 hour phase. Cell proliferative effects were also observed at 48 hours in IGF-1 treated cells. Cellular damage (MDA levels) was not statistically significant for any treated group for the entire duration of the experiment. Most notable differences were observed in cellular morphology for both IGF-1 and GH treated cells. IGF-1 resulted in condensation of the nuclear material as early as 24 hours after treatment. In conclusion: (1) RAW 264.7 responded to both IGF-1 and GH equally (viability and proliferation), and (2) morphological changes were observed in all cells treated with both hormones compared to control group. This study indicate that GH hormone could induce its effect directly or indirectly through IGF-1.

INHIBITION OF NITRIC OXIDE POTENTIATES GLUCOSE-HYPERTENSION IN RATS

Christie R. Claxton^{1*}, Michael W. Brands², and Joseph A. Cameron¹, ¹Jackson State University, Jackson, MS 39217 and ²University of Mississippi Medical Center, Jackson, MS 39216

Endothelial dysfunction, has been proposed to contribute to vasoconstriction or hypertension in many conditions characterized by hyperinsulinemia or

hyperglycemia. However, there is little known about the role of the endothelium before dysfunction develops. This study tested whether nitric oxide production, before endothelial dysfunction develops, plays an important role in counteracting the hypertensive response to chronic glucose infusion. Glucose was infused (18.6 mg/kg/min, iv.) for 7 days in 8 normal rats (G) and in 9 rats with a chronic background iv. infusion of L-NAME at 10 mg/kg/min (G+L). Mean arterial pressure (MAP), measured 24 hr/day, increased an average of approximately 11 mmHg in the G rats. L-NAME treatment increased MAP an average of 28±2 mm Hg in the G+L rats, and glucose infusion raised MAP more than 30 mm Hg above that, averaging 155±8 mm Hg by day 6. In addition, heart rate increased from an average of 389±8 bpm to 441±16 bpm by day 6, while there was no significant change in the G rats. Glomerular filtration rate decreased significantly with L-NAME treatment and decreased in both groups by day 3 of glucose infusion, reaching lower levels in the G+L rats. These results show that NO is required to minimize the increase in MAP during glucose infusion, and suggest renal and neural mechanisms may be important in mediating that effect.

THE EFFECTS OF INOSITOL HEXAPHOSPHATE ON THE INFLAMMATORY RESPONSE IN TRANSFORMED RAW 264.7 MACROPHAGES

Mara Johnson*, Michelle Tucci, James L. Hughes, Zelma Cason, and Hamed Benghuzzi, University of Mississippi Medical Center, Jackson, MS 39216

Inositol hexaphosphate (IP-6) has received much attention for its role in interfering with tumor progression and slowing the metastasis of neoplastic cells. However, there is little information regarding the antioxidant properties of IP-6 or its ability to enhance the natural disease resistance of the body. The specific objectives of this experiment were to investigate the effects of IP-6 that might have on the proliferation and viability of RAW 264.7 transformed macrophages and to morphologically and biochemically investigate the role of IP-6 as a free radical scavenger. Transformed RAW macrophages were obtained from the American Type Culture Collection (Rockville, MD) and maintained in sterile media (RPMI) supplemented with 10% fetal bovine serum and 1% antibiotics and antimycotics. The cells were plated on to 24 well plates at a density of 1×10^6 cells/well. The cells were divided into five groups of four wells per group per phase (24, 48, and 72 hours). Cells in Group I were treated with media alone and served as controls. Cells in Group II were treated with lipopolysaccharide (LPS) only. Cells in Groups III, IV, and V cells were treated with 1000 μ g of IP-6 + LPS, 500 μ g of IP-6 + LPS, and 100 μ g of IP-6 + LPS, respectively.

Cell number, as well as, histopathology, MDA, and protein was determined at the end of 24, 48, and 72 hours. Data obtained from this investigation revealed that the rate of cell proliferation was totally dependent on the dose of IP-6. At 24 and 48 hours and upon the exposure of high dose of IP-6 the mitotic ability of the cells was higher ($p < 0.05$) than the rate at 72 hour phase. Morphological evaluation of cells at all three phases revealed that there were no significant changes in the architecture of cells upon the exposure of IP-6 compared to the control group. The results of this study suggest that IP-6 may have had an excitatory effect on the inflammatory cell secretions and this phenomenon was found to be dose dependent.

HISTOPATHOLOGICAL EVALUATION OF KIDNEY TISSUES EXPOSED TO SUSTAINED DELIVERY OF STEROIDS IN OVARIECTOMIZED ADULT FEMALE RATS

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Kidney tissue has been used extensively to investigate the mechanisms of steroid action. The specific objective of this investigation was to histopathologically evaluate the kidney cortical changes associated with sustained delivery of dehydroepiandrosterone (DHEA), diosgenin (DG), or estrogen (E) using ovariectomized rats. A total of 15 rats were divided randomly into five groups of 3 rats per group. Animals in groups II-V were ovariectomized (OVX), and animals in groups III-V were implanted with a single tricalcium phosphate lysine drug delivery device (TCPL) loaded with DHEA (40 mg), DG (40 mg), or E (20 mg), respectively. Animals in Group I served as unimplanted intact control. At the end of 17 days post implantation, the animals were sacrificed and the kidneys were harvested, processed, embedded, sectioned and screened for cellular alterations. Digital image analysis (glomeruli areas, and diameter) as well as light microscopy (glomeruli number) were employed to screen the cross sections of kidney tissues. Data obtained from this study show significant decreases in glomeruli area in OVX animals treated with estrogen ($p < 0.05$) compared with either control groups or other treatment groups. DHEA and its precursor, DG, had no effect on glomeruli area, number or length when compared by analysis of variance to the control intact or OVX control groups. The length of glomeruli in OVX estrogen treated animals was not different from any treatment or control group. Estrogen treatment also caused a significant decrease in body weight in the animals compared with the other groups ($p < 0.05$), and in kidney weights between the estrogen treated animals and DG treated animals at $p < 0.05$. Overall conclusion:

sustained delivery of DHEA or DG resulted in a maintenance of the kidney function in OVX animals while E treatment resulted in severe nephrotic hypotrophy conditions.

SCREENING ANTISENSE OLIGONUCLEOTIDES FOR THE DOWNREGULATION OF THE EXPRESSION OF THE EQUILIBRATIVE NBMPR-SENSITIVE NUCLEOSIDE TRANSPORTER (ES)

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In view of the fact that heart disease is the leading cause of death among Americans and the world population, there is an urgent need for innovative therapeutic intervention approaches. Nucleoside transport inhibition has been demonstrated to be an effective means of enhancing the cardioprotective effects of adenosine, and is being investigated as a viable therapeutic approach in ischemic heart disease and stroke. This study was initiated to discover antisense oligonucleotides (ODNs) as potential downregulators of the expression of the NBMPR-sensitive equilibrative nucleoside transporter (es). In this regard, thirteen (13) ODNs were screened as inhibitors of the es transporter protein synthesis by a flow cytometry method using CEM cells and a liposomal delivery system. The results suggest that four of the thirteen antisense ODNs tested, namely, ES-1 (5'-ATGGTGATGGTGTCTCGGT-3'), ES-4 (5'-CCGTCCCTCGACTCTG-3'), ES-5 (5'-TCCTTCTGTCCATCCTTT-3') and ES-11 (5'-CCATAGCCACAGCAGGA-3') may be used to down-regulate the cellular expression of the es transporter.

THE EFFECT OF DHEA AND AED ON THE VIABILITY OF RAW 264.7 MACROPHAGES

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The effect of adrenal hormones namely dehydroepiandrosterone (DHEA, 10-50 µg/day) and androstenedione (AED, 10-50 µg/day), on RAW 264.7 macrophage survival at 24, 48 and 72 hours after lipopolysaccharide (LPS, 2 mg/ml) exposure was investigated in an *in vitro* environment. RAW cells were obtained from American Type Culture Collection and standard laboratory protocols were followed in cells plating (10⁶ cells/well), phase terminating, morphological evaluation, and biochemical marker analysis. From physiologic to supraphysiologic doses of DHEA and AED at 24 hours caused increased levels of cellular proteins and cell number without causing any significant (p<0.05) change in cellular

membrane integrity (Malondialdehyde, MDA) or viability (morphology). At 48 and 72 hours, cells treated with either AED or DHEA did not sustain the increased cellular proliferation as observed at 24 hours and did not significantly differ (P < 0.05) in cellular protein content. RAW 264.7 cells treated with LPS for 30 minutes prior to AED or DHEA exposure caused slight decrease in cell number and cell protein content. The decrease in both cell number and cell protein content were not attributed to increased cell damage or decreases in cell viability due to the fact that the cellular MDA levels were not statistically higher than the control values (p<0.05). Dot blot analysis of pro-inflammatory cytokine (TNFα) production after LPS treatment was suppressed by DHEA while AED had a minor influence on the responses. These data imply that LPS mediated activation of RAW 264.7 cells can be inhibited by the addition of pharmacological doses of adrenal hormones such as DHEA.

THE ROLE OF THE ROUTE OF ADMINISTRATION OF POLY-CHLORINATED BIPHENYLS (PCBs) ON THE REPRODUCTIVE AND VITAL ORGANS OF ADULT FEMALE RATS

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Studies have shown that high doses of Polychlorinated biphenyls (PCBs) given by conventional methods (orally or injections) have adverse effects on the reproductive and vital organs of adult female rats. However, there has not been documentation as to the effects of PCBs on adult female rats by means of a sustained delivery system. The specific objectives of this study were: (1) to investigate the effects of sustained delivery (TCPL ceramics) of PCB versus conventional mode of administration (injection) on the reproductive and vital organs of the adult female rat, (2) to evaluate the role that PCB that might have on the estrus events of adult female rats upon the exposure by sustained delivery (TCPL ceramics) and conventional mode (injection), and (3) to histopathologically evaluate the effect that PCB might have on the ovarian and accessory organs upon the sustained delivery for 21 days. A total of 10 adult female rats (BW 270-300 gm) were randomly divided into three groups. Group 1 (n=3) served as the control, group 2 (n=4) was injected intramuscularly every other day with Aroclor 1254 (0.1 cc), and each rat in group 3 (n=3) was implanted with TCPL capsules (5 mg of 2,3,3',4,5-Pentachlorobiphenyl). Aseptic surgical techniques were performed throughout the experiment. Blood (1 cc) was collected biweekly for biochemical analysis, and body weights were recorded as well. Pap smears were taken daily at approximately the

same time for 25 days, and two slides were made for each pap taken (1 pap stain, 1 Diff Quik). At the end of 21 days post-implantation, all control and experimental animals were sacrificed following standard lab procedures (overdose of Halothane). The reproductive and vital organs were collected, weighed, fixed, embedded, sectioned, and stained (H&E) for histological evaluations. Data obtained from this investigation suggest the following: (1) TCPL devices were able to deliver PCB at sustained levels for 21 days, (2) regardless of the route of PCB administration no significant change was observed in total body weight compared to the controls, (3) conventional administration of PCB resulted in a remarkable changes in the fallopian tubes compared to control and sustained delivery implanted animals, (4) there were no obvious change was observed in the phases of estrus cycles upon the exposure of PCB, and (4) histopathological evaluation of spleen, kidneys, heart, adrenals, ovaries, uterus, and cervix tissues exposed to PCB did not reveal any significant changes compared to the intact group.

THE EFFECT OF POLYCHLORINATED BIPHENYL ON RAW 264.7 CELLS

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Polychlorinated biphenyls (PCBs) refer to a group of chlorinated hydrocarbons that have been used widely in industry since the early 1900's. Among their physical properties, PCBs are thermally stable, non-reactive, have low water solubility and low electrical conductance. These features made PCBs the perfect choice for use in flame-retardants, electrical insulators, lubricants and liquid seals. However, these characteristics have also allowed the very stable PCBs to resist degradation treatments and accumulate in the environment. The effects of PCBs exposure, at low doses ranging between 10-100 mg PCB (Arclor-1254), on the viability of RAW 264.7 macrophage cells after 24 and 48 hours of incubation. Furthermore, several studies have indicated that PCBs exposure resulted in pathophysiological conditions at the reproductive level, this study was designed to determine the interrelationship between PCBs and estrogen (E, 10 mg) and its role in the viability of RAW cells. Macrophages were cultured and plated in 24 well-plates according to standard protocols. The wells were divided into eight groups (n=4 wells/group, 1×10^6 cells/well). The cells in groups 1-3 were treated with vehicle (serum- control for estrogen, DMSO-control for PCB, and media alone, respectively). Cells in groups 4 and 5 were treated with low (10 mg) and high (100 mg) doses of PCB. Cells in group 6 were treated with estrogen, and cells in groups 7 and 8 were treated with low dose PCB +

estrogen and high dose PCB + estrogen, respectively. Cell viability and damage (Malinodialdehyde, MDA level) were determined after 24 and 48 hours as well as cell morphology. The results of this study showed that low and high doses of PCB depressed cell number by 52%. Estrogen treatment caused no effect on cell number in comparison to cells treated with serum alone. Cell number in response to estrogen and low and high doses of PCB decreased cell number by 50%. Similar results were also observed at 48 hour time phase. Morphological evaluation of the cells revealed healthy spindle shaped multinucleated cells in the control group. PCB exposure induced morphological changes includes: cells became small, round, and increased evidence of cellular injury and debris. Estrogen treatment did not show changes from the control group. However estrogen and PCB treatments caused the cells to become round, tightly compact nuclei with evidence of cell fragmentation. The results of this investigation showed that exposure to either 10 or 100 mg of PCB had detrimental effects on the RAW 264.7 macrophage cells as early as 24 hours. Combination treatment with estrogen didn't provide any protective measures to the viability of RAW cells exposed to PCBs.

SEARCH FOR NATURAL PRODUCT INHIBITORS OF SECRETED ASPARTIC PROTEASE FROM *CANDIDA ALBICANS*

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The yeast *Candida albicans* invades the tissues of the body via the SAP (secreted aspartic protease) enzymes. The proteolytic activity of the SAP enzymes lyses cell membranes, allowing the yeast to cause infection. Therefore, the SAP enzymes are important virulence factors and reasonable targets for drug therapy in the prevention and treatment of yeast-borne diseases. The SAP assay screens natural products for inhibition of the SAP enzyme using a fluorescent substrate. The substrate is specific for aspartic proteases and the assay is rapid, amenable to high throughput, and can be done in a 96-well plate. Due to the large number of natural product extracts available to the National Center for Natural Products Research (NCNPR), an elimination strategy is used in the assay. Samples of the natural product extracts are first tested at 200 mg/mL. The samples that are active (showing > 80% inhibition of SAP) are then tested at a lower concentration of 10 mg/mL. The samples that continue to show inhibitory activity are then tested in a secondary assay at 50, 10, and 2 mg/mL to determine the IC₅₀, the concentration that results in 50 % inhibition of the SAP. These samples are then prioritized according to their IC₅₀'s and undergo bioassay directed fractionation done by the chemists at the NCNPR. The

samples are fractionated until a pure compound is obtained that shows appreciable SAP inhibitory activity. As of September 20, 1999, 3,256 plant extracts have been tested in the SAP assay. Approximately 5% of these extracts were tested in the secondary assay based on their inhibitory activity. 122 of the extracts (approximately 3.7% of the plant extracts tested in the primary assay) had IC₅₀'s of less than 50 mg/mL. Two pure compounds have been isolated from plant extracts of *Miconia myriantha* which have IC₅₀'s in the range of 7-10 mg/mL. A second assay is being developed to determine the specificity of the samples that inhibit SAP. Renin and pepsin are being explored as possible aspartic protease enzymes for this assay. The isolated pure compounds that specifically inhibit SAP activity are potential sources for drugs to treat infections by *Candida albicans*.

THE EFFECTS OF CORTISOL ON THE VIABILITY AND PROLIFERATION OF HEP-2 CELLS

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It is well known that bronchial epithelial cells are able to convert cortisol and synthetic cortisols such as hydrocortisone to inactive metabolite cortisone via the enzyme 11beta-hydroxysteroid dehydrogenase. The effects of cortisol, however, have not been investigated in the human larynx carcinoma cell line, Hep-2. Because the enzyme is expressed in human airway epithelial cells as well as other types of epithelial cells, we hypothesize that cortisol effects are limited due to the rapid metabolism to cortisone, which is then unable to bind to the glucocorticoid receptors. In this study, Hep-2 cells were treated with various doses of cortisol (0, 1, 5, 10, 20 and 50 mg/dl) for 24, 48 and 72 hours. After 24, 48 and 72 hours of treatment the cells were harvested and cell numbers were determined by hemacytometer counting. In addition to cell number, cell damage (Malondialdehyde, MDA levels), cellular protein content, and cellular morphological characteristics were determined at each phase. The data obtained from this investigation demonstrated the following: (1) Cell counts: Cell number was suppressed at all doses of cortisol tested at the initial time points until the cells were able to metabolize the cortisol to the inactive cortisone. All treatments showed statistical differences at $p < 0.001$ using the Kurskal Wallis one way ANOVA on ranks. (2) MDA: The exposure to the highest cortisol concentration (50 mg/dl) showed evidence of increased MDA levels after 24 hours, and by 48 hours there was a statistically significant increase in MDA levels in cells treated with either 20 and 50 mg/dl cortisol. (3). Protein: Cortisol caused a statistically significant increase in the median values

among the treatment groups for protein concentration at all time points investigated. (4) Morphology: Morphological differences existed among the cortisol treated cells compared with cells treated with media alone. In conclusion, the investigation provides significant information regarding the interrelationship between the steroid hormone cortisol and the viability and proliferation of human larynx carcinoma cells in culture.

THE CHARACTERIZATION OF ACETYLCHOLIN-ESTERASE INHIBITION BY ALDICARB IN JAPANESE MEDAKA AT HIGH SALINITY

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Aldicarb is a carbamate pesticide used on crops in the Southeastern United States to kill insects and nematodes on crops. These crops include cotton, sugar cane, peanuts, potatoes, sugar beets, and other ornamental plants. The crops are often grown adjoining estuaries, which undergo large fluctuations in salinity. Aldicarb inhibits cholinesterase enzymes. This results in a build up of acetylcholine. This build up, cholinergic overload, causes over stimulation at the neuromuscular synaptic joint leading to convulsions and death. Salinity has been shown to enhance toxicity of thioether pesticides, terbufos and aldicarb, in euryhaline fish (Hemmer et al., Schlenk & El-Alfy, 1998). Results from recent studies show that female Japanese medaka, *Oryzias latipes*, are more sensitive to aldicarb at high salinity in comparison to male Japanese medaka. The reason for this is currently unknown. In this study the inhibition of acetylcholinesterase (AChE) is analyzed in euryhaline fish, Japanese medaka, exposed to aldicarb at high salinity. Time course characterization AChE inhibition by different aldicarb zones (LC 20, LC 50, and LC 90) in Japanese Medaka at different salinity regimens (1.5, 12, and 20 ppt) is presented. To examine the developmental differences, the effect of salinity on toxicity of aldicarb in Japanese medaka hatchlings is also presented.

LEVELS OF HYDROGEN PEROXIDE IN TISSUES RETRIEVED FROM PATIENTS WITH FAILING IMPLANT DEVICES MAY PLAY AN ACTIVE ROLE IN CYTOKINE PRODUCTION

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Late aseptic loosening of total joint implants continues to be a common cause of implant failure. However, the pathophysiology of implant loosening remains controversial as to which factors at the interface between tissue and implant play a crucial role in implant

failure. The most prominent feature of the foreign body membrane obtained from patients undergoing revision hip surgery in the presence of lymphocytes, histiocytes, giant cells, and immature collagen formation. Biochemical and immunochemical analysis of the tissues obtained from implant failure patients revealed increased levels of pro-inflammatory cytokines as well as increased levels of hydrogen peroxide and decreased catalase activity. Macrophage activation by cytokine (TNF α) or lipopolysaccharide (LPS) is mediated via translocation of NF κ B from the cytosol to the nucleus and appears to be dependent upon phospholipase D (PLD) activation. Increasing concentrations of hydrogen peroxide also caused increases in macrophage release of pro-inflammatory cytokine (IL-1). This response may also be mediated via the PLD pathway. In tissues of patients with failing primary joint implants over production of hydrogen peroxide in response to wear debris stimuli, may activate NF κ B and initiate cytokine production.

PHYSIOLOGICAL RESPONSES ASSOCIATED WITH SUSTAINED DELIVERY OF T, DHT, AND AED IN MALE RATS

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The factors responsible for the marked gender differences in risk of coronary disease and atherosclerosis remain controversial. Some clinicians and experimental evidence supports a protective effect of endogenous estrogen, however, the epidemiological data do not support this conclusion. The role of endogenous androgens on atherosclerosis progression has received little attention over the years. The specific objectives of this study are: 1) to deliver testosterone (T), dihydrotestosterone (DHT), or androstenedione (AED) at sustained levels by tricalcium phosphate lysine (TCPL) ceramic delivery devices, and 2) to evaluate lactate dehydrogenase activity (LDH), total cholesterol, thiobarbituric reactive species (TBARS) and histopathological changes associated with excess androgens delivery in adult intact male rats. A total of sixteen male rats were randomly divided into four groups of four rats per group. Rats in group I served as intact controls, and animals in groups II-IV were implanted with a single TCPL delivery device containing T (40 mg), DHT (40 mg), or AED (40 mg), respectively. Animals in all groups were weighted and blood was drawn biweekly for cholesterol, LDH and TBAR analysis. At the end of ninety days post-implantation, the animals were sacrificed and the organs removed, processed embedded, sectioned and screened for morphological changes. The results of this study suggest

that: 1) sustained delivery of androgens caused a statistically significant increase ($p < 0.05$) in the prostate and seminal vesicle weights, while the epididymis weights remained similar to control intact animals, 2) decreases in adrenal gland weight was detected in animals treated with androgens compared to control animals, 3) kidney weights increased in all androgen treated animals compared to control, 4) no differences were observed in heart spleen or body weights between the groups, 5) TBAR analysis, as well as, LDH activity were not different between androgen treated animals and control animals, and 6) total cholesterol was significantly reduced in T and DHT treated groups compared with control and AED treated animals. The decrease in total cholesterol and reduction in adrenal gland weight may suggest impairment of cholesterol synthesis. In conclusion, this study provides information on the effects of sustained release of DHT, T and AED on the reproductive organs, vital organs, as well as physiological parameters (TBARS and total cholesterol) of atherosclerotic plaque formation in adult male rats.

MAPPING OF MONOAMINERGIC RECEPTORS IN HUMAN AMYGDALA

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The amygdala is a key structure in the brain's integration of emotions and stress. The amygdala receives dense noradrenergic and dopaminergic projections from the locus coeruleus and from the ventral tegmental area, respectively. These two catecholaminergic neuronal systems are critically involved in the pathophysiology of depression. Therefore, the amygdala is an important region for the study of neurochemical abnormalities in depression that involves norepinephrine and dopamine. The purpose of this study was to create a "neurochemical" map of the distribution of dopaminergic and noradrenergic receptors and transporters in this very complex brain structure. Many of the amygdaloid nuclei can be distinguished based on differences in size, packing density, and staining intensity of their constituent neurons in Nissl preparation. These properties, together with the histochemical localization of an enzyme (acetylcholinesterase) marker, were used to create anatomical templates for measuring the density of certain receptors using quantitative autoradiography at multiple levels in several discrete regions of the human amygdala. Our study demonstrated that dopamine D2/3 receptors and noradrenergic α_2 -adrenoceptors were predominantly localized in the central and in the basolateral nuclei of the amygdala. However, D1 and α -adrenoceptors were more evenly distributed among areas of the amygdaloid complex. Both transporters occurred in a low

density throughout the amygdala. These neurochemical maps of amygdala are necessary for revealing individual variability and for assessing changes in noradrenergic and dopaminergic proteins in depression.

FRIDAY MORNING

Gulf Hall

8:30 INTRAVAGINAL ANTIMICROBIALS PREVENT TRICHOMONIASIS IN MICE

W.B. Lushbaugh^{1*}, A. Paxton¹, P. Shah¹, A. Banga², J. Jaynes³, J. Cleary^{1, 4}, and R. Finley¹, ¹University of Mississippi Medical Center, Jackson, MS 39216; ²Mercer University, Atlanta, GA 30341; ³Demeter, Inc., Philadelphia, PA 15221; and ⁴University of Mississippi, University, MS 38677

A chemical prophylactic that protects against acquisition of sexually transmitted infections (STI) without disrupting the vaginal environment is needed. The efficacy of the novel peptide antibiotic (Peptidyl MIMstm D2A21) to prevent acquisition of *Trichomonas vaginalis* (Tv) was tested in mice. *Trichomonas* infections in estrogenized *Lactobacillus acidophilus* pre-infected mice were sporadic so we examined several other *Lactobacillus* species as pre-infections to modify the mouse vaginal flora. Tv infections of estrogenized mice pre-infected with *L. vaginalis* or *L. rhamnosus* (Lr) were more prevalent and persistent than those in mice pre-infected with *L. crispatus* or *L. acidophilus*. The efficacy of intravaginal microbicides to interfere with Tv acquisition was tested in estrogenized, Lr pre-infected mice. The mice were intravaginally pre-treated with placebo gel, 0.5% or 2% Peptidyl MIMstm D2A21 gel, or 500 mg/mL metronidazole gel just prior to Tv challenge. Pre-treatment with 2% D2A21 or metronidazole gels significantly ($P < 0.001$) prevented Tv infection. None of 30 metronidazole-treated-mice and three of 30 2%-D2A21-treated-mice became infected while about half of control mice became infected. These studies suggest that intravaginal microbicides incorporating Peptidyl MIMstm D2A21 with activity against a variety of STI may be practical for prevention of STI in humans.

8:45 LOW DOSE IONIZING RADIATION EFFECTS ON BIOLOGICAL SYSTEMS

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A cell contains many elements and compounds including about 80 % water (H₂O). Absorption of ionizing radiation (alpha, beta, gamma, neutron, and x-rays) by the cells causes ionization, and excitation of atoms and molecules, and dissociation of covalent bonds in molecules.

Within an extremely short period ($\sim 10^{-10}$ seconds) large numbers of ions and free radicals are produced which are highly chemically reactive. The problem in the biological systems is the production of hydrogen peroxide (H₂O₂), which is a poison to the cells. In addition, H₂O₂ readily forms a peroxide radical, which then attacks other bio-organic molecules to form a relatively stable organic peroxide. This process may prove fatal to the cell if the original organic molecule happens to be a basic molecule such as a key enzyme. The change in the nature of the basic molecule effectively removes it from the cell. The process of conversion of the original basic molecules causes serious damage to the cells. The rate at which energy is transferred per unit length or mass determines how effective a given radiation is at injuring the cells. So far no law exists which would predict exactly the kind and amount of damage produced in a given cell following an irradiation. Electron-Spin-Resonance Spectroscopy is used to study the spectra of the free radicals. The amplitude of the resonance signal is proportional to the number of free radicals which in turn should be proportional to the radiation absorbed dose.

9:00 SYNERGISTIC ENHANCEMENT OF COLLAGENOUS PROTEIN SYNTHESIS BY NIFEDIPINE AND TUMOR NECROSIS FACTOR- α

Roger B. Johnson, University of Mississippi Medical Center, Jackson, MS 39216

Gingival overgrowth commonly occurs coincident to therapy with calcium channel blockers. The biologic mechanism for this condition is unknown; anecdotal evidence suggests that gingivitis may contribute to development of the overgrowth. This study tests the hypothesis that collagenous protein synthesis is synergistically enhanced by nifedipine (N) and the pro-inflammatory cytokine, tumor necrosis factor- α (TNF- α). Fibroblasts were isolated from biopsies of normal gingiva and cells separated into two groups. Group I were exposed to media containing 0, 5, 50, or 500 ng/mL TNF- α , or 10^{-7} M N for 7 days; group 2 were exposed to those concentrations of TNF- α + 10^{-7} M N. ³H-proline was added to the medium for the final 24 hours. Cells and matrix were harvested and radioactivity determined by liquid scintillation analysis. Means (dprn/ 10^4 cells) were compared by factorial ANOVA and Scheffé comparisons. Collagenous protein synthesis was significantly reduced by a concentrations of TNF- α and was significantly enhanced by 10^{-7} M nifedipine and all concentrations of TNF- α + 10^{-7} M nifedipine. Thus, patients may be more susceptible to gingival overgrowth during nifedipine therapy, due to the synergism between TNF- α and nifedipine on collagenous protein synthesis by gingival fibroblasts. Supported by the University of Mississippi School of Dentistry.

9:15 EVAPORATIVE LASER LIGHT SCATTERING DETECTOR FOR GPC ANALYSIS OF POLY (L/D, L-LACTIDE) POLYMERS

C.C. Inman*, S.B. Roberts, and A.D. Puckett, University of Mississippi Medical Center, Jackson, MS 39216

The GPC system consisted of a Rheodyne injector (Rheodyne Inc., Cotati, California) with 200 μm injection loop, LDC Milton Roy Constametric 3000 pump, LDC Milton Roy refractoMonitor IV refractive index detector, and a column set consisting of five styragel GPC columns. The column set contained three Shodex (Showa Denko, Tokyo, Japan 8 mm x 250 mm) columns (A-803/S, A-804/S and A-805/S) and two Waters Corporation (Milford, Delaware 7.8 mm x 300 mm) 10^5 \AA and 10^6 \AA columns. All solutions were filtered through a 0.45 μm Teflon filter before injection onto the column set. A microcomputer and strip chart recorder collected the output from the detector. The LDC Milton Roy PC GPC software was used for data collection and analysis. The GPC system was calibrated using narrow distribution polystyrene standards obtained from PolySciences. Seven polystyrene standards ranging from $7.8 \times 10^6 \text{ g/mole}$ to $2.0 \times 10^4 \text{ g/mole}$ were dissolved in HPLC grade chloroform at 1-2 wt. % and chromatographed in triplicate to establish a calibration curve. A plot of molecular weight versus elution volume was constructed and fit to a 5th degree polynomial. This calibration was then used to calculate the weight average (M_w), number average (M_n), and polydispersity index (M_w/M_n) for the 70:30 poly (L/D, L-lactide) samples from retention volume data collected for each sample.

9:30 A CASE STUDY FOR BUILDING AGENCY SUPPORT FOR COMMUNITY-BASED HEALTH PROJECTS: THE DELTA FUTURES PROJECT

M. Williams^{1*}, D. Lamar², A. Arrington³, and Reid Jones², ¹Delta Hills Public Health District, Greenwood, MS 38939; ²Delta State University, Cleveland, MS 38733; and ³Mississippi Valley State University, Itta Bena, MS 38941

Rural health care agencies are usually small, understaffed, under-resourced, and on the wrong side of the 'digital divide.' Analyses of data from the Mississippi State Department of Health demonstrated that per capita health care concerns were generally more severe in rural districts. Building collaborative relationships was difficult in these circumstances. The report described the Delta Futures Project, an innovative 'peer educator' approach to perinatal health risk management. Guidelines were presented for developing strong collaboratives among largely rural agencies. Strong collaborations were still needed with major health care research and education centers.

9:45 Break

10:00 INFLUENCE OF DIACETYL AND HEAT ON CELLULAR LEAKAGE AND DEATH OF *STAPHYLOCOCCUS AUREUS* AND *SALMONELLA TYPHIMURIUM*

I.O. Farah* and S.R. Tatini, Jackson State University, Jackson, MS 39217 and University of Minnesota, St. Paul, MN 55108

Influence of diacetyl on cellular leakage and/or death of *Staphylococcus aureus* (*S. aureus*; FRI-100) and *Salmonella typhimurium* (*S. typhimurium*) in the presence and absence of 30% sucrose and NZ-amine broth at 37, 45 and 55°C was studied using Microbiological and Spectrophotometric techniques. Diacetyl exists naturally in starter distillate and is usually added to enhance the flavor at the end of the fermentation process. Our objective was to examine its use before the onset of fermentation towards the safety of fermented products. Results showed significant difference ($p < 0.05$) between control and diacetyl treatments; average mean difference was $> 5 \text{ log colony forming units per ml (CFU/ml)}$ within 1 hour (h). Interesting trends were also observed when differences with respect to absorbance ratios, temperature and control were normalized; multiple peaks in relation to incubation times. Results also showed that diacetyl (0.1%) caused more cellular leakage and death of *S. aureus* at 45°C as compared to 37°C, and that cellular leakage per se was not directly related to death. Diacetyl, however, caused rapid death of *S. aureus* and *S. typhimurium* in the presence of 30% sucrose and NZ-amine broth at 55°C; $> 7 \text{ log CFU/ml}$ death within 1 and 2 h respectively. We also conducted a study with commercial starter distillate (7%) and proved its ability to control both organisms under the same test conditions within 1h at 55°C. It is concluded that diacetyl is a potential candidate for the control of foodborne pathogens especially under low water activity conditions such as those encountered during meat fermentation.

10:15 SEALING POTENTIAL OF NEW ONE BOTTLE DENTAL ADHESIVES

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The purpose of this study was to evaluate *in vitro* microleakage behavior of several one bottle adhesives and a conventional primer/adhesive system utilizing the universal hybrid composite Amelogen (Ultradent Products, Inc.). Fifty class V cavities were prepared at the facial C.E.J. of bovine incisor teeth to simulate cervical abrasion/erosion lesions. The five groups of ten teeth were treated with the enamel and dentin total etch technique (15

second application phosphoric acid) then restored following manufacturer's directions with the appropriate adhesive: GlumaOneBond (GLU1), SnapBond (SNPB), PQ1 (PQ1), ProBond (ProB), Prime&BondNT (PBNT), and bulk filled with Amelogen universal composite and light cured for sixty seconds. Microleakage was evaluated separately at the enamel (incisal) and dentin (gingival) margins using the following scale: 0 (no leakage) to 4 (gross leakage). Results were analyzed with the Mann-Whitney Test. Mean dentin microleakage values gave the following ranking: PQ1 (1.4) < ProB (2.2) < SNPB (3.1) < PBNT (3.36) < GLU1 (3.7). There were no significant differences in the leakage behavior between any of the groups at the enamel margin. PQ1 exhibited statistically less microleakage at the gingival (dentin) margins than any of the one bottle adhesives, however, the difference between PQ1 and the conventional primer/adhesive ProBond was not significant.

10:30 A CASE STUDY IN BUILDING GRASS ROOTS SUPPORT FOR COMMUNITY BASED HEALTH PROJECTS: THE SAFE AT HOME PROJECT

S. French^{1*}, J. McCrory², C. Ekanem³, and Reid Jones⁴,
¹Delta Health Partners, Marks, MS 38646; ²Delta State University, Cleveland, MS 38733; and ³Mississippi Valley State University, Itta Bena, MS 38941

Federally funded health care programs often neglect the crucial aspect of developing "grass roots" support in the local community. This is particularly important for rural communities, which are distant from major hospitals, research centers, and medical specialists. The Safe at Home Project has been repeatedly funded to provide creative solutions for health problems such as SIDS, teen pregnancy, and low birth weight. Over the years, Safe at Home has built effective and extensive collaborative relationships with health care professionals, Head Start, schools, local government, civic clubs, businesses, and local media. Project personnel are presently expanding existing relationships with regional universities. The presentation provided a program report on the project as well as a case study in effective community support building.

10:45 HEALTH RISKS FROM LOW-DOSE IONIZING RADIATION EXPOSURES

Amin Haque, Alcorn State University, Alcorn State, MS 39096

The average person in the United States is exposed to an effective dose equivalent of approximately 360 mrem per year from natural and technological radiation sources. The nature and severity of effects depend on: nature of

radiation, absorbed dose, dose rate, dose distribution, age of the object, general health, and previous exposures. The rate at which energy is transferred per unit length determines how effective a given ionizing radiation is at injuring the cells. The toes of biological effects seen in humans from exposures to high doses (100,000 millirem or more) of radiation are: SOMATIC (Prompt and Delayed), TERATOGENIC, and GENETIC. If individuals cumulative radiation dose is 1000 mrem, the chances of eventually developing cancer during their life may increase by 25%. For low doses, extrapolations are made from the results at high doses and high dose rates, which may not be appropriate. No law exists which would predict exactly the kind and magnitude of damage produced in a given cell following an irradiation. There is no theory to predict what really happens at the lowdose rates. According to NIH, no biological effects are expected at low dose of less than 10 mrem per year. Extensive literature indicates that minute doses of ionizing radiation actually benefit animal growth and development, fecundity, health and longevity. The mechanism of radiation hormesis is not understood. It is very important to determine a threshold value of radiation below which no damage is caused to the tissues.

11:00 FORMULATION AND STABILITY OF NALTREXONE SUSPENSION FOR REDUCING EPIDURAL OPIOID SIDE EFFECTS

Brian K. Tsang, Ahmed S. Abdel-Aziz*, and John H. Eichhorn, University of Mississippi Medical Center, Jackson, MS 39216

Naltrexone is a pure opioid antagonist that unlike naloxone is highly effective orally. Recently, naltrexone, 6 mg, has been shown to reduce the side effects of epidural morphine without reversal of its analgesic effect. However, naltrexone is only available in 50 mg tablets. This high dose of naltrexone is designed for use in detoxifying addicts. Naltrexone suspensions at concentration of 1 mg/ml were prepared. Our goal is to produce 6 mg doses for use in reducing epidural opioid side effects. The naltrexone suspensions were then tested for stability at room temperature over five consecutive days. High performance liquid chromatography was used for quantifying the concentration of naltrexone samples. There were no detected difference in physical characteristics (color, clarity, and crystal formation) or, pH values of naltrexone suspensions over the course of the five days duration of the stability study. In addition, there was no statistical difference in mean concentration of naltrexone suspensions (1 mg/ml). In conclusion, this study proves that formulation of naltrexone suspensions prepared from the 50 mg naltrexone tablets can be kept in room temperature for five days without a loss of the active ingredient. This easy

formulation of naltrexone 6 mg can then become available for wider use in reducing the side effects of epidural opioids.

11:15 Divisional Business Meeting and Awards Presentations

**HISTORY AND PHILOSOPHY
OF SCIENCE**

Chair: Robert Hamilton, Mississippi College
Vicechair: Robert Waltzer, Belhaven College

FRIDAY MORNING

Deer Isle

8:30 THE ETHICAL IMPLICATIONS OF THE HUMAN GENOME PROJECT

Robert G. Hamilton, Mississippi College, Clinton, MS 39058

The Human genome Project is another major step in the development of our understanding of life in general, and human life in particular. At each step in the development of our understanding of life, the loss of mystery has had minor to profound effects on our sense of self, and related ethical issues. The Human Genome Project will allow for the definition of a human purely in terms of the genome. The implications of such a definition are profound, not only relating to well known issues such as health care, but in allowing for a whole new means by which individuals can be categorized. Such implications raise the central issue of privacy, and the associated issues of the costs and benefits of such privacy to both the individual and society in general. The Human Genome Project will allow for a development of a sense of self that includes a more complete understanding of our genome, and thereby, our biological "strengths" and "weaknesses." The interaction of this view of self with societal norms, also based on a more complete knowledge of genomics, has the potential to radically alter ethical practices, particularly in areas such as government, clinical practice, insurance risk assessment, education, and research.

9:00 MiniSymposium on Biological Species

A BIOLOGICAL PERSPECTIVE CONCERNING SOME CURRENT ARGUMENTS ON THE NATURE OF SPECIES

Kenneth J. Curry* and Paula J. Smithka, University of

Southern Mississippi, Hattiesburg, MS 39406

Confusion concerning the concept of species is inevitable because it has served distinctly different groups within biology and because of uncertainty as to the nature of species. The most embracing concept of species should fit all subdisciplines. It should fit our intuitive concept of natural kinds, it should reflect phylogeny, it should include a mechanism for evolution, and it should have pragmatic and predictive value. The most widely applied concept in recent years, the biological species concept, postulated species as a group defined by reproductive isolation. This met some of the requirements for a species concept, but it has proven not to have good predictive value outside of a few groups and apparently does not reflect phylogeny accurately or promote a reasonable mechanism for evolution. Recent candidates for the species concept have included Van Valen's ecological species based largely on cohesion through ecological forces, Cracraft's evolutionary species based on diagnosable groups, and Templeton's cohesion species that combines interbreeding populations and environmental constraints. Mishler and Donoghue have promoted a case for a pluralistic species concept that would embrace different concepts for different groups of organisms. Philosophers are debating whether species should be treated as individuals or classes. The weight of argument seems to be on the side of classes, but the nature of both classes and individuals is still fertile ground for discussion.

A PHILOSOPHICAL PERSPECTIVE CONCERNING THE DEBATE REGARDING THE STATUS OF SPECIES: CLASSES OR INDIVIDUALS?

Paula J. Smithka* and Kenneth J. Curry, University of Southern Mississippi, Hattiesburg, MS 39406

Species have historically been considered to be classes or groups of individual organisms. Recent literature suggests that species should not be regarded as classes, but rather as individuals, analogous to particular organisms. Ghiselin and Hull maintain that in order for species to be units of evolution, they must be historical entities. Their contention is that classes are atemporal, and hence, ahistorical concepts and therefore cannot be units of evolution. Individuals, on the other hand, exist within a spacio-temporal framework, and so are historical entities. This is why Ghiselin and Hull think that species are better thought of as individuals. We examine this debate and argue that the notion of species as individuals generates problems of its own and maintain that species really are better thought of as classes and that classes need not necessarily be ahistorical.

10:00 Break

10:15 WHAT HAPPENED WHILE FOUR GENERATIONS OF WHITFIELDS STUDIED CHEMISTRY IN MISSISSIPPI

Johnnie-Marie Whitfield, Chemical Heritage Foundation, Philadelphia, PA and Millsaps College, Jackson, MS 39210

Four generations of Whitfield women in my immediate family have studied chemistry in central Mississippi for over 100 years as well as three generations of Whitfield men. The threads of these lives weave an intriguing web with numerous, dramatic chemical advances that have directly impacted their lives as well as many others in the twentieth century. Family anecdotes will be intertwined with materials from the Chemical Heritage Foundation archives in this fast-paced presentation. Support from Millsaps College and the Chemical Heritage Foundation is gratefully acknowledged for this presentation.

10:45 MISSISSIPPI SECTION OF THE AMERICAN CHEMICAL SOCIETY SALUTES POLYMER SCIENCE DEPARTMENT AT THE UNIVERSITY OF SOUTHERN MISSISSIPPI

Johnnie-Marie Whitfield^{1*}, Stella Elakovich^{2*}, and Robert Y. Lochhead^{2*}, ¹Millsaps College, Jackson, MS 39210-0515 and ²University of Southern Mississippi, Hattiesburg, MS 39406-5043

On February 19, 1999, the Mississippi Section of ACS honored the Polymer Science Department at USM with a Global Salute as part of the International Chemistry Celebration Year activities. The Section was then invited to make a presentation at the National ACS Meeting in New Orleans in August of 1999 in the History Division. Come and share the latest version of this team presentation by the Councilor, the 1999 Chair of the Mississippi Section, and the Chair of Polymer Science Department - now part of the new School of Polymers and High Performance Materials at USM.

FRIDAY AFTERNOON

Deer Isle

1:00 THE MYTH OF REDUCTIONISM: PROBLEMS POSED TO REDUCTIONISM BY KUHN'S THEORY OF SCIENTIFIC REVOLUTIONS

Edison M. Williams III, University of Southern Mississippi, Hattiesburg, MS 39406-5024

The issue of reductionism is important for science. Reductionism claims that entities, laws and theories can be reduced from the more complex to a simpler form. For example, the reduction of sociological trends to theories of genetic mapping. The purpose of this paper is to provide an

examination of reductionism and to explore the difficulty and, in fact, the impossibility of achieving such a goal. 'Reductionism' is a vague term unless it is accompanied by qualifiers. So unless 'reductionism' is defined more stringently, the goal of reductionism may be viewed as ambiguous. The three qualifiers are ontological, methodological and inter-theoretic. Within the parameters of this paper all three types of reductionism will be challenged with inter-theoretic being given the most attention. Reductionism in its most general sense assumes the existence of two elements, transtheoretical terms and a cumulative progression of scientific development. Both transtheoretical terms and a cumulative progression of scientific development are challenged by Kuhn's theory of scientific revolutions with the specific challenge arising in Kuhn's description of paradigm shifts and the resulting incommensurability of such paradigms. If a Kuhnian perspective of scientific development is accepted and I argue that it should be, then the goal of reductionism can not be achieved.

1:30 EVEN MODEL BASED SCIENCE IS STILL DRIVEN BY LINGUAL THEORY

Benjamin Maddox, University of Southern Mississippi, Hattiesburg, MS 39406

In this paper I intend to show that scientists are forced to use lingual theories even when the methodology of models, described by Aronson, Harré, and Way, in their book Realism Rescued, is used. According to Realism Rescued theories are models and models are ontological chunks of the world. Aronson, Harré, and Way try to show that science is reality driven and not a function of lingual theories or paradigms. My point is that in most modern experimentation and/or modeling the data is too complicated to understand without some sort of key for translation. I intend to show that when scientists attempt to use the methodology of Realism Rescued their views will still be a function of lingual theory and not a direct line to reality because of the complexity of the data used.

2:00 Break

2:15 INVESTIGATION INTO THE ONTOLOGICAL NATURE OF MENTAL STATES AND PROCESSES

Takasha Lewis, University of Southern Mississippi, Hattiesburg, MS 39406

Twenty-five years ago neuroscience was forever changed with the discovery of the opiate receptor in the brain. This led to the discovery of the body's natural opiates known as endorphins. Endorphins, a class of proteins known as peptides, were found to regulate our behavior,

mood and health. This pinnacle discovery, and the research that followed spawned debate after debate over the real nature of mental states and processes. Are these events reducible to processes of a complex physical system—the materialist thesis? On the other hand, are mental states and processes the result of a distinct kind of phenomenon that is non-physical in nature—the dualism thesis? My goal is to analyze the mind-body debate in conjunction with its related scientific research, and formulate an answer to the ontological question, —what is the essential nature of mental states and processes?

2:45 SCIENTIFIC-SPIRITUAL APPROACH OF HEALING: ANCIENT INDIA'S GIFT

S. Kant Vajpayee* and T.M. Parchure*, University of Southern Mississippi, Hattiesburg, MS 39406 and US Army Engineer Waterways Experiment Station, Vicksburg, MS 39180

Several fields of science such as mathematics, astronomy, pharmacy, and medicine were highly developed in ancient India. Some of the pioneering literature is available in Sanskrit even today, and has been translated in other languages. The pharmaceutical science as an element of the Ayurveda deals with the use of bio-ingredients derived from flora and fauna in healing human ailments. Since they are already associated with the living tissues of plants and animals, their use has minimal side effects and the treatment usually offers permanent cure. The bio-ingredients are widely used in India for medicinal purposes in competition with the Western inorganic synthetic medicines. Diet control, fasting, self-discipline and use of mental power are some of the techniques of treatment leading to healing. Yoga and meditation, now popular in the West, are the other ones. The human body is spiritually considered to be a microcosm of the whole universe created from five "spirits"—earth, water, wind, space, and fire (cosmic energy). Based on a strong mind-body interaction, it is believed that there are eight strategically located centers in our body; their excitation and control lead to a long, happy, and healthy life. This concept, not well known in the West, will be discussed in the presentation.

3:15 Break

3:30 CREATION SCIENCE AND THE PRINCIPLE OF TOLERANCE: AN ILL-CONCEIVED PHILOSOPHIC PLOY

Michael J. Fitzgerald, University of Southern Mississippi, Hattiesburg, MS 39406

Creation "scientists" usually invoke a Principle of Intellectual or Political Tolerance in order to have their views taught in High Schools or Universities along side

evolutionary theory. The paper will argue that such an invocation is an ill-conceived philosophic ploy for the creation "scientist" for several reasons. 1) A Principle of Intellectual Tolerance is not a principle of philosophic relativity that would maintain "All explanations are equally plausible." 2) There is no good reason to suppose that Creation "scientists" would abide by such an intellectual principle, if their views were in fact taught in tandem with evolutionary theory, and 3) A philosophically tolerant intellectual outlook does not require one to give "equal treatment" to scientifically worthless views.

4:00 POSITIVE EVIDENCE FOR DESIGN IN THE NATURAL WORLD

Robert Waltzer, Belhaven College, Jackson, MS 39202

This presentation will examine intelligent agency, consider applications in the biological world, and conclude with a perspective on scientific progress. (See Dembski, 1999 Touchstone 12:4 p. 76). Fields such as forensic science, archaeology and the search for extraterrestrial intelligence (SETI) have developed criteria to evaluate intelligent agency. First a determination between necessity and contingency is made. If contingency is evident then a further determination is made between chance and design. In the movie *Contact* the sequence of beats and pauses of the space signal evidenced design in that it was not explainable by physical laws and displayed a pattern containing information. Contingency can also be evidenced by the detection of purpose. In biological systems the parts of the eye evidence purpose. Also, DNA shows order and possesses information, which is not reducible to the laws of biochemistry. This is positive evidence for design in the natural world. And it can be taken further. Just as one speculates about the nature of ancient civilizations, speculation about the nature of the designer can provide a foundation for the generation of new hypotheses regarding both the designer and that which is designed. The designer displays great knowledge, skill, organization, economy, and creativity and these characteristics can assist in the discovery of as yet unknown facts. Mainstream science should be open to design theory because it follows the rules of science and could lead to discovery.

4:30 Divisional Business Meeting

MARINE AND ATMOSPHERIC SCIENCES

Chair: Charlotte Brunner, University of Southern Mississippi

Vicechair: Jeffrey Lotz, University of Southern Mississippi

THURSDAY MORNING

Ship Isle

8:40 BOTTOM SCATTERING VARIABILITY DURING THE 1996 PANAMA CITY, FLORIDA, HIGH-FREQUENCY ACOUSTIC EXPERIMENT

Marcia A. Wilson^{1*}, Jerald W. Caruthers¹, Ralph Goodman² and Steve Stanic¹, ¹Naval Research Laboratory, Stennis Space Center, MS 39529 and ²Naval Research Laboratory on IPA from Pennsylvania State University, State College, PA 16804

An experiment was performed in shallow water near Panama City, Florida to study spatial variability of high-frequency bottom reverberation. A towed body with two transducer arrays installed at 15 and 40 degrees from horizontal was tested. The active transducer emitted a 1ms acoustic pulse every tenth of a second as the towed body moved over the relatively uniform sand bottom. Frequency rotated among 4 to 7 frequencies between 75 and 375 kHz. Reverberation envelopes for each frequency were plotted to show the changes in amplitude and arrival time for a series of pulses interacting with the bottom along the track of the towed body. An integrated reverberation level for each pulse was obtained. Several statistical analysis methods were used to determine whether changes in the reverberation probability density function were sufficient to indicate a difference in seafloor characteristics encountered. Analysis based on the chi-squared test was able to quantify differences between segments of data along a given track.

9:00 A MODULAR OCEAN DATA ASSIMILATION SYSTEM

Daniel N. Fox* and Germana Peggion, Naval Research Laboratory, Stennis Space Center, MS 39529 and University of Southern Mississippi, Stennis Space Center, MS 39529

A scalable, rapidly relocatable ocean analysis and forecast system has been developed to provide accurate estimates of the acoustic environment. The system is built from reusable software modules, which facilitates adding or modifying capabilities, and runs well on a wide spectrum of computer hardware, from low-end workstations to supercomputers. In situ measured ocean profiles of temperature and salinity are optimally interpolated into a novel synthetic ocean environment which is generated using remotely sensed data and linear regressions derived from 100 years of measured profiles. This analysis is then used to initialize a robust, relocatable version of the Princeton Ocean Model, including tides. The system has

been found to be much more accurate than other commonly used ocean climatologies and will be demonstrated in several areas including the northern Gulf of Mexico.

9:20 DYNAMICAL BALANCE IN THE INDONESIAN SEAS CIRCULATION

William H. Burnett* and Vladimir M Kamenkovich, Stennis Space Center, MS 39529-5001 and University of Southern Mississippi, Stennis Space Center, MS 39529

A high-resolution, regional, four-open port, non-linear, barotropic ocean model (2D POM) is used to show that a pressure difference between the Pacific and Indian Ocean is not the dominant factor determining the total transport of the Indonesian throughflow. Two types of experiments were performed. In Experiment 1, the normal and tangential velocities at the ports are prescribed. The total transports through these ports are taken from analyses of historical observations, and the total inflow and outflow balanced to ensure mass conservation. Experiment 1's steady state results were used as boundary conditions for Experiment 2 where sea surface elevations and tangential velocities are specified at the open ports. To study the influence of the pressure head, the sea-surface elevation found in Experiment 1 was perturbed by a constant value at the open ports. A series of experiments were performed and the relative importance of the different terms in the momentum equations were analyzed both within and outside the equatorial zone.

9:40 HIGH PERFORMANCE VISUALIZATION OF METOC INFORMATION

George W. Heburn, Naval Meteorology and Oceanography, Stennis Space Center, MS 39529

Historically, graphical representations have been used to convey complex meteorological and oceanographic (METOC) information to the end user. Initially, this was in the form of hand drawn analyses of an iso-surface of some METOC parameter, i.e., pressure, temperature, etc. and sent to remote users via facsimile broadcast. Today, with the wide spread use of computers and the Internet, the primary conveyance of METOC is in the form of computer generated analyses of iso-surfaces and 2D and 3D grid fields of METOC parameters. As the desktop graphics workstations become more powerful and immersive display devices become more prevalent the opportunity exists to make better use of scientific visualization techniques to provide METOC information to the Warfighter. The Naval Meteorology and Oceanography Command (NMOC) in partnership with Mississippi State University (MSU), Jackson State University (JSU), and the Center for Higher Learning/University of Southern Mississippi (CHL/USM), has embarked on a High Performance Visualization Center

Initiative (HPVCI). The HPVCI will create the infrastructure for ...a center without walls, in which the researchers can perform their research without regard to geographical location interaction with colleagues, accessing instrumentation, sharing data and computational resources, and accessing information in digital libraries. This will initially include efforts in the following: (1) collaborative scientific visualization; (2) the management/manipulation of very large geophysical and simulation data sets; (3) adaptive computation for battlefield tactics; and (4) electronic classroom, distance learning and educational outreach. The ultimate goal of this research program is to develop better visualization techniques to provide the Warfighter with the METOC information needed to exploit the natural environmental condition to his advantage.

10:00 Break

10:20 A NEW GRADUATE DEGREE IN
HYDROGRAPHIC SCIENCE AT THE
UNIVERSITY OF SOUTHERN MISSISSIPPI

Denis A. Wiesenburg*, Donald G. Redalje, and André Godin, University of Southern Mississippi, Stennis Space Center, MS 39529

A new graduate degree program in Hydrographic Science has recently been established by The University of Southern Mississippi (USM) Department of Marine Science. Along with the U.S. Navy, USM now offers, one-year non-thesis Master of Science degree in Hydrographic Science. Presently, there are no accredited academic programs in Hydrographic Science, within the United States, that are certified at the Category A level by the FIG/IHO International Advisory Board. The USM curriculum has been designed to meet requirements of the FIG/IHO Category A standards for academic proficiency in hydrographic surveying. The curriculum will be presented to the FIG/IHO International Advisory Board for certification in April 2000. The USM Department of Marine Science is located at the Stennis Space Center that is also the home of the U.S. Naval Oceanographic Office (NAVOCEANO), the Naval Research Laboratory-Stennis Space Center (NRL-SSC) and the NOAA National Data Buoy Center. Department of Marine Science faculty members, as well as other USM faculty with related knowledge and expertise, will actively participate in the delivery of this new graduate degree program in Hydrographic Science. Expertise from nearby industry and governmental agencies (e.g. NRL-SSC, NAVOCEANO) are also available to provide additional support to the program. The unique aggregation of hydrographers, oceanographers, and facilities at the Stennis Space Center provides an ideal location for this new program.

10:40 ONTOGENETIC CHANGES IN BIOCHEMICAL
COMPOSITION OF RED SNAPPER *LUTJANUS*
CAMPECHANUS

Kenneth R. Camp^{1*}, Patricia M. Biesiot¹, and Jeffrey M. Lotz², ¹University of Southern Mississippi, Hattiesburg, MS 39406-5018 and ²Gulf Coast Research Laboratory, Institute of Marine Sciences, Ocean Springs, MS 39566-7000

Changes in proximate analysis (protein and lipid), lipid classes, and fatty acid composition were monitored during early development of red snapper *Lutjanus campechanus*. Ova, embryos, and larvae from day 0 to 17 days post-hatch were sampled. Protein was the major constituent at 49-78% of the ash-free dry mass (AFDM) and increased consistently, in mass and proportion, between the embryo and 17 day old stages. Total lipids were highest in ova and embryos at 34% AFDM, decreased markedly to 12% AFDM by day 3 due to yolk absorption, and increased to 16% AFDM by 17 days post-hatch because of exogenous feeding. Proportions of major lipid classes changed during development. Sterol esters (SE) and triacylglycerols (TAG) occurred in ova but were almost completely depleted by end of the yolk sac stage (3 days post-hatch). By day 17, SE and TAG stores were replenished. Phosphatidyl choline and phosphatidyl ethanolamine remained at high levels throughout development, presumably conserved because of their roles as membrane lipids. The dominant fatty acids were docosahexaenoic acid (22:6 ω 3), palmitic acid (16:0), oleic acid (18:1 ω 9), eicosapentaenoic acid (20:5 ω 3), and linolenic acid (18:3 ω 3) which comprised, respectively, 35-40 mol%, 12-17 mol%, 8-12 mol%, 4-7%, 0-7% of the fatty acid pool. Partial funding was provided through NMFS/DOC grant number NA86FL0476.

11:00 PHYTOPLANKTON PIGMENTS AS INDICATORS OF ENVIRONMENTAL QUALITY IN ST. LOUIS BAY AND MISSISSIPPI SOUND

Karie E. Holtermann* and Donald G. Redalje, University of Southern Mississippi, Stennis Space Center, MS 39522

As part of an environmental quality study of the St. Louis Bay, Mississippi, samples were taken for High Performance Liquid Chromatography (HPLC) phytoplankton pigment analysis. Samples were taken at 9 stations during incoming and outgoing tides over the course of 9 months. Pigment analysis using HPLC followed the procedure of (Wright et al. 1991). A model using signature pigments as indicators of phytoplankton species was used to determine trends. In coastal and estuarine environments it is expected that larger phytoplankton such as diatoms or dinoflagellates will dominate due to their ability to utilize higher concentrations of nutrients found there. Smaller phytoplankton will dominate in oceanic environments where nutrients are not as abundant. Analysis of two stations, one representing an estuary environment inside St. Louis Bay and one representing the Mississippi Sound environment were compared. Diatoms were more abundant in the Mississippi Sound while dinoflagellates dominated in St. Louis Bay as shown by the presence of indicator pigments.

11:20 UTILIZATION OF A HYPERVARIABLE REGION AS A GENETIC TAG FOR RED SNAPPER, *LUTJANUS CAMPECHANUS*

Amber F. Garber*, Kenneth C. Stuck, and Walter D. Grater, University of Southern Mississippi, Institute of Marine Sciences, Gulf Coast Research Laboratory, Ocean Springs, MS 39564

The ultimate goal of a marine finfish stock enhancement program is the release of hatchery-reared fish that successfully reproduce and interbreed with the receiving native populations. Since generational contributions of released fish cannot be estimated by physical tagging, a reliable genetic tag must be identified and employed. As part of an ongoing stock enhancement program for red snapper, *Lutjanus campechanus*, in the northern Gulf of Mexico, we assessed the potential for using a hypervariable region sequence of the mitochondrial DNA control region (mtCR) as a genetic tag. Total genomic DNA was extracted from 27 red snapper, amplified, cloned, sequenced, and aligned to determine the genetic structure of the mtCR. A hypervariable region of 170 base pairs (bp) was identified where 23 of the 27 red snapper were found to be unique. To assess the potential of this region for use as a genetic tag, total genomic DNA was extracted from additional red snapper and amplified

utilizing primers that flank the hypervariable region. These samples are currently being sequenced. Preliminary analysis of the sequence data indicates that the level of polymorphism in the hypervariable region may be useful in specific genetic population assessments at release sites.

11:40 FACTORS INFLUENCING POPULATION LEVELS OF THE STONE CRAB, *MENIPPE ADINA* IN MISSISSIPPI SOUND

Virginia Shervette^{1*}, Harriet Perry², Patricia M. Biesiot¹, Kirsten Larsen², and James R. Warren², ¹University of Southern Mississippi, Hattiesburg, MS 39406-5018 and ²Gulf Coast Research Laboratory, Institute of Marine Sciences, University of Southern Mississippi, Ocean Springs, Mississippi 39566-7000

Many marine organisms are restricted to habitats which provide essential refuge. The stone crab, *Menippe adina*, is associated with rock rubble jetties and oyster reefs in northern Gulf of Mexico estuaries. Lack of extensive hard bottom habitat, competition for limited space, and predation all operate to influence population levels. Establishment of low profile artificial reefs in Mississippi Sound provided an opportunity to investigate refuge limitation in juvenile stone crabs and to examine the roles of predation and inter-specific competition in controlling population levels. There is strong evidence that size-specific refuge limitation exerts control on both population size structure and density of stone crabs. Stone crab larvae and small juveniles (10-24 mm carapace width) are relatively abundant in Mississippi Sound and the species does not appear to be recruitment limited. Larger juveniles are less common and their numbers may be related to quantity and quality of suitable habitat. Competition for available habitat may be acute between *M. adina* and other xanthid crabs (*Eurypanopeus depressus* and *Panopeus simpsoni*). Competition for habitat also occurs between stone crabs and the toadfish, *Opsanus beta*. Toadfish collected in the study area are active predators on the three xanthid taxa.

THURSDAY AFTERNOON

Ship Isle

1:20 MITOCHONDRIAL GENETICS AND SYSTEMATICS IN THE GENUS *PARALICHTHYS*

Glenn M. Hendrix*, Kenneth C. Stuck, and Walter D. Grater, Gulf Coast Research Laboratory, University of Southern Mississippi, Ocean Springs, MS 39564

Three species of *Paralichthys* occur in the Northern Gulf of Mexico: *P. albigutta*, *P. lethostigma*, and

P. squamilentous. *Paralichthys lethostigma* is an important recreational and commercial species in Mississippi and is listed as a secondary species for possible enhancement by the U.S. Gulf of Mexico Stock Enhancement Consortium. There is little published information available on the genetics of *Paralichthys*, and no published mitochondrial DNA sequences for the three species in this study. We conducted this study to determine the potential of using 12S rRNA (commonly used for taxonomic identification of marine finfish) as a genetic marker for the identification of *Paralichthys* species from the northern Gulf. Total DNA was extracted from five individuals of each species and used as template for a PCR that amplified approximately 900 base pairs of the 12S gene. The resulting PCR fragments were gel purified, T/A cloned, and sequenced. The sequences were then screened for 30 restriction endonuclease sites, and it was found that a combination of Msp I and Xho I could be used to separate the three species. This molecular technique may be particularly useful for identifying otherwise indistinguishable specimens, such as newly hatched larvae.

1:40 OPTICAL AND PHYSICAL PROPERTIES CHARACTERIZE SURFACE DYNAMICS IN THE CHESAPEAKE BAY PLUME

Michele Routhier^{1*}, Robert A. Arnone², and Richard Gould², ¹University of Southern Mississippi, Stennis Space Center, MS 39529 and ²Naval Research Laboratory, Stennis Space Center, MS 39529

Surface optical and physical properties of the Chesapeake Bay plume are examined through a tidal cycle during the Chesapeake Bay Outflow Plume Experiment (COPE II, May 1997) to determine small scale structure of mixing processes. We describe the movement of the plume using surface salinity and the optical properties of absorption (a) and scattering (b) coefficients. Coupled with the shipboard measurements, five aircraft hyperspectral images over a 6-hour partial tidal cycle show the changing surface patterns. Surface a and b values from an ac9 instrument decreased along a 24 km offshore ship transect. The absorption coefficient at 412 nm decreased from 1.3 m⁻¹ inside the plume to 0.1 m⁻¹ outside, and the scattering coefficient at 555 nm decreased from 3.30 m⁻¹ to 1.05 m⁻¹. We compare the ac9 a and b measurements with estimates derived from the hyperspectral imagery. The short time and space scales resolvable with hyperspectral aircraft imagery makes it a unique tool for characterizing plume dynamics.

2:00 HEAVY METAL CONCENTRATIONS IN CHACEON QUINQUEDENS TISSUES FROM THE NORTHERN GULF OF MEXICO

Harriet Perry^{1*}, Wayne Isphording², Christine Trigg¹,

Newton Fawcett³, Richard Waller¹, and Kirsten Larsen¹, ¹University of Southern Mississippi, Institute of Marine Science, Gulf Coast Research Laboratory, Ocean Springs, MS 39566; ²University of South Alabama, Mobile, AL 36688; and ³University of Southern Mississippi, Hattiesburg, MS 39406-5043

The geryonid, *Chaceon quinquegens*, is common in slope waters of the eastern Gulf of Mexico (GOM) at depths greater than 400 fathoms. Highest concentrations of red crabs occur in the north central GOM in an area influenced by run-off from the Mississippi River. Their geographic location, close association with sediments, and protracted intermolt period favor accumulation of metal contaminants. Ten male and ten female red crabs were collected using molded plastic traps. Sediment and water samples were taken concurrently with trap collections. Crabs were dissected at sea and samples of gill, muscle, and hepatopancreas taken. Eggs were removed from ovigerous females. Trace elements/heavy metals were measured using inductively coupled plasma spectrophotometry and atomic absorption spectrophotometry. Concentrations for sediment and water were approximately \leq levels previously reported for the GOM or other oceanic areas. Cu, Zn, As, Cd, Cr, Sn, Sc, and Hg levels in most wet tissues were found to be significantly higher than sediment levels. Bioaccumulation was most evident in the hepatopancreas, followed by the gills, and muscle tissue. Mean concentrations of Cr and Pb in wet muscle tissue were greater than FDA levels of concern.

2:20 THE HOLOCENE PALEOENVIRONMENT OF THE PEARL RIVER MARSH, MISSISSIPPI AND LOUISIANA

Richelle A. Hanson* and Charlotte A. Brunner, University of Southern Mississippi, Stennis Space Center, MS 39529

The goal of this study is to determine paleoenvironmental changes in the Pearl River Marsh using foraminiferal assemblages. The present-day marsh, located on the border of Mississippi and Louisiana, is microtidal with salinity ranging from fresh to brackish (<12). Four 3" diameter vibra-cores were taken in a transect from the freshwater marsh, through the brackish marsh, and ending near Lake Bourne. The cores, which averaged 6 m in length, penetrated Holocene peats and sands, with three piercing the underlying Pleistocene Prairie Formation. A census of foraminifers was taken at 50–100 cm intervals in each core by microscope observation of wet samples. Consistent with the present-day salinity gradient, the assemblage from the upper 100 cm of the mid-marsh core is dominated by brackish, benthic, agglutinated foraminifers with a trace of saline species. In contrast, the assemblage includes only brackish species from 152–250

cm. There is an interval of barren peat from 305–369 cm. The assemblage below is similar to the surface assemblage. These results are interpreted as the response of the foraminiferal assemblage to changes in salinity caused by formation of the St. Bernard Lobe of the Mississippi River Delta. Prior to ~3500 yBP, the Pearl River Marsh experienced open exchange of fresh and salt water. During formation and activity between ~3500 and 1500 yBP, the St. Bernard Lobe isolated the Pearl River from the salt input from the Mississippi Sound. During subsidence of the St. Bernard Lobe, infiltration of sound waters progressively increased, leading to the present-day, brackish salinity.

2:40 Break; Divisional Business Meeting

3:00 ROLE OF SURFACTANTS IN PHYTOREMEDIATION

Julia S. Lytle*, Thomas F. Lytle, and Larry Stewart, University of Southern Mississippi, Institute of Marine Sciences, Gulf Coast Research Laboratory, Ocean Springs, MS 39564

Contaminated sediments are a major concern in the marine environment. A promising alternate procedure for cleaning up contaminated sediments is through the use of plants, referred to as phytoremediation. Plants naturally ooze exudates from their roots that act as surfactants to release sediment-bound contaminants into the sediment pore water. Once contaminants are dissolved into the water, they are bioavailable to plants and other organisms. Uptake and degradation by organisms can effectively remediate the sediments. An experiment was designed to test the effect of two levels of a nonionic surfactant on the bioavailability of a polynuclear aromatic hydrocarbon (PAH), fluoranthene, for uptake by the estuarine plant, *Sesbania vesicaria*. The objective of the study was to determine what surfactant level is needed to effectively make sand-bound fluoranthene bioavailable to *S. vesicaria*. Seven microcosms, each containing three replicate treatments, were prepared with and without PAH contaminated sands and saturated with either distilled water, water with a low surfactant concentration, or water with a high surfactant concentration. Controls were prepared for each treatment. After a six-week exposure, fluoranthene concentrations in plant tissue and sands were measured using a fluorescence spectrophotometer. Uptake was expected to be greatest in plants growing in contaminated sands wetted with the higher surfactant concentrations. Plant growth (height, biomass and root elongation) was correlated with plant uptake of fluoranthene.

3:20 THE USE OF SEAWIFS BIO-OPTICAL PROPERTIES TO TRACE FLORIDA'S

HARMFUL ALGAL BLOOMS

Donna Thomas^{1*}, Robert A. Arnone², Richard P. Stumpf³, Karen Steidinger⁴, and Brad Pederson⁵, ¹University of Southern Mississippi, Stennis Space Center, MS 39529; ²Naval Research Laboratory, Stennis Space Center, MS 39529; ³NOAA National Ocean Service, Silver Spring, MD 20910; ⁴Florida Department of Environmental Protection, St. Petersburg, FL 33701; and ⁵Mote Marine Laboratory, Sarasota, FL 34326

We traced the spatial and temporal extent of a *Gymnodinium breve* bloom off of the Florida panhandle from August through October 1999 using a time series of inherent optical properties (spectral absorption and backscattering) and chlorophyll concentration derived from SeaWiFS imagery. High cell counts of *Gymnodinium breve* were correlated with SeaWiFS-derived chlorophyll concentration. We discuss the influence of elevated cell counts on the backscattering to absorption ratio and chlorophyll concentration derived from SeaWiFS. Improved atmospheric corrections and new iterative techniques allow SeaWiFS algorithms to be extended into the coastal environment to derive the bio-optical properties. SeaWiFS provides real-time trends of the bio-optical properties that help identify the environmental and biological cues used to predict the occurrence of future outbreaks of harmful algal blooms.

3:40 AMPHIPOD FAUNA OF LOW PROFILE ARTIFICIAL REEFS IN MISSISSIPPI SOUND

Harriet Perry*, Kirsten Larsen, Sara LeCroy, Christine Trigg, and James R. Warren, Institute of Marine Science, University of Southern Mississippi, Gulf Coast Research Laboratory, Ocean Springs, MS 39566-7000

Artificial reefs serve as fish attractants and may increase production of some species by increasing habitat. Although over twenty low profile artificial reefs (oyster shell, concrete rubble, limestone gravel) have been constructed in Mississippi inshore waters, there are no data on reef community structure or the association of fish populations with these reefs. A study of the faunal assemblages associated with reef colonization in Mississippi Sound was begun in December 1998 as part of a larger program to assess productivity of these reefs in relation to recreational fishing opportunities. Colonization was studied by placing a series of crates filled with 0.025 m³ of limestone gravel or oyster shell on a newly created limestone/shell reef. A portion of the crates are sampled at 3, 6, 9 or 12-month intervals and all organisms removed and counted. The present data are taken from the initial three-month colonization period. Amphipods were the most abundant macro-crustaceans associated with the reef materials. Two genera of free-living gammarideans

dominated the amphipod fauna on both substrates: *Melita* and *Apocorophium*. There was no significant difference in the species composition between the two substrate types. *Melita nitida* was extremely abundant; *Melita longisetosa* and *Apocorophium louisianum* were also common in samples. *Monocorophium acherusicum* was found only in oyster shell samples in limited numbers.

4:00 Divisional Poster Session

DIET ANALYSES OF FISH ASSOCIATED WITH LOW PROFILE ARTIFICIAL REEFS IN MISSISSIPPI SOUND
Israel Anderson Denham^{1*}, James R. Warren², and Jude LeDoux², ¹Mississippi Gulf Coast Community College, Gautier, MS 39533 and ²Gulf Coast Research Laboratory, University of Southern Mississippi, Ocean Springs, MS 39566-7000

Artificial reefs have become important to the Mississippi Gulf Coast recreational fisheries. These inshore reefs promote tourism along the Gulf Coast by attracting sport fishermen. Over twenty inshore artificial reefs have been established in the Mississippi Sound. One reef (Gulf Park Estates) was chosen to provide information on the benthic organisms that colonize this reef and utilization of the reef by local fish species. During this study, samples were taken from the reef at three month intervals using entanglement gear. All fish were returned to the Gulf Coast Research Laboratory where stomachs were removed and preserved. Stomachs were removed from *Menticirrhus americanus*, *Cynoscion arenarius*, *C. nebulosus*, *Leiostomus xanthurus*, and *Paralichthys lethostigma*, and the stomach contents were analyzed. Ostracods, copepods, and cumaceans were found within stomachs from *L. xanthurus*. Stomach contents from *M. americanus* consisted primarily of unidentifiable fish remains. *Cynoscion nebulosus* and *C. arenarius* stomach contents consisted predominately of fish and shrimp.

SAGA OF THE SEA TURTLES

Jennifer Hale, J.L. Scott Marine Education Center and Aquarium, University of Southern Mississippi, Biloxi, MS 39530

Sea Turtles have gained worldwide attention due to their endangered status. Human activity has contributed to their decline. Populations have been decimated by hunting, either for consumption or for the use of the shell in ornamentation, and by drowning as a result of being taken as by-catch. To add to their troubled future, many sea turtles are becoming infected with the fibropapilloma tumors which are growths that are virally caused. Discover how and why these fatal tumors are rapidly spreading through the sea turtle populations and what measures are

being taken to help these animals survive. Materials will be provided to the attendees.

SEASONAL OCCURRENCE, ABUNDANCE, AND RECRUITMENT OF THREE XANTHID CRABS ON A LOW PROFILE ARTIFICIAL REEF

Christopher Hayes^{1*}, Kirsten Larsen², Harriet Perry², Christine Trigg², and James R. Warren², ¹Cooperative Intern Program, Mississippi Gulf Coast Community College, Gautier, MS 39553 and ²Gulf Coast Research Laboratory, University of Southern Mississippi, Ocean Springs, MS 39566-7000

The establishment of low profile artificial reefs composed of limestone gravel and/or oyster shell in coastal waters of Mississippi provided the opportunity to study the seasonal occurrence, abundance, and recruitment of three species of xanthid crabs (*Eurypanopeus depressus*, *Panopeus simpsoni*, and *Menippe adina*) associated with these structures. *Menippe adina* supports limited commercial fisheries in the northern Gulf of Mexico. The mud crabs, *E. depressus* and *P. simpsoni*, are ecologically important components of oyster reef communities. Plastic crates filled with either limestone or oyster shell substrate were placed on an existing low profile reef located in approximately 1.5 m of water. Four crates of each substrate were placed on the reef in each season (winter, spring, and summer). Crates were removed from the water after three months. Crabs were picked from samples and identified to species. Each crab was measured and weighed and a total number and weight by species recorded. Egg-bearing females were noted. Recruitment occurred for all species in the late summer/early fall.

PRODUCTION OF PHYTOCHELATINS IN PREDOMINANT MARSH PLANTS AS A RESPONSE TO SEDIMENT HEAVY METAL CONTAMINATION

Nicole A. Housley^{1*}, Thomas F. Lytle², Kenneth McMurtrey³, and Julia S. Lytle², ¹Cooperative Intern Program, Mississippi Gulf Coast Community College, Gautier, MS 39533; ²Gulf Coast Research Laboratory, University of Southern Mississippi, Ocean Springs, MS 39566-7000; and ³University of Southern Mississippi, Hattiesburg, MS 39406

Of available methods to remediate metal contaminated soil, phytoremediation offers significant advantages. Use of plants to remove/immobilize metals in soils is effective in many applications and non-destructive to natural environmental systems. We have examined ability of coastal marsh plants to remove metals from contaminated sediments and the mechanisms of removal and storage in the plants. Many terrestrial and aquatic plants produce metal-binding phytochelatin, synthesized from glutathione in response to heavy metals. To determine

whether marsh plants also produce these compounds and may serve to sequester and store these metals, we have tested *Juncus roemerianus* and *Spartina alterniflora* by spiking associated sediments with Cd and placing barriers around plants to restrict movement of the Cd. After a two month exposure, exposed and control plants were removed, tissue extracted, and phytochelatins derivatized before separation and quantification by HPLC. Associated sediments were analyzed for Cd and other metals (Cu, Zn, Ag, Cr, Ni, Pb, Co). These metals were fractionated into bioavailable and non-bioavailable by a simultaneous extraction procedure so that the presence and level of tissue phytochelatins could be related to quantity of heavy metals readily available to plants.

DEVELOPMENT OF A WEB SITE FOR HARMFUL ALGAL BLOOM SPECIES FOUND IN MISSISSIPPI SOUND

Elizabeth A. Quave^{1*}, Cynthia A. Moncreiff², Todd A. Randall², and John D. Caldwell², ¹Cooperative Intern Program, Mississippi Gulf Coast Community College, Gautier, MS 39553 and ²Gulf Coast Research Laboratory, University of Southern Mississippi, Ocean Springs MS 39566-7000

Toxic and harmful algal bloom species that can occur in northern Gulf of Mexico waters will be featured on a web site under development by the authors. This site will include the classic "red tide" alga *Gymnodinium breve*, several species of *Prorocentrum*, *Dinophysis caudata*, and *Alexandrium monilatum*, plus several of the roughly 20 other potentially harmful algal species that are known to occur in coastal Mississippi waters. The site will be targeted toward the general public as a source of basic details on algal blooms, their causes, and the potential effects they can have on people, wildlife, and the environment. Species accounts will consist of photomicrographs, line drawings, and general life history information plus the possible effects of exposure to these harmful algal blooms. Videotapes of harmful algal blooms that occur during the project time frame will also be made using a microscope imaging system to aid in identification and will be included on the site.

THE EFFECTS OF HURRICANE GEORGES ON THE PELICAN ROOKERIES

Alison Sharpe, J.L. Scott Marine Education Center and Aquarium, Institute of Marine Sciences, University of Southern Mississippi, Biloxi, MS 39530

Along the coastal areas of the United States, the brown pelican can be seen soaring effortlessly over the marine and estuarine waters. Just a few years ago, the brown pelican was listed as an endangered species

throughout its range. Today, in most areas, they have been removed from their endangered status. In September of 1998 Hurricane Georges struck the Mississippi coast, leaving a wake of destruction along our mainland and decimating the brown pelican rookeries along the Chandeleur Island chain. This presentation will discuss the nesting problems and whether natural disasters, like hurricanes, might be a contributing factor that could return these marine birds to the endangered species list.

BIOCHEMICAL RESPONSES OF *SESBANIA VESICARIA* TO A POLYUNSATURATED AROMATIC HYDROCARBON, FLUORANTHENE

Larry Stewart*, Julia S. Lytle, and Thomas F. Lytle, University of Southern Mississippi, Institute of Marine Sciences, Gulf Coast Research Laboratory, Ocean Springs, MS 39564

Bioremediation is one of the most promising developments in modern pollution control. Plants contain enzymes that can either detoxify the contaminant, or can stimulate bacteria in the rhizosphere which can degrade the contaminant. Plants release materials through their roots, referred to as exudates. This nutrient rich material is a food source to bacteria and also acts as a surfactant to solubilize soil-bound contaminants onto the plant roots. Some plant species are able to take up the contaminant into their tissue. However, plants cannot survive without defense mechanisms that allow them to cope with these contaminants. Many estuarine plants have evolved various mechanisms of defense. Glutathione, a known plant antioxidant can relieve oxidative stress and as an enzyme, can degrade toxins. Ascorbic acid is another antioxidant plants synthesize in response to oxidative stress. In a laboratory designed study, *Sesbania vesicaria* was grown in sands coated with 10 ppm fluoranthene. Two levels of surfactants were added to test containers to simulate the exudates' ability to reduce surface tension and solubilize contaminants. After 6 weeks of exposure, plant tissue (root and leaf) was extracted and glutathione and ascorbic acid levels were measured. The objective of the study was to determine what concentration level of surfactant is needed to solubilize sediment-bound fluoranthene and to assess the effect of elevated surfactant levels as a function of plant response.

FRIDAY MORNING

Ship Isle

8:40 TECHNIQUE DEVELOPMENT FOR SURFACTANT CHARACTERIZATION OF PLANT EXUDATES

Ashley D. Trahan^{1*}, Larry Stewart², Julia S. Lytle², and Thomas F. Lytle², ¹University of Southern Mississippi, Hattiesburg, MS 39406 and ²University of Southern Mississippi, Gulf Coast Research Laboratory, Ocean Springs, MS 39564

Contaminated sediments pose a significant threat to environmental and human health. They are a major sink for a wide range of pollutants. An alternative method for cleaning up these waste sites is the use of organisms, primarily bacteria, and plants. Plants release exudates that act as a nutrient source for bacteria, and these materials also act as a surfactant which can help to solubilize sediment-bound contaminants. Bacteria have been identified that produce exudates specifically to facilitate the degradation of highly insoluble organic compounds and presumably plants may also behave similarly. Exudates can vary in composition depending on species and maturity of plant and the root rhizosphere. To better understand the role of exudates as surfactants, an experiment was designed to characterize exudates from *Spartina alterniflora* collected at different time intervals of their growth. Plants were grown under hydroponic conditions in order to easily collect plant water exudates. Ionic and nonionic standards were used to develop a technique for characterizing surfactants; using an Orion surfactant electrode. No evidence of cationic or anionic surfactants was found and nonionic surfactants analysis will require isolation from exudates before further analysis. Other experiments established the enhanced solubility of certain polynuclear aromatic hydrocarbons in aqueous solutions containing the *S. alterniflora* exudates and suggested the role these exudates may play in mobilization of sediment contaminants. Exudates were frozen for later analysis when further development of nonionic surfactant techniques are complete.

9:00 EFFECTS OF A RECURRENT COASTAL PLUME ON THE LIGHT ABSORPTION EFFICIENCY OF PHYTOPLANKTON SPECIES IN SOUTHEASTERN LAKE MICHIGAN

Kimberly A. Kelly^{1*}, Steven E. Lohrenz¹, and Gary L. Fahnenstiel², ¹University of Southern Mississippi, Institute of Marine Sciences, Stennis Space Center, MS 39529 and ²NOAA Great Lakes Environmental Research Laboratory, Muskegon, MI 49441

Microphotometric techniques were used to measure the light absorption characteristics of phytoplankton at the single-cell level. Typically, phytoplankton absorption has been determined at the community level using bulk measurements. Use of microphotometric techniques enables the direct measurement of the *in vivo* absorption efficiency factor

$Q_a(\lambda)$ of individual cells. Light is an important variable controlling the development of the spring diatom community in Lake Michigan. This study examined the impact of a recurrent coastal plume on variations in light availability and the associated absorption characteristics of three phytoplankton groups in the vicinity of the plume. Three groups were examined including *Aulacoseira islandica*, *Aulacoseira subarctica* and smaller centric (8-10 mm) diatoms. The magnitude of $Q_a(\lambda)$ for all phytoplankton groups did not vary significantly with depth or time or across plume gradients. However, a comparison between species revealed that the spectral shape of $Q_a(\lambda)$ differed in the blue wavelengths. The centric diatoms had a higher blue-to-red ratio than the *Aulacoseira* species. The possibility is considered that such differences in light absorption efficiency impart a competitive advantage that could contribute to the higher abundance of centric diatoms in plume assemblages.

9:20 HISTOPATHOLOGY OF WHITE SPOT VIRUS IN THE RED SWAMP CRAYFISH, *PROCAMBARUS CLARKII*

Rena Krol^{1*}, K. Vijayan², Jeffrey M. Lotz¹, and Robin Overstreet¹, ¹Institute of Marine Sciences, Ocean Springs, MS 39566 and ²Central Institute of Brackishwater Aquaculture, Madras, India

White spot virus (WSV), a major disease-causing agent in the shrimp aquaculture industry in the eastern hemisphere, can also infect *Procambarus clarkii*, the economically important freshwater crayfish from the southeastern U.S. This study examines WSV in *Procambarus clarkii* by transmission electron microscopy and light microscopy and compares the viral infection with that found in shrimp. Captive crayfish were injected with an inoculum of WSV-infected tissue from *Penaeus monodon* from India. In another experiment, crayfish were fed tissues of *Litopenaeus vannamei* which had been exposed to WSV-infected *P. monodon*. Gill, foregut, and cuticular epidermis were prepared for light microscopy. Foregut was prepared for transmission electron microscopy (TEM). By the second day post injection, animals exhibited lethargy and morbidity. No white spots appeared in the exoskeleton. By the fourth day, cumulative mortality was 100%. The feeding experiments ran for 17 days. Cumulative mortality at that time was 88% for crayfish fed WSV-infected *P. monodon* and 50% for crayfish fed *L. vannamei* exposed to WSV-infected *P. monodon*. Histology revealed WSV infection in cell nuclei of the three tissues examined. TEM of foregut showed bacilliform virions 240-310 nm long by 80-100 nm wide. Some virions were found in membrane-bound vesicles in the cell cytoplasm. This study was funded in part by USDA, CSREES Award No. 98-38808-6019.

9:40 DISSOLVED RARE EARTH ELEMENTS IN THE LOWER MISSISSIPPI RIVER

Alan M. Shiller^{1*}, Julie Havens¹, and Robyn Hannigan²,
¹University of Southern Mississippi, Stennis Space Center, MS 39529 and ²Old Dominion University, Norfolk, VA 23529

Rare earth elements (REEs) form an unique series in which incremental changes in chemical properties occur across the series as a result of decreasing ionic radius as f-shell electrons are filled in. In general it is found that heavier REEs are preferentially complexed in solution whereas lighter REEs are preferentially sorbed to particle surfaces. Most of the REEs are found in the trivalent oxidation state in natural waters. However, oxidation of Ce(III) to Ce(IV) and subsequent scavenging removal of Ce(IV) can lead to lower than expected dissolved concentrations of this element (the so-called Ce anomaly). In our study, dissolved REE concentrations were determined in a monthly time series of the lower Mississippi River which was conducted from October 1991 to December 1993. Overall our results agree with limited previous investigations; i.e., the river shows enrichment of heavy REEs relative to light REEs and also has a significant Ce anomaly. However, the previous investigations relied on only single samples from the river. Our seasonal investigation reveals significant temporal variations in the river's REE chemistry. In particular, we observe substantial (and generally correlated) variations in heavy REE enrichment and Ce anomaly. Overall the most fractionated (with respect to crustal composition) waters generally occur in winter and spring and the least fractionated waters occur in summer.

10:00 RESISTANCE OF NAIVE AND PREVIOUSLY EXPOSED *LITOPENAEUS VANNAMEI* (CRUSTACEA: PENAEIDAE) TO TAURA SYNDROME VIRUS OR WHITE SPOT VIRUS

Anne Marie Moore*, Jeffrey M. Lotz, and Verlee Breland, Gulf Coast Research Laboratory, Institute of Marine Sciences, University of Southern Mississippi, Ocean Springs, MS 39566-7000

Taura syndrome virus (TSV) and white spot virus (WSV) are the two most important shrimp pathogens affecting aquaculture of the white-legged shrimp *Litopenaeus vannamei* in the Western Hemisphere. A matter of days after exposure to TSV the mortality in a population of cultured *L. vannamei* is typically 75% whereas mortality after exposure to WSV is likely to be 90%. As part of an ongoing study on the pathology and epidemiology of TSV and WSV we undertook to compare the survival of naive *L. vannamei* and survival of previously exposed *L. vannamei* to re-challenge with the homologous virus. Shrimp between

1 and 5 g were exposed by feeding infected shrimp cephalothoraces at a rate of 3% body weight. Survivors of such primary exposures were used for subsequent re-exposures to virus. Several re-exposure experiments were performed with the TSV and WSV survivors. In a typical experiment 12 TSV survivors were challenged with TSV and 10 WSV survivors were challenged with WSV. After 21 days the TSV survivors challenged with TSV had 0% mortality whereas the WSV survivors rechallenged with WSV had 100% mortality after 5 days. It appears that surviving a TSV challenge imparts resistance to rechallenge with TSV whereas survival of a WSV challenge does not impart resistance to re-challenge with WSV. Partial funding was provided through USDA/CSREES grant number 98-38808-6019.

10:20 Break

10:40 CALIBRATION OF SPLIT-FLOW THIN-CELL (SPLITT) FRACTIONATION

Toshi Uozumi* and Alan M. Shiller, University of Southern Mississippi, Stennis Space Center, MS 39529

Split-flow thin-cell (SPLITT) fractionation is a continuous particle separation technique which is relatively new and still under development. SPLITT is a rapid hydrodynamic separation technique applicable to environmental samples. Separation is achieved using the gravitational settling of particles as they traverse the SPLITT cell. Each operation separates particles into two fractions at a certain cutoff diameter which can be easily changed by adjusting flow rates (i.e., the transit time of particles through the SPLITT cell). In theory, the necessary flow rates are predictable by first principle calculations; however, the actual cutoff diameter does not always match the theoretical cutoff diameter. This seems to be the case especially when a sample contains particles with differing densities. Therefore, the cutoff diameter requires calibration by measuring the actual size of the separated particles. This procedure can be done by using a combination of SEM and an image-processing program with a capability of quantifying particle dimensions. In our study, river particles (1-64 microns) taken from the Mississippi River are separated into four different size fractions using the SPLITT technique. The separation of Mississippi River suspended particles is a first step in work aimed at understanding the nature of seasonal changes in the surface area of the river particles.

11:00 SIZE-DEPENDENT VARIATIONS OF PHYTOPLANKTON SPECTRAL ABSORPTION IN COASTAL WATERS SOUTH OF CHESAPEAKE BAY

Steven E. Lohrenz^{1*}, Christopher L. Carroll¹, and Alan D. Weidemann², ¹University of Southern Mississippi, Stennis Space Center, MS 39529 and ²Naval Research Laboratory, Stennis Space Center, MS 39529

Critical to our understanding of coastal ecosystems is knowledge of phytoplankton distributions. Our ability to characterize phytoplankton distributions in coastal environments has the potential to be greatly enhanced by the application of remote sensing. One factor contributing to uncertainty in estimates of pigment concentrations by remote sensing is variability in pigment absorption coefficients. The coastal region south of Chesapeake Bay is an excellent area to examine consequences of variability in phytoplankton communities. Various studies have noted differences in phytoplankton size and taxonomic composition among different water masses in the region. Our objective was to examine whether variations in pigment spectral absorption accompanied the differences in phytoplankton size and taxonomic composition. The shapes of the pigment absorption spectra for near-shore low salinity (plume) stations were characterized by lower blue-to-red absorption ratios than was the case for higher salinity stations further offshore. The spectral shapes of the <3 micron size fractions at the near-shore stations were similar to those observed at the offshore stations indicating that the observed differences in spectral shape were size-related. Our findings demonstrate that characterization of pigment absorption by remote sensing must take into account variations in phytoplankton size and associated absorption properties.

11:20 THE EFFICACY OF THREE MARSH PLANTS IN PHOTOREMEDIATION OF HEAVY METALS

Jeffrey Lyons^{1*}, Nathaniel Smith², Thomas F. Lytle³, and Julia S. Lytle³, ¹Vanderbilt University, Nashville, TN; ²Alcorn State University, Alcorn State, MS 39096; and ³University of Southern Mississippi, Gulf Coast Research Laboratory, Ocean Springs, MS 39564

Phytoremediation, vegetation-enhanced bioremediation, offers an attractive alternative to conventional means of decontaminating sediments. Little research has explored use of coastal marsh plants in phytoremediation of sediments. Three prominent marsh plants, *Juncus roemerianus*, *Spartina alterniflora*, and *Sagittaria lancifolia* and associated sediments were collected from a Department of Defense site with known elevated levels of heavy metals, from Ocean Springs Harbor and also from a control site in Ocean Springs. Plant roots and leaves were acid digested and analyzed by either flame or furnace atomic absorption spectrophotometry for Cu, Zn, Co, Ag, Cr, Cd, Ni and Pb. Sediments were digested to remove

“bioavailable” fractions of metals associated with either iron oxide, manganese oxide or organic phases. *S. lancifolia* (being most exceptional in ability to translocate metals from roots to leaves) and *S. alterniflora* generally contained higher uptake levels of metals than *J. roemerianus* with Cd, Cu and Ni being most dramatically accumulated. Pb and Zn were less well accumulated. Cr though at high total levels occurred in sediment mostly in forms not readily available to plants and was at very low levels in plant tissues and vividly demonstrates the importance of defining sediment metals in terms of “bioavailable” rather than total amounts as a level most environmentally meaningful.

11:40 TRANSMISSION OF WHITE SPOT VIRUS TO *LITOPENEAUS VANNAMEI* (CRUSTACEA: PENAEIDAE)

M. Andres Soto*, and Jeffrey M. Lotz, Gulf Coast Research Laboratory, Ocean Springs, MS 39566-7000

White spot virus can cause up to 100 % crop mortality on shrimp farms. The transmission coefficient, $\hat{\alpha}$, derived from a mathematical epidemiology model with the Reed-Frost method of pathogen transmission was used to compare transmission from cannibalism to transmission from water of white spot virus to *Litopenaeus vannamei*. The formula for estimating the transmission rate is: $\hat{\alpha} = 1 - \exp((S_1 / S_0) / I_0)$, where, S_0 and I_0 are the number of susceptible and infected animals, respectively, at the beginning of the experiment, and S_1 are the number of susceptible animals at the end of the experiment. Twelve susceptible animals (S_0) were placed in each of nine cylindrical tanks (surface area = 1 m²). In four tanks, shrimp were allowed to cannibalize one dead, infected shrimp, and shrimp in four other tanks were exposed by cohabitation to one infected shrimp. Shrimp in one tank served as the negative control. After 14 hours all shrimp were isolated to avoid further exposure from newly infected shrimp and at day four the experiment was stopped. All shrimp were examined histologically for white spot virus. The transmission coefficient from cannibalism was 0.38, and from water was zero. Partial funding was provided by USDA/CSREES grant # 98-38808-6019.

MATHEMATICS, COMPUTER SCIENCE AND STATISTICS

Chair: Walter T. Brehm, US Air Force/Keesler Medical Center

Vicechair: Dale Bowman, University of Mississippi

THURSDAY MORNING

Caribbean Room

9:00 PATTERN K-POTENT RAY PATTERN MATRICES

Jeff Stuart^{1*}, LeRoy Beasley², and Bryan Shader³, ¹University of Southern Mississippi, Hattiesburg, MS 39406; ²Utah State University, Logan, UT 84322; and ³University of Wyoming, Laramie, WY 82071

For a complex matrix A , the ray pattern of A is the class of all complex matrices whose the zero- nonzero pattern is specified by that of A and such that the argument of each nonzero entry is that of the corresponding entry of A . The ray pattern is called pattern k -potent if k is the smallest positive integer for which $A^{(k+1)} = A$ as ray patterns. We provide a canonical form for patterns with respect to permutation similarity and signature similarity by diagonal, unitary matrices. We characterize the irreducible ray patterns that are pattern k -potent, and we provide necessary conditions for the structure of each off-diagonal block of the Frobenius normal form of a reducible, pattern k -potent ray pattern.

9:15 TILING CONVEX POLYGONS WITH EQUILATERAL TRIANGLES

John C. Mayer¹, Tameka LaShun Wilder^{2*}, John C. George², Lovell Agwarambo², ¹University of Alabama at Birmingham, Birmingham, AL 35294-1150 and ²Tougaloo College; Tougaloo, MS 39174

The purpose of this project was to answer several questions pertaining to the tiling and tessellation of convex polygons using equilateral triangles. According to The Oxford English Dictionary, a tessellation can best be defined as an arrangement or close fitting together of minute parts or distinct colors. Convex figures are figures that if given any two points in the polygon, the entire line segment between them does lie inside the polygon. The whole objective of this project was to construct polygons, triangular, pentagonal, and hexagonal figures, with equilateral triangles. The next step was to derive and prove a formula to create these figures. In addition, this project would also thoroughly explain how to find these figures within a bigger equilateral triangle. One shall then be able to compare any given number ' k ' and figure out whether or not this number ' k ' can be either two of the different figures. Through the data found in this project, a number ' k ' was proven not to be in any two polygons or all three polygons. However, through the substitutions of different values of ' k ' one was unable to completely conclude this answer to be no due to the fact that there may exist several open-end solutions. Acknowledgements: This project was

funded by NFS-AMP & MGE Programs.

9:30 INTEGRAL KERNEL/FREQUENCY SHIFT ALGORITHMS FOR IMAGE DATA COMPRESSION

Joseph Kolibal* and Suming Fang, University of Southern Mississippi, Hattiesburg, MS 39406

The properties of a class of computational methods, which are suitable for the purpose of data approximation, are investigated for suitability in constructing lossy compression algorithms. The specific objectives are to carry forward preliminary research and to investigate several alternative approaches to improve the performance of the algorithms with regard to image compression. Significant gains can be made from cleverly and efficiently coupling spectral shift methods with convolution operators to achieve an efficient lossy image compression method suitable for use with image data. The approach utilizes probabilistic integral kernel methods to construct approximants which serves as the core of the compression algorithm.

9:45 Break

10:00 FIP: A PATTERN RECOGNITION SOFTWARE TOOL DEVELOPED USING MATLAB FOR THE CLASSIFICATION OF GAS CHROMATOGRAPHIC DATA

Abdullah Faruque^{1*}, Howard T. Mayfield², and Barry K. Lavine³, ¹Mississippi Valley State University, Itta Bena, MS 38941; ²Armstrong Laboratory, Tyndall Air Force Base, FL 32403; and ³Clarkson University, Potsdam, NY 13699

This paper describes the implementation of FIP (Fuel Identification Program), a pattern recognition software tool intended to type classify fuels presented as gas chromatographic profiles by using neural network and other statistical pattern recognition techniques. Various data preprocessing techniques necessary to support the pattern recognition techniques are also provided. Data visualization tools are also provided to permit visual assessment of the data patterns and their relationships. FIP software tool has been used successfully by the Fuel Identification Research Group at Armstrong Laboratory, USAF. The development of this software system takes advantage of the high performance computational and visualization routines of the MATLAB programming environment. Data analysis component of FIP includes: (1) principal component analysis, (2) fisher and variance weight calculations and (3) feature selection. Using MATLAB's graphics routines, 2-dimensional or 3-dimensional plots of the principal components can be displayed. Classification methods in FIP include both

neural network and statistical pattern recognition techniques. Neural network methods include the back propagation neural network (BPN) and radial basis function (RBF) neural network. Statistical pattern recognition component of FIP includes linear discriminant analysis (LDA), quadratic discriminant analysis (QDA), regularized discriminant analysis (RDA), soft independent modeling of class analogy (SIMCA) and discriminant analysis with shrunken covariance (DASCO). FIP provides two ways to calculate classification error rate: (1) bootstrap error rate and (2) cross-validated error rate. The neural network and statistical pattern recognition techniques used in FIP can also be used in other pattern recognition problems with little modification.

10:15 MULTIVARIATE NONLINEAR TIME SERIES MODELING

Jane L. Harvill* and Bonnie K. Ray, Mississippi State University, Mississippi State, Mississippi 39762 and New Jersey Institute of Technology, Newark, New Jersey 07102

A multivariate extension of the univariate nonlinearity test of Tsay (1986) is presented. Simulation results show that the multivariate test is more powerful than its univariate counterpart, especially for series having nonlinear structure involving several components of the vector process and weakly or moderately cross-correlated process error terms. Next, exploratory methods for determining appropriate lagged variables in a vector nonlinear time series model are investigated. The first is a multivariate extension of the R statistic from Granger and Lin (1994), which is based on an estimate of the mutual information criterion. The second method uses Kendall's $\hat{\delta}$ and partial $\hat{\delta}$ statistics for lag determination. These methods provide nonlinear analogues of the autocorrelation and partial autocorrelation matrices for a vector time series. Simulation results indicate that the methods reliably identify appropriate lags. Finally, a brief discussion of work in progress model estimation techniques in the vector nonlinear time series case follows. Some non-parametric methods which avoid the "curse of dimensionality" are suggested as possible solutions to this problem.

10:30 ON THE ROBUST CHARACTER OF CONTROL CHARTS FOR VARIABLES WHEN STANDARDS VARY RANDOMLY

Hari M. Sharma, East Mississippi Community College, Mayhew, MS

In the process control, the control charts are used as statistical techniques. While defining control limits for these charts, standards or product qualities are considered to be constant. In the present study, in view of constant environmental stresses and other factors over a long period

of time, standards are treated as random variables which are represented by Prior Distributions and are updated by using experimental data in Bayesian framework, to develop Posterior Distributions. OC curves (operating characteristic functions) have been used a rational means for analyzing robustness of the system.

10:45 HYPERSPECTRAL ALGORITHM DEVELOPMENT FOR WATER APPLICATIONS

David C. Hughes* and Ron Holyer, University of Southern Mississippi, Hattiesburg, MS 39406

This presentation describes principal component analysis (PCA) of hyperspectral data. Hyperspectral remote sensing systems sense energy in several hundred spectral bands in the visible and near-infrared portions of the electromagnetic spectrum. These high-resolution spectral image data facilitate numerous spectroscopic applications here on Earth. Inter alia, the data are used to identify materials, detect features, and quantify environmental parameters on the Earth's surface, or along the intervening atmospheric path. We have modeled radiative transfer in the waters of the Gulf of Mexico to produce a large database of spectral curves of remote sensing reflectance and water-leaving radiance. These data are subjected to PCA so as to characterize the "important" spectral bands of radiance information for water in the Gulf. The preliminary results indicate that data set dimensionality is reduced by a factor of ten when PCA is applied.

11:00 Divisional Business Meeting

THURSDAY AFTERNOON

Caribbean Room

1:30 MINOR TRACKING PROGRAM FOR COLLEGES

Vanessa Siegal* and Donald R. Schwartz, Millsaps College, Jackson, MS 39210

Most college students declare a major but very few students declare a minor. It is our theory that many students, if informed that they are close to achieving a minor, would decide to "go for it" since having a minor will usually enhance a student's overall future prospects. At Millsaps College, no minor is satisfied in exactly the same way as any other minor. Minors often have a set of required courses, as well as up to four other "groups" of courses (each with their own options) that must be taken. Our major challenge was to represent these various requirements for every minor offered. We have developed a Minor Tracking System for exactly this purpose. The

project required that a database be designed to determine whether classes taken by a student fulfill (or come close to fulfilling) any of the minors offered by the College, and that a user interface be developed to summarize and present this information. As an additional advising feature, our system even lists students who are any given number of hours away from a specific minor. Our presentation gives the details of the database design, as well as how we merged it with a Visual Basic interface that is efficient, professional, and easy to use.

1:45 A MULTIMODE XML-BASED EDITOR FOR SMIL AUTHORING

Lindsay M. Akers* and Andrew V. Royappa, Millsaps College, Jackson, MS 39210

Synchronized Multimedia Integration Language (SMIL) was introduced recently by the World Wide Web Consortium. SMIL is an Extensible Markup Language (XML) system that utilizes structured text to represent multimedia presentations in a form suitable for transmission over the World Wide Web. Several programs exist for constructing SMIL presentation files. The present research is to design and implement a SMIL editor with a novel combination of features. The editor allows the user to view the SMIL presentation in different ways. First, the editor can display the actual XML code of the presentation in a tree-like format that closely mirrors the structured text representation. Users may directly edit XML elements and attributes. A second mode displays an XY-slice of the presentation at any point in time, giving the user a "What You See Is What You Get" (WYSIWYG) view. Finally, the editor can also display a timeline view. The user may edit the presentation graphically using standard user interface controls in each mode. For instance, the user may change the spatial relationships of objects in the WYSIWYG mode, and change their temporal relationships in the timeline mode. A prototype for the system is under construction. It is being developed as a Windows '95 application using the Delphi rapid application development system, employing object-oriented XML components to read, write and manipulate structured text trees.

2:00 ANALYSIS OF HOME RANGE DATA USING GENERALIZED ESTIMATING EQUATIONS

Jake Olivier* and Dale Bowman, University of Mississippi, University, MS 38677

Many procedures for analyzing home range data implicitly assume independence despite the fact that most data is not statistically independent either spatially or temporally. The procedure introduced here attempts to allow for independence in the data through correlation parameters in the covariance matrix. The method relies on

generalized estimating equations to estimate a utilization distribution that is an estimate of the probability of finding the animal at a particular location within a fixed region of interest. The procedure also allows for methods of introducing covariates into the estimation process so that factors such as habitat, ground cover and other biological patterns may be included as factors affecting the utilization distribution.

2:15 DETERMINATION OF INFLUENTIAL DOSE GROUPS

Dale Bowman and Gibson Johnston*, University of Mississippi, University, MS 38677

In a typical bioassay, one objective is to estimate a dose response curve. The designs presently used are usually predetermined by government guidelines. Here, an alternative method is proposed based on the chosen form for the dose response curve and the determination of influential dose groups. Influence depends upon both the form of the curve and the number of animals in each dose group. Once influential dose groups have been determined, the design can be changed to shift the focus to specific interests. For example, the focus can be shifted from high doses to low doses, where human exposure typically occurs. The proposed method should provide better estimates for the NOEL and confidence limits for benchmark dose levels. This paper proposes a test for influential dose groups and illustrates this test on a specific data set.

2:30 Break

2:45 A COMPARISON OF METHODS USED TO TEACH PROBABILITY IN INTRODUCTORY STATISTICS

Karen D. Morgan* and Dale Bowman, University of Mississippi, University, MS 38677

Recently there has been much debate about the amount of probability which should be taught in an introductory statistics course and about the manner in which probability should be presented. Studies have shown that many students have intuitive beliefs about probability which often are self-contradictory and often contradict laws of probability. These intuitions, difficult and often impossible to correct, are based in large part upon a frequentist approach to computing probabilities. The challenge of this research is to use the students' intuitive understanding of frequentist computations to teach the basic concept of probability. In this way, it may be possible to alter some misconceptions and reinforce basic concepts of probability. A study was designed to compare a new approach to teaching probability using computer simulations with a more classic method using the laws of

probability.

3:00 BAYESIAN BOOTSTRAP PROCEDURES FOR ESTIMATING RISK IN DEVELOPMENTAL TOXICITY EXPERIMENTS

Gwen Aldridge* and Dale Bowman, University of Mississippi, Oxford, MS 38655

A typical teratological study involves a control group and several dose groups of randomly assigned females who early in gestation or prior to mating are administered fixed doses of the toxic substance being tested. Prior to term, the dams are sacrificed and the uterine contents are examined to check for either malformation of fetuses, fetal death or other event of interest. The outcome of interest is considered to be binary. Since the litter sizes vary, in studies of this type the data occur in clusters having random cluster sizes. A developmental model which not only accounts for the intralitter correlation of the fetuses, but also the possible dose effects on the size of the litter is desired. The proposed model estimates the probability of an adverse effect at a given dose level as a weighted average, where each observed proportion in the sample is weighted according to the estimated likelihood of its occurrence. A Bayesian bootstrap method is incorporated in the computation of the estimated likelihoods. The advantages of the Bayesian bootstrap over classic estimation procedures and ordinary bootstrap methods include the ability to incorporate prior information into the analysis and the ability to simulate a posterior distribution. The proposed model gives good results particularly at the lower dose levels which is desirable since the lower levels typically correspond to the level of exposure in humans.

3:15 PROPORTIONS WITH A ZERO NUMERATOR: MAKING INFERENCES USING THE "RULE OF THREE"

Carolyn R. Boyle, Mississippi State University, Mississippi State, MS 39762-9825

If p is the probability that an event will occur, the binomial distribution gives the probability of k occurrences of the event in n independent trials. When p is small, it is likely that no events will be observed even if n is relatively large. This situation often arises in biomedical research where p , for example, is the prevalence of a rare disease or the rate of occurrence of an uncommon therapeutic side effect. The normal approximation to the binomial is not appropriate for calculating an upper confidence limit for p when the point estimate of p is zero, but an upper confidence limit can be obtained using either the binomial, the F , or the Poisson distributions. Alternatively, a simple empirical rule gives a close approximation to those methods and is easily calculated using mental arithmetic. The "Rule

of Three" states that $(0, 3/n)$ is an approximate 95% confidence interval for $p = 0/n$. For example, if $n = 30$, an approximate 95% confidence interval for p is $(0, 0.1)$. This paper will review the relationship between the "Rule of Three" and the more exact methods, discuss the use of the rule as a tool for the statistical consultant, and give an example of the use of the rule to estimate the prevalence of bovine spongiform encephalopathy ("Mad Cow Disease") in the United States' beef supply.

3:30 Business Meeting of the Mississippi Chapter of the American Statistical Association

FRIDAY MORNING

Pre-Assembly Area

9:00–11:00 MEET THE STATISTICIAN

Walter T. Brehm, Clinical Research Laboratory, 81st Medical Group, Keesler AFB, MS 39534

The importance of considering how data will be analyzed early in the planning of an investigation or experiment cannot be overemphasized. The distinguished statistician Sir R.A. Fisher said, "To call in the statistician once the experiment is done may be no more than asking him to perform a postmortem examination: he may be able to say what the experiment died of." Don't let this happen to you! Come to the Annual meeting of the Mississippi Academy of Sciences and MEET THE STATISTICIAN. The members of the Division of Mathematics, Computer Science, and Statistics will be providing free, 20 minute consultations in the areas of experimental design, statistical design & analysis selection, and sample size determination. Some analyses may be possible with advanced arrangements. Contact the division chairman, Walt Brehm, 81st Medical Group, 301 Fisher St., Rm 1A132, Keesler AFB, MS 39534 or walter.brehm@keesler.af.mil to arrange an appointment. Students are welcome and walk-ins may be accepted. It could be the most important 20 minutes of your whole project.

PHYSICS AND ENGINEERING

Chair: T.M. Parchure, Waterways Experiment Station

THURSDAY MORNING

Chandeleur Room

9:00 HEXAPODS—MACHINE TOOLS WITH STAR TREK LOOKS

S. Kant Vajpayee, University of Southern Mississippi, Hattiesburg, MS 39406-5137

Technically a parallel kinematic link mechanism, the hexapod represents a revolutionary design concept since the dawn of machine tools. The idea originated with its application as an aircraft flight simulator. In this configuration two struts extend from each point of a triangular base to a triangular overhead platform where the simulator cockpit rides. Motor-driven ballscrews extend and retract the struts in response to controller commands. The transplantation of the idea to machine tool design had to wait until controllers could do the calculations fast enough. In the hexapods each command is a non-linear function of six sets of coordinates; even a simple X motion has to be translated into six coordinated leg lengths moving in real-time. The biggest benefit of hexapod is its higher volumetric accuracy—two to three times that of the conventional Cartesian structures. In the hexapod, the worst single element is the worst machine error. In contrast, classical machine tools stack up errors from all the elements. The hexapod is five times more rigid and four times faster than a conventional machine tool. All these are expected to translate into higher productivity. Half-a-dozen companies currently manufacture hexapods.

9:15 SOCIAL ACCOUNTABILITY SA 8000—A NEW INTERNATIONAL STANDARD

S. Kant Vajpayee, University of Southern Mississippi, Hattiesburg, MS 39406-5137

The success of ISO 9000 and 14000 has propelled the world community to take the first step toward improvement of working conditions in factories throughout the world. As an embodiment of global community, the International Organization for Standardization created a new standard entitled SA 8000, where SA is an abbreviation for social accountability. SA 8000 aims to address and eventually eliminate unfair, inhumane labor practices. It targets poor factory conditions around the world. It has been written by a 25-member advisory board consisting of representatives from renowned organizations. SA 8000 requires that employers pay wages sufficient to meet workers' basic needs, provide a safe working environment, not employ child or forced labor, and limit work to 48 hours per week. Its implications to factories worldwide are quite unprecedented. For example, US companies may find that moving operations overseas no longer makes economic sense; goods imported into the US, produced by the sweat of child labor, will become expensive. Companies are already being certified to SA

8000. It seems that this international inter-industry standard will dramatically accelerate the globalization process already in full swing.

9:30 PREVENTING SALINITY INTRUSION IN ESTUARIES AND NAVIGATION LOCKS

T.M. Parchure, US Army Engineer Waterways Experiment Station, Vicksburg, MS 39180

Intrusion of salt water from ocean in estuaries is a common natural occurrence driven by the differences in densities of salt and fresh water. The extent of salinity intrusion is predominantly a function of the magnitude of tidal range and quantity of fresh water flow. An increase in salinity intrusion may have profound adverse effects on the aquatic life forms and sedimentation patterns of the region. Increased salinity may also make water unfit for human consumption and industrial use. Structures such as barrages and navigation locks constructed on estuaries have to take into account the possibility of salt water intrusion and take preventive measures to arrest such intrusion. Several methods were considered for an engineering project to achieve this objective. These methods are described, which included options such as construction of a submerged sill on river bed, pneumatic curtains, hinged gates, holding ponds, and selective withdrawal. Selection of an effective method requires numerical or physical model study. Several estuaries require maintenance dredging in order to ensure adequate depth for navigation of vessels. Increased channel depth increases the extent of salinity intrusion. Assessment of the impact of channel deepening and preventive measures suggested through engineering studies are described.

9:45 EFFECT OF HEAVY SUBSTITUTION IN THE BENZENE RING ON THE RING-MODES OF BENZENE 1 PHENYLTHALLIUM DIFLUORIDE

Chandra M. Pathak* and B.P. Asthana, Alcorn State University, Alcorn State, MS 39096 and Banaras Hindu University, Varanasi 221005, India

The vibrational frequencies related to the ring modes in benzene remain fairly constant when one of the hydrogen atoms in the benzene ring is substituted with a single lighter atom or a lighter group of atoms. The present work describes the effect of replacing a single hydrogen atom in the benzene ring with a relatively heavier group : TIF₂. The studies included the investigation of the infrared spectra of Phenylthallium Difluoride in solid phase covering the spectral region 4000 - 20 cm⁻¹ and the normal coordinate analysis. The far-infrared spectra in the region 500 - 20 cm⁻¹ were recorded and investigated for the first time. The normal coordinate analysis was carried out, using

the 'least square iterative technique' assuming a geometrical model with a C_{2v} symmetry for the molecule and has supported the frequency assignment quite well. Twenty-eight symmetrized principal force constants and seven interaction force constants have been found to reproduce the observed frequencies. The average percentage error between the calculated and observed frequencies has been found to be 2.01% with the standard deviation not exceeding 6.63 cm^{-1} . The standard deviation in the force constants was found to lie in the range 0.002–0.235 mdyne/A.

10:00 Break

10:15 CALIBRATION OF LASER-INDUCED BREAKDOWN SPECTROMETRY SPECTRA

Jagdish P. Singh, Fang-Yu Yueh, Chun Fu Su, Khurram Z. Moghal*, and Robert L. Cook, Mississippi State University, Mississippi State, MS 39762

In the past years, we have reported the results of the laser-induced breakdown spectroscopy (LIBS) technique to the MAS annual meetings. The results included the identification of the metal elements in the vitrified glass samples, the concentration ratios of the elements, and the effect of the sample temperature on the spectral intensities and concentration ratios. Recently, an attempt was made to employ the technique for calibrating the elemental concentrations present in an arbitrary sample. Five standard aluminum alloy samples with the known elemental concentrations were used in this study. In principle, at a certain sample temperature the intensity of a given line is linearly proportional to the elemental concentration. However, the matrix effects, excitation conditions, and other factors may significantly affect the measurement accuracy. Detailed results of the calibrations will be presented.

10:30 SOFTWARE DEVELOPMENT FOR 3-DIMENSIONAL DCO RATIO ANALYSIS

Russ Terry^{1*}, Bent Herskind², Mats Bergstrom³, Peter Varmette¹, and Wenchao Ma¹, ¹Mississippi State University, Mississippi State, MS 39762; ²Niels Bohr Institute, Copenhagen, Denmark; and ³Universitet zu Koln, Cologne, Germany

Directional Correlation of Oriented nuclei (DCO) ratio analysis is a very common and important approach used in finding the multipolarity of gamma ray transitions and subsequently to determine spin and parity of excited nuclear states. Traditionally DCO ratio analysis has been accomplished through the analysis of double coincidence data using an asymmetric two-dimensional coincidence matrix. This method often fails for weak transitions in a

complex decay scheme or at high spin due to short-comings of 2-D coincidence measurements. The goal of this project is to develop software and techniques for performing DCO ratio analysis using an asymmetric 3-dimensional coincidence cube. The high-fold, high-statistics data available from large gamma ray detector arrays such as "Gammasphere" and "Euroball" compounded with the high speed and data storage capacity of modern computers have made it possible in recent years to generate and handle 3-dimensional data cubes. Since an asymmetric, as opposed to a symmetric, coincidence cube cannot be folded, compression techniques must be implemented to increase manageability of the data. A 1024 x 1024 x 800 channel cube requiring only 0.5 GB was generated from a Gammasphere experiment at Argonne National Lab using the reaction of $^{76}\text{Ge} + ^{96}\text{Zr}$. By using this double gating (3-D) approach, it is found that transitions are more easily and accurately resolved from spectra. A graphical interface was developed to increase ease and efficiency. The principle and technique will be demonstrated.

10:45 EXCITATION LEVELS IN VERY NEUTRON-DEFICIENT ^{111}Te ISOTOPE

W. Liu^{1*}, Peter Varmette¹, W.C. Ma¹, Bent Herskind², G. Hagemann², G. Sletten², Mats Bergstrom², G. De Angelis³, M. Cinausero³, C. Fahlander³, H. Jensen³, D. Napoli³, and P. Spolaore³, ¹Mississippi State University, Mississippi State, MS 39762; ²Niels Bohr Institute, Denmark; and ³INFN Laboratoria Nazionale de Legnaro, Italy

In order to study the high spin states of very neutron deficient Xe, I, Te isotopes, an experiment was performed at Legnaro National Laboratory using the reaction of $^{58}\text{Ni} + ^{58}\text{Ni}$. Beam energy of 275 MeV was chosen, which was higher than one would usually use, to bring into the compound system highest possible angular momentum. The symmetric reaction was calculated to be very "cold" thus reducing the fission cross section. The decay gamma rays, charged particles and recoiling nuclei were detected with the GASP spectrometer array (consisting of 40 Compton-suppressed Germanium detectors), the ISIS detector array (consisting of 39 Silicon telescopes), and the Recoil Mass Spectrometer. In the off-line analysis, gain-matched and Doppler corrected gamma rays were sorted into thirteen coincidence matrices with different mass and charged-particle (proton and alpha) gating conditions. Data analysis is in progress and results will be presented.

11:00 HI ABSORPTION TOWARDS PDS 456

C.H. Young^{1*}, C.L. Brogan², and M. Yun³, ¹Mississippi State University, Mississippi State, MS 39762; ²University of Kentucky; and ³National Radio Astronomy Observatory

PDS 456 is a nearby quasar that was discovered by the Pico dos Dias Survey in 1997. This object is of interest in the field of quasi-stellar object (QSO) formation because it is very bright in the optical regime ($B=14.69$), and it also has a high, inferred dust mass. We chose to observe this source in the hopes of detecting an HI absorption line towards the quasar. Confirmation of the presence of gas surrounding this quasar would suggest one of three possible scenarios: 1) the dust and gas form an acquiescent halo around the central engine of this object, 2) copious amount of mass is being ejected away from the quasar while the object is in a transition stage from dust-enshrouded to naked QSO, or 3) the central engine of the quasar is accreting large amounts of matter. We initially postulated that the second of these scenarios was the most likely for PDS 456 because of the bright infrared and optical characteristics. However, observations made with the Very Large Array on two separate occasions, instead, support the third scenario. We intend to present the data and results of analysis. Also, implications of this discovery on the theories for QSO formation will be discussed. Finally, we will propose further investigations, which might include searching for emission lines or observing with the Very Long Baseline Array (VLBA).

11:15 Divisional Business Meeting and Awards
Awards are made possible through the generosity of the Waterways Experiment Station, Vicksburg, MS

THURSDAY AFTERNOON

Chandeleur Room

1:30 UTILIZING A COMPUTATIONAL NUMERICAL MODEL TO STUDY THE PULTRUSION OF COMPOSITES

Corey L. Wallace* and Tyrus McCarty, University of Mississippi, University, MS 38677

The purpose of the project is to identify variables in the Pultrusion process and utilize these variables to enhance production quality. A mathematical model is utilized in the production design. This mathematical model dictates the computer program that performs the simulation of the process. The product of the process is a composite. A composite is a material derived from two or more materials. The desired result is to gain the best qualities from all of the components. The composite is formed on the macroscopic level and is made from unconventional materials, while alloys are made from metallic materials. The controllable variables are shape, viscosity of the initiates, the speed at which the material is fed through the Pultrusion machine and a combination of others. Testing is

done through use of the PTI 804 commercial scale protruder. The University of Mississippi and one other American University are the only educational institutions with this scale; thus making this a unique experiment. Pultrusion is a method of manufacturing in which a composite is produced. The process follows a systematic method. Fibers of a material are pulled through a resin bath, then through a shaping system that also removes excess material. This section gives the material its uniform shape. The material is then heated and cured until ready. It is finally cut into the desired length. The composite is to take the desirable qualities from the materials. The research aspects of Pultrusion indicate that it is not as thoroughly tested as the other methods of forming composites. Other methods of forming a composite include compression molding, injection molding and extrusion. Pultrusion remains the target production method due to its cost-effectiveness. Through experimentation the shape of the material entry is altered. It is believed that the change in shape will increase pressure, alleviating voids in the material. The voids are pressure points of the material and cause failure of the offspring composite. The project experimentation involves a 9-degree angle wedge shape. This information is calculated through computer programs and simulations. The resulting answers indicate that both an increase in viscosity and an increase in pull speed raise centerline pressure for the region of concern. The increase in pressure will alleviate voids providing stronger composites. The increase in quality will raise Pultrusion as the manufacturing method of choice.

1:45 A COMPARISON OF HORIZONTAL AND VERTICAL PENDULUM ARCHERY SIGHTS

John W. Lipscomb, Jr., University of Southern Mississippi, Hattiesburg, MS 39406

Archery accuracy requires estimating the target distance – a difficult task with 20% error in the field. If the archer is elevated, pendulum sights can adjust the aiming point to compensate for various ranges. One-inch horizontal and vertical pendulum sights are currently in use. The aiming point of a horizontal pendulum is at the same elevation as the pivot. It provides good trajectory correction, but it must be used from an elevated position. Shooting at targets on the same or a higher elevation is not possible because too much correction occurs. A vertical pendulum has the aiming point directly below the pivot point. For the same length, this pendulum cannot correct the aiming point as well as a horizontal pendulum but it can be sighted-in and used horizontally on the ground. For comparing the two pendulums, a 250-fps initial arrow velocity with ± 1.5 inch maximum trajectory error was assumed. A spreadsheet program was used to model the

arrow flight including arrow initial velocity and decay, elevation differences, and target distance. If both pendulums are sighted-in 15 feet over the target with ± 1.5 inch maximum error, the maximum ranges of the horizontal and vertical pendulums are 85.1 and 75.6 feet respectively. This difference of 11.8% is acceptable because the vertical pendulum can be used on targets from 15 feet below to 15 feet above the archer with the similar accuracy.

2:00 DETECTOR TESTING FOR THE JEFFERSON LABORATORY G^0 EXPERIMENT

Sarah K. Phillips^{1*}, Allison Lung², Bond Hutchinson³, and David Larson⁴, ¹Mississippi State University, Mississippi State, MS 39762; ²Thomas Jefferson National Accelerator Facility, Newport News, VA 23606; ³Louisiana Tech, Ruston, LA 71272; and ⁴University of Maryland, College Park, MD 20742

The goal of the G^0 experiment (E91-017) is to measure parity-violating asymmetries over the range $0.1 \leq Q^2 \leq 1.0 \text{ GeV}^2$ at both forward and backward angles. These measurements will be used to separate the G_E^S and G_M^S form factors (the neutral weak E current analogs of the electric form factor G_E and the magnetic form factor G_M). Using these form factors, the u , d , and s quark contributions to the charge and current of the nucleon can be determined. The G^0 detector will be able to measure asymmetries at both forward and backward angles. It consists of a toroidal array of eight superconducting coils, designed to focus particles of the same momentum and scattering angle from the target to a single point. The detector will have sixteen scintillator pairs for each of the eight octants, which surround the beamline to cover ϕ of 360° for maximum solid angle.

2:15 Break

2:30 POSITRON AND PION BACKGROUND CONTAMINATION TO THE MEASUREMENT OF THE RATIO OF THE ABSORPTION CROSS SECTION OF LONGITUDINALLY AND TRANSVERSELY POLARIZED VIRTUAL PHOTONS IN THE RESONANCE REGION

Kurt M. Spurlock* and James A. Dunne, Mississippi State University, Mississippi State, MS 39762

Inclusive electron scattering experiments consist of scattering a beam of electrons off a target and detecting the scattered electrons. Properly counting these scattered electrons is essential to the determination of the ratio of the absorption cross sections of longitudinally and transversely polarized virtual photons, a ratio known as R . An accurate

measurement of R provides a more reliable model of electron-nucleon scattering. The results of the experiment are skewed, however, by the counting of unwanted electrons and misidentified electrons that traverse the spectrometer. A major source of this background comes from \bar{d} mesons, or pions, and electron-positron (e^-e^+) pair production from decaying, neutral pions (\bar{d}^0). The \bar{d}^0 is created as the electron beam traverses the target and quickly decays into two photons. These photons, in a charge symmetric process (i.e., the oppositely charged particles are produced in a one-to-one ratio), convert to e^-e^+ pairs in the target. The scope of this research consists of determining the background coming from \bar{d} mesons and charge symmetric processes for each kinematic setting.

2:45 SPACE-BASED IMAGES OF EARTH: A NEW ERA OF HIGH-RESOLUTION

Harold Dunsford¹, John Patrick Lestrade^{1*}, and David Bandi², ¹Mississippi State University, Mississippi State, MS 39762 and ²MapSAT, Starkville, MS 39759

Since the days of Sputnik, there has been a lot of interest in commercial applications of satellite images of the Earth. This interest has recently surged with the availability of 1-meter resolution data, an order of magnitude better than past resolutions. While our group is primarily involved in creating new mathematical algorithms designed to extract information from space-based imagery, we are also involved with joint corporate and government efforts to increase awareness of the new, potential benefits. In this paper, we present an overview of what data are available and we present ideas for interesting commercial applications.

3:00 FEASIBILITY STUDY OF A STEP BEAD AS OPPOSED TO A SQUARE BEAD IN GENERAL STAMPING OPERATIONS IN THE AUTOMOTIVE INDUSTRY

Josias Israel, Mississippi State University, Mississippi State, MS 39762

This study was purposed to analyze the usability and feasibility of the step bead, in the areas of raw material and tool operating cost. As opposed to the square bead, the step bead has been neglected in general stamping operations due to lack of knowledge of the applications of such tooling. Even though, intuitively, the cost savings are there, the actual use of the step bead has not yet been justified. Though the use of a draw bead tester machine, the aim of this experiment was to reproduce the results that the step bead would generate in actual production and compare them to the results gathered from the standard square bead. The process was then simulated using the same simulation package used to model actual stamping processes. The

results from both the physical and simulated experiments proved too trivial an initial foundation for the justification of the step bead in actual production.

3:15 OCTUPOLE VIBRATIONS IN THE SD WELL OF 190 Hg

Hanan Amro^{1*}, Robert V. F. Janssens², Greg Hackman², Susan Fischer², Irshad Ahmad², Mike Carpenter², Frank Moore³, Ben Crowell⁴, Teng Khoo², Torben Lauritsen², John Timar⁵, and Anna Wilson⁵, ¹Mississippi State University, Mississippi State, MS 39762; ²Argonne National Laboratory, Argonne, IL 60439; ³North Carolina State University, Raleigh, NC 27695; ⁴Fullerton Community College, Fullerton CA 92833; and ⁵University of Liverpool, Liverpool L69, United Kingdom

In an experiment that has been carried out using Gammasphere, the excited states in 190 Hg were populated with the reaction $^{160}\text{Gd}(^{34}\text{S},4n)$ at a beam energy of 159 MeV with a thick target (1.17 mg/cm^2) evaporated on a 13 mg/cm^2 Au backing. Three or higher-fold coincidence events were recorded. The triple-gated spectra corresponding to the 17 angular rings of Gammasphere were constructed individually. From gamma-ray centroids in each of the angle sorted spectra, the fractions of full Doppler shift $F(\tau)$ were extracted for transitions in the yrast and the first excited SD bands. Dipole transition rates have been established for the inter-band transitions, which connect those two SD bands. The measured $B(E1)$ strengths are of the same order as those reported for E1 inter-band transitions in nuclei with a substantial dipole moment arising from octupole collectivity. The intrinsic quadrupole moments, Q , were extracted for both SD bands and found to be essentially the same ($dQ = 0.1 \pm 1.9\text{ eb}$). Therefore, the present results show that there is no difference in deformation between the two SD bands. This, along with the measured $B(E1)$ strengths of the inter-band transitions, favors the interpretation of the excited SD band as a rotational band built on an octupole vibration. The comparison of the Q moment of the yrast SD band in 190 Hg with the moments of yrast SD bands in other Hg isotopes further strengthens the conclusion that the quadrupole deformation associated with SD minimum in the Hg isotopes is very stable and that Q values exhibit very little dependence on the nuclear mass or on the intrinsic structure of the SD bands being considered.

3:30 Divisional Poster Session

ELECTROCHEMICAL CELL DESIGN CONCEPTS FOR THE NEW MILLENNIUM

William C. Mahone*, M. Ellison, O. James, and J. Brown, Mississippi Valley State University, Itta Bena, MS 38941

We have constructed a variety of electrochemical cells of different types designed to interface with alternative energy process cycles. These include zinc-air cells, aluminum copper cells and aluminum dry cells. We are using these prototype cells to study controlling processes. With these data and data from continuing studies we will optimize our design parameters and draw conclusions about the feasibility of their use.

HYDROGEN OXYGEN FUEL CELL DESIGN CONCEPTS

William C. Mahone* and T. Pierre, Mississippi Valley State University, Itta Bena, MS 38941

We have constructed a prototype hydrogen-oxygen fuel cell. The purpose of this cell is to allow us to study controlling processes, particularly porous electrode and salt bridge design. Fuel cells have high promise for the future because they are non-polluting, and highly efficient with the promise of providing low cost electricity. Also the hydrogen, which powers our fuel cell, is chemically generated on demand rather than stored hydrogen from k-bottles. Hydrogen handling is one of the major problems and costs associated with hydrogen-oxygen fuel cells.

REGIONAL SOLAR RADIATION PROFILE AND SOLAR POWER CONVERSION

William C. Mahone*, A. Robinson, C. Flowers, and B. Adams, Mississippi Valley State University, Itta Bena, MS 38941

We have carried out a variety of measurements of the Sun's angle to earth observer view (Solar Angle). We have also carried out measurements of various aspects of the solar intensity profile at various times under various conditions. A third series of measurements allowed us to determine the power output of conventional solar panels at various time of the day under various conditions. With these data and data from continuing studies we draw conclusions about the feasibility of solar power systems in this area.

FRIDAY MORNING

Chandeleur Room

9:00 ARTIFICIAL SOFT AND HARD SURFACES AND THEIR APPLICATIONS IN ELECTRO-MAGNETICS: A REVIEW

Ji Wang* and Ahmed A. Kishk, University of Mississippi, University, MS 38677

A review on the understanding of the artificially soft and hard surfaces will be presented. Soft and hard surfaces are well known in acoustics. Such surfaces are

naturally present for electromagnetic waves because of the polarization nature of the electromagnetic fields. However, these surfaces can be recognized by constructing anisotropic surfaces. These anisotropic surfaces can be developed by corrugated perfectly conducting surfaces or by dielectric coating of the conductor surface and loading the dielectric surface by conducting strips. The corrugated or strip loaded surfaces are hard when the waves propagate along the strips or the corrugation. They are soft when the waves propagate transversely to the strips or the corrugations direction. Using such surfaces one can control the boundary condition and use it to strengthen or weaken the waves propagating on the surface. The soft surfaces are used in the design of transversely corrugated horns to improve the polarization of the horn and reduce the sidelobe levels. These horns are normally used as feeds for reflector antennas. Hard surfaces are used to design polarization independent struts (that support feeds in front of the parabolic reflector) to reduce the forward scattering from the struts and consequently improve the radiation performance of the reflector. The surface integral equations are used to formulate these problems and solved using the method of moments. In some cases the approximate surface impedance is used with the corrugated surfaces and the asymptotic strip boundary condition is used with strip loaded surfaces. The results will show the improvement in the radiation characteristics of the antenna when these surfaces are used properly.

9:15 ANALYSIS OF CIRCULAR WAVEGUIDE WITH STRIPS LOADED WALLS USING ASYMPTOTIC BOUNDARY CONDITIONS

Michael Morgan* and Ahmed A. Kishk, University of Mississippi University, MS 38677

A circular waveguide with wall coated by uniform dielectric layer loads with conducting strips is analyzed using the approximate Asymptotic Strips Boundary Conditions (ASBC). The strips could be oriented along the waveguide axis or circumferentially oriented in a periodic form to artificially create hard or soft surfaces, respectively. Such structures can be analyzed accurately by using the Floque's mode expansions, which is tedious. Here, the ASBC is used to simplify the solutions under the assumption that the strips period p is approaching zero. With this assumption, the tangential fields along the strips are zero electric field and continuous magnetic field and the tangential electric field in the transverse direction to the strips is continuous. At certain conditions the loaded strip surface can be electromagnetically soft or hard that makes the waves not propagating or propagating along the surface, respectively. The waveguide with such surfaces creates a uniform linear field distribution across its cross

section, as we will show graphically. This makes it a good linearly polarized antenna with high gain and high sidelobe level for the hard surface and low sidelobe level for the soft surface. Here, our analysis provides the proper dimensions for the waveguide to achieve the soft and hard surfaces. It was found that the dielectric thickness is a function of the waveguide radius and approaches a quarter wavelength as the waveguide radius increases.

9:30 INPUT INTERFACE FOR A FINITE DIFFERENCE TIME DOMAIN ELECTROMAGNETIC SIMULATION TOOL

Chris L. Riley*, James D. Vernon, Atef Z. Elsherbeni, and Charles E. Smith, University of Mississippi, University, MS 38677

The finite difference time domain (FDTD) technique is widely used in the analysis of electromagnetic problems and in the design of antennas and microwave devices. The FDTD is a computation procedure that applies Maxwell's equations in time domain to the problem at hand. Commonly it requires a large number of time iterations and a significant amount of storage allocation for field components and material properties in the computational domain. These issues are under continuous investigation for adapting the method to current computer resources. A description of the geometry of the device under test for the computational engine is a very time consuming task, if programmed for every individual case. The optimal solution is to develop an interactive graphical input interface that creates and displays device details and transfers geometrical information to appropriate parameters for the FDTD computational engine. The purpose of this paper is to address this issue of creating an efficient interface. The interface should be simple to understand, and yet powerful to handle complex and composite structures. The development of such an interface is achieved by using the Microsoft Visual Basic, and the graphical library OpenGL. Examples of the simulated structures such as printed circuit board connectors and printed spiral and meander line antennas are considered.

9:45 ANALYSIS OF DIELECTRIC RESONATOR ANTENNAS MADE OF DIFFERENT DIELECTRIC MATERIALS

Xiao Zhang*, Ahmed A. Kishk, and Allen W. Glisson, University of Mississippi, University, MS 38677

The dielectric resonator antenna (DRA) is a newly developed antenna made of high dielectric material placed above a conducting ground plane. Many different excitation mechanisms can be used for the antenna. In this work we use a coaxial probe penetrating through the ground plane and housed inside the dielectric material. DRA's have

typically been made of a single very low loss ceramic material. However, resonators consisting of more than one dielectric material can be used to effectively create two resonators that are coupled to each other. With the proper excitation and selection of these resonators, the bandwidth of the DRA can be increased or the antenna can be designed for multi-frequency use. In this work two resonators are used with one resonator being stacked on top of the other above the ground plane. The DRA is then analyzed numerically using the method of moments after image theory is applied to the structure. The effect of different parameters on the antenna performance is investigated. It is found that the probe position and length have a significant effect on the input impedance of the antenna and on the bandwidth. Also, changing the arrangements of the two dielectric resonators has a significant effect on the antenna performance because of the change in the coupling factor between the two resonators and the excitation probe. Results will be presented to show the effect of these parameters on the antenna performance.

10:00 Break

10:15 PARAMETRIC STUDY OF THE DIELECTRIC RESONATOR ANTENNAS WITH CONICAL SHAPE

Yan Yin*, Ahmed A. Kishk, and Allen W. Glisson, University of Mississippi, University, MS 38677

Dielectric resonator antennas are usually designed as circular discs of high dielectric material located on a perfectly conducting ground plane. In this study a dielectric resonator antenna of truncated conical shape is used to investigate the effect of this geometry on the dielectric resonator antenna performance as compared with the dielectric disc. The investigation is performed numerically using the method of moments for axisymmetric objects. With the aid of the image theory one can also analyze a half-cone dielectric resonator (split through its axis of symmetry) by converting it to a full axisymmetric cone. When the cone is placed with its axis of symmetry normal to the ground plane, either the TM_{01} mode or the HEM_{11} mode can be excited by locating a coaxial probe either on the cone axis or off the axis, respectively. The TM_{01} mode produces a monopole type radiation pattern (end fire), while the HEM_{11} mode produces a narrow slot type pattern (broadside). When the half cone is placed on the ground plane, the probe excitation is directed normal to both the ground plane and cone axis of symmetry. Different mode types will again be excited based on the probe location inside the dielectric. Thus, the radiation pattern type can be controlled by the probe position. The effect of the cone apex

angle and the probe position on the input impedance is also investigated. It is found that the split structure provides wider bandwidth than the unsplit structure.

10:30 A NEW DEVICE FOR IMPOSING UNIFORM, CYCLIC STRAINS TO CELLS GROWING ON IMPLANT ALLOYS

Chad Winter* and Joel D. Bumgardner, Mississippi State University, Mississippi State, MS 39762

The objective of this study was to demonstrate an effective means for applying known, uniform, cyclic strain to cells growing on implant materials *in vitro*. The cell culture strain device was designed based on the application of the four-point bending principle. A medical-grade-2 Titanium plate was used as the cell substrate, and strain was applied at eight deflection levels at frequencies of 0.5-10 Hz for durations of 12-72 hours. Strain gauges recorded average maximum strain levels of 188 ± 6.5 , 251 ± 8.3 , 321 ± 10.4 , 428 ± 11.8 , 565 ± 9.5 , 754 ± 14.1 , 892 ± 5.8 , and $1020 \pm 9.3 \mu$ strains. The device was tested with photo elastic film and viewed with a polarizer at the 8 different deflection levels. Human gingival fibroblasts (HGF) were seeded at 10^5 cells/cm² on the plate in silicone-attached polystyrene wells. The strain device, with attached HGF cells, was tested in an amiable bioenvironment. Results from photo elastic coating indicated a uniform strain field existed within the center region of the plate. Cells in the test plates stained viable and exhibited similar morphology to controls. Tests are being conducted to evaluate the responses of osteoblastic cells growing on implant surfaces at the different strain levels. The cell culture strain plate produced known, uniform, repeatable, and consistent cyclic strains to cells growing on the surfaces of implant materials.

10:45 A DIGITAL PHASE LOCK LOOP USING IN-PHASE AND QUADRATURE SIGNALS

Cheng Jia* and Paul M. Goggans, University of Mississippi, University, MS 38677

A new digital phase lock loop (DPLL) was developed to recover the time-varying ground surface velocity from the output of a laser Doppler vibrometer (LDV) used in landmine detection. The LDV output is frequency modulated by the velocity signal and the DPLL is used as a demodulator. The LDV output signal is band-pass limited and its center frequency is much greater than its bandwidth. To avoid the high sampling rate required to sample the band-pass limited signal, the LDV output is converted to base-band in-phase and quadrature signals before it is sampled and quantized. The software-based DPLL is implemented using floating-point arithmetic. As a result, a dynamic range comparable to an analog phase

lock loop can be achieved. Unlike an analog phase lock loop, the DPLL uses a phase detector that is linear for phase differences between -180 degrees and +180 degrees. Consequently, the DPLL has an improved ability to achieve and maintain phase lock. This paper presents results obtained for both simulated and measured LDV output signals.

11:00 A DIGITAL SIGNAL PROCESSING IMPLEMENTATION OF THE TMS320C31 TO ANALYZE AND CATEGORIZE A SAMPLE OF COSMIC GAMMA-RAY BURSTS

Morgan Simpson and John Patrick Lestrade*, Mississippi State University, Mississippi State, MS 39762

A Power Density Spectrum (PDS) analysis of Gamma Ray Burst (GRB) data has been implemented using the TMS320C31 digital signal processor. This relatively inexpensive, flexible chip is used in a wide range of applications. Implementation includes programming the TMS320C31 to receive and process the data. The analysis includes processing of data using PDS algorithms for 20 GRB's whose durations range from 10 seconds to over 200 seconds. A metric is chosen to sort the PDS of a given burst into different categories. The TMS320C31 outputs the PDS and the results of the categorization. This implementation of Digital Signal Processing hardware demonstrates the feasibility of utilizing DSP techniques for on-spacecraft analysis of gamma-ray burst data.

**PSYCHOLOGY AND
BEHAVIORAL NEUROSCIENCE**
Chair: Pamela Banks, University of Mississippi
Medical Center

THURSDAY MORNING

Caprice Room

9:45 Joint Divisional Business Meeting with Social Sciences

10:15 MISTRUST AND DISINTEREST BETWEEN BLACK AND WHITE STUDENTS

Shawn L. Clark, Jerome Burt, and Billy A. Barrios*, University of Mississippi, University, MS 38677

In the eyes of many of this nation and the world, Mississippi continues to be seen as the worst place on earth with regards to just and harmonious relations between the races. Numerous commentaries have been written tracing

the long history of White oppression of Blacks in the state. And yet, there have been few empirical investigations into the nature of Black-White relations in the state. The present paper reports the two most recent investigations in our ongoing program of research on Black-White relations at the University of Mississippi. Study I examined the fundamental soundness of a self-report measure of "mistrust of Whites" among Black male students. Strong support was obtained for an empirically-derived four factor solution, with each of the factor scores found to be highly reliable, moderately related to one another, and correspondingly related to other relevant individual difference and situational variables. Study II examined the fundamental soundness of an unobtrusive, observational procedure for the assessment of "receptivity to Blacks" among White male students. The procedure consisted of surreptitious recording of participants in a waiting room situation with either a Black male confederate or a White male confederate, with these four-minute interactions being coded by raters for eye contact, interpersonal distance, openness of body posture, positive affect, and engaging verbal responses. High interrater reliability estimates were obtained for the behavioral measures along with high interrelationships among the measures. With respect to differential responding between the two waiting room situations, our White male subjects displayed more eye contact, greater levels of conversation, more positive affect, and greater openness of body posture towards the White confederate than they did towards the Black confederate. Together, the two studies offer support for the soundness and the promise of the constructs of mistrust and receptivity in investigating and understanding race relations at the University of Mississippi.

10:30 EFFECTS OF AGE AND CONSPECIFIC CHARACTERISTICS ON SCENT-MARKING BEHAVIOR IN THE BUSHBABY

S. Watson*, D. Spires, T. White, N. Pearce, and S. Turner, Jackson State University, Jackson, MS 39217

The small-eared bushbaby (*Otolemur garnettii*) is a nocturnal prosimian primate. Like many nocturnal mammals, their social systems are highly dependent on olfactory cues. Thus, scent-marking is a primary means of communication. Scent-marking serves a variety of adaptive functions and may vary in response to different environmental stimuli. Two forms of scentmarking (urine-washing, ano-genital marking) have been associated with reproductive activities

whereas two others (foot marking, chest marking) have been described as displacement behaviors associated with novel environments. We examined these scent-marking behaviors in four sexually mature and four immature male

bushbabies. The subjects were exposed to an open field environment that had been previously unoccupied (BASELINE) or occupied by either another male (MALE), a sexually mature female (MF), or a sexually immature female (IF) conspecific. Mature bushbabies performed more foot marking in both BASELINE ($p = .01$) and MALE conditions ($p < .001$) than immature bushbabies. Mature bushbabies also displayed more chest marking in the BASELINE condition ($p = .008$). Marking behavior of mature and immature bushbabies did not differ in the MF or IF conditions. Overall, subjects performed more displacement-type scent-marking than reproductive-type scent-marking ($p = .04$). These results suggest that the bushbabies may have been more responsive to the novelty/territoriality aspects of the open field environment than to the presence of cues from conspecifics. This research was supported by NSF grant #9874475.

10:45 ANGER AND RETENTION IN SUBSTANCE ABUSE TREATMENT

Carmenita Jiles^{1*}, Robert M. Awalt², Michael S. Shopshire², and Patrick M. Reilly², ¹Jackson State University, Jackson, MS 39217 and ²San Francisco Veterans Affairs Medical Center, University of California, San Francisco, CA 94143

Anger control problems have been correlated with substance abuse, relapse to substance abuse, and treatment retention. The purpose of this study was to determine the prevalence of dysfunctional anger and the best predictor of treatment retention. The prevalence of anger and treatment retention was studied in 319 male substance abuse patients enrolled in treatment at the San Francisco Veterans Affairs Medical Center. The Addiction Severity Index (ASI; McLellan, Luborsky, O'Brien, & Woody, 1980) measured substance use. The State-Trait Anger Expression Inventory (STAXI; Spielberger, 1988) assessed dysfunctional levels of anger. It was hypothesized that many patients would report dysfunctional levels of anger and dysfunctional anger would be a strong predictor of treatment retention. Results showed that 45% of the sample (mean score = 27.31, SD = 4.51) reported a score of 22 or above on the STAXI, indicating dysfunctional anger. Dysfunctional anger was not a strong predictor of treatment retention. Results of survival analysis showed that patients with greater ASI drug use scores stayed in treatment an average of 58 days (mean score = 26.7), while patients with lower ASI drug use scores stayed in treatment an average of 47 days (mean score = 4.56). ASI composite scores were found to be the best predictors of treatment retention. Determining anger prevalence and retention may improve treatment options.

11:00 THE EFFECTS OF CO-VICTIMIZATION ON

AFRICAN AMERICAN ADOLESCENTS' PSYCHOLOGICAL WELL-BEING

Bryman E. Williams, Jackson State University, Jackson, MS 39217

The prevalence of violence within African American communities and schools is causing some African American adolescents to experience deficits in their psychological well-being. The purpose of this study was to analyze the effects of co-victimization on three different groups (e.g., college students, rural adolescents, and institutionalized adolescents) of African American adolescents. Co-victimization refers to the experience of directly observing the violent assault of another person, including incest, sexual abuse, sexual assault, aggravated physical assault, armed robbery, arson, and murder. The sample consisted of 238 adolescents (187 males, 141 females). The data were collected from freshmen attending southern university in Louisiana ($n=80$), a rural, predominantly African American high school (6th - 12th grade) in Louisiana ($n=173$), and a correctional facility ($n=75$). The Beck Depression Inventory, Piers-Harris Children's Self-Perception Scale, a co-victimization scale, and a demographic questionnaire were completed by each participant. It was hypothesized that African American adolescents who are co-victimized by violence will have low self-esteem and high levels of depression. The major findings were as follows: (1) there was a statistically significant correlation relationship between depression and co-victimization and (2) the relationship between self-esteem and co-victimization was not statistically significant. An analysis by group was also conducted. The findings were: (1) the institutionalized adolescents experience every level of violence assessed on the survey; (2) there was a statistically significant correlation between depression and co-victimization for the rural group, but not the institutional or college group; and (3) perception of neighborhood violence and co-victimization ($p < .001$) were correlated for all three groups. Gender differences on depression, co-victimization, and self-esteem were not found. In sum, existing research indicates that adolescents' psychological well-being suffer as a result of co-victimization. These findings have implications for behavioral interventions designed to instill and/or reinforce resiliency in adolescents.

11:15 Divisional Poster Session

THE RELATIONSHIP BETWEEN COGNITIVE DYSFUNCTION AND DEPRESSIVE SYMPTOMS IN AN OUTPATIENT PSYCHIATRIC POPULATION

Cho Y. Lam*, Phillip R. Godding, Dinesh Mittal, and Rafael A. Torres, University of Mississippi Medical Center,

Jackson, MS 32216 and G.V. (Sonny) Montgomery VA Medical Center, Jackson, MS 39216

The Cognitive Capacity Screening Examination (CCSE) and the Beck Depression Inventory (BDI) were administered to 76 psychiatric outpatients with 3 different types of diagnosis (i.e., cognitive disorders, non-depressive psychiatric disorders, and mood disorders). Results showed a significant association, after controlling for age, between cognitive dysfunction and depressive symptoms, $r = -.48$, $p < .01$. Participants who performed poorly on a cognitive screening exam were more likely than those who performed well on the same test to report a severe level of depressive symptomatology. Participants were divided into three age categories: under 55 year old, 55 to 65 year old, and over 65 year old. This study found a significant difference in mean CCSE score among the three age groups, $F = 118.43$, $p < .05$. Participants in the highest age group (over 65 year old) were more likely than their younger counterparts to receive a low CCSE score and be diagnosed with cognitive disorders. Furthermore, a significant difference in disorders prevalence was found among the three different age groups, $\chi^2 = 15.54$, $p < .01$. Participants who were under 55 year old, 55 to 65 year old, and over 65 year old were most frequently diagnosed with non-depressive psychiatric disorders, mood disorders, and cognitive disorders respectively. These findings indicated that issues of comorbidity should be carefully considered when working with elderly patients in an outpatient psychiatric setting.

BODY SHAPE SATISFACTION AND GENERAL HEALTH

Leslie Sumberlin* and Katherine Kocel, Jackson State University, Jackson MS 39217

Health practices established during late adolescence have been linked to chronic diseases. Recent research suggests that appearance motivates health care in young people. Understanding the relationship between appearance concerns and health may enable better health care interventions. Gender and ethnic groups seem to differ with regard to body shape satisfaction and weight satisfaction. This investigation attempts to evaluate the relationship between satisfaction with body shape and weight and general health. Gender related differences in body shape and weight satisfaction have been reported in predominantly white populations, with females showing less satisfaction with body shape and weight. Black Americans report more body shape satisfaction and less concern with weight. A survey of health related beliefs of students at two major Mississippi Universities was completed. 245 of the participants were females and 203 were males. Mean age was 18.9. 242 were of European ancestry and 198 were of African ancestry. Blacks were

significantly more satisfied with their body shape. There were no gender or ethnicity related differences in weight satisfaction. Body shape satisfaction was significantly related to high levels of general health. There was a significant interaction with black men reporting the highest levels of general health and black women the lowest. White men and women did not differ with regard to general health. It appears that there may be gender and ethnic differences in the association between appearance concerns and health.

NEUROLOGICAL IMPEDANCE PATTERNS: AN INVESTIGATION INTO A POSSIBLE LINK BETWEEN THE NUCLEUS ACCUMBENS AND THE LATERAL HYPOTHALAMUS

Veronica M. Osborne* and Stephen F. Bollinger, Jackson State University, Jackson, MS 39217

In our laboratory, impedance patterns and frequencies of the nucleus accumbens have been similar to those of the lateral hypothalamus. Lateral hypothalamus has been associated with onset of hunger. The nucleus accumbens has been identified as an incentive site (Kalat, 1998). The purpose of this study was to examine the possible link between lateral hypothalamus and nucleus accumbens patterns and frequencies. It was hypothesized that lateral hypothalamus and nucleus accumbens would produce approximately the same amount of frequencies and have a similar pattern. Two sexually mature male albino Sprague-Dawley rats were implanted with one platinum bipolar electrode in one of the selected sites. After ten days rats were tested in an experimental chamber for six minutes daily. During testing, impedance measurements were recorded for two minutes prior to the rat eating chocolate, two minutes while the rat ate chocolate, and two minutes after the rat ate chocolate. The results were recorded with a physiograph. Data were assessed by visual inspection and compared for variations in patterns- Our hypothesis that lateral hypothalamus and nucleus accumbens would produce approximately the same amount of frequencies was supported. However, our hypothesis that the pattern would be similar was not supported. The lateral hypothalamus pattern displayed a higher amplitude than the nucleus accumbens' pattern.

GENDER, RACIAL, AND FAMILIAL INFLUENCES ON EARLY ADOLESCENT PROBLEM BEHAVIOR

Lakeisha M. Bland^{1*}, Oksana Malanchuk², and Jacqueline Eccles², ¹Jackson State University, Jackson, MS 39217 and ²University of Michigan, Ann Arbor, MI 48109

The purpose of this study was to examine the correlates of problem behavior in a racially and economically diverse sample of young adolescents. Using

data collected in the Prince George's County study, problem behavior in 1,032 eighth graders was examined. The research investigated differences in the occurrence of problem behavior by gender, ethnicity, family structure, and socio-economic status (SES). Additionally, the moderating effects of authoritative parenting and affective relationships on problem behavior were examined. Consistent with the literature, gender was found to be a predictor of problem behavior with males displaying more problem behavior than females ($t = 6.57, p < .000$). Contrary to the literature, family structure was not found to be predictive of problem behavior for males. Neither race nor SES was found to be a predictor of problem behavior. Finally, in families with either an authoritative parenting style or high parent-adolescent affective relationships, adolescents reported fewer behavior problems. Overall the best predictor of problem behavior was previous problem behavior. These results suggest that problem behavior in adolescence may be minimized by early intervention. Additionally, research focusing on pre-adolescent risk factors may reveal preventive child-rearing strategies.

SCIENCE EDUCATION

Chair: John Ammons, Mississippi Delta Community College
 Vicechair: Willie R. Heard, University of Southern Mississippi

THURSDAY MORNING

Atlantic Room

8:30 INTRODUCING BIOTECHNOLOGY THEMES INTO A HIGH SCHOOL BIOMEDICAL MENTORSHIP PROGRAM

Cindy Cook* and Rob Rockhold, University of Mississippi Medical Center, Jackson, MS 39216-4505 and Murrah High School, Jackson, MS 39216

Base Pair, which brings Jackson Public High School students into research laboratories at the University of Mississippi Medical Center, utilizes a preparatory course entitled, *Biomedical Research*. This course teaches cell and molecular biology and prepares students in related laboratory skills. A theme of biotechnology is used to unify the classroom didactic structure, develop individual and group presentations, and perform laboratory exercises. Using a lesson plan developed as a *Base Pair* exercise, and a biotechnology curriculum written by Dr. R. Hairston from the University of Southern Mississippi, *Biomedical*

Research utilized Biotechnology Explorer® kits developed by the Bio-Rad Corporation and the San Francisco Bay Area Biotechnology Education Consortium. These kits, which are inexpensive, use a minimum of laboratory equipment and exploit the visual allure of green fluorescent protein, teach concepts behind and the practice of, accurate use of micropipetting, sterile bacterial inoculation and culture, centrifugation, column and electrophoretic chromatography, restriction endonuclease digestion of DNA, and DNA fingerprinting. Kits and essential equipment are provided by the Howard Hughes Medical Institute-supported *Base Pair*, program, but are easily within the reach of individual schools using teacher-initiated grant proposals. The theme of biotechnology should be considered as a valuable and eminently flexible tool upon which to construct advanced science course lesson plans in the high school environment. (Supported by the Howard Hughes Medical Institute)

8:45 BASE PAIR: BIOMEDICAL RESEARCH MENTORSHIP UNITES A MEDICAL CENTER, A HIGH SCHOOL DISTRICT, A STATE ACADEMY OF SCIENCE AND A PRIVATE FOUNDATION

Rob Rockhold, University of Mississippi Medical Center, Jackson, MS 39216-4505

Base Pair, a biomedical research mentorship program, joins Jackson Public School District students and teachers with University of Mississippi Medical Center faculty for student career orientation, science curriculum enhancement, and teacher professional development. Begun in 1992 and funded by the Howard Hughes Medical Institute since 1994, *Base Pair* uses extensive interactions with the Mississippi Academy of Sciences to promote publication of student and teacher research activities. Twenty-three scientific papers, abstracts or presentations co-authored by a high school student and 9 co-authored by a high school teacher have been produced. Four high school courses, including one approved for statewide use and one that examines the societal impact of biotechnology from a humanities perspective, have been developed by teachers in the program. Both student and teacher training efforts focus on contemporary biotechnology laboratory techniques, presentation skills with an emphasis on communication to the lay public, and using electronic information resources to become "discriminating self-learners." This unique collaboration has elicited enhanced enthusiasm for science learning in an urban school district. (Supported by the Howard Hughes Medical Institute)

9:00 EVALUATING AND TESTING THE EFFECTIVENESS OF "HANDS-ON"

TEACHING AS OPPOSED TO TRADITIONAL INSTRUCTIONAL METHODS

Kristy N. Packer* and Joan McCoy-Messer, Jones County Junior College, Ellisville, MS 39482

The objective of this study is to evaluate the effectiveness of "hands-on" teaching, as opposed to the traditional lecture instructive methods. In this study, a survey of students indicated areas of instruction that were especially difficult to comprehend. The survey showed that cellular structure and function was difficult for students to grasp and retain. An instructional model was constructed for use in the biology lecture course. The effectiveness of this model was evaluated by comparing the exam results of the "hands-on" learning to the lecture-base exam results. Successful concepts that could be infused into the biology lectures will be discussed.

9:15 PROBLEM SOLVING MADE EASY IN GENERAL CHEMISTRY

Mudlagiri B. Goli, Mississippi Valley State University, Itta Bena, MS 38941

It is becoming harder and harder to teach chemistry to freshman. Our students are confused and ill prepared to solve the problems in chemistry classes. Under this circumstance now the question that faces us all the teachers is *how to get the things across to the students*. What I have observed is that one can still get the things across provided we motivate them. What I also feel is that the very basic systems that we use again and again in chemistry class cgs and mks are the part of the problems if not root cause of the confusion. These systems are foreign to our students. One has to make an honest attempt to download the conversion factors into the minds of the students in a non-threatening easy to understand manner. Lot of relevant labs, hands on models, easy to follow jovial language in the classroom can do the trick. I have finally found it is hard but not impossible to get our students involved in the learning process.

9:30 AN ACTIVITY-BASED FORMAT FOR A MICROBIOLOGY COURSE OFFERED AT NIGHT

Mary F. Lux* and Sabrina H. Bryant, University of Southern Mississippi, Hattiesburg, MS 39406

An activity-based microbiology course was developed for a weekly night class on the Forrest County Campus of Pearl River Community College. The typical student was a part-time student with daytime responsibilities, commuted from some distance and was enrolled in an allied health associate degree program. It was a challenge to maintain students' interest from 5 p.m. to 10 p.m. The expense of time, materials, and energy

required to prepare and present a laboratory component were less effective when the students did not relate those activities to the lecture component of the course. The theme for each evening is introduced with a relevant laboratory experience. The practical application stimulated interest in the topic, presented terms, and introduced concepts. Continuation of the theme into lecture allowed students to make connections between the practical applications in lab and the related topics in the didactic portion of the course. Retention rate at midterm for Fall 1998 was 73%. Midterm retention rate was 90% for Fall 1999, using the activity based format.

9:45 Break

10:00 EISENHOWER PROFESSIONAL DEVELOPMENT PROGRAM (EPDP): TEACHING EDUCATORS SCIENCE TECHNIQUES (TEST)

Babu P. Patlolla*, Leroy Johnson, and Voletta P. Williams, Alcorn State University, Alcorn State, MS 39096

The Department of Biological Sciences at Alcorn State University hosted a four week workshop for eighteen (fifteen in-service and three pre-service) biology teachers from June 14, 1999 to July 9, 1999. In-service teachers were selected from the local school districts, and pre-service teachers who were graduate students in biology education at Alcorn State University. Another high school teacher was appointed as a "Master Teacher" to serve as a mentor instructor in the program. Activities included computer applications (from word processing to power point presentations), molecular biology techniques (DNA extractions, gel electrophoresis, and PCR), and incorporation of varied learning styles into teaching methods (critical thinking skills, team building, and problem solving). Participants were given pre and post surveys as a part of program evaluation by an internal and external evaluator to analyze the effectiveness of the program. Additionally, participants took field trips to two research laboratories in the state and attended seminars. Two follow-up sessions will take place in the next academic year to discuss the implementation of the learned material at their local schools. Participants enjoyed the field trips and were excited about the new knowledge acquired from the program and were ready to share with their colleagues. Pre-service teachers had an opportunity to interact with experienced teachers, and understand the responsibilities of the teacher before they actually begin managing a classroom. (This project was funded by Mississippi Institutions of Higher Learning through Title 11 Eisenhower Professional Development Program # 99-117E.)

10:15 ORGANIC CHEMISTRY AND STUDENTS...HOW TO GET THEM INVOLVED

Mudlagiri B. Goli, Mississippi Valley State University, Itta Bena, MS 38941

Last many years (decades) all of us have seen enrollment dwindling in chemistry majors. The students are scared of the word science. Particularly so about chemistry, physics and mathematics. The big question is how to make them less fearful of the subject and make the chemistry learning a fun process. In this talk I am going to talk about teaching organic chemistry. The things that work here and the things that do not. Patience is a pre requirement for the teacher. Molecular model sets, chemical drawing programs, lively liberal organic language are part of the process.

10:30 A HIGH SCHOOL HUMANITIES COURSE INCORPORATING BIOTECHNOLOGY ISSUES

Karen Redhead* and Rob Rockhold, Murrah High School, Jackson, MS 39216 and University of Mississippi Medical Center, Jackson, MS 39216-4505

A high school course has been designed that incorporates contemporary science and biotechnology content into a non-science discipline, provides a structured outlet for off-school site mentorship activities in humanities fields, and promotes novel aspects of inquiry-based learning in a high school environment. A humanities teacher prepared a detailed lesson plan during an eight week summer mentorship program at the University of Mississippi Medical Center, under the auspices of the Howard Hughes Medical Institute-supported *Base Pair* program. The course entails a one semester didactic component at the school site, followed by a second semester, during which each student would be paired with a mentor in a legal, political or financial/economic field off-site. Emphasis during the first semester will be on the use of non-traditional humanities resources, including extensive use of the World Wide Web and on instruction from science teachers in essential elements of biotechnology science. Students will be coached to develop skills as "discriminating learners," meaning development of an ability to discern sources of factually accurate information. They will also refine personal skills in management of large bodies of highly diverse information related to a specific subject of inquiry, while developing an ethical approach to information research. The course provides integration of science and humanities that is essential since biological technologies exert increasing influence in our society. (Supported by the Howard Hughes Medical Institute)

10:45 DEVELOPMENT AND IMPLEMENTATION OF AN ONLINE PHYSICAL SCIENCE
COURSE FOR NON-SCIENCE MAJORS

Lena M. Miller*, Anthony M. McDowell, and Jason V. Pugh, Mississippi Gulf Coast Community College, Gautier, MS 39553 and Mississippi Space Grant Consortium, University, MS 38677

Physical Science Survey I has been developed and is currently being implemented as one of the first completely online science courses in the state. Students enrolled in Physical Science I are able to participate in lectures and perform test online. Laboratory materials are distributed online, and students perform the hands on experiments in the home without the need of the traditional laboratory setting. The key to the success of this type of course is communication. Although, this project is not unique in terms of online learning, it is one of the few projects that enhance a lab-based course for non-science majors. The course is achieved via a popular courseware development platform. Students acting on scholarships and work-study programs act as the primary content developers. Initial usage of the online course will begin in the spring semester of 2000.

11:00 Divisional Poster Session
PREPARATION AND CHARACTERISTICS (TYNDALL EFFECT) OF COLLOIDS

Nora C. Gough and Anil K. Sharma*, Mississippi Valley State University, Itta Bena, MS 38941

Colloidal dispersions represent an intermediate situation between true solutions and suspensions. The solute particles in a colloid are not individual molecules or ions; rather, they are microscopically sized groups of molecules or ions, or large intertangled polymeric molecules, with sizes on the order of 10-100 nanometers. Colloids are distinguished from true solutions by their interaction with light (Tyndall Effect). Although the particles in colloids are microscopically small, they are still large enough to scatter light. Under the correct conditions, some colloidal dispersions can be made to form semisolids called gels. Colloids of starch and gelatin were prepared and the Tyndall Effect was examined. An interesting gel (called canned heat) of commercial significance was prepared and its properties were investigated. Colloidal hydrous iron oxide was prepared and the coagulation of iron oxide was examined.

A HISTORY OF THE MARINE FISHERIES SECTION AT THE GULF COAST RESEARCH LABORATORY

Jennifer J. Trump* and Joyce M. Shaw, Cooperative Intern Program, Mississippi Gulf Coast Community College, Gautier, MS 39533 and Gulf Coast Research Laboratory, University of Southern Mississippi, Ocean Springs, MS

39566-7000

Archival materials are an important special collection at the Gunter Library of the Gulf Coast Research Laboratory (Institute of Marine Sciences). Within the archival collection are numerous publications, articles, photographs, and newspaper clippings by and about Fisheries section personnel. The purpose of this project was to document the history of the Fisheries section by organizing these materials. Reprints and other publications were sorted, organized, and added to an existing bibliographic database. Selected Fisheries section researchers were interviewed, and a poster highlighting the results was created.

THURSDAY AFTERNOON

Atlantic Room

1:30 K-8 SCIENCE TEACHERS' INSTITUTE AT MILLSAPS COLLEGE

Johnnie-Marie Whitfield, Millsaps College, Jackson, MS 39210-0515

Established in 1997, this four year old program has involved Millsaps College faculty members in chemistry, mathematics, and education working with both preservice and inservice K-8 teachers intensively in the summer followed by academic year workshops and professional team presentations at the local, state, and national level. Designed to enhance the professional development of the teacher participants as well as help change the way science is presented by these teachers in their classroom, the STI and the Millsaps Teacher Resource Center are helping to make a difference in central Mississippi. The program design actively utilizes the National Science Education Standards as well as the Mississippi Science Framework. Funding is gratefully acknowledged from Mississippi Institutions of Higher Learning Title II Eisenhower Professional Development Grant and Millsaps College.

1:45 THE IMPACT OF SCIENCE AND MATHEMATICS ACHIEVEMENT ON THE OVERALL PERFORMANCE INDEX OF RURAL SCHOOL DISTRICTS

Reid Jones*, and E. Pierce, Delta State University, Cleveland, MS 38733 and Mississippi Valley State University, Itta Bena, MS 38941

A Performance Index (PI) has been developed by the Mississippi State Department of Education and tied to the accreditation levels for school districts. The PI is based largely on achievement tests scores but takes many other district factors into account. While the PI formula gives

equal weights to the various achievement tests (e.g. reading, language), regression studies demonstrated that statistically, mathematics and science achievement test had greater associations with a district's PI. Consequently, science and mathematics achievement has a disproportionate impact on the level of accreditation earned by the district.

2:00 SCIENCE AND MATHEMATICS OVER ACHIEVERS IN THE MISSISSIPPI DELTA

A. Montague^{1*}, S.L. Ansah², and Reid Jones¹, ¹Delta State University, Cleveland, MS 38733 and ²Mississippi Valley State University, Itta Bena, MS 39841

Data from the State Department of Education were used to construct regression equations that set science and mathematics achievement scores as the dependent variables. Independent variables included economic variables, achievement scores from early grades, size of district, and ethnicity. As in many reports, socioeconomic variables were strongly associated with science and mathematics performance. Then, districts in the Delta were identified where science and mathematics performance exceeded that which was predicted for them using the regression equation. Teachers and administrators in these "over achieving" districts were contacted to determine what they were doing that might have produced these successes. Early counseling of students and a district wide emphasis on science or mathematics instruction were identified as key factors from surveys and interviews.

2:15 Break

2:30 ARE SCIENCE AND MATHEMATICS INSTRUCTION BEST SERVED BY INCREASING THE NUMBER OF STUDENTS IN THE COLLEGE CORE CURRICULUM?

S.L. Ansah*, and Reid Jones, Mississippi Valley State University, Itta Bena, MS 38941 and Delta State University, Cleveland, MS 38733

Studies in Mississippi and elsewhere have consistently demonstrated a significant positive relationship between enrollment in college core curricula and science and mathematics achievement. However, this effect may occur because A) the best students take a college core curriculum, B) taking the college core curriculum enables students to perform better on science and mathematics achievement, or C) in some cases, both of these are true. Districts in Mississippi have been encouraging students to take more and more of the college curriculum over the past ten years. Analysis of the most recent data from the State Department of Education, however, have demonstrated that this may not always be desirable. Districts in the

Mississippi Delta were found to non significant, and in some cases negative associations between taking college core courses and reading and mathematics achievement. This was not true outside the Delta, and all associations between reading and mathematics achievement remained positive and significant. Discussion with teachers and administrators suggested that some students in the Delta may be enrolling in college core courses before they have an adequate background.

2:45 CONCURRENT VALIDITY OF BIOLOGY AND ALGEBRA ACHIEVEMENT TESTS

J. Anderson^{1*}, A. Montague¹, M. Smith¹, and A. Newsome², ¹Delta State University, Cleveland, MS 38733 and ²Mississippi Valley State University, Itta Bena, MS 38941

Mississippi has added achievement tests in biology and mathematics to complement nationally standardized tests which are used in the elementary and middle school grades. Consequently, significant correlations between these tests during one annual cycle of testing provide evidence of concurrent validity. Data obtained from the State Department of Education were analyzed yielding significant ($p < .01$) inter-test correlations ranging from +.37 through +.81. These values are respectable evidence of validity in light of the fact that standardized achievement tests across many years could be related to content specific achievement testing for biology and mathematics.

3:00 PREPARING SCIENCE AND MATHEMATICS TEACHERS TO USE EDUCATIONAL TECHNOLOGY IN RURAL AREAS

M. Wilson^{1*}, G. Burke², H. Cronin¹, and Reid Jones¹, ¹Delta State University, Cleveland, MS 38733 and ²Mississippi Valley State University, Itta Bena, MS 38941

Rural districts are usually small, relatively isolated, and have very limited resources for developing science and mathematics laboratories and computer facilities. However, most districts in Mississippi have good facilities for distance learning and a variety of grants have made computer and low cost laboratory facilities available. School of teacher education have been able to adapt their curriculum and add new emphases on educational technology. Recent grants from the U.S. Department of Education have allowed teacher education programs in the Mississippi Delta to take a leadership role in the preparation of science and mathematics teachers for these districts. The grants are described with examples of the new technologies being used.

3:15 NABA FOURTH OF JULY BUTTERFLY COUNTS IN MISSISSIPPI

John D. Davis, St. Andrews Episcopal Middle School, Ridgeland, MS 39157

The North American Butterfly Association (NABA) is dedicated to the pleasures of studying the distribution, ecology and aesthetics of butterflies and the conservation of these insects. NABA offers many activities useful to educators. These include information on butterfly gardening, rearing, photography, art contests, bulletins and websites on butterfly sitings and abundance. A NABA activity enjoyed by all ages is the annual Fourth of July Butterfly Count. Patterned after the famous Audubon Christmas Bird Counts, the 4th of July Butterfly Counts depend on volunteers to record the sitings of butterflies over a measured area during midsummer. These counts provide vital data on the status of butterfly populations. In Mississippi, such counts have been regularly made at Clinton, the DeSoto National Forest and the Noxubee Wildlife Refuge. Other sites are needed. If you are interested in starting a count in your area, write: NABA, 4 Delaware Road, Morristown, NJ 07960, or consult NABA's website: www.naba.org.

FRIDAY MORNING

Atlantic Room

8:30 "SOS—SAVE OUR SHARKS:" AN INTERACTIVE WAY OF PRESENTING THIS APEX PREDATOR

Javier J. Rivera, J.L. Scott Marine Education Center & Aquarium, University of Southern Mississippi, Biloxi, MS 39530

There are over 375 species of shark worldwide. These sharks differ in where they reside in the water column, in their appearance, and the manner in which they feed. A flip chart and artifacts will be used to show the basic characteristics of this "apex predator." This presentation will give attendees an idea of how they may take this incredible animal into their classrooms. The "Save Our Sharks" presentation is one of the most frequently chosen rotations at the J.L. Scott Marine Education Center & Aquarium during its three-hour, academic-year Project Marine Discovery Program which is comprised of four, 45-minute interdisciplinary and hands-on

8:45 A COMPREHENSIVE LOOK AT THE VENOM APPARATUS FOUND IN JELLYFISH INDIGENOUS TO THE GULF OF MEXICO

Rebecca L. Espey, J.L. Scott Marine Education Center & Aquarium, University of Southern Mississippi, Biloxi, MS 39530

The jellyfish is an organism with a gelatinous

body, no backbone, and stinging tentacles that cause panic on beaches worldwide. These cnidarians have an intricate venom apparatus used for obtaining prey. Unfortunately this same apparatus causes blistering, rashes, and sickness in humans. The primary objective of this presentation is to educate the public on the mechanics of the stinging process and what measures to take after an encounter. Selected printed materials will be available to attendees.

9:00 INVENTORY OF FISH SPECIES FROM A MISSISSIPPI ESTUARY DURING NOVEMBER THROUGH FEBRUARY

Greg S. Christodoulou, J.L. Scott Marine Education Center & Aquarium, University of Southern Mississippi, Biloxi, MS 39530

Estuaries are well known as highly productive areas and are important nurseries for an abundance of organisms. Climatic factors such as rainfall and seasonal variations in temperature affect the composition of organisms found in these systems. The J.L. Scott Marine Education Center and Aquarium in Biloxi, MS, utilizes such a site in many of its educational programs. From mid-March to the end of October, participants in these programs seine along East Beach in Ocean Springs, MS, to determine the diversity of fish present in this area. Often, some specimens are transported to the aquarium for display. The aquarium staff conducts limited collecting during the months of November through February when the educational programs are not in process. Therefore, this study will determine which fish species are present during these months, and if needed, provide specimens for display. These seasonal collections, i.e., spring, summer, fall, and winter will reveal preliminary diversity and further studies will be required for substantiating numbers of organisms.

9:15 A SCIENCE RESOURCE CENTER AS A WAY OF OPTIMIZING TEACHER ACCESS TO SCARCE LABORATORY EQUIPMENT

Sabine Heinhorst^{1*}, Lynn Morris², Charlotte Rayburn², Dodie Jordan², and Beth Boleware², ¹University of Southern Mississippi, Hattiesburg, MS 39406-5043 and ²Oak Grove Middle School, Hattiesburg, MS 39402

Science is often taught without any hands-on activities, because limited financial resources do not allow each teacher to acquire the equipment and supplies necessary to provide hands-on activities for all children. As a consequence, children tend to become bored with science and lose interest early on. To try and counteract that trend, we have established a central Science Resource Center at a local school with the help of a generous grant from a local funding agency. The Center houses scientific equipment and specialty items in quantities that allow the children of

one or two classes at a time to perform scientific experiments in small groups. All items are organized into thematic unit boxes (e.g. "magnetism") that can be quickly and easily checked out by even the busiest teacher. Copies of lessons and of interdisciplinary hands-on activities that comply with the National Science Standards and the Mississippi Science Framework are ready for use, so that the teachers do not waste time and energy assembling equipment, materials and supplies for a thirty-minute activity. Such a center makes the most of limited financial resources and could potentially become a prototype for other schools in Mississippi.

9:30 Break

9:45 THE ART OF SCIENCE

Amanda Farrium* and Linda Skupien, Cooperative Intern Program, Mississippi Gulf Coast Community College, Gautier, MS 39533, and Gulf Coast Research Laboratory, University of Southern Mississippi, Ocean Springs, MS 39566-7000

To facilitate the implementation of a complementary program at the Peter Anderson Festival, the Gulf Coast Research Laboratory needed to be involved in art from a science perspective. This project was designed to demonstrate the relationship between art and science. This relationship was substantiated through interviews with scientists who use art in their research. The areas of art discussed in these interviews encompassed different uses of art, i.e., photography, multimedia and computer equipment, employed by the scientists in "bridging the gap" between their research and the understanding and relevance of those data to a variety of audiences. After interpreting and analyzing the interview responses, the relationship which exists between scientists through the use of art has been further substantiated. These data and their interpretations will be shared with attendees.

10:00 CAN I GET UNDRESSED NOW?

Amy Preston* and Willie R. Heard, Cooperative Intern Program, Mississippi Gulf Coast Community College, Gautier, MS 39553 and J.L. Scott Marine Education Center, University of Southern Mississippi, Ocean Springs, MS 39566-7000

The primary focus of this research was to investigate the effects of long-term burial of the carcass of a baby bottlenose dolphin. This is a continuation of last year's research and presentation, "How to Undress A Bottlenose Dolphin For The Classroom." We will revisit the problems of federal licensing procedures for possessing the dolphin, and the decision-making processes relating to the best methodologies for the removal of the dolphin's

flesh from the skeleton. Lastly, we will discuss preserving the dolphin's skeleton for exhibition.

10:15 THE DEVELOPMENT OF MICROSOFT POWER POINT PRESENTATIONS FOR EDUCATIONAL PURPOSES

Jessica Waits* and Edna Waller, Cooperative Intern Program, Mississippi Gulf Coast Community College, Gautier, MS 39533 and Magnolia Park Elementary School, Ocean Springs, MS 39566-7000

The primary objective of this project was to create Microsoft Power Point Presentations to introduce elementary students to the current science lesson in which they were studying. These presentations were developed through extensive Internet research. The development involved the application of general computer knowledge by "laying out" several slides with the insertion of factual information about the lessons and graphics to illustrate the topic. The presentations are for student utilization in the classroom and are designed to enhance the knowledge of the particular area. Some of the topics for the slide presentations include Newton's Laws and the solar system.

10:30 TEACHING AID ON THE STUDY OF THE SKELETAL SYSTEM

Desiree Young^{1*}, James Baggett², and Lena Melton², ¹Cooperative Intern Program, Mississippi Gulf Coast Community College, Gautier, MS 39533 and ²Gulf Coast Research Laboratory, University Of Southern Mississippi, Ocean Springs, MS 39564-7000

Anatomy students who are absent from the laboratory portion of studying x-ray of the skeletal system sometimes have difficulty in regaining the knowledge acquired by the other students. The instructors within the Biology Department of the Community College believe this problem can be alleviated through a CD-presentation of the x-rays. After scanning the x-rays, the format was changed and the x-rays were then burned to CD-Rom. An appropriate title was chosen and the editing process was implemented to refine each x-ray. The overall purpose of this presentation is to foster and increase awareness of Human Anatomy and Physiology I, specifically as it relates to the study of skeletal system x-rays by students who cannot attend class or for students who wish to review the materials prior to testing.

10:45 Divisional Business Meeting

SOCIAL SCIENCES

Chair: Ann Marie Kinnell, University of Southern Mississippi

Vicechair: Emmanuel C. Nwagboso, Jackson State University

THURSDAY MORNING

Caprice Room

9:00 PATHOLOGICAL CONDITIONS REPRESENTED IN THE KELLOGG COLLECTION (22CL527 CLAY COUNTY, MISSISSIPPI)

Lisa L. Colonias* and Erin M. Outlaw*, University of Southern Mississippi, Hattiesburg, MS 39406

The Kellogg Collection is composed of approximately 43 individuals and dates to the Early Mississippian Period (c. A.D. 1000). The Collection may represent the cemetery of a small hamlet in northeast Mississippi. Their diet was primarily maize according to archaeological indicators on the dentition. We have examined two specific pathologies, anemia and treponematosis, as an indicator of health, diet and mortality in this small population. Treponematosis (commonly known as syphilis) has been identified in a number of Native American populations. Only one individual exhibited characteristics of prolonged systemic treponematosis. This is evident from the thickening and multiple porosities exhibited by the long bones. It appears to have been the non-venereal form of the disease. The Collection was also examined for anemia. This pathology is common in prehistoric Native Americans since maize is low in iron. There is evidence of porotic hyperostosis (porous skull) on the frontal and parietal bones of three individuals, one of which showed signs of recovery. Cribra orbitalia, another indicator of anemia, was also noted on two of these individuals above and within the orbits of the eye. The frequency of these pathologies occurs in less than 12% of the site. Thus, the population likely supplemented their diet with meat from hunting. These findings indicate a moderately healthy population consistent with other known Early Mississippian sites.

9:15 FAUNAL EXPLOITATION AT THE DIAMONDHEADSITE (22HA550): A DIACHRONIC STUDY OF SUBSISTENCE STRATEGIES AT A GULF COAST SHELL MIDDEN

Jessica L. Allgood, University of Southern Mississippi, Hattiesburg, MS 39406

Excavations at the Diamondhead Site recovered a large sample (20,000 specimens) of faunal remains. This shell midden, located on the lower Jourdan River on the Mississippi Gulf Coast, was periodically utilized from 100 BC to 1500 AD. Based on shifting frequencies of certain taxa, it appears that site function, duration of occupation, and seasonality of use changed through time. This paper will examine seasonal, ecological and functional indicators in order to better understand 1) how this site was used through time, 2) elaborate our current understanding of Mississippi prehistory, and 3) explore how this relates to other Gulf Coast shell middens.

9:30 SEX, COLOR AND POWER: 'INTERRACIAL' RELATIONSHIPS IN AMERICAN MOTION PICTURES, 1967-97

Celeste Wheat* and Amy Chasteen, University of Southern Mississippi, Hattiesburg, MS 39406

Since the release of "Guess Who's Coming to Dinner" in 1967, portrayals of 'interracial' romances in motion pictures have been relatively infrequent and often highly politicized. In this paper we provide an in-depth analysis of fifteen films that feature storylines about interracial relationships. By applying a narrative analysis framework to these films we are able to document patterns in portrayals of interracial romance and identify key changes in film treatment of this issue. Our analysis reveals both persistent formulas for telling stories about interracial relationships and also significant changes in post-1970s tales about color, romance and social response.

9:45 Joint Divisional Business Meeting with Psychology and Behavioral Neuroscience

ZOOLOGY AND ENTOMOLOGY

Chair: Timothy C. Lockley, USDA APHIS PPQ IFA

Vicechair: Alex D.W. Acholonu, Alcorn State University

FRIDAY MORNING

Caribbean Room

9:00 STUDY OF METABOLIC RATES OF GUPPY (*POECILIA RETICULATA*) AND MOSQUITO-FISH (*GAMBUSIA AFFINIS*) AT DIFFERENT TEMPERATURES

Tameka L. Ivory and Julius O. Ikenga*, Mississippi Valley State University, Itta Bena, MS 38941

The metabolic rate of an organism is the sum of complex chemical activities, per unit time, that it must carry out to survive. A segment of these activities, otherwise known as aerobic respiration, occurs in the mitochondria and requires the use of oxygen as the final electron acceptor. We developed this study to compare the metabolic rates (mRs) of guppy (*Poecilia reticulata*) and mosquitofish (*Gambusia affinis*) at 23 to 27°C. Indirect respirometry, which measured the amount of carbon dioxide (CO₂) produced, rather than the amount of oxygen consumed by the test fishes, was used to determine the mRs. The mRs were calculated in $\mu\text{M CO}_2$ produced by test fishes/ml/hr. The average mRs (7.95, 9.80, 11.0, 12.0, and 14.0 $\mu\text{M CO}_2$ /ml/hr) for *P. reticulata* were found to progressively increase as the temperature (23, 24, 25, 26, and 27°C) respectively increased. At the same temperatures above, however, the average mRs so far collected for *G. affinis* (11.3, 11.0, 12.6, 14.0, and 12.5 $\mu\text{M CO}_2$ /ml/hr) failed to show any similar progressive increase. *P. reticulata* that were one half the weight of *G. affinis* had mRs of 9.00, 12.0, and 28.5 $\mu\text{M CO}_2$ /ml/hr at 23, 26, and 27°C, respectively. Comparatively, the *G. affinis* that were twice the weight of *P. reticulata* had mRs of 11.5, 11.6, and 17.3 $\mu\text{M CO}_2$ /ml/hr at 23, 26, and 27°C, respectively.

9:15 THE ABILITY OF DRAGONFLY LARVAE TO GRAB A SPECIFIC LOCATION ON A PREY'S BODY

Marty L. Harvill* and Robert M. Kobza, Mississippi University for Women, Columbus, MS 39701 and Florida International University Miami, FL 33199

The main objective of this study was to determine if *Aeschna* dragonfly larvae randomly grab a prey or target a specific area on the prey's body. The study was conducted in a partitioned holding/observation chamber (38 L) using 14 *Aeschna* dragonfly larvae (3rd and 4th instar) and 50 (11-25 mm) *Gambusia* fish. The water temperature was maintained at 22°C and during observations the light level was turned down to 0.0145 lux. Dragonfly larvae were starved for two days before eight larvae and 12-15 *Gambusia* were placed into the observation chamber. Each of 45 captures of fish by dragonflies were video taped and measurements taken of the total length of fish (mm) and grab location to the tip of the mouth (mm). We examined the distribution of grab location/total length of fish ratios and found the targeted grab location was location specific which indicated a nonrandom grab. This study allows us to better understand the optic ability and natural selection on these ambush predators.

9:30 VARIABILITY IN FEEDING AND SEARCHING BEHAVIOR OF FIELD

COLLECTED POPULATIONS OF FRUIT FLIES
(*DROSOPHILA MELANOGASTER*)

Jimena M. Aracena* and Rebecca Rogers, Mississippi University for Women, Columbus MS 39701

Populations of *Drosophila melanogaster* were collected in the field near Columbus, MS. Isofemale lines derived from the field collections were tested in the laboratory on patches of sucrose solutions. We found variability in feeding thresholds, search behavior on patches of food, and survival during food deprivation between the populations tested. Because these traits are crucial to survival and also have been demonstrated to be heritable, they are subject to natural selection. We propose this pilot study as a model for laboratory selection and eventual characterization of behavioral heritable traits.

9:45 THE *ANACRONEURIA GUAMBIANA*
COMPLEX OF SOUTH AMERICA
(PLECOPTERA: PERLIDAE)

Bill P. Stark* and Maria del Carmen Zúñiga, Mississippi College, Clinton, MS 39058 and Universidad del Valle, Cali, Colombia

Anacroneuria is a large, neotropical stonefly genus with over 200 nominal species found from Argentina to Arizona. Most species are known from their original descriptions and there has been little effort made to understand phylogenetic relationships within this diverse assemblage. In this study we formally define the *Anacroneuria guambiana* group and recognize *A. chorerra* Stark (Venezuela), *A. guambiana* Zúñiga & Stark (Colombia), *A. pacifica* Rojas & Baena (Colombia), *A. regleta* Stark & Rojas (Colombia), *A. socapa* Stark & Zúñiga (Colombia), and *A. uru* Stark & Sivec (Peru) as members of the complex. A preliminary phylogeny of the group is proposed based on characters extracted from variations in male aedeagal morphology.

10:00 Break

10:15 CHARACTERISTICS AND TOXICITY OF THE
DRINKING WATER DISINFECTION BY-PRO-
DUCT 3-CHLORO-4-(DICHLOROMETHYL)-5-
HYDROXY-2[5H]-FURANONE (MX) TO ME-
DAKA (*ORYZIAS LATIPES*)

David R. Geter^{1*}, William E. Hawkins¹, and John W. Fournie², ¹Gulf Coast Research Laboratory, University of Southern Mississippi, Ocean Springs, MS 39564 and ²U.S. Environmental Protection Agency, Gulf Breeze, FL 32561

The compound 3-chloro-4-(dichloromethyl)-5-hydroxy-2(5H)-furanone, also known as MX, is a by-product of wood pulp manufacture and a contaminant of chlorinated drinking and sewage water. MX has recently

been shown to be carcinogenic to rodents. However, no data exist for its effects on fish. We investigated the acute toxicity of MX in a 48-hour LC50 static exposure using Japanese medaka (*Oryzias latipes*) fry. Ten-day-old medaka were exposed to MX concentrations of 0, 25, 50, 100 and 200 mg/L. Calculations using the moving average and binomial methods gave an approximate 48-hour LC50 of 138 and 128 mg/L, respectively. The MX in solution decreased an average of 15% in 48 hours across all test concentrations with a half-life of 120 hours. Concentrations of MX found in environmental and drinking waters (normally in the lower parts per billion) are far below that found to be toxic to medaka in this study. Nevertheless, these data help establish exposure conditions that will allow us to investigate mechanisms of MX effects on fish, especially studies designed to determine the carcinogenicity of MX.

10:30 INTERSPECIFIC DIFFERENCES IN
SAGITTAE OF *CYNOSCION* (TELEOSTEI:
SCIAENIDAE)

Windsor E. Aguirre, Gulf Coast Research Laboratory, Ocean Springs, MS 39566

Length and height of sagittae (saccular otoliths) were measured in nine species of the genus *Cynoscion* (Teleostei: Sciaenidae), four from the western Atlantic and five from the eastern Pacific. Compared to other American sciaenids, sagittae of *Cynoscion* are relatively large and elongate. In all species of *Cynoscion* examined, sagitta length grows at a faster rate than sagitta height. As a consequence, sagittae become relatively longer as the fish get larger. However, slopes for both sagitta length and height decrease as standard length increases, with sagittae becoming smaller relative to the overall size of the fish. Differences in sagitta shape and size exist among the species examined. Sagittae of *C. nothus* are of greater height than those of the other species, appearing rounder in shape. Sagittae of *C. arenarius*, *C. regalis*, and *C. squamipinnis* are relatively large and elongate, and very similar to one another. Sagittae of *C. nebulosus* are of slightly less length and height than those of the above mentioned species. Sagittae of *C. albus*, *C. analis*, *C. phoxocephalus*, and *C. xanthulus*, tend to be smaller than those of the other species. The reasons for these differences are not clear. However, sagittae are useful for distinguishing among morphologically similar species within *Cynoscion* and may contribute to the understanding of phylogenetic relationships.

10:45 ARE OMEGA-3 FATTY ACIDS A CRUCIAL
LIPID STORE IN DESICCATION RESISTANT
DORMANT EGGS OF THE TEMPORARY

POND COPEPOD *AGLAODIAPTOMUS STAGNALIS* FORBES?

Judith L. Williams* and Patricia M. Biesiot, University of Southern Mississippi Gulf Coast, Long Beach, MS 39560 and University of Southern Mississippi, Hattiesburg, MS 39406

Lipids are important reserves of energy for developing as well as dormant organisms. Marine copepods store tremendous amounts of wax esters and triacylglycerols (TAG) prior to dormancy in oceanic environments. Marine copepods also have unusually large amounts of omega-3 fatty acids. These fatty acids are crucial for normal development and physiologic function of all animals; for that reason they are often called essential fatty acids (EFA). The temporary pond copepod *Agladiaptomus stagnalis* produces and releases large, desiccant resistant dormant eggs on an annual basis. These eggs accumulate large amounts of both TAG and fatty acids prior to dormancy. Our preliminary data show that females with egg sacs have higher body accumulation of certain EFAs (the same as those shown to be critical in fish and invertebrate development) than those without eggs. This suggests that the females may shunt these vitally important fatty acids into the eggs, thus providing necessary precursors for rapid development following cessation of dormancy.

11:00 WATER QUALITY STUDIES ON THE BIG SUNFLOWER RIVER, MISSISSIPPI

Alex D.W. Acholonu, Gayle Culley*, Yolonda Grant, and Ketia Shumaker, Alcorn State University, Alcorn State, MS 39096

The Mississippi Department of Environmental Quality has set regulations to protect water quality. Water quality standards were adopted by the State in 1995 for interstate, intrastate, and coastal waters. The policy was adopted to protect and upgrade lotic (running) water quality within the State. This study was therefore conducted to find out if the Big Sunflower River meets the standard of fresh water bodies in Mississippi. Adverse water quality is usually indicated by such conditions as increased concentrations of metals and nutrients, decreased dissolved oxygen, and diverse changes in physical characteristics. During the period September to October 1999, water samples were collected at different locations in three replicates from the Big Sunflower River in the area near the Delta National Forest in Sharkey County. This area is about 51 miles north of Vicksburg. The samples were collected, taken to the laboratory, and analyzed according to standard methods. Of the many parameters tested: viz., surface water temperature, hardness, alkalinity, pH, nitrate, zinc, dissolved oxygen, copper, chromate, phosphate, chlorine,

and fluorine, the following were recorded: hardness, alkalinity, pH, dissolved oxygen, chromate, chlorine, and fluorine. The average surface water temperature was 24.30°C. This is a preliminary report. The study is still in progress. But based on the results so far obtained, the Big Sunflower River appears to be polluted, at least, at the areas surveyed.

11:15 ANALYSIS OF BED SEDIMENTS OF THE BIG SUNFLOWER RIVER IN MISSISSIPPI FOR POLYCYCLIC AROMATIC HYDROCARBONS

Alex D.W. Acholonu¹, Arther T. Gates^{1*}, Keturah Morris¹, and K.T. Valsaraj², ¹Alcorn State University, Alcorn State, MS 39096 and ²Louisiana State University, Baton Rouge, LA

Acholonu et al. (1997) conducted a study on benthic invertebrates and their substrates at Lake Yazoo and the Yazoo River. This study revealed the presence of three different kinds of polycyclic aromatic hydrocarbons (PAHs) which are pollutants, namely; pyrene, chrysene, and dibenzo(a,h)-anthracene. A similar study was recently initiated at the Big Sunflower River, a tributary of the Yazoo River. Between the months of May and October 1999, bed sediment samples were collected from different sites in three replicates from the Big Sunflower River in the area in close proximity to the Delta National Forest in Sharkey County. The area is about 51 miles north of Vicksburg. The samples were collected about 50 meters apart using the Ekman grab and/or a Ponar grab and occasionally by scraping the bottom with a plastic pale in shallow areas. The samples were put in pales, taken to the laboratory and refrigerated until chemically analyzed. The sediments were extracted using EPA-SW 846 method 3550B (ultrasonic extraction) and cleanup performed using EPA-SW Method 3630C (Silica Gel Cleanup). The extracts were analyzed using HPLC (gradient method). The following PAHs were detected in all sites: benzo(a)pyrene, phenanthrene, fluoranthene, pyrene, and chrysene. This is a preliminary report as the study is still in progress. Based on the results obtained so far, the Big Sunflower River is polluted at least in the areas studied.

11:30 Divisional Business Meeting

11:45 Divisional Poster Session

MORPHOLOGICAL AND BEHAVIORAL DIFFERENCES OF THE COMMON ORCHARD SPIDER, *LICAUGE VENUSTE*, IN RELATION TO DIFFERENT FOREST MANAGEMENT PRACTICES

Melodie Sheri Millsaps, Mississippi University for Women, Columbus, MS 39701

The purpose of this study was to determine how forest management practices effect orchard spiders. In previous research, it was noted that the orchard spiders living in different habitats and forest management areas showed signs of slight morphological and behavioral differences. To determine exactly how the surrounding environment had effected this spider, spot maps were collected noting the habitat and forest management area these spiders were found in. A check list was also devised for each spider found that checked for leg color, web height, community occurrences, and abdomen size. During the study it was recorded that these spiders sometimes live in communities with spiders of a different species, also. Analysis of the data concluded that the orchard spider still has the densest population and moist, low-lying areas on uneven-aged forest management. 59.5 % of the sample spiders had metallic legs and the average abdomen size of these spiders is 2.5 mm. Data analysis also indicated that 97.88% of the spiders build there webs below 1 m, 58.38% of these spiders live in web communities, and 24.87% of those spiders lived in communities with different species. It was concluded that successful orchard spiders have metallic legs, webs below 1 m, 2.5 mm abdomens, and normally live in communities. It is not that beneficial, however, for orchard spiders to form communities with different species.

SPECIAL PRESENTATIONS

THURSDAY MORNING

Caprice Room

1:00 REMOTE SENSING SYMPOSIUM

John Colonias, Institutions of Higher Learning, Jackson, MS

The Mississippi Institutions of Higher Learning and NASA's Commercial Remote Sensing program address issues relating to the commercialization of remote sensing technologies. This technology, destined to dominate the next millenium, finds wide applicability in areas such as those related to telemedicine, intelligent transportation systems, farming, and forestry. Presentations and panel topics will include: (1) the science of remote sensing, (2) sociological implications, and (3) issues relating to geographical information systems.

SOFTWARE USABILITY ISSUES FOR INTEGRATING GIS AND SCIENTIFIC VISUALIZATION

Julie Baca, Jackson State University, Jackson, MS 39217

Many research areas, particularly in environmental sciences, require techniques of both Geographic Information Systems (GIS) and scientific visualization systems. However, integrating these two technologies in a way that is seamless for the user presents many challenges. This research effort focuses on assessing current solutions to these challenges and proposing new alternatives.

HIGH-RESOLUTION REMOTE SENSING FOR RISK ASSESSMENT AND HAZARD MITIGATION

Gregory L. Easson and Bruce A. Davis, University of Mississippi, University, MS 38677 and NASA, Commercial Remote Sensing, Stennis Space Center, MS 39529

Emergency planning officials at the county and municipal level need accurate information describing the landcover, slope and elevation of their areas of jurisdiction. This information is needed to assess areas of potential flood risk from hurricane storm surge and rainfall, and to develop mitigation plans to reduce risk. These needs include monitoring residential and commercial development in potential flood hazard areas and development that alters the amount of impervious surface area within and surrounding the city. In this project high-resolution multispectral imagery was merged with high-resolution topographic survey data to form a risk assessment and hazard mitigation tool for the city of Long Beach, Mississippi. Long Beach is a small city on the Mississippi Gulf Coast that has undergone rapid residential and commercial growth due to casino development and increased tourism. The multispectral imagery was obtained from Positive Systems Incorporated. The imagery contains four bands, three visible and one infrared, with resolution of one meter. The imagery was geo-referenced using digital transportation data at 1:24,000 scale and image to image registration to create a mosaic image of the city of Long Beach. This mosaic was classified to determine the amount of property within the city covered by impervious surface. In addition to the imagery, high-resolution topographic data were gathered using a LIght Detection And Ranging (LIDAR) system. This data set contains an elevation point for each square meter of Long Beach and has an elevation accuracy of ± 0.5 feet. These data were used to develop a Digital Elevation Model that was used to compute the slope of each pixel in the imagery and to delineate basins within the city. The combination of the imagery and topographic data will be used to parameterize an overland flow model that will be used to determine flood risks throughout the city. The imagery is also being used to evaluate the suitability of hurricane shelters. In

particular the imagery is used to assess the hazards associated with nearby trees and other potential falling objects. The model implementation is expected to be completed by July, 2000 and will be used as a pilot study to test the feasibility of these types of studies for the entire Mississippi Gulf Coast.

THURSDAY AFTERNOON

Gulf Hall

5:00 Dodgen Lecture: Environmental Issues
David Orr, Oberlin College, Oberlin, Ohio 44074

FRIDAY MORNING

Pre-Assembly Area

9:00 MEET THE STATISTICIAN

Walter T. Brehm, Clinical Research Laboratory, 81st Medical Group, Keesler AFB, MS 39534

The importance of considering how data will be analyzed early in the planning of an investigation or experiment cannot be overemphasized. The distinguished statistician Sir R.A. Fisher said, "To call in the statistician once the experiment is done may be no more than asking him to perform a postmortem examination: he may be able to say what the experiment died of." Don't let this happen to you! Come to the Annual meeting of the Mississippi Academy of Sciences and MEET THE STATISTICIAN. The members of the Division of Mathematics, Computer Science, and Statistics will be providing free, 20 minute consultations in the areas of experimental design, statistical design & analysis selection, and sample size determination. Some analyses may be possible with advanced

arrangements. Contact the division chairman, Walt Brehm, 81st Medical Group, 301 Fisher St., Rm 1A132, Keesler AFB, MS 39534 or walter.brehm@keesler.af.mil to arrange an appointment. Students are welcome and walk-ins may be accepted. It could be the most important 20 minutes of your whole project.

Caprice Room

9:00 COMMUNICATING SCIENCE THROUGH THE NEWS MEDIA

Burnis R. Morris, Associate Professor and Talbert Lecturer, Department of Journalism, University of Mississippi, University, MS 38677

Leading practitioners and journalism educators discuss the state of science journalism and offer advice for scientists seeking publicity. Topics include sexy content in the health and science magazine industry, public relations and the placement of science stories, and what your hometown paper needs to know.

Panelists include:

- Dale Thorn, Assistant Professor,anship School of Mass Communication, Louisiana State University, Baton Rouge, LA
- Tom Sommers, Managing Director, Hill and Knowlton Public Relations, Houston, TX
- Barbara Austin, Director, Public Affairs, University of Mississippi Medical Center, Jackson, MS
- Annie Oeth, Editor, Science/Environmental Stories, The Clarion-Ledger, Jackson, MS
- Samir Husni, Professor of Journalism, University of Mississippi, Jackson, MS



2001 Annual Meeting
February 8 & 9
Tupelo, Mississippi



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