

MISSISSIPPI  
ACADEMY OF SCIENCES



SIXTY-SIXTH ANNUAL MEETING

February 21 & 22, 2002

BILOXI, MISSISSIPPI

President Casino Broadwater Towers  
2060 Beach Boulevard

Hosted by

The University of Southern Mississippi

# Journal of the Mississippi Academy of Sciences

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Journal of the Mississippi  
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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 20, 2002**

<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 21, 2002**

<u>TIME</u>	<u>EVENT</u>	<u>LOCATION</u>
8:00 AM to 4:30 PM	Registration	Island Bar
8:30 AM to 4:30 PM	Divisional Programs	See Pages 11-90
8:45 AM	Structure Visualization in Biochemistry Education: Seeing Is Believing; lecture by Robert Bateman	Emerald Room
9:00 AM to 7:00 PM	Exhibits	Crystal and Topaz Rooms
4:30 PM	2001 Dodgen Lecture & Presentation of Awards; lecture by Stephanie F. Cave	Gulf Hall
6:00 PM to 7:00 PM	Hospitality Hour	Crystal and Topaz Rooms
6:30 PM	MAMP Executive Meeting	Gulf Hall
7:00 PM	IMAGE Student Meeting	Gulf Hall

**FRIDAY, FEBRUARY 22, 2002**

<u>TIME</u>	<u>EVENT</u>	<u>LOCATION</u>
7:15 AM	Past-Presidents' Breakfast	Brass Banana
8:15 AM to 8:45 AM	MAS Business Meeting	Pacific Room
8:00 AM to 2:00 PM	Registration	Island Bar
8:30 AM to 12:30 PM	Divisional Programs	See Pages 11-90
9:00-11:00 AM	Protection of Human Subjects: the Expanding Roles of the Institutional Review Board; workshop conducted by Reid Jones, Georgene Clark, and Jane Weare	Caribbean Room
9:00 AM to Noon	Exhibits	Crystal and Topaz Rooms



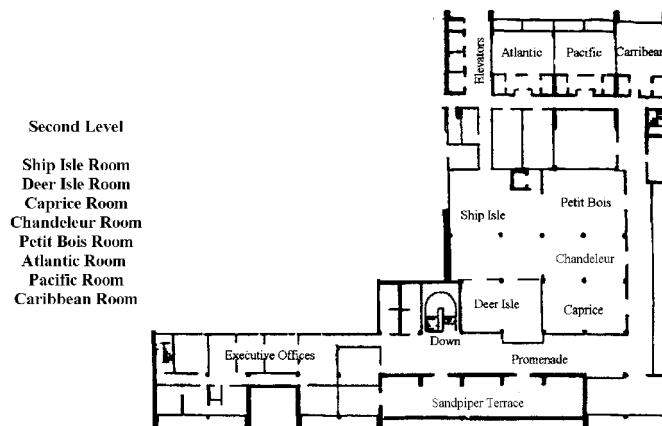
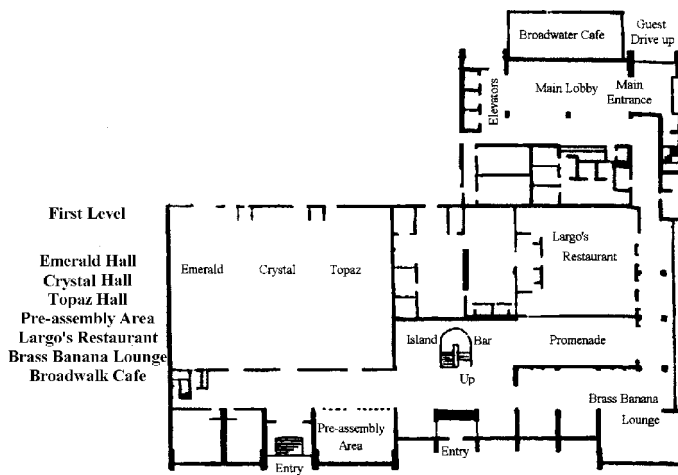
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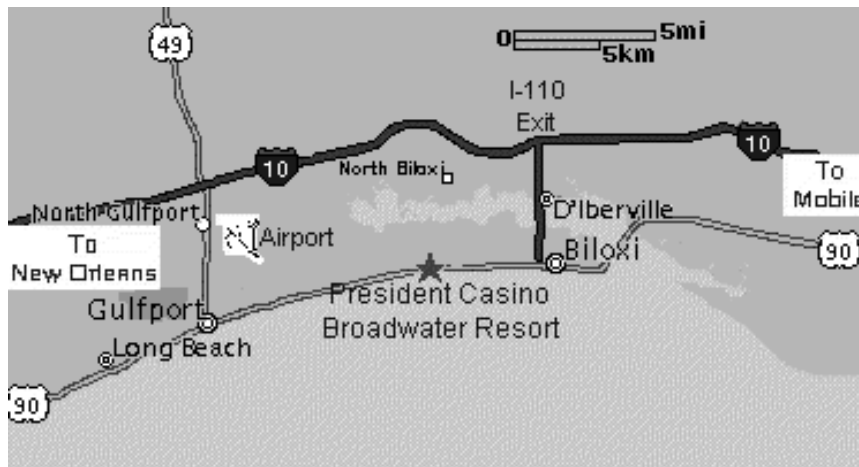
MISSISSIPPI ACADEMY OF SCIENCES MEETING OVERVIEW

	Island Bar	Emerald	Topaz/Crystal	Deer Isle	Caprice	Chandeur	Petit Bois	Caribbean	Pacific	Athantic	Ship Isle	Gulf Hall
THURSDAY MORNING	Registration	Cellular, Molecular and Developmental Biology	Exhibits	Marine and Atmospheric Science	History and Philosophy of Science	Physics and Engineering	Geology and Geography	Psychology and Social Sciences	Agriculture and Plant Science	Science Education	Chemistry and Chemical Engineering	Health Sciences
THURSDAY AFTERNOON	Registration	Cellular, Molecular and Developmental Biology	Exhibits	Marine and Atmospheric Science	Mathematics, Computer Science and Statistics	Physics and Engineering	Geology and Geography	Psychology and Social Sciences	Agriculture and Plant Science	Science Education	Chemistry and Chemical Engineering	Health Sciences
THURSDAY EVENING			Hospitality Hour (follows Dodgen Lecture)									Dodgen Lecture and Awards Presentations
FRIDAY MORNING	Registration	Cellular, Molecular and Developmental Biology	Exhibits	History and Philosophy of Science	Mathematics, Computer Science and Statistics	Physics and Engineering	Zoology and Entomology	Workshop: Protection of Human Subjects: The Expanding Roles of the Institutional Review Board	MAS General Business Meeting	Science Education	Chemistry and Chemical Engineering	
FRIDAY AFTERNOON												

## President Casino Broadwater Towers



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



## Dodgen Lecture—2002

### Vaccine Controversies: Past and Present

Stephanie F. Cave, M.D.



Stephanie Cave was born in New Orleans, Louisiana—the second of four children. She had considered majoring in journalism in college, but her older sister talked her into a career in medical technology. The first three years of college were in Baton Rouge at LSU. The clinical year was done at Ochsner Foundation Hospital, where she graduated in 1966 with honors.

In 1967 she married Donald Cave, attorney, and had three sons over the following four years. At that time she was also working in laboratory medicine. Clinical chemistry was always a favorite of hers. She taught medical technology, pre-med, and pre-dent students in the Allied Health Department at LSU for ten years. During that time she obtained a Master of Science in clinical chemistry from the LSU Medical School in New Orleans,

Louisiana.

Prompted by her husband in 1978, Stephanie applied to medical school and fulfilled a dream. She attended LSU Medical School in New Orleans for four years and graduated with an M.D. in 1983. The next three years were spent at Earl K Long Hospital in a Family Practice Residency. In 1986 she was board certified in Family Practice.

From 1986 to the present time, Stephanie has been in the private practice of medicine in Baton Rouge, Louisiana. She is also on the clinical faculty at LSU Medical School in New Orleans. Her practice started out as a typical family practice but it has evolved over time into an integrative medicine practice. Because her main interest for years had been chemistry, she incorporated metabolic treatment into her practice, using very few prescription drugs. Most of her practice involves mapping and normalizing biochemistry.

For the past five years, one focus of the practice has been the treatment of autism spectrum disorder. She and her associate, Dr. Amy Holmes, see and treat over 900 autistic children. The realization that children received high levels of ethylmercury in a number of vaccines led them to establish a protocol for the removal of the metal. As a result, many of the children have normalized in physical characteristics and behavior.

Stephanie testified in a Congressional hearing on mercury in vaccines in July, 2000 and has just finished a book entitled *What Your Doctor May Not Tell You About Children's Vaccinations*. In the book, she gives parents information about the vaccines in the hope that they can make intelligent choices on how to safely vaccinate their children.

She and her associate travel extensively, giving seminars and talks to educate the public about the vaccines and the treatment of autism. In addition to autism. She treats a variety of other medical problems using the metabolic mapping including fibromyalgia, chronic fatigue, hormone imbalances, and allergy. Stephanie Cave describes her practice as enjoyable, satisfying, and stimulating. In spite of having had several careers, she

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.





still describes herself as “an old med tech.”



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**AGRICULTURE AND  
PLANT SCIENCE**

Chair: Maria T. Begonia, Jackson State University  
Vicechair: Girish K. Panicker, Alcorn State  
University

**THURSDAY MORNING**

Pacific Room

8:30 Introduction

8:45 EFFECT OF MUSCADINE GRAPE FIBER AND WHEAT BRAN FIBER ON CECAL BUTYRIC ACID, FECAL OUTPUT, AND WEIGHT GAIN IN RATS

Juan C. Bruch and Betty J. Ector\*, Mississippi State University, Mississippi State, MS 39762

The ability of butyric acid to inhibit cell proliferation and enhance cell differentiation has been well documented. Studies have shown high cecal concentrations of butyric acid associated with wheat bran consumption. The primary objective of this research was to determine the cecal concentration of butyric acid associated with the consumption of muscadine powder and compare it with that associated with wheat bran consumption. Weanling male rats were fed six test diets: control, fiber free, and diets that contained 5% or 10% fiber from wheat bran or 5% or 10% fiber from muscadine powder. Food and water consumption, weight, and fecal output were recorded during the experimental period. After 28 days, the rats were sacrificed and cecal concentrations of butyric acid were measured. Food consumption was not different among rats fed wheat bran and muscadine powder. Fecal output was significantly ( $P < .05$ ) greater for rats fed 10% fiber from muscadine powder than for those fed all other diets. Rats which consumed fiber from muscadine powder had significantly lower concentrations of cecal butyric acid than rats which consumed fiber from wheat bran. The results of this study indicate that the consumption of muscadine powder does not yield significant amounts of butyric acid in the cecum and may not influence cell proliferation nor differentiation in the rat colon.

9:00 INFLUENCE OF EGTA ON CADMIUM UPTAKE BY WHEAT

Afrachanna D. Butler\*, Courtney J. Young, Rodrick J. Warren, Umeko T. Griffin, Bobby F. Crudup, Maria F.T. Begonia, and Gregorio B. Begonia, Jackson State Univer-

sity, Jackson, MS 39217

There is an increasing interest in phytoextraction as an alternative technology to clean up Cd-contaminated soils. However, the success of phytoextraction depends on the identification of plant species that can both tolerate toxic metal levels, and accumulate substantial amounts of the metal into the shoots. Also, efficient uptake of Cd is dependent on the availability of the metal for absorption by the roots. Cognizant of the effects of chelates in increasing the availability of metals, this study was conducted to determine the optimum concentration of a synthetic chelate, ethylene[oxyethylenetrinitrilo] tetraacetic acid (EGTA) that maximizes the phytoextraction of cadmium (Cd) from a contaminated soil by wheat (*Triticum aestivum* L cv. TAM-109). Wheat seeds were sown in various concentrations of Cd and EGTA mixed with a growing medium composed of sieved soil and peat (2:1, v:v). Experimental units were arranged in a 4 Cd x 4 EGTA factorial in a Completely Randomized Design (CRD) with 4 replications. After six weeks of growth, the plants were harvested and their Cd contents were extracted and quantified using atomic absorption spectroscopy. Results revealed that wheat plants were relatively tolerant to Cd x EGTA combinations as exhibited by non-significant differences in their dry biomass and chlorophyll contents. EGTA applied at 5 mmol/kg was the most effective in enhancing Cd uptake by wheat.

9:15 GAMMA IRRADIATION PROCESSING TO REDUCE THE RISK OF VIBRIO INFECTIONS FROM RAW OYSTERS

Linda S. Andrews\* and Susan DeBlanc, Mississippi State University, Pascagoula, MS 39567

*Vibrio vulnificus* and *V. parahaemolyticus* are natural inhabitants of estuarine and ocean environments. As such they are naturally concentrated in filter feeding molluscan shellfish, oysters, clams, etc. These *Vibrio* pathogens cause serious illness and death in susceptible persons when consumed along with raw half-shell oysters. *Vibrio* spp. have proven to be relatively sensitive to irradiation exposure compared with other food borne pathogens like *Salmonella* and *Listeria*. This study investigated irradiation processing as an alternative post harvest treatment (PHT) for raw shell stock oysters to reduce *V.v.* and *V.p.* to nondetectable levels and still maintain the raw half-shell qualities consumers expect in raw oysters. Live oysters, with naturally incurred and artificially inoculated *Vibrios*, were exposed to 0–3 kGy dose Cobalt-60 gamma radiation. *Vibrio vulnificus* was effectively reduced from  $10^6$  cfu/g oyster meat to nondetectable levels (<3 mpn/g oyster meat) with an exposure dose of 0.75 kGy. *Vibrio parahaemolyticus*, TX03:K6, proved to be more resistant

and required 1.0 kGy for its reduction to nondetectable levels. Sensory quality was maintained with irradiation exposure up to 1.5 kGy. Higher irradiation doses increased the mortality rate and reduced shelf life. At 2 kGy, the oysters produced an unpleasant yellow exudate. In summary, a 1 kGy dose reduced the Vibrios to nondetectable levels and at the same time maintained good sensory quality, a normal shelf life of 15 days, and minimum mortality. The authors wish to thank Daniel VanGent for his technical assistance at the Nuclear Science Center, Louisiana State University, Baton Rouge, LA 70806.

9:30 OFF-FLAVOR DEVELOPMENT, DETECTION, AND REDUCTION METHODS IN CHANNEL CATFISH PROCESSING

Juan L. Silva<sup>1\*</sup>, Marinela Barrero<sup>1</sup>, Russell Bazemore<sup>1</sup>, Casey Grimm<sup>2</sup>, and Karen Bett<sup>2</sup>, <sup>1</sup>Mississippi State University, Mississippi State, MS 39762, and <sup>2</sup>USDA-ARS, SRRC, New Orleans, LA 70179

Channel catfish (*Ictalurus punctatus*) is the fourth most consumed seafood species in the U.S. and Mississippi is its major producer and processor. These fish are mild in flavor, thus easy to prepare in many ways. However, off-flavors caused by blue-green algae and other minor off-flavors are a major problem in the industry. Two major compounds, geosmin and 2-methyl isoborneol are key in the musty and blue-green off-flavors in catfish. Other compounds may be responsible for such descriptors as woody, chemical, and putrid, among many. Fish that are off-flavor are rejected by the processor and carry a loss to the farmer. Detection methods to detect the off-flavors have been developed. However, "flavor checkers" are capable of detecting these compounds below 1 ppb. Physical (deep skinning, tumbling), processing aids (ozone, H<sub>2</sub>O<sub>2</sub>), and additives (citric acid, salt, marinades) are possible intervention processes that could be used to decrease or eliminate these off-flavors. A brief overview of the problem and some possible solutions will be discussed, including the sites during processing where the methods could be used.

9:45 PERFORMANCE OF APPLE AND PEAR CULTIVARS IN NORTHERN MISSISSIPPI

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

Apple and pear cultivars were planted in 1987 and produced a measurable crop the third year after planting. First-year harvest indicated that 'Yellow Delicious' apple produced more than the other cultivars. In 1991, 'Red Chief CS' outproduced the other cultivars. Most cultivars were equally productive the third year; the exception was 'Paula Red' which was the lowest yielding cultivar. Results illustrate bloom period, harvest date, yield, and fire blight

susceptibility of apple and pear cultivars in northern Mississippi. Based on cumulative yields for 4 years, it is concluded that apple and pear yields are within the normal range of production. Apple cultivars 'Red Chief CS' (Campbell Strain) and 'Red Chief MS' (Mercier Strain) are recommended for Mississippi based on yield and tolerance to fire blight. Pears, as indicated by bloom period, were very susceptible to late-spring freezes. 'Moon-Glo' pear is not recommended for Mississippi due to its susceptibility to fire blight. 'Orient,' 'Keiffer,' and 'LeConte' are recommended based on yield and tolerance to fire blight.

10:00 ENHANCING FARM EFFICIENCY AND PROFITABILITY IN SELECTED MISSISSIPPI COUNTIES

Aquanda Jones\*, Patrick E. Igbokwe, Liang C. Huam, Franklin Chukwuma, Bernard Cotton, and Juliet G. Huam, Alcorn State University, Alcorn State, MS 39096

Field experiment was used to determine the effect of three cropping systems (conventional, transitional and organic) on 'Beauregard' sweet potato survival, growth and yield potential. The study was conducted on a farmer's field in Marks, Quitman county, in North Mississippi. preparation, fertilizer applications and pest control varied with cropping system. Moisture application was by natural rainfall and overhead irrigation. Up-to-date findings indicate that the cropping systems did not influence plant survival, vine length, internode length, stem diameter and vine fresh and dry weights. The overall sweet potato number and weight were highest for conventional cropping system and lowest for the transitional and organic cropping systems. The numbers and weights for the #1, #2, and cull sweet potato grades were also highest for the conventional cropping system and lowest for the transitional and organic cropping systems. The jumbo sweet potato grade was not influenced by the cropping systems. The overall yields from the transitional and organic cropping systems were comparable to that reported for the conventional cropping system when harvests from their companion crops were considered.

10:15 RESOLVING RELATIONSHIPS AMONG NARCISSUS CULTIVARS

Robert G. Hamilton\*, Tiffany Scarff, Daila Morgan, Kimberly McGehee, and Scott Rimes, Mississippi College, Clinton, MS 39056

Since there is very little molecular genetic information available for Narcissus cultivars (daffodils), we used random amplified polymorphic DNAs (RAPDs) to compare the three cultivars, Wee Bee, Little Gem and Bagatelle. These three cultivars are miniatures, in the yellow trumpet group, 1Y-Y. Since they are quite similar in appearance, it

is quite possible that they may not be distinct cultivars. DNA extractions required a modification of a commercially available kit. Five different primers yielded 129 different fragments among the three cultivars, 53 of which occurred twice among the cultivars. Using the UPGMA routine in PHYLIP, we completed one analysis of all 129 fragments and one analysis of just the 53 that occurred twice. Data from the 53 fragments that occurred at least twice in each cultivar where they were present indicated that 'Wee Bee' and 'Little Gem' are more similar to each other than either is to 'Bagatelle.' Data from the analysis of all 129 fragments indicated that 'Bagatelle' and 'Little Gem' were a little more similar to each other than either is to 'Wee Bee.' Data from the breeders of these cultivars suggests that 'Wee Bee' originated prior to 'Bagatelle' and 'Little Gem,' supporting the analysis derived from all 129 fragments. This project was supported by a grant from The American Daffodil Society.

10:30 Break

10:45 EFFECTS OF KAOLIN CLAY ON SOUTHERN Highbush BLUEBERRIES (*VACCINIUM* spp.)

J.D. Spiers<sup>1</sup>, Frank B. Matta<sup>2\*</sup>, J.B. Braswell<sup>2</sup>, and D.S. Marshall<sup>1</sup>, <sup>1</sup>USDA/ARS, Small Fruits Research Station, Poplarville, MS 394701, and <sup>2</sup>Mississippi State University, Mississippi State, MS 39762

Four separate studies were conducted to report the effects on kaolin applications on southern highbush blueberries (*Vaccinium* spp.). When applied to mature blueberry plants, kaolin clay emulsion dried to form a white reflective film. Kaolin applications affected bud development, fruit set and development, plant growth, and photosynthetic response, but had no effect on fruit yield or fruit quality parameters. 'Cooper' received a single application of kaolin during early flowering (bud stages 3–6). Kaolin increased flower bud development and fruit set, regardless of flower bud stage at application. Berry size was reduced with kaolin, perhaps due to increased number of fruit present. 'Magnolia' received a single application of kaolin at pre-fruit set, early fruit set, mid-maturity, and pre-harvest resulting in a linear increase in plant volume with early applications. Fruit yield and quality parameters were not affected by kaolin. Photosynthesis rates of treated plants did not differ compared to control plants. However, treated plants had higher transpiration rates than unsprayed plants. Kaolin reduced canopy temperature while maintaining photosynthetic rates and fruit yield, and increased transpiration, fruit set, and plant growth.

11:00 BLUEBERRY SHELF-LIFE UNDER

#### ALTERNATE CO<sub>2</sub> STORAGE

Adel Al-qurashi\*, Frank B. Matta, and James O. Garner, Jr., Mississippi State University, Mississippi State, MS 39762

Blueberry cultivar 'Tifblue' was stored at 4EC and exposed to various CO<sub>2</sub> concentrations (.035%, 15%, and 25%). Berry weight loss was reduced at 15% and 25% CO<sub>2</sub>. Juice pH and titratable acidity were not effected. Soluble solids concentration (SSC) increased with time in storage and was lowest under CO<sub>2</sub> treatment. Berry firmness was not affected by CO<sub>2</sub> treatment. Berry appearance under 15% and 25% CO<sub>2</sub> was greater compared to regular refrigeration. CO<sub>2</sub> concentration approximating 20% delayed ripening, indicating increase shelf-life.

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### THURSDAY AFTERNOON

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Pacific Room

1:15 Divisional Poster Session

COMPARATIVE CADMIUM PHYTOEXTRACTION EFFICIENCIES AMONG THREE TALL FESCUE CULTIVARS

Erica R. Dillon\*, Olufunke Okuyiga-Ezem\*, Oscar T. Hundley, Ashley N. Davis, Afrachanna D. Butler, Maria F.T. Begonia, and Gregorio B. Begonia, Jackson State University, Jackson, MS 39217

Phytoextraction of metals like cadmium (Cd) has emerged as a promising, cost-effective alternative to conventional engineering-based remediation methods. The success of this technology is dependent upon the selection of plant species or cultivars that (a) can tolerate toxic metal levels, and (b) accumulate substantial amounts of metals into their shoots for easier harvest. In our search for plant species/cultivars that can grow vigorously during the colder periods of an annual crop rotation cycle, seeds of three tall fescue cultivars (Spirit No. 1, Titan Tall No. 1, Fawn No. 1) were sown in 150 mL plastic elongated tubes containing sand. Beginning at 3 days after emergence until harvest, plants were alternately watered with appropriate concentrations of aqueous cadmium nitrate or modified nutrient solution. After six weeks of growth, plants were harvested and their shoot and root Cd contents were extracted and quantified using atomic absorption spectroscopy. Results showed that based from their biomass, the three tall fescue cultivars tolerated the lower concentrations of Cd but exhibited reduced biomass at the highest Cd concentration. Generally, more Cd were taken up by the roots as opposed to the shoots. Among the three cultivars tested, Spirit No. 1 and Tital Tall No. 1 appeared to be efficient cultivars for Cd phytoextraction and

therefore, deserve further evaluation using a Cd-contaminated soil and longer growing period.

#### RESOLVING VARIATION WITHIN NARCISSUS CULTIVARS

Robert G. Hamilton\*, Tiffany Scarff, Kimberly McGehee, and Daila Morgan, Mississippi College, Clinton, MS 39056

A previous study of genetic variation among *Narcissus* (daffodil) cultivars revealed evidence of variation within cultivars. Since each cultivar is presumably derived from cloning of bulbs, this variation was unexpected. We analyzed three cultivars from the Gray Group, 'RIKKI' (7w-y), 'SUNDISC' (7y-y) and 'CLAIRE' (7y-y). Three of each cultivar were analyzed using random amplified polymorphic DNAs with one primer. Data indicated uniformity among samples of 'RIKKI' and 'SUNDISC,' however 1 of the 3 samples of 'CLAIRE' differed from the other two. This simple method of analysis could provide a means to confirm or reject individual plants as representative of a given cultivar.

#### SWEET POTATO OR YAM? A CONSTANT DILEMMA

Juliet G. Huam\*, Patrick E. Igbokwe, Liang C. Huam, Franklin Chukwuma, and Bernard Cotton, Alcorn State University, Alcorn State, MS 39096

Sweet potato or yam? While the names of the two root vegetables are used interchangeably in the supermarkets and among consumers, the two plants are totally different vegetables. This paper will attempt to clear the confusion between the two vegetables in term of their origin, availability, botany, appearance, and nutritional value. Sweet potato (*Ipomea batatas*), a dicotyledon, belongs to the Morning Glory family and is a native of Peru and Ecuador. Popular in the southern United States, this yellow tuber has smooth, thin skin with short, elongated ends. It is a nutritive powerhouse for fiber, vitamin C, potassium, beta-carotene, and is practically fat-free. Yam, on the other hand, is a member of the Lily family (*Dioscorea*). A monocotyledon, the yam originated from West Africa. True yam is found in the tropical countries and is not readily available in the United States. It has rough, scaly, reddish-brown skin with pointed ends. It contains abundant carbohydrates, beta-carotene and fiber. For many American, sweet potato shows up more during Thanksgiving dinner. This vegetable has been undervalued and under appreciated. It has potential nutritional value and definitely can be used throughout the year. Because of its versatility, it can be transformed into pies, puddings, muffins, canned vegetables or biscuits. Yam or potato: they can be used interchangeably with few modifications made in the recipes.

SPATIAL VARIABILITY OF INFILTRATION IN A LOESSIAL SOIL UNDER TWO CROPPING SYSTEMS  
Cedric A. Sims\* and Alton B. Johnson, Alcorn State University, Alcorn State, MS 39096

An experiment measuring spatial variability of infiltration, relative elevation, and organic carbon was conducted in the Summer of 2000 in Southwest Mississippi on no-till (NT) and conventional till (CT) fields. The soil in both tillage systems was Memphis silt loam (Fine silty, mixed, thermic Typic Hapludalf) with corn-cotton rotation. One of the fields under study was NT planted in corn (*Zea mays* L.) and two were CT planted in corn and cotton (*Gossypium* sp.). A double ring infiltrometer was used on grids to measure water infiltration rate. Correspondingly, soil moisture, organic carbon, and elevation were measured at each node of the established grids. The models describing semivariograms for relative elevation, infiltration and organic carbon in the fields were either exponential, linear or spherical. The NT-corn field had a coefficient of variability (CV) of 53.72% with the range, sill and nugget of 422 m, 0.696 m, and 0.169 m, respectively. The CT-corn had a CV of 38.90% with the range, sill and nugget of 87.46 m, 0.07 m, and 0.06 m, respectively. The CT-cotton had a CV of 37.24% with the range, sill and nugget of 311 m, 0.10 m, and 0.05 m, respectively. The test of normality indicated that values of relative elevation, infiltration and organic carbon were not normally distributed for the NT-corn, CT-corn, and CT-cotton fields. Semivariograms for infiltration and organic carbon for all fields showed nugget effects, however, only elevation semivariogram for CT-cotton showed a nugget effect but was not as strong as those of the other parameters.

EFFECTS OF CADMIUM ON THE SEQUENTIAL EXPRESSION OF CHLOROPHYLL IN *BRASSICA JUNCEA*

M.S. Zaman\*, C. Jennings, P. Kumar, and A.M. Powell, Alcorn State University, Alcorn State, MS 39096

Phytoremediation, a green technology, uses vegetation to remove heavy metals or other pollutants from the environment. Phytoremediation depends upon identifying plant species that can tolerate and accumulate high concentrations of pollutants. Cadmium (Cd) is an ubiquitous pollutant in the biosphere. Pilot studies in our laboratory indicated that this plant species is tolerant to high concentrations of Cd in soils, and it accumulates Cd from soils as well. Since chlorophyll is related to plant production, in this study, we evaluated the effects of Cd on the sequential expression of chlorophyll for 9, 14, 21, and 28 days of plant life. Plants were grown on Memphis silt loam soil containing various concentrations of Cd. Data

indicated a dose related inhibition of chlorophyll-*a*, chlorophyll-*b*, and total chlorophyll expressions in Cd treated plants. This suggests that *Brassica juncea* may also be used to develop plant models to biomonitor soil pollutants. Further investigations are being conducted in our laboratory to explore the hyperaccumulation potential of *Brassica juncea* for soil Cd in the presence of chelating agents.

#### YARDLONG BEAN: A NEW CROP FOR MISSISSIPPI GROWERS AND CONSUMERS

Christine Coker\* and Mike Ely, Mississippi State University, Biloxi, MS 39531

Ethnicity plays a strong role in niche market development, and this market is currently under served. As Asian populations continue to grow in Mississippi, especially along the Gulf Coast with the increasing number of non-Caucasian shrimpers, it is important to recognize new market opportunities. The fruits and vegetables desired by the diverse Asian population is often unavailable or of poor quality due to extensive shipping distances. Mississippi growers can meet this need for fresh oriental produce at a higher price than traditional vegetables. Yardlong or asparagus bean (*Vigna sesquipedalis*) is related to the cowpea. The cultural practices for yardlong bean is similar to that of traditional pole beans. However, there is still much to be learned about this crop in terms of pest, management, disease susceptibility, and variety superiority. The objectives of this research were to compare yardlong bean varieties and collect observational data regarding production practices. Four replications of 8 yardlong bean varieties were grown at the Beaumont Horticultural Unit during the summer of 2001. Beans were grown on 4 ft trellises set 1 ft above the soil line. Beans were harvested twice a week. Date of first harvest, number of harvests, and yields were affected by variety. Preliminary data show that 'Red Seed' and 'Red Stripe Seed' varieties are best suited for growing conditions in southern Mississippi. However, mosaic viruses may pose a potential production problem.

#### BIOACCUMULATION OF CADMIUM AND LEAD IN INDIAN MUSTARD GROWN IN METAL CONTAMINATED SOILS

Ketia L. Shumaker\*, A.M. Powell, and M.S. Zaman, Alcorn State University, Alcorn State, MS 39096

Heavy metal contamination of soil is a persistent problem. Soil contaminants such as cadmium (Cd), and lead (Pb) are hazardous to human health. Phytoremediation uses vegetation to remove pollutants from the environment. Phytoremediation of soil is relatively cost effective and reliable compared to conventional methods such as

chemical treatment and excavation. Soil phytoremediation depends upon identifying plant species that can tolerate high concentrations of soil pollutants and accumulate pollutants from the soils. In this study, we investigated the growth response of Indian Mustard (*Brassica juncea*) to soil Cd and Pb and its phytoremediation potential of soil Cd and Pb. Plants were grown on Memphis silt loam soils containing various concentrations of Cd and Pb. Plants were grown in porous bottom planters under vital lighting for 16 h light and 8 h dark cycles. Planters were placed on reservoir trays (separate trays for each treatment group). Watering was done on every other day or as needed with distilled water, and once a week with full strength Hoagland solution. On day 30 of the experiment, plants were harvested, cleaned, and oven dried. Samples were acid digested and analyzed for tissue metal contents. Data were analyzed for growth response of plants to soil metal contents and bioaccumulation of metals. Data indicated dose related effects of Cd and Pb on plant growth and bioaccumulation of metals. Investigations are being conducted in our laboratory to further explore the hyperaccumulation potential of *Brassica juncea* for soil Cd and Pb.

#### CERCOSPORELLA RUBI AND ROSETTE DISEASE OF BLACKBERRY

Melinda R. Lyman<sup>1\*</sup>, Kenneth J. Curry<sup>1</sup>, Barbara J. Smith<sup>2</sup>, and Susan V. Diehl<sup>3</sup>, <sup>1</sup>University of Southern Mississippi, Hattiesburg, MS 39406-5018; <sup>2</sup>USDA, Agricultural Research Service, Poplarville, MS 39470; and <sup>3</sup>Mississippi State University, Mississippi State, MS 39762

*Cercospora rubi* is present in rosette infected blackberry floral buds at the time of floral initiation and persists until flowers become senescent. At both light and electron microscopic levels, signs of necrosis appear when infected floral buds reach 6.0 mm in diameter and continues as the flower opens. The ovary wall and ovule of infected, opened flowers are heavily necrotic as compared to those of healthy, opened flowers. Hyphae also proliferate on stamens and ultimately clog the stomium as it is formed. *Cercospora rubi* has an advantage over other saprophytes since several cycles of sporulation occur during the time other fungi are establishing themselves on the dead flower. The mode of primary infection in the spring is uncertain. Does *C. rubi* overwinter as a teleomorph on dead floricanes or as an anamorph on primocane buds? We rarely isolated *C. rubi* from dormant primocane buds, although a number of other fungi were found. Dead floricanes were examined weekly from January through June for the *Mycosphaerella* teleomorph of *Cercospora*. An unidentified species of *Mycosphaerella* was commonly found on dead canes which we are currently attempting to



identify to species.

#### ECONOMICS OF ECHINACEA CULTIVATION

Liang C. Huam\*, Patrick E. Igbokwe, Magid Dagher, Robin Walker, and Skip Owens, Alcorn State University, Alcorn State, MS 39096

The farm-level value of herbs produced in North America is more than \$1 billion, with the market growing at least 10 percent annually. One herb with an established market is Echinacea, commonly known as purple coneflower. Echinacea is the most widely used herb in the United States because of its antibiotic, antiviral, and antiinflammatory characteristics. Recently some Mississippi producers have begun to grow Echinacea as an alternative enterprise. While research information on Echinacea's medicinal properties is abundant, cost, and yield information are virtually non-existent. The purpose of this paper is to present economic information for two Echinacea species (*E. purpurea* and *E. pallida*) that are commercially important and can be cultivated locally. Production and economic data for this paper were obtained from results of current Echinacea research conducted at Alcorn State University Experiment Station. Results in this study indicate that the two Echinacea species can be grown profitably in Mississippi. Profit margin for *E. pallida* is higher than *E. purpurea*. Positive returns are obtained when yields exceed 1500 and 1250 lbs per acre at current prices of \$2.50 and \$3.00 per lb of dried roots for *E. purpurea* and *E. pallida*, respectively.

#### Divisional Talks Resume

##### 2:15 EFFECT OF CARBOHYDRATE COMPOSITION AND TEMPERATURE ON SEED GERMINATION OF COWPEA CULTIVARS

Rafaela Carvajal<sup>1</sup>, Clarence E. Watson<sup>1\*</sup>, Kristina F. Connor<sup>2</sup>, and James O. Garner, Jr.<sup>1</sup>, <sup>1</sup>Mississippi State University, Mississippi State, MS 39762, and <sup>2</sup>U.S.Forest Service, Mississippi State, MS 39760

Twenty-five cultivars of cowpea (*Vigna unguiculata* L. Walp.) were previously screened to evaluate their ability to germinate at low (10EC), moderate (30EC), and high (40EC) temperature. Four cowpea cultivars were chosen to evaluate carbohydrate composition. The main sugars present in ungerminated cowpeas were sucrose (9 to 18 mg g<sup>-1</sup> seed), raffinose (1 to 3 mg g<sup>-1</sup> seed), and stachyose (5 to 10 mg g<sup>-1</sup> seed). In germinating seeds at 10EC, the cultivar with highest germination percentage showed the highest sucrose content in cotyledon tissue and the lowest sucrose content in embryo tissues, suggesting a faster and more efficient use of sucrose for germination and

seedling growth. Sucrose content was high in cultivars with low germination at low temperature, which indicated an accumulation of the sugar as it was not used for germination and development processes. This trend changed at higher temperature; the sucrose content in the embryo tissues decreased denoting that it have been used in the germination process. In germinating cowpea seeds, raffinose and stachyose were found at low temperature, but not at higher temperatures, which could be explained by the negative effect of low temperature on enzyme activity.

##### 2:30 INFLUENCE OF ORGANIC MANURES AND MULCH ON YIELD AND QUALITY OF MUSCADINE (*VITIS ROTUNDIFOLIA*)

Girish K. Panicker<sup>1\*</sup>, Ahmed Al-Humadi<sup>1</sup>, Cedric A. Sims<sup>1</sup>, Juan L. Silva<sup>2</sup>, and Frank B. Matta<sup>2</sup>, <sup>1</sup>Alcorn State University, Lorman, MS 39096, and <sup>2</sup>Mississippi State University, Mississippi State, MS 39762

Organic farming has become a welcome alternative in the field of agriculture due to the uncontrolled spread of organic pollutants (POPs) and their infiltration into the environment and our bodies. Muscadine (*Vitis rotundifolia* var. 'Summit') was grown in Geneva Double Curtian Trellies System on Memphis Silt Loam Soil (Typic Hapludalph, silty, mixed, thermic). Three treatments of organic manures (cow-C; poultry-P; cow poultry-CP) with pine mulch were applied in basins around each plant in a C.R design. Control treatment received regular inorganic fertilizers and traditional cultural practices. Biomass development, yield, and fruit and water qualities were evaluated. Percent ground cover, stem diameter, and yield were higher in organic plants. There was no significant difference in diameter, length, and degree brix of the fruit. No pathogenic organism from organic manures was found in fruits. Soil compaction was higher in control and it was lower in organic treatments due to the higher level of organic matter content. Higher concentrations of nitrate-N and P were noticed in the surface soil after manuring, but there was no trend in N or P enrichment of groundwater.

##### 2:45 CHALLENGING THREE POTENTIAL PHYTOACCUMULATORS FOR LEAD IN CONTAMINATED DREDGED SOIL

Ketia L. Shumaker\*, Elgenaid I. Hamadain, and Charles Rhyne, Jackson State University, Jackson, MS 39217

Recent studies indicate that plant species *Triticum aestivum*, *Sesbania exaltata*, and *Ipomoea lacunosa* are all potential hyperaccumulators for heavy metal lead (Pb) in hydroponic systems. The purpose of this study was to challenge the hyperaccumulation capability of these three plant species for Pb in contaminated dredged soil from a

confined disposal facility in Bayport, Wisconsin. Soil was sampled from three distinct locations. Laboratory soil analysis of these locations identified not only Pb but also 16 other metals. Ten plants of each species were grown in pots for four weeks under laboratory conditions. The plants were harvested and separated into roots and shoots for dry weight and Pb tissue analysis. Plant weights were compared to *S. exaltata* and *I. lacunose* grown in Pb-free hydroponic culture showing biomass reductions in plants grown in Bayport soil. All three plant species accumulated and concentrated a significant amount of Pb in the root tissue biomass. However, analysis of the shoot Pb content and concentration was not significant. Soil location played a significant role in the root Pb content and concentration. Data also showed relatively large variability among plants of the same species and soil location. This can be attributed in part to individual plant uptake. Overall, data suggest that all three plant species are able to tolerate highly contaminated soil conditions with the potential of accumulating significant amounts of Pb.

3:00 Break

3:15 INFLUENCE OF ORGANIC MANURES AND MULCH ON PHYSICOCHEMICAL AND MICROBIAL ATTRIBUTES OF TABLE MUSCADINES (*VITIS ROTUNDIFOLIA*)

Juan L. Silva<sup>1\*</sup>, Frank B. Matta<sup>1</sup>, Girish K. Panicker<sup>2</sup>, Ahmad Al-Humadi<sup>2</sup>, and Cedric A. Sims<sup>2</sup>, <sup>1</sup>Mississippi State University, Mississippi State, MS 39762, and <sup>2</sup>Alcorn State University, Alcorn State, MS 39096

Muscadines are grown in the Southeast US for table, juice, wine, and preserve products. An alternative to conventional farming is organic farming. This is desired by a segment of the consumers. However, new good agricultural practices guidelines call for the safe production of these crops. Muscadines (*Vitis rotundifolia* var. Summit) were grown and transported to the quality laboratory for analyses. Three treatments of organic manures with pine mulch (cow, C and poultry, P manures, and PC) were applied in basins around each plant in a C.R. design. Control treatment, CON, received regular inorganic fertilizers and traditional cultural practices. Treatments did not show any difference in total acidity (~0.22%), pH (~3.45), phenolics (~350 mg/L), pectin (~1.3 g/100 g), and soluble solids (~13.5 Brix). Sensory panelists did not find differences between treatments. The microbial profile of the fruit was similar, regardless of treatment. Several bacteria, molds, and yeast associated with spoilage of muscadines were found on the surface. However, no pathogenic organisms could be identified in fruit from any of the

treatments.

3:30 SCREENING ANTIOXIDANT PLANTS FOR PHYTOREMEDIATION ABILITY OF 2,4,6-TRINITROTOLUENE

Lovell O. Agwarambo<sup>1\*</sup>, Protiti Khan<sup>1</sup>, and Steve Larson<sup>2</sup>, <sup>1</sup>Tougaloo College, Tougaloo, MS 39174, and <sup>2</sup>Waterways Experiment Station, Vicksburg, MS 39180

Phytoremediation is a viable, effective, and economically attractive technology which uses plants to remove chemical contaminants from soil and ground water. A major munitions contaminant, TNT has been known to be remediated by several plants such as, *Myriophyllum aquaticum* (Parrot feather), and *Elodea*. This study focuses on screening plants which have natural antioxidant phytochemicals for their ability to remediate TNT from soil and ground water. Several plants containing different types of antioxidants (carotenoids, vitamin C, allyl sulfides, phyto-sterols, and vitamin E), were screened first for their antioxidant properties and then for their remediation abilities for TNT. Results for remediation abilities were analyzed by high performance liquid chromatography (HPLC). Results also suggested that many of the plants that had antioxidant properties were also able to remediate TNT, and therefore suggested that there may be a possible correlation between antioxidant capacities and remediation abilities of plants studied.

3:45 EFFECT OF FATTY ACID COMPOSITION AND TEMPERATURE ON SEED GERMINATION OF COWPEA CULTIVARS

Rafaela Carvajal, James O. Garner, Jr.\*, and Clarence E. Watson, Mississippi State University, Mississippi State, MS 39762

Twenty-five cowpea cultivars were screened for germination under stress condition (10 or 40EC) temperatures compared with the standard 30EC. After screening, four cultivars were selected to study seed lipid composition. The main fatty acids detected in cowpea seeds were palmitic acid (16:0), palmitoleic acid (16:1), stearic acid (18:0), oleic acid (18:1), linoleic acid (18:2), linolenic acid (18:3), and arachidic acid (20:0). Cultivars with higher germination percentage had higher stearic, oleic, and linolenic acid content in ungerminated seeds. In germinating seeds of all cultivars, the proportion of unsaturated fatty acid was higher than saturated fatty acid at lower temperatures. The 18:2/18:1 and 18-carbon unsaturated to 18-carbon saturated ratio at 10EC, were slightly higher in the cultivars with higher germination percentage, and were significantly higher at 30EC.

4:00 Divisional Business Meeting

**CELLULAR, MOLECULAR AND  
DEVELOPMENTAL BIOLOGY**

Chair: Roy J. Duhé, University of Mississippi  
Medical Center

Vicechair: Ross Whitwam, Mississippi University for  
Women

**THURSDAY MORNING**

Emerald Room

8:30 Special Joint Session with the Science Education  
Division

Introduction; Howard Walters and Roy J. Duhé, J.L. Scott  
Marine Education Center and Aquarium, Biloxi, MS  
39530, and University of Mississippi Medical Center,  
Jackson, MS 39216

8:45 STRUCTURE VISUALIZATION IN  
BIOCHEMISTRY EDUCATION: SEEING IS  
BELIEVING

Robert Bateman, University of Southern Mississippi,  
Hattiesburg, MS 39406

With the advent of powerful desktop and laptop  
personal computers has come a wealth of computational  
tools that can aid in the understanding of chemical and  
biochemical concepts. This talk will survey several of the  
free structure visualization software packages that are  
currently used in biochemistry instruction. The emphasis  
will be on the most effective uses of these tools both inside  
and outside the lecture classroom.

9:30 Introduction; Roy J. Duhé

Session 1: "Molecular Insights from Biophysical  
Techniques"

9:45 DETECTION OF PROTEASE ACTIVITY WITH  
A BIOSENSOR

Daryl Pollard<sup>1</sup>, Patrina Thompson<sup>2</sup>, Amy Denson<sup>1</sup>, Steven  
Adamson<sup>1</sup>, Newton Fawcett<sup>1</sup>, and Jeffrey Evans<sup>1\*</sup>, <sup>1</sup>Univer-  
sity of Southern Mississippi, Hattiesburg, MS 39406, and  
<sup>2</sup>Alcorn State University, Lorman, MS 39096

The quartz crystal microbalance (QCM) is a  
biosensor that can measure mass changes accompanying  
biochemical processes. A decrease in mass occurring on the  
biosensor's quartz surface is sensed as an increase in  
vibrational frequency of the crystal. Approximately a one  
Hz increase in frequency represents a 1 nanogram mass

decrease on the crystal. We examined whether the QCM  
biosensor could detect proteases by detecting the change in  
mass of protein that accompanies proteolytic cleavage. In  
testing for protease activity we first attached the protease  
substrate casein to the surface of the biosensor. When the  
casein coated biosensor was incubated with the protease  
trypsin, a mass change occurred as casein was released  
from the biosensor. This mass change representing protease  
activity was detected by the biosensor.

10:00 INTERACTION OF AN HIV PEPTIDE WITH  
MODEL MEMBRANES

Yuko Tsutsui\*, Slobodanka D. Manceva, and Peter Butko,  
University of Southern Mississippi, Hattiesburg, MS 39406

Trans-activator protein (TAT) is a protein  
produced by HIV. This peptide is thought to have a trans-  
location activity and can carry fused molecules into the  
cytosol of the cell by forming an inverted micelle. Our  
interest was to test the hypothesis if this peptide can trans-  
locate itself through phospholipid membranes. The peptide  
used in this study has tryptophan (Trp), an aromatic amino  
acid, as the end of the peptide chain so we were able to do  
studies of fluorescent peptide/lipid interactions. In this  
study we used large unilamellar vesicles (LUVs) as model  
membranes. Studies done with neutral (phosphatidyl  
choline-PC) and positively charged (10% phosphatidyl  
glycerol PG/PC) LUVs suggest that the peptide lipid  
interactions are due to the electrostatic forces between  
negatively charged peptide and positively charged LUVs.  
Experiments done on release of fluorescence dye entrapped  
in LUV show that a high concentration of the peptide was  
necessary in order for 50% dye to be released, implying that  
the peptide does not destroy LUVs by making a pore. By  
using quenching of the Trp fluorescence with acrylamide  
we obtained a quenching constant, which was the same as  
the one acquired for free Trp in a solution. These two  
studies show that the peptide does not insert in the lipid  
membrane, and it rather destroys them through a different  
mode of action.

10:15 MODE OF ACTION OF *BACILLUS THURINGI-  
ENSIS* d-ENDOTOXIN CYT1A: DETERGENT  
OR PORE FORMER?

Slobodanka D. Manceva<sup>1\*</sup>, Marianne Pusztai-Carey<sup>2</sup>, Paul  
Russo<sup>3</sup>, and Peter Butko<sup>1</sup>, <sup>1</sup>University of Southern  
Mississippi, Hattiesburg, MS 39406; <sup>2</sup>Case Western  
Reserve University, Cleveland, OH; and <sup>3</sup>Louisiana State  
University, Baton Rouge, LA

Cyt1A is a d-endotoxin from *Bacillus thuringi-  
ensis* var. *israelensis*, which is highly toxic to the Diptera  
larvae. It is used as an environmentally safe insecticide,  
although its cytolytic mechanism is a subject of

controversy. It is believed that it makes pores or cation-selective channels in lipid membranes. However, a mass of evidence collected in the last few years does not support that hypothesis. We propose that this protein commences cell death by destroying the cell membrane in a detergent-like manner, rather than by inserting into the membrane and forming a pore. In this work we tested our hypothesis by employing fluorescence photobleaching recovery (FPR), dynamic light scattering (DLS) and electron microscopy (EM) to study Cyt1A-induced changes in size distributions of large unilamellar vesicles (LUV). Upon addition of the toxin to the LUV with a diameter of 100 nm, a new population of lipid particles with a diameter of 54 nm appeared. Since no change in the vesicle size is expected when a pore is formed in its membrane, our results give support to the detergent-like model of Cyt1A's action

#### 10:30 INHIBITION OF RGS PROTEINS

Leighton Janes<sup>1\*</sup>, R.R. Neubig<sup>2</sup>, and H.E. Outlaw<sup>1</sup>, <sup>1</sup>Delta State University, Cleveland, MS 38733, and <sup>2</sup>University of Michigan Medical School, Ann Arbor, MI 48103

Inhibition of RGS interactions can lead to assessing RGS function and specificity in cells and provide a basis for understanding mechanisms of therapeutic drugs that target RGS interactions. RGS inhibitor proteins include YJ13 (lactam), YJ14 (lactam), and YJ16 (BU)-3. Of the peptides tested, YJ13 is the most potent inhibitor of RGS stimulation and is the best fit for the Alpha subunit binding pocket. The inhibitor peptides are more specific to RGS4 than RGS8. YJ13 may be modified to better inhibit RGS stimulation with more specificity.

10:45 Break

#### Session 2: "The Evolution of Biological Catalysis"

11:00 RNA STRUCTURE PROBING AND ANALYSIS  
Rishi Agarwal\* and Faqing Huang, University of Southern Mississippi, Hattiesburg, MS 39406

The "RNA World" hypothesis describes a pre-protein world where RNA was able to both carry genetic information (later evolved into DNA) and act as biocatalysts (most of them replaced by proteins). To support the RNA world hypothesis, numerous artificial RNA enzymes (ribozymes) have been isolated by the powerful combinatorial technique called SELEX. Structural and functional analysis of RNA can provide mechanistic basis for RNA catalysis. A self-capping ribozyme named Iso6, an RNA previously isolated in vitro, was employed to investigate the various structural changes that may occur upon binding with divalent metal ions, primarily Ca<sup>2+</sup>. Structural probing of Iso6, i.e., using a variety of chemical

and enzymatic probes, was used to search for possible sites of protection, binding sites or conformational changes. Initial experiments were conducted by searching for optimal chemical and enzyme concentrations by which Iso6 was either cut randomly or specifically. The specific cuts of RNA could provide structural information of Iso6, while random digestion of Iso6 yielded markers to map nucleotide locations. Reagents used included chemicals Pb<sup>2+</sup>, DMS, and DEPC and enzymes RNase T1 and nuclease S1. Different sizes of RNA fragments were fractionated by denaturing polyacrylamide gel electrophoresis, and quantitation of individual RNA bands was achieved by phosphorimaging. Many probing experiments under different conditions were conducted. The results demonstrated applicability of our RNA probing methods to the investigation of RNA structure and mechanism in general. However, we have yet to locate specific structural and conformational changes upon metal and substrate binding. Further experiments will be necessary to reveal the structural information from Iso6 RNA.

#### 11:15 IN VITRO EVOLUTION OF A THIOESTER SYNTHASE RIBOZYME

Tricia M. Coleman\* and Faqing Huang, University of Southern Mississippi, Hattiesburg, MS 39406

Thioesters are important intermediates in the metabolism of modern organisms. Coenzyme A (CoA), a common coenzyme, participates in various biochemical pathways, functioning through the formation of thioesters via its sulfhydryl group. Our lab has previously isolated RNA sequences capable of catalyzing the synthesis of CoA, NAD, and FAD from their respective precursors, thereby supporting the availability of these coenzymes in an 'RNA world.' In order to demonstrate the utility of these coenzymes as well as the plausibility of thioester synthesis in an RNA world, an iterative in vitro evolution procedure was used to identify a series of catalytic RNAs (ribozymes) with thioester synthase activity. Active sequences were recovered from a large heterogeneous pool of 30-, 60-, 100-, and 140-nucleotide random-sequence, coenzyme A-linked RNA molecules. Biotinyl adenylate was chemically synthesized and used as a reactant for the thioesterification reaction, the end result of being the formation of a covalent C-S bond between the carboxyl of biotin-AMP and the sulfhydryl of CoA. Active ribozymes from all four different size pools were isolated and product formation has been confirmed by streptavidin gel mobility shift assays, HPLC analysis and mass spectroscopy. Ribozymes were selected with a series of divalent metal cofactors as well as imidazole. Which of these metals is required for catalysis is being determined and kinetic parameters are being investigated.



11:30 SCREENING OF *ARABIDOPSIS THALIANA* INSERTION MUTANTS FOR A KNOCKOUT IN THE SULFITE REDUCTASE GENE

Sudha Sankaran\*, Gordon C. Cannon, and Sabine Heinhorst, The University of Southern Mississippi, Hattiesburg, MS 39406

Chloroplasts are semi-autonomous organelles much like the mitochondria, having their own genome. Their DNA is compacted into nucleoids by specific DNA binding proteins, and structure and morphology of these nucleoids are vital to the different roles these complexes play in the replication and transcription of the chloroplast genome. One protein has been characterized that is associated with soybean (*Glycine max*) chloroplast nucleoids: the DNA compacting protein DCP68, which was also identified as a sulfite reductase. The amino acid sequence deduced for this protein has approximately 90% homology with sulfite reductase from *Arabidopsis thaliana* and other plants. We are currently searching for an *A. thaliana* line that has a knockout insertion in its sulfite reductase gene to study the biological effects of this mutation on nucleoid structure and function. First-round screening of *A. thaliana* mutant pools with gene-specific primers has yielded six potential knockout candidates. Current sequencing efforts are geared towards elucidating the location of the insertions and assessing their usefulness for the planned study.

11:45 THE RATE ENHANCEMENT EFFECTS BY ENCAPSULATION OF RIBULOSE-1,5-BISPHOSPHATE CARBOXYLASE WITHIN A CARBOXYSOME

Eric B. Williams\*, Sabine Heinhorst, and Gordon C. Cannon, University of Southern Mississippi, Hattiesburg, MS 39406

The encapsulation of ribulose-1,5-bisphosphate carboxylase (RuBisCO) within a carboxysome has been shown to increase the enzyme's catalytic capabilities. One hypothesis states that the putative enhancement of the RuBisCO activity within the carboxysome results from the enzyme's co-localization with carbonic anhydrase (CA), which provides saturating levels of CO<sub>2</sub> for the carboxylation reaction. To test this hypothesis, various concentrations of a potent CA inhibitor were used to inhibit the endogenous CA that is thought to be located within the carboxysome. In addition, exogenous CA was added to carboxylation reactions to determine if there was any enhancement of the rate of carboxysomal CO<sub>2</sub> fixation. Both approaches showed no significant differences in RuBisCO activity. The possibility that the carboxysome shell is differentially permeable for CO<sub>2</sub> and its competitor for the active site of RuBisCO, O<sub>2</sub>, was examined. Assays

were performed to distinguish the differences in RuBisCO catalytic activity under controlled atmospheric conditions of 100% and 0% O<sub>2</sub> to test whether selective exclusion of oxygen plays a significant role in the increase of the catalytic capabilities of RuBisCO by the carboxysome shell.

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THURSDAY AFTERNOON

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Emerald Room

2:00 Session 3: "Poster Party"

PHYSICAL AND CHEMICAL PROPERTIES OF LIDOCAINE-INCORPORATED HYDROPHILIC FILMS PRODUCED VIA HOT-MELT EXTRUSION

Lakeshia Moore\* and Michael Repka, University of Mississippi, University, MS 38677

Hot-melt extrusion is one of the most widely used techniques in the industry of plastics. Today, more than one-half of all plastic products are produced by this method. Hot-melt extrusion technology is also a viable process to produce thin, flexible, and stable hydrophilic and hydrophobic films. For pharmaceutical applications hot-melt extrusion offers many advantages over the traditional ways of producing films. Shorter and more efficient processing times to the final product, environmental advantages due to the elimination of organic solvents, less labor and equipment demands, favorable cost, and less time of the drug subjected to heat are only a few of the many rewards. Hot-melt extrusion equipment consists of an extruder, a hopper, melting zones, dies, collection equipment, and monitoring tools. In this particular project hot-melt extrusion is utilized to prepare hydroxypropyl cellulose (HPC) and hydroxypropyl methylcellulose (HPMC) films containing lidocaine as a model drug.

THE EFFECT OF EAT-16 AND GPB2 ON THE COMPLEX OF M2 AND GAO-1 ON SF9 CELLS

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The goal of this project was to determine if *Caenorhabditis elegans* GPB2-EAT16 acts as a bg in hormone signaling. Complex formation of EAT16-GPB2 was demonstrated and expression characteristics for the M2 muscarinic receptor in SF9 cell membranes were optimized.

MOLECULAR CLONING OF HOXA1 FROM RAT FETAL BRAIN TISSUE

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The vertebrate hindbrain is subdivided into a series of compartments called rhombomeres. During development of the hindbrain certain genes are expressed to differentiate the compartments. One gene in particular, *Hoxa1*, is expressed in the hindbrain exclusively during the period of neural tube formation determining segmentation and identity in the developing hindbrain and associated structures. It is expressed in the embryo, in the adult intestine and in tumors, specifically in carcinoma cells. According to recent studies, knockout of *Hoxa1* will cause segmentation defects leading to the partial deletion of rhombomeres. For example, in the rat, the misexpression of *Hoxa1* leads to ectopic differentiation of vestibuloacoustic (VII) motor neuron in rhombomere 2. Our objective was to efficiently clone *Hoxa1* using RNA from rat fetal brain tissue. Rt-PCR results revealed the amplicon of *Hoxa1* was obtained using random hexamer, oligo-dT, and the reverse primer of *Hoxa1* with a denature temperature of 55EC. Our amplicon was exactly 750 bp, the size needed for transformation. PCR results revealed an amplicon at 1200 bp with a denature temperature of 60EC using only the random hexamer RNA. After excising the amplicon and transforming, the cells were placed in a midprep for growth. We concluded that our cDNA successfully transformed. Our ability to clone this gene will enable us to determine its role in cancer and the consequent opening of new frontiers in understanding molecular mechanisms in cancer development, progression and therapy.

#### EXPRESSION AND PURIFICATION OF ACTIVATION DOMAINS FROM A EUKARYOTIC TRANSCRIPTION FACTOR

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The most characteristic requirement of gene control in multicellular organisms is the execution of precise developmental decisions so that the right gene is activated in the right cell at the right time during the development of many cell types that all form a multicellular organism. Often this control is at the level of transcription of genes. The main goal of the project is to analyze a protein that controls transcription of some genes. This protein called SPH Binding factor (SBF), contains two different regions that are necessary to stimulate transcription of different types of genes. We cloned one of these regions into a plasmid in order to express it in *Escherichia coli*. To clone specific DNA fragments in a plasmid vector, the fragment was produced and then inserted into the vector DNA. Restriction enzymes and

DNA ligases were used to produce these recombinant DNA molecules. Once the clone of cells bearing the desired segment of DNA was isolated, a large amount of this protein fragment of SBF was purified so that further study could take place.

#### 7-KETOCHOLESTEROL INHIBITS IL-1RA IN HUMAN MONOCYTES

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Interleukin-1 (IL-1) is a pro-inflammatory cytokine that has been shown to be involved in early atherogenesis by activating endothelial cells and monocytes. Its biologic effects are regulated at multiple levels including the coordinate expression of a novel receptor antagonist, IL-1Ra, which binds IL-1 receptors without transducing a signal. IL-1Ra exists in cell associated and secreted forms and is induced in monocytes by bacterial lipopolysaccharide (LPS) and phorbol-13-myristate acetate (PMA). Proatherogenic oxysterols are known to induce IL-1 in monocytes. The intracellular isoform inhibits IL-1-induced transcription through a non-receptor mediated mechanism. We investigated the effect of pro-atherogenic mediators on monocyte IL-1Ra production. Hypothesis: icIL-1Ra is down-regulated by oxysterols (7-ketocholesterol, KS) which facilitate the atherogenic process. Methods: Human monocytic cell lines (THP-1, U937) were plated at 1 M/ml in RPMI with 10% FBS in twenty-four well plates, and stimulated for 48 hrs with PMA and/or LPS with and without KS. A sandwich ELISA employing commercially available antibodies was used to measure supernatant and cell-associated IL-1Ra. Results: As expected in U937s, PMA and/or LPS induced high levels of IL-1Ra. KS (40 µg/ml) inhibited IL-1Ra production, 87%, 43%, and 83% in PMA, LPS, or PMA/LPS-stimulated cells, respectively. In THP-1 cells, KS also inhibited PMA and LPS induced IL-1Ra. Inhibition of secreted IL-1Ra was primarily seen in U937 cells. Both forms were inhibited in THP-1s. The atherogenic effects of oxysterols include inhibition IL-1Ra production in monocytes, inducing an imbalance of IL-1Ra:IL-1 atherogenesis.

#### TOLERATED XENOGRAPHS USING VIRUS STEALTH TECHNOLOGY

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The objective is to examine the structure and function of MHC Class I transmembrane and cytoplasmic

domains. Reduction of pig MHC class I proteins increases human NK cell-mediated lysis and decreases human T cell-mediated lysis. It was further noted that ICP47 is able to inhibit MHC cell-surface expression.

#### DETERMINATION OF GLUTAMATE DEGRADATION BY *YERSINIA PESTIS*

Shaneka Simmons\* and Robert Brubaker, Jackson State University, Jackson, MS 39217, and Michigan State University, East Lansing, MI 48824

Essential virulence genes such as V antigen and Yersinia Outer Membrane Proteins (Yops) are carried on an ~70-kb low-calcium-response (Lcr) plasmid. These virulence genes play a role in the blockage of inflammation and the expression of cytotoxins within host cells. Duplication of the amount of  $\text{Ca}^{2+}$  (2.5 mM) and  $\text{Mg}^{2+}$  (1.5 mM) present in blood permits vegetative growth of *Y. pestis* in artificial media with repression of V antigen and other virulence factors encoded on the Lcr plasmid. Bacteriostatis and production of virulence factors occur in intracellular fluid that lacks  $\text{Ca}^{2+}$  and contains ~20 mM  $\text{Mg}^{2+}$ . Upon loss of the Lcr plasmid, *Y. pestis* acquires the ability to grow at 37EC without added  $\text{Ca}^{2+}$  and does not produce Yops or V antigen. To address the role that the low-calcium-response mechanism plays in host cell death, several experiments were conducted. The Sigma Plot computer program was used to analyze and assign the best linear fit to graphs pertaining to Lcr nutritional requirements. Maximum optical densities were achieved through the replacement of  $\text{Na}^+$  with  $\text{K}^+$  or  $\text{Li}^+$ . Combination of  $\text{Na}^+$  and L-glutamate resulted in toxicity of Lcr cells due to evident loss of aspartase. These results suggest that in the absence of  $\text{Ca}^{2+}$  and presence of  $\text{Mg}^{2+}$ ,  $\text{Na}^+$ , and L-glutamate *Y. pestis* undergoes abrupt bacteriostatis. Since *Y. pestis* lacks aspartase activity in this environment, the bacteria converted L-glutamate into aspartic acid during the time of bacterial restriction. In an effort to rid itself of aspartate, the bacteria may release excess aspartic acid into host cells. Since excess aspartate is harmful to the host, it is possible that the host converts aspartic acid back into glutamic acid, causing constant conversions of these amino acids between bacteria and victim, at the victim's expense. Therefore, cell death could possibly be associated with anti-inflammation, cytotoxicity, and the constant effort of the host to convert aspartate back into glutamate.

#### *IN VITRO* CYTOTOXICITY OF HUMAN LIVER CARCINOMA CELL LINE (HEPG2) EXPOSED TO CADMIUM CHLORIDE

Shaneka Simmons\* and Barbara A. Wilson, Jackson State University, Jackson, MS 39217

Cadmium, a naturally occurring heavy metal, is

widely used in industry and consumer products. It is expelled into air, water, or soil from the burning of fossil fuels and spills at toxic or hazardous waste disposal sites. Cadmium chloride has been classified a human carcinogen. Ingested cadmium accumulates in the kidney. Elevated levels of respiratory, prostate, and other cancers have been shown in persons occupationally exposed to cadmium. The goals of this project are: (1) to determine the acute toxicity cadmium chloride ( $\text{CdCl}_2$ ) using the trypan blue dye exclusion and lactate dehydrogenase (LDH) assays; and (2) to determine the cellular response mechanism of  $\text{CdCl}_2$  in human hepatic carcinoma cell (HepG2) lines; and (3) to assess the genotoxic effects of  $\text{CdCl}_2$  in HepG2 cells. Based on data collected for determining percent (%) cell viability at the 24-, 48-, and 72-hour exposure, the experimental LC50 value for cadmium chloride appears to range between 1.5–2.5 ppm. These LC50 values represent the concentrations of chemicals required to produce 50% cell death. Western blot analysis was used to evaluate p53, HSP70, c-fos and Bcl-2 cellular protein expression. The findings provided in this study indicate a possible mechanism for  $\text{CdCl}_2$  cytotoxicity effects in HepG2 cells. This work is supported by NSF-STARGE.

#### ACUTE CYTOTOXICITY AND CELL MEDIATED RESPONSE IN HUMAN LIVER CARCINOMA CELL LINE (HEPG2) FOLLOWING EXPOSURE TO 2,4,6-TRINITROTOLUENE

Joyce Y. Belcher\* and Barbara A. Wilson, Jackson State University, Jackson, MS 39217

2,4,6-trinitrofluorene is an explosive used in military shells, bombs and grenades. It enters the environment through liquid and solid wastes that result from manufacturing, processing, or recycling of the compound in military arsenals. The goals of this project are: (1) to determine the acute toxicity of 2,4,6-trinitrofluorene (TNT) using the trypan blue dye exclusion and lactate dehydrogenase (LDH) assays; (2) to determine the cellular response mechanism of TNT in human hepatic carcinoma cell (HepG2) lines; and (3) to assess the genotoxic effects of TNT in HepG2 cells. Based on data collected for determining percent (%) cell viability at the 24-, 48-, and 72-hour exposure, the experimental LC50 value for TNT appears to range within 6 and 7 ppm during the 48 and 72 hours of exposure. These LC50 values represent the concentrations of chemicals required to produce 50% cell death. Western blot analysis was used to evaluate NFkB gene expression. The tumor suppressor gene product p53, which is a critical mediator of the cellular response to DNA damage, was also evaluated in HepG2 cells treated with TNT. Findings provided by this work may indicate a possible cellular pathway by which TNT causes cytotoxicity



in HepG2 cells. This research is supported by the Office of Naval Research for Interns in Biomolecular Sciences.

#### CELL SURVIVAL AND CELLULAR RESPONSE MECHANISMS OF HUMAN LIVER CARCINOMA CELL LINES (HEPG2) TREATED WITH ARSENIC TRIOXIDE

Howard Loving\* and Barbara A. Wilson, Jackson State University, Jackson, MS 39217

People working or living near industries and facilities that manufacture various products may be exposed to higher than background levels of hazardous substances. Arsenic, a naturally occurring metal, is released into the air when contaminated materials are burned. It enters the body through inhalation, ingestion, and direct contact. The maximum contaminant level for arsenic exposure is 50 µg/L in humans. Health effects associated with arsenic exposure include diabetes, cardiovascular disease, hearing loss, and neurological and neurobehavioral effects. The maximum contaminant level for arsenic exposure is 50 µg/L. The goals of this project are: (1) to determine the toxicity of arsenic trioxide using the lactate dehydrogenase (LDH) assay; (2) to determine the cellular response mechanism of arsenic in human hepatic carcinoma cell line (HepG2); and (3) to assess the genotoxic effects of arsenic in HepG2 cells. To conduct this experiment, HepG2 cells were seeded at  $1 \times 10^6$  cells/ml and exposed to the chemicals for 48 hours. LDH analysis was used to determine the lethal concentration (LC<sub>50</sub>). Total protein concentration was determined using the Bradford Assay. Western blot analysis was used to evaluate p53 cellular protein expression. And, apoptosis was assessed by DNA fragmentation. Results indicated that the LC<sub>50</sub> value for arsenic trioxide was shown to be 11–12.5 ppm. The tumor suppressor gene product p53, which is a critical mediator of the cellular response to DNA damage, was expressed after treatment of HepG2 cells with arsenic trioxide. This work is supported by NSF-STARGE and NIH-RCMI.

#### INDUCTION PROFILE AND CELLULAR RESPONSE MECHANISMS OF HUMAN LIVER CARCINOMA CELL (HEPG2) LINE TREATED WITH ARSENIC TRIOXIDE, CADMIUM CHLORIDE, AND 2,4,6-TRINITROTOLUENE

Barbara A. Wilson\* and Cedrick Whitaker, Jackson State University, Jackson, MS 39217

Metals are an important and emerging class of carcinogens as are residues from military arsenals. At least three metals, arsenic trioxide and cadmium chloride have been shown to be very potent carcinogens in laboratory animals. All three of these compounds have been classified as human carcinogens. The goals of this project are to: (1)

to determine the acute toxicity of arsenic trioxide (As<sub>2</sub>O<sub>3</sub>), cadmium chloride (CdCl<sub>2</sub>) and 2,4,6-trinitrotoluene (TNT) using the trypan blue dye exclusion and lactate dehydrogenase (LDH) assays, and (2) to determine the cellular response mechanism of As<sub>2</sub>O<sub>3</sub>, CdCl<sub>2</sub>, and TNT in human hepatic carcinoma cell line (HepG2). Based on data collected for determining percent (%) cell viability the experimental LC<sub>50</sub> value for As<sub>2</sub>O<sub>3</sub> appears to range between 6 and 12 ppm after 48 hours exposure. For TNT the LC<sub>50</sub> value appears to range within 6 and 7 ppm between 48 and 72 hours of chemical exposure, and for cadmium chloride the LC<sub>50</sub> value appears to range between 1.5 to 2 ppm. To assess the acute cytotoxicity and cellular response mechanism of As<sub>2</sub>O<sub>3</sub>, CdCl<sub>2</sub>, and TNT, human liver carcinoma cells (HepG2) were exposed to each compound at various time intervals. Total protein concentration was determined using the Bradford Assay. Western blot analysis was used to evaluate cellular protein expression. Programmed death was assessed by DNA fragmentation. The tumor suppressor gene product p53 induction profile was also determined. This work is supported by NSF-STARGE and the Office of Naval Research for Interns in Biomolecular Sciences.

#### EFFECT OF THREE CHLORINATED HYDROCARBONS ON DNA DAMAGE IN MICE LIVER CELLS

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The decay of the environment and the resultant effect on the human health grows daily. Pesticides and several cleaning products are used in much higher quantities than are actually needed. Halogenated hydrocarbons have long been regarded as pharmacological and toxicological entities and are widely used in industry as solvents, degreasing agents, plasticizers and chemical intermediates in the manufacturing of other chemicals (Tafazoli and Kirsch-Volders, 1996). Rodent animal bioassays are considered to be valuable tools for investigating toxicological effects of environmental pollutants. In the present study five different concentrations of 1,1-dichloroethane; 1,1,1trichloroethane and 1,1,2,2-tetrachloroethane were used to test the DNA damage in mice liver cells. Ethanol was used as the solvent control. The procedures of Mertens and Hammersmith (1995) for DNA extraction and gel electrophoresis were followed. All three chlorinated hydrocarbons showed an increased migration of DNA in electrophoresis when compared with the control.

#### INHIBITION OF HEPATIC CYTOCHROME P450 BY

### CHLORPYRIFOS AND METHYL PARATHION IN NEONATAL RATS

Patrick B. Kyle\*, K.E. Schneider, R.C. Baker, and R.E. Kramer, University of Mississippi Medical Center, Jackson, MS 39216

The adult pattern of hepatic cytochrome P450 enzymes is imprinted neonatally. Organophosphorus compounds, through induction and oxidative desulfuration-dependent inactivation of P450 with subsequent changes in endogenous hormone metabolism, might cause changes in the levels and pattern of cytochrome P450 in neonates which could persist into adulthood. Studies were performed to examine the effects of chlorpyrifos (2 mg/kg) and methyl parathion (5 mg/kg) on hepatic P450s of neonatal rats. Pups of each sex were treated dermally once daily from postnatal day 3 to postnatal day 15. The rate\* of NADPH-dependent conversion of methyl parathion to methyl paraoxon (\*nmol/min/mg prot) in microsomes from livers of control pups decreased over 20 minutes from  $0.91 \pm 0.07$  to  $0.34 \pm 0.22$ ; an effect consistent with desulfuration-dependent inactivation of P450. Neither rate was affected by methyl parathion treatment ( $0.74 \pm 0.06$ ,  $0.46 \pm 0.16$ ). In contrast, chlorpyrifos treatment inhibited the initial rate by ~45% ( $0.51 \pm 0.04$ ) and the final rate by ~90% ( $0.05 \pm 0.03$ ); the latter effect suggesting that chlorpyrifos is a more efficient suicide substrate than is methyl parathion. In contrast, both chlorpyrifos ( $0.14 \pm 0.01$  versus  $0.09 \pm 0.01$  nmol/mg prot) and methyl parathion ( $0.12 \pm 0.01$ ) increased total hepatic microsomal cytochrome P450 content. These data indicate that the effects of organophosphorus compounds on hepatic P450s reflects a combination of inhibition and induction. The mechanisms and specific isozymes involved remain to be identified. (Grant R06/CCR419466 from the CDC).

### A DISCUSSION OF GLUTAMINYL CYCLASE IN THE RAT BRAIN

Kimberly Cornelius, Alcorn State University, Alcorn State, MS 39069

Glutaminyl cyclase also known as QC, is an enzyme that catalyzes the cyclization of N-terminal glutamine of peptides into pyroglutamic acid and releases the amide nitrogen in the form of ammonia. It has been identified in plants, bacteria, bovine and porcine pituitary, and secretory vesicles from brain, adrenal, medulla, and B-lymphocytes. Protein purification, antibody purification, gel electrophoresis, western blotting, immunofluorescent staining, and light microscopy, were utilized for this research. The light microscopy work was an attempt to locate QC in the sections of a rat. The sections were probed with a primary antibody that recognizes QC as well as a secondary antibody to fluoresce the site of the recognized

protein. The Western Blots of the brain tissue show that QC is present in the brain. While the microscopy work shows mixed results. To get a better understanding of what is going on, a more comprehensive microscopy study must be performed as well as different blotting techniques. QC is still a mystery, while peptidyl-glycine alpha-amidating monooxygenase (PAM), a similar protein has been well characterized.

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## FRIDAY MORNING

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Emerald Room

Session 4: "Molecular Toxicology"

### 8:30 THE EFFECT OF HUMIC ACID ON MICROBIAL ECOTOXICITY OF 1-AMINOPYRENE DURING SOLAR PHOTOLYSIS PROCESS

Ana L. Balarezo, Veleka N. Jones, and Huey-Min Hwang\*, Jackson State University, Jackson, MS 39217

1-Aminopyrene (1-AP), a polycyclic aromatic hydrocarbon (PAH) compound, is a major metabolite during biotransformation of 1-nitropyrene by microflora in natural environment and in the guts of animals and humans. Under UV-A irradiation, 1-AP has been shown to cause light-induced DNA single stranded cleavage. The humic substances in aquatic ecosystems can influence the bioavailability, toxicity and fate of organic xenobiotics. Therefore, photochemical fate and effect of PAHs in natural aquatic environments may differ significantly across sites. The objectives of this study are to assess the effect of HA on microbial ecotoxicity of 1-AP during photolysis process. Microbial ecotoxicity of 1-aminopyrene (1-AP) during different time courses in the presence and absence of humic acids (HA) was measured with spread plate counting and microbial mineralization of  $^{14}\text{C}$ -D-glucose. At 1-AP concentration of 10  $\mu\text{M}$ , microbial heterotrophic activity was significantly inhibited in the presence of HA (20-60 ppm) in light and in darkness. Exposure to HA in light and darkness, however, does not inhibit bacterial viability at the HA concentration range administered. Therefore, inhibition on microbial activity in darkness could have been caused by the decrease of glucose availability, instead of toxicity of HA. Funding support: (1) NIH-RCMI 1G12RR12459-01 and NIH-MBRS S06GM08047 (to JSU); and (2) U.S. Department of the Army #DAAD 19-01-1-0733 to JSU.

### 8:45 LIGHT-INDUCED DNA DAMAGE BY COSMETICS AND SKIN CARE PRODUCTS

Karishma A. Parekh\*, Yuguo Jiao, and Hongtao Yu, Jackson State University, Jackson, MS 39217

Skin care products and cosmetics are used on a regular basis for appearance, conditioning, and protection. It is known that skin care products are capable of causing mild allergic reactions but previous studies are inconclusive on the effects of these chemicals. These products are usually a complex mixture of chemicals with distinct properties. Especially, since the chemicals in the skin are subject to light irradiation, the combination effect of light and these chemicals needs to be studied. In this research, we have identified ten chemicals found in cosmetics and skin care products that may cause damage to DNA in combination with repeated exposure to UVA radiation. The chemicals used in these experiments are: methylparaben, 2-hydroxy-4-methoxy-benzophenone, 2-phenylbenzimidazole, 4-methoxy-cinnamic acid, azulene, vitamin E, vitamin E acetate, 4-chloro-*m*-phenylenediamine, 2,4-toluenediamine, and 4-amino-2-nitrophenol. Upon UVA irradiation, 2-phenylbenzimidazole, azulene, and 4-chloro-*m*-phenylenediamine cause DNA single strand cleavage. The other chemicals show little variance from the control and are therefore considered not causing DNA damage. The UVA-induced cleavage of supercoiled plasmid DNA is dependent upon concentration of these chemicals and UVA dosage. A longer irradiation time or higher concentration induces more DNA cleavage. Since the combination of these chemicals and UVA light induce DNA cleavage, they can be more toxic and carcinogenic to humans when in combination with UVA light. This research is in part supported by the NASASHARP<sup>+</sup> Program and the US Army Research Office DAAD 19-01-10733 to JSU.

9:00 SELECTIVE CYTOTOXICITY OF ARSENIC AND CADMIUM ON HEPG2 AND RAT PRIMARY LIVER CELLS: DIFFERENTIAL RESPONSE TO PIFITHRIN

Rowshan Begum\* and Ibrahim O. Farah, Jackson State University, Jackson, MS 39217

Pifithrin or PFT-a is a reversible inhibitor of p53 function. In response to genotoxic agents p53 instructs the cells to perform DNA repair or to commit suicide. Our objective was to study the degree of differential protection PFT-a offers to primary rat liver cells and HepG2 cells to toxic effects of arsenic and cadmium. Following growth to 90% confluency under standard conditions, cells were exposed to toxic agents simultaneously with PFT-a (10 ppm). Surviving cells were detected following exposure to fluorescein diacetate (FDA) and ascent fluorospectroscopy. Percent survival was calculated using regression analysis. Mean LC-50 of HepG2 cells following exposure to arsenic was  $13.7 \pm 1.0$  ppm with PFT-a and  $13.4 \pm 0.6$  ppm without it. For rat primary liver cells, LC-50 was found to be  $670 \pm 2.5$  ppm with and  $573.15 \pm 1.9$  ppm without PFT-

a. With cadmium, LC-50 for HepG2 cells was found to be  $6.95 \pm 2.5$  ppm with PFT-a and  $7.35 \pm 1.9$  ppm without it. In rat primary liver cells, LC-50 was found to be  $57.72 \pm 0.8$  ppm and  $58.1 \pm 5.5$  ppm, respectively with and without PFT-a. Results at this level for rat primary liver cells and arsenic were significant. Inherent response of the two cell lines to the toxic agents were also apparent. Use of Pifithrin as a protective agent for normal cells from the side effects of cancer chemotherapy is thus suggestive.

9:15 THE SNXA1 MUTATION OF *ASPERGILLUS NIDULANS* AFFECTS THE DNA DAMAGE CHECKPOINT

James S. Goode, Ann C. Long, and Sarah Lea McGuire\*, Millsaps College, Jackson, MS 39210

The DNA damage checkpoint functions to protect cells from mutation by halting progression into mitosis in the presence of damaged DNA. One mechanism by which this checkpoint functions is to inhibit the activity of the universal mitotic regulator, p34cdc2. Using the filamentous fungus *Aspergillus nidulans* as a model system, we have generated a series of mutations which affect the activity of the *A. nidulans* p34cdc2 homolog, NIMXCDC2. One of these mutations, *snxA1*, abrogates the DNA damage checkpoint such that cells enter mitosis in the presence of what would normally be a sublethal amount of DNA damage. We have undertaken genetic, cytologic, and biochemical analyses of the effects of the *snxA1* mutation on the DNA damage checkpoint. Double mutant analyses indicate that *snxA1* functions in the same DNA damage checkpoint pathway as the UVSBRAD3 protein, a protein kinase similar to the human protein that leads to ataxia telangiectasia when mutated. Cytologic analyses suggest that, like a mutation in UVSBRAD3, mutation of *snxA1* leads to re-replication of DNA in the absence of mitosis. Biochemical analyses indicate that SNXA does not function by affecting the activity of NIMXCDC2, which is a major component of the DNA damage checkpoint pathway. These data suggest that either SNXA functions downstream of NIMX activity or it functions to localize NIMX or regulators of NIMX in response to DNA damage.

9:30 DIFFERENT PATHWAYS USED BY *GINKGO BILOBA* EXTRACT AND VITAMIN E PROVIDE NEUROPROTECTION OF PC12 CELLS FROM APOPTOSIS DUE TO MULTIPLE CELLULAR INSULTS

Julie V. Smith\*, Adam J. Burdick, and Yuan Luo, University of Southern Mississippi, Hattiesburg, MS 39406

Standard *Ginkgo biloba* extract (EGb 761) has neuroprotective effects. The cellular mechanism remains unclear. Oxidative stress has been implicated in nerve cell

death occurring in a variety of neurological disorders. Determination of neuroprotective mechanisms by antioxidants is of importance for understanding the molecular basis of neurodegeneration. PC12 cells undergoing apoptosis are a well-accepted model for studying the potential mechanisms of protection. Here we have determined in PC12 cells the effects of pre-treatment of EGb 761, its components Bilobalide B (BB), Ginkgolide B (GB) and the antioxidant Vitamin E on cell survival following multiple forms of apoptosis induction: serum-deprivation, Staurosporine treatment, and treatment with Amyloid  $\beta$  protein. Determinative assays include: TUNEL assay for detection of DNA fragmentation, Mitosensor assay for fluorescent staining of mitochondrial membranes, and Caspase 3 activity assay. Our results show that pre-treatment with EGb 761 or Vitamin E prevented serum deprivation-, Staurosporine-, and Amyloid  $\beta$ -induced apoptosis. EGb 761, but not Vitamin E, inhibited Staurosporine-induced activation of caspase 3. BB and GB show more significant inhibition than EGb 761. These results suggest that different cellular mechanisms may underlie multiple neuroprotective effects of EGb 761. Acknowledgement: This work is supported by NIH.

9:45 Break

Session 5: "Cytokine Signaling"

10:00 TRANSCRIPTIONAL REGULATION OF INTRACELLULAR INTERLEUKIN-1 RECEPTOR ANTAGONIST

John K. Jenkins, University of Mississippi Medical Center, Jackson, MS 39216

Interleukin-1 (IL-1) is a potent pro-inflammatory cytokine. Its biologic effects are regulated at many levels including the presence of different isoforms of a novel and specific receptor antagonist, interleukin-1 receptor antagonist (IL-1Ra). One secreted and several intracellular isoforms of IL-1Ra (sIL-1Ra and icIL-1Ra) exist. sIL-1Ra binds IL-1R and inhibits IL-1 binding. It has been hypothesized that inadequate amounts of IL-1Ra to counter the effects of IL-1 occur in several inflammatory diseases. icIL-1Ra, interestingly, though not secreted, does bind IL-1R. Its biologic function is unclear, but it is thought to inhibit IL-1 mediated events downstream of IL-1R resulting in reduced IL-1-induced gene expression. The two isoforms of IL-1Ra are differentially and coordinately expressed from a single gene. We have examined the mechanisms of the transcription regulation of the icIL-1Ra gene to better understand its role in IL-1 homeostasis. icIL-1Ra is constitutively expressed in most epithelial cells (which do not express sIL-1Ra) at high levels. icIL-1Ra is a very late

gene product of endotoxin-stimulated monocytes, which typically express sIL-1Ra early in response to this stimuli. We have cloned the 4.5 kb of 5' sequence and created deletional mutants. Transient transfections with promoter deletions indicated that the constitutive expression in epithelial cells and inducible expression in monocytes mapped to different promoter regions. Electrophoretic mobility shift assays of potential transcription factor binding sites in the proximal icIL-1Ra promoter indicated different transcription factors are involved in the epithelial cell expression and "late"-induced monocyte expression. Furthermore, different epithelial cells use similar transcription mechanisms for icIL-1Ra expression.

10:15 INTRACELLULAR INTERLEUKIN-1 RECEPTOR ANTAGONIST IS DEFICIENT IN RHEUMATOID ARTHRITIS FIBROBLASTS

John K. Jenkins, University of Mississippi Medical Center, Jackson, MS 39216

Interleukin-1 (IL-1) is a potent pleiotropic pro-inflammatory cytokine. Its biologic effects are regulated by a novel and specific receptor antagonist, interleukin-1 receptor antagonist (IL-1Ra). A secreted isoform of IL-1Ra (sIL-1Ra) binds IL-1R, inhibits IL-1 binding, and was recently approved to treat rheumatoid arthritis (RA). An intracellular isoform (icIL-1Ra) is not secreted and does not bind IL-1R, inhibiting IL-1-induced gene transcription downstream of IL-1R. We hypothesized that the inflammatory cytokine milieu in the RA joint differentially suppresses icIL-1Ra compared to noninflammatory osteoarthritic (OA) joints. We cultured human fibroblasts from OA and RA joints and stimulated them with phorbol-13-myristate acetate (PMA), bacterial lipopolysaccharide (LPS) and inflammatory cytokines known to be present in the RA joint. IL-1Ra protein was measured by sandwich ELISA and Western blot. mRNA was detected using a differential RT-PCR method. icIL-1Ra is the primary isoform expressed in all fibroblast types by LPS, PMA, IL-1 and TNF. FGF-1,2, GM-CSF and IL-6 do not induce IL-1Ra. Using signaling inhibitors, maximal expression of fibroblast icIL-1Ra required PMA plus one additional signal. OA fibroblasts responded to LPS, TNF and IL-1 with relatively more icIL-1Ra expression than RA fibroblasts. mRNA analysis confirmed these results. We have identified some of the mechanisms by which the inflammatory milieu may induce icIL-1Ra in synovial fibroblasts. RA fibroblasts do not produce as much icIL-1Ra as OA cells suggesting an intrinsic defect in these transformed cells.

10:30 THE ROLE OF GATA-3 IN INTERLEUKIN-13 (IL-13) TRANSCRIPTIONAL ACTIVATION

Kendria Holt<sup>1\*</sup>, Sheree Watson<sup>1</sup>, Pamela G. Banks<sup>1</sup>, and Steve Georas<sup>2</sup>, <sup>1</sup>Jackson State University, Jackson, MS 39217, and <sup>2</sup>Johns Hopkins University, Baltimore, MD

Asthma is drastically increasing in prevalence, morbidity, and mortality in many developed countries. There is a need to better understand this disease on the molecular level. T lymphocytes play critical role in asthma pathology. The pathophysiological manifestations of asthma are directly related to cytokines produced by Th2 cells. Interleukin-13 (IL-13) is important in asthma because of its effects on mucus production and airway hyper-responsiveness. Previous research suggests that GATA-3, a Th2 specific transcription factor, directly activates IL-13 transcription. The objective of this study was to establish whether GATA-3 binds to the GATA site of the IL-13 promoter by mutation of the GATA sequence. The IL-13 312 luc construct was synthesized using PCR. The IL-13 promoter GATA site was mutated by site-directed mutagenesis. Jurkat T cells were then transfected with reporter plasmids. Cells were stimulated with calcium ionophore and PMA followed by cell lysis and analysis of reporter gene expression by luminometry. Results indicate that IL-13 promoter activity is highly inducible by calcium and PKC signals in Jurkat cells. Mutation of the GATA-3 binding site inhibits IL-13 promoter activity. Enhancement of cg mutant by overexpressed GATA-3 suggests that GATA-3 can activate IL-13 independent of DNA binding.

10:45 THIOREDOXIN-ENHANCED JAK ACTIVITY: A TARGET FOR REDOX-BASED CHEMOTHERAPY?

Roy J. Duhé\*, Sheeyong Lee, Naila Mamoon, John K. Smith, Kiranam Chatti, Kanadadurga Kundrapu, and Amy Marks, University of Mississippi Medical Center, Jackson, MS 39216

The over-expression of thioredoxin, a redox protein, has been reported in a number of leukemias and carcinomas, including HTLV-1-transformed Adult T cell Leukemia/Lymphoma (ATLL) cells. The hallmark of ATLL pathogenesis is the development of IL-2-independent T cell proliferation, which appears to result from the gradual development of constitutive JAK3 activation. While these observations may at first seem unrelated, they are hypothetically linked by the fact that the catalytic activities of Janus kinases (JAKs) are modulated by their redox states. Both JAK2 and JAK3 are maximally active in a reduced state and inactive in an oxidized state; these states are biochemically reversible. Since Janus kinases are essential components in mitogenic signal transduction, the thioredoxin-mediated reduction of Janus kinases is expected to maximize the mitogenic signal to the cell, conceivably resulting in IL-2-independence and neoplastic

transformation. Our hypothesis is that cellular over-expression of thioredoxin enhances the enzymatic activity of JAK via its ability to maintain JAK in a reduced state, and that this biochemical mechanism can be targeted for cancer chemotherapy. Both in vitro and cellular experiments are designed to test this hypothesis. If this hypothesis is correct, it will allow us to rationally evaluate disulfide- and diselenide-based compounds as a novel class of cancer chemotherapeutic drugs.

11:00 Break

11:15 Divisional Business Meeting and Student Awards Presentation

**CHEMISTRY AND  
CHEMICAL ENGINEERING**

Chair: David Creed, University of Southern Mississippi  
Vicechair: John H. O'Haver, University of Mississippi

**THURSDAY MORNING**

Ship Isle Room

9:00 AB INITIO STUDIES OF SILICON ALPHA EFFECT ON THE INTRAMOLECULAR RING-OPENING REACTIONS OF EPOXYSILANES  
Lovell O. Agwarambo<sup>1\*</sup>, Hinda Ahmed<sup>1</sup>, Glake Hill, Jr.<sup>1</sup>, and Jerzy Leszczynski<sup>2</sup>, <sup>1</sup>Tougaloo College, Tougaloo, MS 39174, and <sup>2</sup>Jackson State University, Jackson, MS 39217

Intramolecular nucleophilic substitution reactions are controlled by many factors:- transition state energy, proximity of the reacting functional groups, and the size, energy & stability of the ring product. For the cyclization of  $\omega$ -aminoalkyl bromides, the reaction of 1-Amino-4-bromobutane, which gave a five-membered ring was more reactive than the reaction of 1-Amino-5-bromopentane which gave a six-membered ring. In order to investigate the influence of an  $\alpha$ -silyl group in the energetics of these intramolecular nucleophilic substitution reactions, we conducted the *ab initio* studies of compounds 1-4 below. The results showed that the trimethylsilyl group had an overriding influence over the controlling factors stated above in controlling the cyclization reactions of the systems studied. HO-(CH<sub>2</sub>)<sub>n</sub>-Br: Compound 1; n = 4; Compound 2; n = 5; Compound 3 = 1,1-disubstituted epoxide; Compound 4 = 1,2-disubstituted epoxide. Acknowledgements: 1. a =

Tougaloo College, Tougaloo, MS; b = Jackson State University, Jackson, MS; c = Computational Center For Molecular Structures and Interactions. 2. Funding for this project was provided by NFS CREST Program 3. Chemistry Department, Tougaloo College

9:20 USING LASER LINE DEFLECTION AND SHADOWGRAPHY TO DETERMINE THE EXISTENCE OF ISOTHERMAL FRONTAL POLYMERIZATION OF METHYL METHACRYLATE, ITS FRONT POSITION, AND ITS FRONT WIDTH

Lydia L. Lewis\* and John A. Pojman, University of Southern Mississippi, Hattiesburg, MS 39406

Isothermal Frontal Polymerization (IFP) is a process that is used to produce gradient materials, such as gradient refractive index materials (GRINs) and organic optical limiters (OOLs). IFP is a self-sustaining propagating polymerization resulting from an increased rate of reaction (the Trommsdorff effect), which is a result of a viscous region created at the interface of a polymer seed and a monomer/thermal initiator solution. The optical detection methods of laser line deflection (LLD) and shadowgraphy were used to examine the systems without disturbing them. The systems were examined to determine if a front exists and to determine the resulting front position, width, and velocity with respect to time. Solutions of 2.00 mM 2,2'-azobisisobutyronitrile in methyl methacrylate with poly(methyl methacrylate) seeds of 3 million molecular weight were examined. These systems exhibit frontal behavior at 45–50°C, propagate approximately 0.6 cm in 8 hours, have a front width ranging from 0.3 to 1.0 cm, and exhibit an increased front velocity ranging from 0 to 1.5 cm/hr during the front.

9:40 THE EFFECTS OF pH ON THE SOLUBILITY OF ALUMINUM OXIDE AND KAOLIN

Kristi Budzinski\* and David L. Wertz, University of Southern Mississippi, Hattiesburg, MS 39406

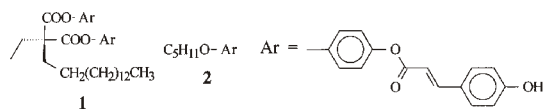
Aluminum oxide and kaolin's solubility were tested in solutions over a range of pH = 2 to pH = 7. The purpose of this experiment is to determine the optimum pH at which aluminum oxide and kaolin have the highest solubility. The solution consisted of nitric acid diluted to the desired pH along with either a weighed amount of kaolin or aluminum oxide as the solute. The aluminum oxide and kaolin were stirred overnight; then each was filtered from the solution and dried. Once the samples dried completely, a spectrum from X-ray fluorescence was used to determine the concentration of aluminum and/or silicon in each sample. The X-ray fluorescence machine has an internal control that corrects for the x-rays emitted by the

rhodium tube. In order to compare findings, the ratio of aluminum peak to rhodium peak area was calculated for the aluminum oxide solutions. In addition to the aluminum peak/ rhodium peak ratio, an aluminum peak/ silicon peak ratio was computed for the kaolin samples. The aluminum oxide solutions show a decreasing aluminum peak/ rhodium peak ratio, suggesting that the aluminum oxide is becoming more soluble as the pH increases. The kaolin solutions do not reveal substantial change in the aluminum peak/ rhodium peak ratio, suggesting that kaolin does not respond to changes in acidity.

10:00 PHOTOCHEMISTRY AND PHOTOPHYSICS OF MODEL COMPOUNDS CONTAINING BIS-ARYL CINNAMATE CHROMOPHORES

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

Liquid crystalline polymers (LCP) containing aryl cinnamate pendant groups exhibit a wide range of photochemical and photophysical behavior which depends on the phase type and chromophore aggregation in the polymer film. The UV-spectrum of an LCP in the solid state is blue shifted, due to ground state aggregation effects, with respect to that in a good solvent. The photochemistry is also different when a film and a solution sample of the LCP are irradiated at 366 nm. Compounds such as **1** containing two aryl cinnamate chromophores were synthesized and characterized. The UV-spectra of these model compounds were collected in solution and as dilute dispersions in a polymer matrix. Their photochemistry was also investigated and similar trends to those in the polymer film were observed. Irradiation at 366 nm of a dilute dispersion of **1** in hydrogenated polystyrene (H-PS) showed predominant 2+2 cycloaddition when compared to model compound **2** in H-PS.



10:20 Break

10:30 INFLUENCE OF AMINO SUBSTITUENTS ON THE ENERGETICS OF ETHIDIUM-DNA COMPLEX FORMATION

Nicholas B. Hammond\*, Nicola C. Garbett, and David E. Graves, University of Mississippi, University, MS 38677

The complex formed between ethidium bromide and nucleic acids has provided a paradigm for the study of DNA binding agents for the last four decades. These studies

have provoked considerable interest in the field of the design of pharmacologically active drugs over the past three decades and generated novel compounds that are effective in the inhibition of DNA and RNA polymerases, topoisomerases, and other DNA modifying enzymes that are critical targets in the treatment of cancer. Although the interactions of ethidium with DNA have been well characterized, many questions remain regarding the role that the amino substituents (located at positions 3 and 8 on the phenanthridine ring) play in the intercalative binding process. The studies described here seek to examine the influence of each of these amino substituents on the energetics and thermodynamic mechanism(s) associated with complex formation. Specifically, we have examined the parent ethidium along with three analogs (the 8-amino-5-ethyl-6-phenyl phenanthradinium chloride; 3-amino-5-ethyl-6-phenyl phenanthradinium chloride; and the 3,8-desamino-5-ethyl-6-phenyl phenanthradinium chloride. This systematic evaluation of DNA binding energetics as determined by optical spectroscopies and isothermal titration calorimetry (ITC) demonstrates that both the placement and/or position of the amino substituents on the intercalating chromophore of the intercalating drug plays a pivotal role in dictating the thermodynamic mechanism(s) of the interactions of these compounds with DNA.

#### 10:50 AFFINITY PURIFICATION OF BOVINE PITUITARY GLUTAMINYL CYCLASE

Kyle F. Lott\*, Graham Weaver, Stephanie Misquitta, Rachell Booth, and Robert Bateman, University of Southern Mississippi, Hattiesburg, MS 39406

Glutaminyl cyclase (QC) is a soluble protein of the mammalian secretory pathway and catalyzes the formation of the pyroglutamyl group at the amino terminus of many bioactive secretory peptides. Although this enzyme has been cloned and expressed in both bacteria and insect cells, little is known about posttranslational processing of the natural tissue form of QC. We have therefore sought to develop a rapid and high yield method of purifying QC from bovine pituitary. This has been achieved by use of anion exchange chromatography followed by affinity chromatography on a dye column. The talk will discuss the purification procedure as well as characterization of the purified enzyme.

#### 11:10 ENZYME MONITORING FOR DETECTION OF PROSTATE CANCER

DeGail Hadley\* and Charles Henry, Mississippi State University, Mississippi State, MS 39762

Prostate cancer is one of the leading causes of death in American men. Studies have implicated the enzyme, Cathepsin B (CB), as playing an important role in

the metastasis of prostate cancer. In this study, capillary electrophoresis was used to develop a method to study prostate cancer by monitoring the activity of the CB enzyme. The limit of detection for the product and the substrate was 1  $\mu$ M. In addition, the amount of product yielded from the enzymatic reaction was found to be time dependant. Future goals are to further optimize the enzyme analysis method, determine the reaction kinetics, and monitor CB activity in prostate epithelial cells.

#### 11:30 AN INVESTIGATION INTO THE SEQUESTERING CAPACITY OF WASHED WOMBAT POWDER FOR HEAVY METAL IONS AND HALIDE SALTS IN AQUEOUS SOLUTIONS

Callie Bounds\* and David L. Wertz, University of Southern Mississippi, Hattiesburg, MS 39406

The purpose of this project was to determine if washed WOMBAT powder could be used as a sequestering agent for heavy metal ions and halide salts in aqueous solutions, to quantify the amount of each element retained on the powder, and to assess if the sequestered ions could be removed from the powder. WOMBAT powder is a by-product of tires that is obtained through the Wertz Oxidative Molecular Bombardment at Ambient Temperature process. The WOMBAT powder was first washed and filtered to remove any naturally occurring metal ions from the surface of the powder. The WOMBAT powder was treated with solutions of mercuric chloride, potassium bromide, cupric chloride, calcium sulfate, and cobalt nitrate. The treated WOMBAT powder was allowed to air dry. A sample of washed but untreated WOMBAT powder was used as a control. Standards composed of activated carbon and each of the salts were made to evaluate how much of each element was retained by the powder. The treated WOMBAT powder was washed in distilled water to remove the metal ions and halides from its surface. X-ray fluorescence was used to analyze all of the samples. The results indicate that the WOMBAT powder can successfully sequester heavy metal ions and some halides from solution and that these ions can be effectively removed from the WOMBAT powder.

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### THURSDAY AFTERNOON

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Ship Isle Room

#### 1:30 DOWN TO EARTH MICROGRAVITY EXPERIMENTS, PART I: THE BENEFITS OF CLASSROOM-BASED DROP EXPERIMENTS

Nicholas J. Carter\*, Brian D. Zoltowski, Kayce Leard, Kristi Budzinski, Christina Watters, William J. Ainsworth,

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

Classroom-based drop experiments possess the capabilities of demonstrating the usefulness of microgravity research to a large audience. Being conceptually simple and cost effective they are ideal for high school and undergraduate education levels. In order to determine the effectiveness of drop experiments, the following three systems were studied: A postage scale, a candle, and a plasma sphere. The results of the latter were confirmed over a larger time scale aboard the KC-135 aircraft. It was determined that the drop experiments were simple and provided meaningful data.

1:50 DOWN TO EARTH MICROGRAVITY EXPERIMENTS: PART II VERIFICATION OF PLASMA BEHAVIOR IN MICROGRAVITY

Brian D. Zoltowski\*, Nicholas J. Carter, Kayce Leard, Kristi Budzinski, Christina Watters, William J. Ainsworth, and John A. Pojman, University of Southern Mississippi, Hattiesburg, MS 39406

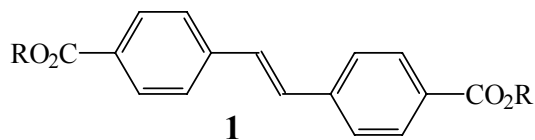
Classroom-based drop experiments possess the capability of demonstrating the usefulness of microgravity research to a large audience. Being conceptually simple and cost effective they are ideal for high school and undergraduate education levels. In order to determine the effectiveness of drop experiments, the following three systems were studied: A postage scale, a candle, and a plasma sphere. The results of the latter were confirmed over a larger time scale aboard the KC-135 aircraft. It was determined that drop experiments are simple and provided meaningful data.

2:10 SYNTHESIS OF LIQUID CRYSTALLINE STILBENE DIOL MONOMERS AND STILBENE POLYESTERS

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

Thermotropic liquid crystalline polymers (LCP) have different phases (mesophases) that can be observed at different temperatures. The photochemistry and photophysics of these polymers are quite dependent on the phase type and organization of the rigid rod parts on the polymers, the mesogens, which are also the chromophores for light absorption. Stilbenes are fluorescent rigid rod mesogens that undergo several photochemical reactions including  $2 + 2$  photocycloaddition and *trans-cis* photoisomerization. We have synthesized several stilbene diol monomers, of general structure **1**,  $R = (CH_2)_nOH$ , which have been copolymerized with substituted malonyl chlorides to produce photoreactive low  $T_g$  co-polyesters with room temperature mesophases. The monomers were

synthesized from *trans*-4,4'-stilbene dicarboxylic acid, **1**,  $R = H$ , via the acid chloride which was converted to the ethyl ester, **1**,  $R = CH_2CH_2$ . The latter was reacted with diols of general structure  $HO(CH_2)_nOH$  using titanium tetraisopropoxide as a transesterification catalyst to afford monomers **1**,  $R = (CH_2)_nOH$ . The monomers were characterized by NMR, IR, and UV-Vis spectroscopy, and elemental analysis, then reacted with malonyl dichlorides to form the co-polyesters (work supported by the NSF REU program).



2:30 PHOTOCHEMISTRY AND PHOTOPHYSICS OF SOME MAIN CHAIN LIQUID CRYSTALLINE STILBENE POLYESTERS

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

The photochemistry and photophysics of a main chain liquid crystalline homopolymer and two copolyesters containing the *trans*-4,4'-dialkoxystilbene dicarboxylate chromophore have been examined. The homopolymer has a high and narrow mesophase temperature range between 165EC and 177EC. The stilbene copolyesters contain butyl or ethyl malonate repeat units that lowered the transition temperatures compared to the homopolymer and resulted in room temperature polymer mesophases. Irradiation of polymer cast films at 313 nm leads to the formation of cyclobutane adducts and polymer crosslinking. UV-Vis spectroscopy shows the disappearance of the aggregated stilbene chromophore with a simultaneous increase in absorption at 250 nm. FT-IR also shows the decrease of *trans*-stilbene peaks at 702 and 668  $cm^{-1}$  and a new peak emerging at 718  $cm^{-1}$ . Subsequent 254 nm irradiation results in the loss of 250 nm absorption, regeneration of structured stilbene absorption above 300 nm but with no indication of aggregate formation, and a decrease in the IR band at 718  $cm^{-1}$ . These changes are consistent with cyclobutane photocleavage back to stilbene. The homopolymer cast film has only excimer-like emission centered at 450 nm. The intensity of the emission decreases with increasing temperature. The copolyester containing the butyl malonate repeat unit also gives the excimer-like emission, but in contrast to the homopolymer, an increase in temperature gives monomer-like emission and decreased excimer-like emission.



2:50 Break

3:00 NUMERICAL SIMULATIONS OF TRANSIENT INTERFACIAL PHENOMENA IN MISCIBLE FLUIDS

John A. Pojman\*, Vitaly Volpert, Rozenn Texier-Picard, and Nicholas Bessonv, University of Southern Mississippi, Hattiesburg, MS 39406, and University of Lyon

To study theoretically interfacial (capillary) phenomena in miscible fluids, we consider a continuous medium with a composition gradient. We describe it with the model consisting of the heat and diffusion equations with convective terms and of the Navier-Stokes equations with an additional volume force written in the form of the Korteweg stresses arising from nonlocal interaction in the fluid. It is proportional to the square of the composition gradient with the proportionality coefficient depending on temperature. We carry out numerical simulations of this model and show that the capillary force can cause convection in the initially quiescent liquid. For physically realistic values of parameters the liquid motion, though decreasing rapidly in time, can probably be observed experimentally. The proportionality coefficient,  $k$ , is the same square gradient parameter in the Cahn-Hilliard theory for diffuse interfaces and for phase separation. We estimate it on the basis of measurements from spinning drop tensiometry and light scattering for two systems: poly(dodecyl acrylate)/dodecyl acrylate and glycerin/water. Because concentration and temperature gradients also cause buoyancy-induced convection, experiments must be performed in weightlessness. Therefore, long term, high quality weightlessness is required to test the predictions of the modeling, and we propose a photopolymerization system to create the concentration and temperature gradients. Transient Interfacial Phenomena in Miscible Polymer Systems (TIPMPS) and a Microgravity Science Glovebox experiment, Miscible Drop in Microgravity (MDMG) are both planned for the International Space Station.

3:20 MEASURING CONVECTION IN MISCIBLE POLYMER SYSTEMS USING PARTICLE IMAGE VELOCIMETRY (PIV)

William J. Ainsworth\* and John A. Pojman, University of Southern Mississippi, Hattiesburg, MS 39406

Convective fluid motion created by the formation of a miscible polymer/monomer interface and induced thermal gradients can be measured using particle image velocimetry (PIV). PIV uses a sheet of laser light passing through a sample to illuminate neutrally buoyant tracer particles that scatter the laser light and follow the convective motion. The miscible polymer/monomer

interfaces were created by the photopolymerization of half of the sample using a high intensity fiber optic UV light source and a sharp mask in a process very similar to photolithography. Studies have been carried out involving the formation of the interface and the creation of thermal gradients within the interface by heating the sample. Video images of the reactions and the resultant fluid flow were analyzed using particle tracking software provided by NASA. From the vector data, we can determine the magnitude and direction of the induced fluid flow, and generate vector maps of the fluid motion under different experimental conditions. The experimental data will be used to develop a numerical simulation of the Effective Interfacial Tension Induced Convection (EITIC) caused by the formation of an interface between two miscible fluids. This method will be used as part of a flight investigation aboard the International Space Station to investigate the miscible polymer systems in the absence of buoyancy driven convection.

3:40 EFFECT OF SUPPORTING ELECTROLYTE ON ION TRANSPORT THROUGH ION EXCHANGE POLYMERS

Lois Zook\* and Johna Leddy, Delta State University, Cleveland, MS 38733, and University of Iowa, Iowa City, IA 52242

While often ignored, changing electrolyte concentration and/or ion size can change the effective diffusion of redox species in cast polymer films. Effective diffusion is defined as a combination of extraction and physical diffusion of a redox moiety within the polymer. Electrochemical experiments employing the techniques of cyclic voltammetry and rotating disk voltammetry can be used to separate out the extraction coefficient,  $K$ , and the physical diffusion parameter,  $D$ , for a redox probe. The effects of ion size and electrolyte concentration on the effective diffusion of a redox probe in the ion exchange polymer Nafion will be discussed. Preliminary results for the study of the redox probe Tris(2,2'-bipyridyl)dichlororuthenium(II)hexahydrate, (RuTrisBypy), indicate that both the size of the supporting electrolyte and the concentration of the electrolyte alter the effective diffusion. In a study of electrolyte concentration, the physical diffusion parameter,  $D$ , for RuTrisBypy decreased as the electrolyte concentration increased, while the extraction coefficient,  $K$ , initially increased to a maximum value, then began to decrease. In a study of ion size, the diffusion coefficient for RuTrisBypy decreased as the hydrated radius of the electrolyte increased, and the extraction coefficient increased with increasing electrolyte size. Once one understands how both these parameters,  $K$  and  $D$ , change with the choice of electrolyte, one can better tailor diffusion

through polymer films for specific applications.

4:00 QUANTITATIVE ANALYSIS OF ALUMINUM CONTENT OF SOIL, ROOT, AND GREEN SAMPLES FROM A NATIONAL GUARD FIRING RANGE

David L. Wertz and Amanda C. Winters\*, University of Southern Mississippi, Hattiesburg, MS 39406

This research is designed to determine the degree to which reaction byproducts from firings of multiple launch rocket systems (MLRS) accumulate in the environment. Powdered aluminum is a reactant in the ignition, and both aluminum and aluminum oxide are produced. One sample each of soil, roots, and greens are taken from predetermined sites at varying distances from, and positions relative to, the firing point. These samples are washed (in the case of roots and greens), dried, ground to a fine powder, and analyzed using x-ray fluoroscopy. The peak areas of several different elements (including aluminum) are measured. Data from samples taken both before and after test firings are compared, and all results are expressed as an aluminum:silicon ratio. Research is still in progress—analysis of “before” samples is being performed, and preparations are being made for processing of “after” samples. Preliminary data indicate that aluminum is already present in most of the soil and root samples, albeit in small quantities (possibly due to the abundance of clay in the area). No aluminum has been measurable in the green samples.

4:20 Divisional Business Meeting

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FRIDAY MORNING

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Ship Isle Room

8:20 Divisional Poster Session

LEACHABLE LEAD IN SMALL ARMS FIRING RANGE SOILS

Natalie M. Ballard\*, Barbara Tardy, and Jefretha Christian, Alcorn State University, Lorman, MS 39096, and Waterways Experiment Station, Vicksburg, MS

Lead contamination is of great concern because of its adverse effects on human health. Lead is a heavy metal that is toxic to humans and animals. Its extensive use and widespread dispersal in the environment have resulted in numerous lead contaminated soils. The health concern with lead contaminated soils mostly arises from plant contamination by soil particles, solids, and dust ingested by humans and grazing animals. It is very important to minimize adverse lead impacts on the environment.

Reducing lead solubility and bioavailability in contaminated soils without removing the soil is one of the issues involved in reducing the effects of lead on the environment. The U.S. Army operates Small Arms Firing Ranges (SAFRs) at various locations in and outside the United States. The ranges are used for munitions training for military personnel. In operation for a number of years these ranges are contaminated with spent munitions, lead bullets, and other metal contaminants. Although SAFR projectiles primarily contain lead, copper, and antimony, lead is by far the most toxic. Soil samples were collected from three sites: Fort Polk located in Louisiana, a SAFR in New Orleans, Louisiana and a site located in Kodiak, Alaska. Soil samples removed from several SAFRs have shown that lead in the munitions degrade and corrode producing lead particles that are not physically removable from the surrounding soil. Notwithstanding other metal contaminants, corrosion, and degradation of spent bullets producing lead particles that may be come mobile is the greatest environmental concern. The U.S. Army Engineer Research and Development Center (ERDC) is conducting studies on soils from three ranges to assist in providing strategies for remediation and management practices at various SAFR sites.

COMPARING METHODS OF ASSESSING TOXICITY TESTING OF LEAD AND ARSENIC IN WATER

Andrea J. Kelley\* and Chandra S. Theegala, Alcorn State University, Alcorn State, MS 39096, and Southern University, Baton Rouge, LA 70813

*Daphnia magna* are small freshwater crustaceans that are commonly called “water fleas.” The reproduction rate and survival rate of the organisms were tested when contaminants were introduced to the organisms environment. Studies showed that arsenic and lead decreased the survival rate when exposed to the contaminants longer than four hours. The organisms’ survival rate was high in concentrations of arsenic for more than 96 hours. Lead appeared to be more lethal to *D. magna* at concentrations of 0.25 ppm to 1.00 ppm. Reproduction did not take place in lead concentrations. Arsenic did reproduce in 0.50 ppm concentrations only. The respirometer was able to detect the oxygen consumption and carbon dioxide production of the organisms in non-contaminated water and water contaminated with 0–5 ppm of lead and arsenic. The respirometer results were compared and contrasted with the acute (short term or static test) results.

ANALYSIS OF GLUCOSE IN THE HYDROLYZATE FROM SAWDUST

Centeria Cornelli<sup>1</sup>, Esmeralda Fuentes<sup>2</sup>, and Ken S.

Lee<sup>1\*</sup>, <sup>1</sup>Jackson State University, Jackson, MS 39217, and <sup>2</sup>Brackenridge High School, San Antonio, TX 78210

In the project to produce ethanol from the sawdust via acid-hydrolysis and fermentation, the determination of concentration of glucose and other organic components in the hydrolyzate is necessary for optimizing the process. However the analysis with HPLC is not feasible due to the high concentration of sulfuric acid. Therefore we use the Seliwanoff reagent for determining of actual concentration of glucose of the hydrolyzate. Since it gives dark red color after that resorcinol reacts with 5-hydroxymethylfurfural (HMF), which is the dehydration product of glucose, the calibration line has been made from the series of known concentrations of glucose. Total concentration of glucose of sample was determined from the line via standard addition method. Total concentration of glucose in hydrolyzate was 7.5%. We have proposed the double analysis to calculate the actual glucose concentration, because the conversion from glucose to HMF needs heat and at room temperature the conversion is not occurred. Difference between results from two analysis, with heat and without heat, can be the actual concentration of glucose in the hydrolyzate. This project is supported by DOE EPSCOR, Grant #DE-FG02-00ER45830.

#### AERIAL DRIFT DETERMINATION OF HERBICIDES WITH ANALYSIS BY HPLC AND AA

April Robinson<sup>1\*</sup>, Jason Corbitt<sup>1</sup>, Candice Scott<sup>1</sup>, Andrew Steele<sup>1</sup>, Marcus Steele<sup>1</sup>, Shawanda Wilson<sup>2</sup>, Phelesia Foster<sup>3</sup>, Dennis Elmore<sup>3</sup>, and Lowrey Smith<sup>3</sup>, <sup>1</sup>Delta State University, Cleveland, MS 38733; <sup>2</sup>Mississippi Valley State University, Itta Bena, MS 38930; and <sup>3</sup>Application Technology Research Unit, USDA-ARS, Stoneville, MS 38776

The Environmental Protection Agency and Mississippi Department Environmental Quality suspended aerial application of the herbicide, glyphosate, for three months during Spring, 2001, due to the damage to non-glyphosate resistant crops created by the wide application glyphosate the previous year. This study examines the horizontal drift of the herbicide, glyphosate, and a tracer, rubidium, as they are applied from an aerial and tractor platform. Spray droplets were collected at selected sampling sites on flat Mylar sheets, drinking straws, and cotton strings. The droplets were removed from each of these collection devices using HPLC grade ethanol or reverse osmosis water. Subsequently, the glyphosate samples were analyzed with a Waters LC Module 1 controlled by Waters Millennium 2000 software. The Rb samples were analyzed by a Perkin Elmer 5000Z electrothermal atomic absorption spectrophotometer. A grid of the spray area and adjacent drift impacted area will be presented.

#### CHIRAL HPLC BEHAVIOR OF HYDROXYLATED AND METHOXYLATED DOPAMINE DERIVATIVES

Kenneth D. McMurtrey\*, Eron Schellinger, Anthony Pittman, Chris Strawbridge, and John G. McCoy, University of Southern Mississippi, Hattiesburg, MS 39406

1-Methyltetrahydroisoquinoline derivatives of dopamine have been suggested to play possible roles in the development of human maladies including both alcoholism and Parkinson's disease. One but not both of the two possible stereoisomers is thought to have pharmacological activity. This paper examines the effects of phenolic and methoxyl substituents at the 6- and 7- positions of the 1,2,3,4-tetrahydroisoquinoline molecule on HPLC resolution of the above stereoisomers.

#### GC-FID ANALYSIS OF THE DEGRADATION OF SURFACTANTS IN WATER BY FENTON'S REAGENT

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

In continuation of our previous studies on the use of Fenton's reagent for the remediation of organic pollutants in water, we are currently studying the effectiveness of Fenton's oxidation reaction for the removal of surfactants in water. Preliminary results obtained from GC-FID analysis of the chloroform extracts of untreated and treated samples in water indicate that Fenton's reagent is very efficient in removing most of the components, particularly the more volatile components of surfactants in water.

#### REMOTE SENSING OF VOLATILE LIQUIDS

William C. Mahone and Joi Sawyer\*, Mississippi Valley State University, Itta Bena, MS 38941

Remote Sensing is the technique of acquiring information about an object without actually coming in contact with the object. This information comes in the form of electromagnetic radiation. New technology is allowing applications of remote sensing technology in a variety of ways. There are a variety of factors that can influence the incoming distribution of frequencies and intensities of radiation that is registered as a return spectral profile. These can be reflectance from a surface or absorption or emission of radiation by gas molecules that occupy the space between the sensor and the reflector. The object of our investigation is to use remote sensing to analyze a vapor flux between the reflector and the sensor. If successful this technique could be used to remotely analyze hazardous spill sites or chemical warfare agents.

#### A REINVESTIGATION ON THE USE OF AN ACIDIC H<sub>2</sub>O<sub>2</sub> SOLVENT SYSTEM IN THE CHEMICAL-DISSOLUTION ANALYSIS OF FLY ASH

Matt Myers\*, Myron Hutson, and Marcus Steele, Delta State University, Cleveland, MS 38733

Noncrystalline components greatly influence the physical and chemical activity of materials and complicate the identification of crystalline phases. Our research group<sup>1</sup> identified an acidic hydrogen peroxide solvent mixture that competes favorably with sodium hydroxide in removing the noncrystalline materials in complex samples. However, the exact mechanism was not established. Hydrogen peroxide is a strong oxidizing agent in acidic solutions ( $E^0 = +1.77$  V). The purpose of this study was to evaluate the effectiveness of selected acids (HCl, HNO<sub>3</sub>, H<sub>2</sub>SO<sub>4</sub>, CH<sub>3</sub>COOH) in the solvent mixture. We will show that H<sub>2</sub>O<sub>2</sub>-H<sub>2</sub>SO<sub>4</sub> is the most effective solvent mixture in the dissolution of noncrystalline materials in a fly ash sample. A Siemens D5000 x-ray diffractometer was used to examine the crystallinity of the various samples. <sup>1</sup>V.L. Pate and M.L. Steele, "Studies on the Selective Dissolution of Fly Ash." National Student Affiliate Poster Session, 197<sup>th</sup> National ACS Meeting, Dallas, TX, April, 1989.

#### DRYING CHARACTERISTICS AND OXYGEN TRANSPORT IN DREDGED SEDIMENTS

Alma Jackson\* and Clint Williford, University of Mississippi, University, MS 38677

To maintain and improve waterborne navigation, about four hundred million cubic yards of sediment are dredged each year by different industries in the United States. Port dredging is done to create and maintain sufficient water depth so that ships and boats can move safely through bodies of water. The Environmental Protection Agency detected that the sediments are contaminated and that river and harbors will require remediation. Presently, the New York Harbor is the largest sediment cleanup technology-testing program in the United States. This study in the New York Harbor dredged sediment is carried out to determine the drying characteristics of the sediment in the confined disposal facilities. Confined disposal facilities are an open body of land that has been cleared to serve as repositories for contaminated sediments. The tasks of this project included investigating the sediment pore water evaporation, shrinkage, pore collapse, and other physical characteristics when additives are added to the sediment. In addition, measurements such as the redox conditions and oxygen penetration in the sediment were also conducted in this research.

#### SCREENING FOR LIGNIN IN MICROBIAL CONSORTIA

O.L. Griffin\* and Alfred Mikell, Alcorn State University, Alcorn State, MS 39069, and University of Mississippi,

University, MS 38677

The study of lignin, the second most abundant of all organic compounds on Earth and the most complex, has significant importance to biologists and chemists alike. However, to engineers in industries such as paper and pulp production, the degradation of lignin is far more vital. Therefore, research is necessary on the biodegradability of lignin within vascular plants. The objectives of this investigation were to isolate fungi from environments suspected of harboring organisms with lignin degrading activity, to characterize the fungi consortia using direct and indirect methods, and to establish the lignin degrading activity of the consortia. Using various plants as substrates within inoculated environments, it was established that succession occurs within these environments and that the results of direct and indirect methods do not necessarily have to coincide.

#### CATALYTIC DECOMPOSITION OF PCDD/F

Zakiya Nicks\*, Slawomir Lomnick, and Barry Dellinger, Louisiana State University, Baton Rouge, LA

Catalytic oxidation is one of the most efficient forms of destroying polychlorinated-p-dioxins and polychlorinated furans (PCDD/F). Because these chemicals are considered toxic, the government is focusing much concern on lowering the emissions of dioxins produced by industries. This study describes the studies on iron oxide catalyst supported on alumina, silica, and titania for dioxin destruction. As a model compound for dioxins, 2-Chlorophenol was used due to its structural similarities to dioxins. We found that iron oxide depends significantly on the supports used in studied reaction. Of the three catalysts tested, iron oxide supported on titanium oxide exhibited the highest conversion. The preparation method of the catalyst also alters the activity of the catalyst. The sol-gel preparation method gave much higher conversion of 2-chlorophenol than the impregnated method. Also, the introduction of promoters (Ca) enhanced the performance of the catalyst.

#### AQUEOUS SOLVENT EFFECTS ON THE REGIOCHEMISTRY OF THE SINGLET OXYGEN ENE REACTIONS OF ANGELIC ACID AND TIGLIC ACID SALTS

Anisha Bajaj\* and Kristina L. Stensaas, Millsaps College, Jackson, MS 39210

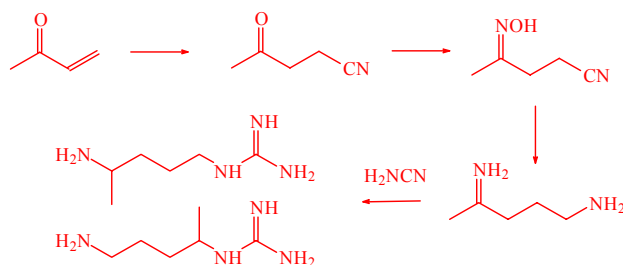
Photooxidations of tiglic acid and angelic acid salts with singlet oxygen were carried out in aqueous deuterated solvents and water/methanol mixtures. Deuterated solvents were used to increase the lifetime of singlet oxygen thereby decreasing reaction times. Proton nuclear magnetic resonance spectroscopy was used to monitor the

product formation in each reaction. The results indicate that the product regioselectivities of these substrates deviate from the corresponding esters. We attribute this behavior to a hydrogen bonding interaction between the salts and the solvent which is not available to the esters.

#### DESIGN AND SYNTHESIS OF AGMATINE DERIVATIVES AS INHIBITORS OF THE MAMMAL AGMATINASE

Eric McClendon<sup>1</sup>, Eric Carlton<sup>2</sup>, Gregory Vaughn<sup>1</sup>, John Piletz<sup>3</sup>, and Ken S. Lee<sup>1\*</sup>, <sup>1</sup>Jackson State University, Jackson, MS 39217; <sup>2</sup>Arkansas School of Math and Science, Jonesboro, AK 72404; and <sup>3</sup>University of Mississippi Medical Center, Jackson, MS 39216

Agmatine is a product of the mammal enzyme, decarboxylase, on L-arginine. It is also known to depress the production of nitrogen oxide in the brain, but it will be degraded with agmatinase and diamine oxidase. In this study, we design and attempt to synthesize a series of agmatine derivatives in order to test them as inhibitors of the mammal agmatinase. The proposed pathway to make the agmatine derivatives is: (1) Michael reaction of HCN on methyl vinyl ketone, (2) Converting ketone to oxime, (3) Reduction of oxime and nitrile groups to amine, (4) Coupling reaction with cyanoamine. Changing the methyl vinyl ketone with various substituents allows us to prepare several agmatine derivatives. The details of the reaction scheme and the experimental results will be discussed.



#### SYNTHESIS AND CHARACTERIZATION OF METAL COMPLEXES OF BENZIL DIPHENYLTHIOSEMICARBAZONE

Brian Napolion\*, Booker Spurlock, and Ramaiyer Venkatraman, Jackson State University, Jackson, MS 39204

Copper(II), cobalt(II), lead(II), nickel(II), and palladium(II) complexes of benzil Di-N4 phenylthiosemicarbazone, (BDPTSC) have been prepared and characterized by conductance, magnetic moment, IR, UV-VIS, and NMR spectral data. From the experimental data cobalt, copper and palladium complexes exhibit a square planar geometry

where as nickel shows an octahedral symmetry with two water molecules. The ligand is found to form an 1:1 type complex with all the metals.

#### SYNTHESIS AND STRUCTURAL CHARACTERIZATION OF TERNARY COMPLEXES OF COPPER(II), CHROMIUM(II), AND LEAD(II) WITH DI AND MONO CARBOXYLIC ACIDS AND AROMATIC DIAMINES

Ramaiyer Venkatraman\*, Mira Walker, Julian Magee, Brian Napolion, and Joseph A. Cameron, Jackson State University, Jackson, MS 39204

Ternary complexes of divalent metal ions (copper(II), cadmium(II) and lead(II)) with mono or dicarboxylic acid (levulinic acid and malonic acid) and aromatic diamines (2,2' bipyridyl, 4,4' dimethylbipyridyl, neocuproine) have been prepared and characterized by conductance measurements, electronic, IR, and NMR spectra. Thermal analysis and magnetic behavior for all the compounds were studied. The solid complexes isolated are in the M/acid/Diamine molar ratio 1:1:1 [M(II) = Cu, Cd, and Pb; Acid = malonic; Diamine = neocuproine].

#### INVESTIGATION OF THE STEREOCHEMICALLY DETERMINING STEP IN THE SQUARATE ESTER CASCADE

Ken S. Lee\*, Ashton T. Hamme, and Leo A. Paquette, Jackson State University, Jackson, MS 39217

The study of the stereochemically determining step of the squarate ester cascade reaction was achieved by isolating two diastereomers of a squarate adduct after mono-addition of an ion with a chiral carbon. Each diastereomer was independently reacted with a second alkenyl anion which lead to the isolation of the same polycyclic compound after the cascade reaction took place. Since the same compound was isolated from two unique diastereomers, the stereodefining step must arise from a common octatetraene intermediate.

#### OXONIUM ION FORMATION FROM ISOXAZOLIDINES

Ken S. Lee\*, Erick Ellis, and Ashton T. Hamme, Jackson State University, Jackson, MS 39217

A number of different isoxazolidines were synthesized from the addition of nitrones to propargylic alcohol systems. These isoxazolidines were subjected to acidic conditions to determine if the isoxazolidine system was stable to acidic conditions. After some of the isoxazolidines were protonated, a rearrangement occurred through an oxonium ion intermediate to form a unique spirocyclic system.

### PROTEIN INTERACTIONS RELATED TO PROTEIN CRYSTALLIZATION

Kristen M. Demoruelle\* and W. William Wilson, Mississippi State University, Mississippi State, MS 39762

The osmotic second virial coefficient,  $B$ , has been found to identify protein interactions in experimental solution conditions that are favorable for protein crystallization. The values of  $B$  describe how the protein molecules interact with each other. When solution conditions for a certain protein produce a  $B$  value falling in the crystallization slot ( $-2$  to  $-8 \cdot 10^{-4}$  mol ml  $g^{-2}$ ), it is concluded that these conditions are favorable for protein crystallization because the proteins have the proper attraction between themselves to produce protein crystals. This work shows data collected for lysozyme, ESA, and VSV N protein solutions. The data include graphs which show conditions favorable for crystal growth along with conformation by actual ESA crystal growth under the identified optimal conditions.

### RESEARCH IN FLUOROUS MEDIA

Neil Stowe\*, Joseph Thrasher, Alfred Waterfeld, and Greg Szulezewski, University of Alabama, Tuscaloosa, AL 35487

Krytox oils are stable liquids with low vapor pressure. A high vacuum system will be used to measure the vapor pressure of Krytox. Vapor pressure can be linked to volatility. This will help DuPont to determine specific applications for homologues of Krytox.

### HIGHLY EXCITED RO-VIBRATIONAL EIGENSTATES OF HOCl

Amy Creel\* and Joseph A. Bentley, Delta State University, Cleveland, MS 38733

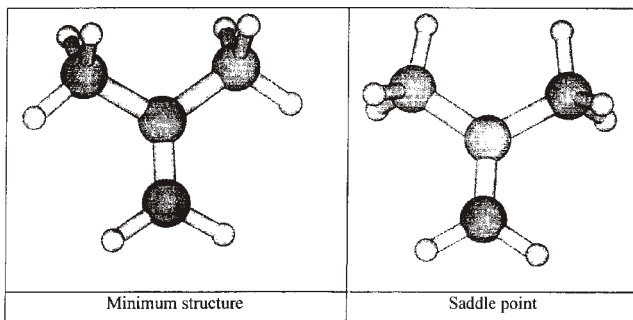
We report the accurate calculation of high-lying ro-vibrational eigenstates of the ground electronic state of hypochlorous acid, HOCl. The Jacobi coordinate system is used. The discrete variable representation (DVR) [Z. Bacic and J.C. Light, *Annu. Rev. Phys. Chem.* 40, 469 (1989)] is used as a basis for both radial coordinates leading to a sparse Hamiltonian matrix. The diagonalization-truncation method is used to give a contracted set of angular basis functions. The eigenvalues are then obtained by using the Implicitly Restarted Arnoldi Method (IRAM). This is part of a recently developed numerical package (ARPACK) designed to solve large scale eigenvalue problems. The energies are calculated using a new potential energy surface for HOCl [S. Skokov, K.A. Peterson, and J.M. Bowman, *Chem. Phys. Lett.* 312, 494 (1999)].

### NORMAL FREQUENCIES OF ISOBUTANE AND ISOBUTANE- $d_8$ : COMPARISON OF THEORETICAL

### AND EXPERIMENTAL RESULTS

Chandra M. Pathak<sup>1\*</sup>, M.K. Shukla<sup>2</sup>, and Jerzy Leszczynski<sup>2</sup>, <sup>1</sup>Alcorn State University, Alcorn State, MS 39096, and <sup>2</sup>Jackson State University, Jackson, MS 39217

The structure and vibrational spectra of isobutane and isobutane- $d_8$  have been theoretically investigated in detail. Since both isobutane and isobutane- $d_8$  are gases at room temperature, the study provided a unique opportunity to compare the theoretically computed vibrational frequencies with those observed by one of us (CMP) in the gas phase. In the present work, different levels of theories such as HF, DFT(B3LYP), MP2, and CCD were applied employing the 6-311 G(d,p) basis set. One of the isomers has a real minimum structure while the other represents saddle point on the corresponding potential energy surface. A detailed comparative study between the theoretically calculated frequencies and the experimentally observed ones, both in isobutane and isobutane- $d_8$  will be presented.



10:10 Break

Divisional Talks Resume

### 10:20 VISCOSITY DEPENDENCE OF SPIN MODES IN FRONTAL POLYMERIZATION OF MULTIFUNCTIONAL ACRYLATES

Kayce Leard\*, Sarah Tompkins, and John A. Pojman, The University of Southern Mississippi, Hattiesburg, MS 39406

Frontal polymerization involves the conversion of a monomer into a polymer through thermal initiation. Our study focused on the expansion of two-dimensional and three-dimensional fronts in a frontal polymerization system where spin modes migrated around the front as it propagated. Spin modes are regions of high temperature that migrate in a helical pattern ahead of the front. The intention of this study was to determine the behavior of a front as it undergoes linear propagation in two-dimensional fronts and propagation from the center of a sphere outward in three-dimensional fronts. We studied the viscosity dependence of spin modes in the frontal polymerization of pentaerythritol tetraacrylate (PETAC), ammonium

persulfate (thermal initiator), and dimethyl sulfoxide (DMSO). Silica gel was added to the system to make the solution more viscous. It has been determined that the appearance of spin patterns decreases with increased viscosity, thus spin modes in polymerization systems are viscosity dependent. Spherical polymerizations and indications of spin modes in high viscosity systems have also been achieved.

#### 10:40 METHOD FOR DETERMINING VISCOSITY OF UNKNOWN SAMPLES

Roger D. Holloway<sup>1\*</sup>, John A. Pojman<sup>2</sup>, and William J. Ainsworth<sup>2</sup>, <sup>1</sup>Alcorn State University, Alcorn State, MS 39096, and <sup>2</sup>University of Southern Mississippi, Hattiesburg, MS 39406

A combination of these methods (fluorometric and viscometer) was used to determine viscosity. This method was used to characterize pyrene, a multi-ringed hydrocarbon compound. A concentration  $1.0 \times 10^{-7}$  M of pyrene in dodecyl acrylate was used in fluorescence experiments to determine the fluorometric intensity. Viscosity data were obtained by using a Brookfield Viscometer (viscosity vs. temperature). The fluorescence data together with viscosity measurements were used to attempt to construct a standard curve of known viscosity verses fluorescence intensity ratio, so that the viscosity of unknown samples can be determine easily.

#### 11:00 WIDE ANGLE X-RAY SCATTERING STUDY OF THE EFFECT OF ORGANIC LIQUIDS ON THE LAYERING OF PITTSBURGH #8 COAL

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

The effects of organic liquids of differing polarities on Pittsburgh #8 coal were examined using wide-angle x-ray scattering techniques. Eight organic liquids were mixed with 2–3 gram samples of coal. After 7–9 days, X-ray scattering spectra were taken from 2 Theta values of 5 degrees to 90 degrees and the spectra were converted to reciprocal space,  $q$ . The peak of the untreated coal lies within the  $1.0\text{--}2.0 \text{ \AA}^{-1}$  range of reciprocal space, which translates to an average distance between layers of  $\sim 4.2 \text{ \AA}$ . The effect of the solvents ranged from producing a more pronounced peak at the same reciprocal space range to shifting the peak. The data was used to examine the molecular-level interactions that the coal was undergoing, such as hydrogen-bonding.

#### 11:20 CONTROLLED INITIATION OF POLYMERIZATION REACTIONS USING MICROENCAPSULATION TECHNIQUES

Brian H. McFarland\* and John A. Pojman, University of

Southern Mississippi, Hattiesburg, MS 39406

The polymerization of a monomer upon addition of an initiator and an accelerator often takes place in an almost instantaneous fashion. The ability to control the time and manner in which these polymerizations take place would offer advantages in storage and in use of these polymerizations in certain applications. This can be accomplished by microencapsulation. Microencapsulation allows a component of the polymerization reaction to be separated from the other components by means of trapping it in a chemical shell. This shell can be removed at the desired time of the user by means such as mechanical shearing, dissolving, and by thermally melting the shell. This releases the core material and the polymerization can then take place. Current methods of microencapsulation being studied include complex coacervation, interfacial polymerization, and *in situ* polymerization. The effectiveness of each method of microencapsulation is studied, as well as the effectiveness of each method of releasing the core material.

#### 11:40 DETERMINATION OF OXIDATIVE TOLERANCE AND CHARACTERIZATIONS OF MICROORGANISMS FROM SWIMMING POOLS AND SPAS

Regina Covington\* and Alfred Mikell, University of Mississippi, University, MS 38677

Water contamination is a popular basis for infection, illness, and death among people today. It is an ordeal that prompts millions to buy faucet filters and bottled water. These extra steps of caution are reasonable when considering that one cannot assess the quality of water merely by observing it. Moreover, crystal clear water can contain some of the most lethal microorganisms known today. These microorganisms usually live in the intestinal tract and are excreted through a bowel movement. As a means of safety, chlorination has been used to combat such creatures through oxidative methods. Unfortunately, microorganisms, particularly those living in swimming pools and spas, have developed antioxidant defense systems that can help them maintain homeostasis and thus continue to live and grow. As a result of this evolution, waterborne pathogens can cause diseases from skin infections to gastrointestinal diseases. Alternative methods of water disinfection are currently being used to compensate for the antioxidant defense systems evolved in microorganisms. Under the conditions that evolved defense systems tolerate present and future resources of water disinfection, water contamination will be the most prominent killer of mankind.

**GEOLOGY AND GEOGRAPHY**

Chair: Ezat Heydari, Jackson State University  
Vicechair: Keil Schmid, Mississippi Office of  
Geology

**THURSDAY MORNING**

## Petit Bois Room

**9:00 LEWIS HARPER—A COLORFUL CHARACTER IN THE HISTORY OF GEOLOGY IN MISSISSIPPI**

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

Lewis Harper (born Ludwig Hafner in Hamburg, Germany) was professor of geology and agriculture at the University of Mississippi (1854–1856) and the third State Geologist of Mississippi (1854–1857). His colorful tenure was characterized by disputes with the chancellor, his colleagues, and his assistants. Little is known of his previous history, except that he taught at an academy in Alabama and claimed to have an LL.D. Harper moved the Geological Survey to rooms in the state penitentiary in Jackson when he was dismissed from the University. Harper's most significant accomplishment as State Geologist was publication in 1857 of *Preliminary Report on the Geology and Agriculture of the State of Mississippi*. This report generated widespread dissatisfaction, adversely affecting the Survey. It was colorfully criticized by Harper's former assistant and successor Eugene Hilgard. The report's geologic map reversed the Eocene and Miocene outcrop belts, but otherwise was the best produced to date. A reading of the book reveals it to be a pretty good report, with carefully reasoned scientific arguments supporting Harper's interpretation of the geology. A colorful misuse of the report occurred in the 1980s, when an article in *Mother Earth News* misquoted Harper as reporting gold in northeastern Mississippi; this generated many inquiries. Harper's history after leaving Mississippi is poorly known. His great-granddaughter reported that he moved to the New York area and later returned to Germany, where he died in 1874.

**9:15 AQUEOUS FAUNA DISCOVERED IN THE LATE PLEISTOCENE (PEORIAN) LOESS OF VICKSBURG, MISSISSIPPI**

Michael Williams, Millsaps College, Jackson, MS 39210

A large outcrop of loess containing aqueous fauna has been discovered in Ballground Creek in Vicksburg, Mississippi. Nearly all of the fauna are freshwater mollusks

and include small clams, snails, and a large washboard mussel. The only non-molluscan fauna include two small crayfish gastroliths. All loess deposits are considered strictly eolian in origin. However, this discovery suggests a much more complicated depositional history for this particular loess deposit than one of strictly eolian origin.

**9:30 THREE NEW FOSSIL REPORTS FROM TESHEVA CREEK, YAZOO COUNTY, MISSISSIPPI**

Michael Williams, Millsaps College, Jackson, MS 39210

Several fossil collecting trips by the writer to Tesheva Creek in Yazoo County, Mississippi between the years of 1997–2001 have produced numerous fossil bones and teeth of Late Pleistocene (Rancholabrean age) land mammals including mastodon, horse, tapir, mammoth, deer, and llama which are derived from the loess deposits of the area. This study concentrates on three new reports from Tesheva Creek. (1) A tooth has been identified as the Pliocene three-toed horse, *Nannippus minor*. This may be the first and only record of a Pliocene vertebrate fossil from Mississippi. (2) A complete proximal phalanx has been identified as the rare Pleistocene llama, *Hemiauchenia macrocephala*. Only about six reports of this llama have been made in Mississippi. (3) A nearly complete left rear metatarsal has been identified as the common Pleistocene horse, *Equus complicatus*. The bone is crushed on one side and has an iron oxide stain on the other side. This bone is extremely rare because most Pleistocene fossils found in Tesheva Creek usually occur as broken or fragmented remains showing heavy transportation abrasion.

**9:45 MINERALOGY OF FINE GRAIN SEDIMENTS ALONG SODA BUTTE CREEK, GREATER YELLOWSTONE ECOSYSTEM**

Jessie Kneupper\* and Lori G. Eversull, Millsaps College, Jackson, MS 39210

Soda Butte Creek has its headwaters in the heavily mineralized terrain of the New World Mining District in southwest Montana. Beyond the uppermost reach of the stream, Soda Butte Creek flows for approximately 25 miles through the northeast section of Yellowstone National Park. Over a century of metal mining and milling has left an impact on the stream's ecosystem. Heavy metal contamination of Soda Butte Creek is well documented. Furthermore, previous research by Millsaps College indicates that these metals are mostly concentrated in the stream's fine-grained (<200 micron) sediments. As part of an on-going study, sediment samples were collected from 24 sites along Soda Butte Creek. The sites are representative of the entire length of the stream, from its headwaters to its confluence with the Lamar River inside



Yellowstone National Park. The mineralogy of the fine-grain fraction was determined by X-ray diffraction (XRD). Results indicate that quartz, plagioclase, smectite, calcite, and dolomite are major constituents of all samples. Kaolinite and mica are primarily present in samples taken from sites closest to the McLaren Mine tailings. Ore minerals indicated by XRD are magnetite, pyrite, and hematite. Magnetite is detected in all samples; however pyrite and hematite are restricted to samples taken from tributaries to Soda Butte Creek. This mineralogical analysis has implications for the mobility and transport of metals in Soda Butte Creek.

10:00 MINERALOGICAL AND TEXTURAL ANALYSIS OF DIFFERENTIALLY WEATHERED DEMOPOLIS CHALK: MACON, MISSISSIPPI

Jason T. Wilson\* and Stan J. Galicki, Millsaps College, Jackson, MS 39210

The Demopolis Chalk exposed east of Macon, Mississippi on Highway 14 at the intersection with Highway 45 has differentially weathered to produce several resistant layers separated by intervals that are more prone to slope formation. Samples taken from both ridge and slope forming intervals were analyzed using insoluble residue, X-ray diffraction, and scanning electron microscopy to investigate the mineralogy and the textural relationship between components of the chalk in relation to the weathering profile. Insoluble residue tests indicate that the chalk is composed of approximately 70 to 80% calcium carbonate. The ridges appear to be more enriched in calcium carbonate than the slopes. The insoluble mineral components are kaolinite, montmorillonite, illite and quartz. Textural relationships between the calcium carbonate and the insoluble fraction were observed using the scanning electron microscope and aid in the interpretation of the diagenetic history of the unit which can be used to explain the current topographic expression.

10:15 Break

10:30 DECLINES IN POTENTIOMETRIC SURFACES OF NEOGENE AQUIFERS, PERRY COUNTY, MISSISSIPPI

Kai Roth\* and David M. Patrick, The University of Southern Mississippi, Hattiesburg, MS 39406

The purpose of this ongoing study is focused on the nature and condition of Miocene and younger aquifers underlying Camp Shelby and Perry County. Also, there was a need to establish the presence of adequate confining layers between these aquifers and between the aquifers and the surface. A database was constructed from driller's log,

electric logs, and monitoring well information, which included well depth, location, well number, ground elevation, screened interval, water level elevation, and lithology. Cross-sections and potentiometric surfaces maps were then constructed for the principal aquifers for different years. There are approximately five principal aquifers combined in the Catahoula and Hattiesburg Formations. These aquifers exhibit approximate depths between 200 to nearly 1100 ft, and well-defined confining layers were present. Water level monitoring data showed a potentiometric surface decline of almost thirty feet between 1943 and 1996 in one 416 ft-deep Hattiesburg Formation aquifer on Camp Shelby, and similar declines in this aquifer elsewhere in Perry County. Of the twenty monitoring wells in this area, only three were monitored on a consistent basis and for longer than one year. The declines in this aquifer are believed to be the result of pumping on Camp Shelby as well pumping in the Hattiesburg area, which is experiencing similar declines.

10:45 SOIL MINERAL ANALYSIS AT MULTIPLE LAUNCH ROCK SYSTEM (MLRS) FIRING POINTS, CAMP SHELBY

Misty D. Savell\* and David M. Patrick, The University of Southern Mississippi, Hattiesburg, MS 39406

The MLRS utilizes a solid fuel propellant which, upon firing, emits aluminum and chloride. The effects of these emissions on the biota are unknown. In order to determine effects, pre-and post-firing soil and vegetation samples are being collected at existing and new firing points and control sites and the soil mineralogy and chemistry are being determined. Ultimately, both the mineralogy and chemistry investigations are aimed at determining the amount, if any, of aluminum and chloride taken up by the soil and vegetation in comparison to pre-firing data. Most firing points are located in upland areas having sandy soils derived from the Citronelle Formation and samples were taken from the upper ten centimeters of the soil. In general, these soils are dark, organic rich, silty or clayey, fine to medium sand consisting of over 90 percent quartz with degraded clay minerals. Field pH, CEC, and extractable aluminum, respectively, for all samples ranged from 4 to 8; 0.9 to nearly 20 Me/100 g; and less than one to 448 ppm. After firing 328 rockets over a four-year period at one site, field pH, CEC, and extractable aluminum, respectively, were 4.3 to 6.1, 3 to 17.2 Me/100 g, and 5 to 177 ppm. Based on these preliminary data, there does not appear to be appreciable differences between soils exposed to firing and soils not exposed to firing.

11:00 WHAT IS THE RELATIONSHIP BETWEEN GEOLOGY AND ENVIRONMENTAL

**ENHANCEMENT FROM DEVELOPMENT?**

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

Military training and ancillary activities are often suspected or accused of adversely impacting the environment. Based upon empirical study, however, these activities may, under certain circumstances, actually enhance certain wetland areas, such as pine flatwoods, and increase wetland biodiversity. For instance, at Camp Shelby, certain training areas which have either been cleared or successively burned were found to contain wetlands which had anomalously high numbers of pitcher plants and a number of rare plant species. These same wetlands also contain the habitat for a threatened and endangered species, the Camp Shelby burrowing crayfish. Significantly, adjacent areas with similar stratigraphic and geomorphic characteristics, which have not been modified by training activities, exhibited lower quality wetlands, less biodiversity, and no significant numbers of rare or sensitive plant species. A review of the data reveals that the training areas which exhibited these environmental enhancements included firing points, the Impact Area, and the Air-to-Ground range. These training areas are located within pine flatwoods in or near low-order riverine or slope wetlands characterized by reduced silt loam soils formed upon fine-grained Miocene sediments which have contributed to the high water tables and have been the subject of frequent, although inadvertent burning caused by range firing, prescribed burning, and mechanical clearing for training purposes have reduced canopy cover in these areas which, in turn, has resulted in increased sunlight and higher water tables.

**11:15 SOLID-PHASE GEOCHEMICAL SURVEY OF THE STATE OF MISSISSIPPI: ON THE NATURE AND DISTRIBUTION OF AS, SE, HG, CU, PB, AND ZN IN STREAM SEDIMENTS AND SOILS**

David E. Thompson<sup>1\*</sup>, Andrew E. Grosz<sup>2</sup>, Paul G. Schruben<sup>2</sup>, and Jeffrey N. Grossman<sup>2</sup>, <sup>1</sup>Mississippi Office of Geology, Jackson, MS 39289, and <sup>2</sup>U.S. Geological Survey, Reston, VA 20192

Over 1500 samples were collected statewide on a 100-km<sup>2</sup> grid-cell-based survey to determine baseline geochemical values for a suite of metallic elements in stream sediment (drainage basins up to 10 km<sup>2</sup>) and soil samples (about 300) from the "Delta" and Black Prairie regions, and to prepare statistically reliable geochemical maps. Samples were analyzed by a number of analytical techniques as detailed by Thompson and others (1998). Salient statistics for stream sediment and soil samples are given below in parts per million. The "Delta" and Gulf

Coast regions have significantly higher baseline values of these potentially toxic elements with respect to adjacent terranes, in part because soils were the sampled media. A strong spatial correlation is shown to exist between regions of elevated values of these metals and land (broadly) classified as agricultural, irrespective of media sampled. Cretaceous sediments in the State, as throughout the continent, also exhibit higher baseline geochemical values than adjacent geologic units.

	SEDIMENTS			SOILS		
	MIN	ME-DIAN	MAX	MIN	ME-DIAN	MAX
As	-0.6	2.3	137	1.7	8.6	27.9
Se	-0.2	-0.2	2.5	-0.2	0.4	4.1
Hg	-0.02	-0.02	0.08	-0.02	0.03	0.20
Cu	-2	3	517	-2	10	62
Pb	-4	13	101	-4	17	50
Zn	-2	14	220	6	49.5	222

**11:30 MINERALOGY OF THE TWIGGS CLAY FORMATION NEAR WRENS, GEORGIA**

Lori G. Eversull, Millsaps College, Jackson, MS 39210

The Twiggs Clay Formation, a thick marine clay of the Barnwell Group, was deposited in neretic environments during a late Eocene highstand. Three zones are discerned near Wrens, Georgia. The lower two represent a highly absorbent fuller's earth. The upper stratum has no commercial value. Samples described herein represent the fuller's earth, and the less absorbent upper stratum. Identification of the minerals in the <2 micron fraction as well as the bulk sample was accomplished by XRD procedures supplemented with the profile fitting function of MacDiff to resolve overlapping peaks. The relative abundance of mineral constituents was determined by peak-area percentage calculations. A typical fuller's earth sample comprises quartz (17%), opal-CT (59%), smectite (24%), and mica (<1%). The less absorbent upper stratum is composed of quartz (34%), smectite (43%), kaolinite (21%), and mica (2%). Ethylene-glycol saturation reveals the smectite component of both strata to be fully expanding. The Twiggs Formation near Wrens has been described as a slightly opaline smectite, and at its type locality the Twiggs is described as comprising up to 30% cristobalite-tridymite and 15% quartz. Results of this work suggest that silica accounts for a much greater proportion of the fuller's earth facies of the Twiggs Formation.

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THURSDAY AFTERNOON

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 Petit Bois Room
 

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## 1:00 BAR MORPHOLOGY AND RELATIONSHIP TO SHORELINE CHANGE ON A RENOURISHED BEACH: HARRISON COUNTY, MISSISSIPPI

Keil Schmid, Mississippi Office of Geology, Jackson, MS 39289

A long-term pattern of erosion, especially in specific and discontinuous areas, along the wholly renourished beach in Harrison County, Mississippi, prompts the need to periodically renourish the entire beach. These 'Hot Spots' along with a varying pattern of shoreline change have been documented; however, a definitive cause is elusive. Variables such as shoreline orientation, culvert locations, harbor structures, and profile morphology have all received attention. While bar morphology on the Harrison County beach has been studied, it has not been compared to shoreline change patterns. In the present research, bar morphology has been categorized using four basic morphologies as both primary and secondary patterns. In addition, the offshore distances of the nearshore bars and shoreline structures were mapped. Bar morphology categories were classified at 50 m intervals and then compared to shoreline change patterns from 1993 to 2000. Initial results from the western portion of the study area suggest highly eroding areas are associated with wide nearshore bar zones and a dominance of widely spaced transverse bars (bars oriented at high angles to the shoreline) that together may indicate higher offshore sediment transport. Structures, both large (harbors) and small (culverts) have localized effects on bar type; the highest levels of erosion are associated with these structures and/or the bar morphology that they create.

## 1:15 LATE PLEISTOCENE NORTHERN GULF OF MEXICO COASTAL PLAIN SURFACES AND VALLEY TERRACES—TOWARD AN IMPROVED CHRONOLOGY

Ervin G. Otvos, University of Southern Mississippi, Ocean Springs, MS 39566

Ever since H. Fisk (1940), ages of Gulf coastal alluvial surfaces; the Bentley, Montgomery, and Prairie were restricted to interglacial high sea-level (= base level) phases. Even the upper Prairie interval was associated with a late Wisconsin interstade. Contrary to early assumptions, it was unrelated to any highstand. The revised Pleistocene subdivision, new dating methods and numerous recently acquired luminescence dates now prove that coastal and valley terrace aggradation between SE Texas and south Mississippi occurred throughout the Sangamon Interglacial

(135–116 ka B.P.), the Eowisconsin (116–80 ka) and glacial Wisconsin (80–10 ka) intervals. Aridity-related sediment increase compensated for low base-levels. Ongoing regional uplift raised coastal surfaces. While terrace aggradation involved at least five stream valleys between 65–30 ka B.P., erosional (strath) terraces also formed frequently. They were cut in early and late Wisconsin times from older alluvial units.

## 1:30 SURFACE MAPPING EFFORTS TOWARD DIFFERENTIATING THE MIOCENE IN MISSISSIPPI

Ken Davis and James E. Starnes\*, Mississippi Office of Geology, Jackson, MS 39289

Surface geologic mapping in the Stronghope, Hazlehurst, Shady Grove, and Wesson quadrangles of Copiah and Lincoln counties by the Office of Geology has recognized the following mapping units: (1) the Miocene age Catahoula Formation, (2) the Miocene Hattiesburg Formation, (3) the Pliocene Citronelle Formation, and (4) the Holocene alluvium. The Catahoula Formation contains generally light-colored sands and clays as well as sandstones and opal-cemented orthoquartzites derived diagenetically from volcanic ash. The Catahoula Formation has marine and nonmarine members as characterized by foraminifera and glauconite, and silicified and lignitized wood that is often associated with orthoquartzites. Thinly bedded pea gravel consisting of black chert and meta-quartzite clasts are commonly associated with indurated sandstones and orthoquartzites. The Hattiesburg Formation contains the typical Hattiesburg clay section but also contains sands similar to those in the Catahoula Formation as well as lutites and opaline-cemented sandstone. A sand at the base of the Hattiesburg Formation having a regional extent was chosen as the marker for the Hattiesburg-Catahoula contact. The Citronelle is characterized by coarse brown chert gravel and oxidized sands, quite different from the pea gravel of the Catahoula Formation and of a different source. The Citronelle contains ironstone-cemented gravel and sand at its base and locally contains goethite and other iron-hydroxide leachate deposits where springs are present.

## 1:45 PARALIC SANDS OF THE COAL BLUFF MEMBER OF THE NAHEOLA FORMATION IN MISSISSIPPI, AN OUTCROP OF THE ANCIENT SHORELINE

David T. Dockery III\* and David E. Thompson, Mississippi Office of Geology, Jackson, MS 39289

Stearns (1957), in his study of the Cretaceous and Tertiary stratigraphy of the northern Mississippi Embayment, noted that near-surface Paleocene sands, below the

basal "1,400-foot sand" of the Wilcox Group, graded down dip (toward the Embayment axis) into shales like those of the underlying Porters Creek Formation. This observation has been reinforced by the Mississippi Office of Geology's mapping and drilling programs. In particular, the sands of the Coal Bluff Member of the Naheola Formation (upper Midway Group) are restricted largely to the member's north-south trending outcrop belt and grade down dip (to the west) into shales. In this case, erosion has exhumed the Late Paleocene shoreline so that it and the present outcrop belt are in the same place. Hughes (1963) studied orthoquartzite boulders along the Coal Bluff outcrop in southwestern Union County, Mississippi, which he recognized as weathered remnants resting on unconsolidated "Wilcox" sands. He believed the depositional environment of the quartzites to be that of a beach and/or offshore bar and noted the underlying sands to form a series of north-south hills along the border of the "North Central Plateau" and the Flatwoods physiographic provinces, and, in places, to form detached outliers within the Flatwoods Province. Large quartzite formations have since been observed in place within the Coal Bluff sands of Union County.

2:00 EVALUATION OF THE WHITE RIVER FAULT ZONE UTILIZING TRANSVERSE TOPOGRAPHIC SYMMETRY

Terry Panhorst\* and Emily Strack, University of Mississippi, University, MS 38677

The White River Fault Zone (WRFZ), a zone of fault sets approximately 16 kilometers wide, poses potential seismic hazards for northwest Mississippi. Calculations of drainage basin symmetry are used to detect preferred river migration in areas suspected of neotectonic activity. The technique used to assess drainage basin symmetry is best utilized in areas defined by dendritic drainage, unconsolidated bedrock, and low regional bedrock dip, all of which characterize conditions in northwest Mississippi. Drainage basins randomly chosen in the study area followed two criteria: (1) stream order of three or larger and (2) distance from the proposed fault boundary. Because of uncertainty in precisely defining edges of the WRFZ, drainages within a 2-mile distance from the projected WRFZ boundary were considered within the WRFZ. Drainage basins outside this area established regional symmetry values to compare with symmetry value calculated for the WRFZ. The transverse topographic symmetry was calculated for linear segments of each selected drainage basin. Polar plots generated to compare the migration direction of the regional trend against the WRFZ boundary yielded a scatter of data, suggesting river basins in the area do not follow a preferred river migration

direction. Rose diagrams produced for the study area indicate river channel orientations, both inside and outside the projected WRFZ, follow the regional lithologic trend of the Mississippi Embayment. Any tectonic influences of surface drainages appears subtle enough to be concealed by regional lithologic controls.

2:15 SHALLOW SEISMIC REFLECTION IMAGING OF THE IDALIA HILL FAULT ZONE, SOUTHEASTERN MISSOURI

William F. Reid, Jr.<sup>1\*</sup>, Robert D. Cosentino<sup>1</sup>, James B. Harris<sup>1</sup>, and John N. Baldwin<sup>2</sup>, <sup>1</sup>Millsaps College, Jackson, MS 39210, and <sup>2</sup>William Lettis & Associates, Inc., Walnut Creek, CA 94596

Shallow seismic reflection imaging was used to characterize the significance of near-surface tectonic deformation associated with the northeast-trending Idalia Hill fault zone in southeastern Missouri. The fault zone is expressed by topographic escarpments, photolineaments, and subsurface faulting in Paleozoic through Quaternary deposits. Two shear-wave seismic reflection profiles (IDAL 1 and IDAL 2) were collected (in July, 2001) across the fault zone in order to identify the location and style of neotectonic deformation and help guide the placement of subsequent paleoseismic trenches. The processed seismic profiles show coherent seismic reflection energy to depths greater than 100 m. Based on correlation with local borehole data and previously acquired compressional-wave seismic reflection data, reflections from the Tertiary/Cretaceous and Cretaceous/Paleozoic boundaries have been identified on the S-wave profiles. Changes in reflection amplitude and coherency suggest the presence of high-angle faults in the subsurface. Deformation features identified in a paleoseismic trench excavated in October, 2001, correlate with the updip projection of a fault interpreted on seismic line IDAL 2. Future seismic investigations are planned in the area to image very shallow (<10 m deep) subsurface (Quaternary) deposits that do not show a geomorphic expression of recent faulting.

2:30 Divisional Business Meeting and Meeting of the Mississippi Stratigraphic Names Committee

2:45 Divisional Poster Session

SEDIMENTOLOGY OF A DELTA FED BY CONSTRUCTION-ENHANCED RUNOFF AND ASSOCIATED SEDIMENT POLLUTION: HENNINGTON LAKE, LAMAR CO., MISSISSIPPI  
Clare Falcon, Mississippi Office of Geology, Jackson, MS 39289

This study was done as part of an investigation

into local construction-sourced sediment pollution in a small bay in eastern Hennington Lake. The extent of the subaerial portion of the delta was mapped using GPS and detailed topographic maps. The subaqueous extent of the delta was delineated by the presence or absence of the delta sediments found in the six push cores taken. Six sedimentary facies were identified: Red colored moderate to well sorted sands; red colored mud; green colored mud; compacted dark gray-black mud; pale gray moderately sorted sand; 'goosey' dark gray mud with plant material. The facies were grouped into facies associations and interpreted as representing deposition in a deltaic environment, natural lacustrine environment, and sediments that were at the surface prior to lake dam construction. The detailed sedimentology made it possible to delineate between the deltaic sediments that had been sourced from the nearby construction site and those that were naturally occurring sediments. The grain size of the sediment pollution changed depending on the location's relationship to the input point. This study will be useful for other lakes with similar problems in order to help predict sedimentation patterns and the type of sediments expected to be found at different locations. These redeposited construction-sourced sediments have very different and variable textural characteristics from the original source material.

#### MERCURY IN ENID, SARDIS, AND GRENADA LAKES: PRELIMINARY INVESTIGATIONS

Carol Blanton Lutken<sup>1\*</sup>, Cathy A. Grace<sup>1</sup>, and Stephen L. Ingram<sup>2</sup>, <sup>1</sup>Mississippi Mineral Resources Institute, University, MS 38677, and <sup>2</sup>PO Box 5233, Oxford, MS 38655

In 1996, the Mississippi Mineral Resources Institute began field investigations designed to isolate the source of mercury in Enid Lake, North Mississippi. Mercury levels in fish taken from Enid Lake by the Mississippi Department of Environmental Quality, in 1994, included many samples that exceeded state (0.75 ppm) and federal (1.00 ppm) guidelines. Initial investigation included collection and analysis of water and sediment. Water parameters affecting methylation of mercury—depth, temperature, dissolved oxygen, total dissolved solids, oxygen reduction potential, pH, conductance—were measured at the surface and at total depth at each sample site. No obvious source of mercury was discovered, though Enid was found to be slightly acidic, a condition which promotes methylation of mercury. The following year, lakes to the north (Sardis) and south (Grenada) of Enid were added to the investigation. The Mississippi Office of Geology's 1999–2000 geological investigation of the area, results of the US Geological Survey's background mercury

sampling, and more fish data were incorporated into the study. All results support persistence of a problem, not evident in the water or substrate, producing levels of mercury in fish that make them unacceptable for human consumption. Mercury concentrations in Enid fish remain consistently high; those from Sardis and Grenada appear to have increased from 1994 through 1997. Few specimens from elsewhere in the Yazoo River drainage basin exhibit concentrations of mercury that exceed state or federal guidelines.

#### HIGH-RESOLUTION SEISMIC PROFILES IN SARDIS LAKE—PANOLA COUNTY, MISSISSIPPI

Charles T. Swann<sup>1\*</sup>, Anthony S. Gossett<sup>1</sup>, Carol Blanton Lutken<sup>1</sup>, and Thomas M. McGee<sup>2</sup>, <sup>1</sup>Mississippi Mineral Resources Institute, University, MS 38677, and <sup>2</sup>Center for Marine Resources and Environmental Technology, University, MS 38677

The Seistec high-resolution seismic profiling system has been used in inland water ways, lakes and reservoirs extensively in Europe, but seldom in the United States. This boomer sourced, line-in-cone receiver system was recently used in Sardis Lake to acquire highly detailed shallow subbottom data regarding the lake's stratigraphy. The objectives of the investigation were to identify sedimentation accumulated since impoundment in 1939, investigate lineaments of the local fluvial systems, and fine-tune technical aspects of the system for work in Mississippi. Data were acquired from a grid of nine seismic lines oriented along the long axis of the lake (northeast) and at approximately 90E to this axis. Preliminary analyses indicate that a well preserved bottom topography is present representing the pre-1939 Little Tallahatchie River channel. Flood plain and apparent elevated terrace deposits associated with the Tallahatchie River were also identified. A discontinuous bed up to one meter thick is interpreted to be sedimentation accumulated since 1939. This bed is absent over some bottom highs and in some channels. The reason for the discontinuous distribution is presently unclear.

#### SEISMIC IMAGES OF STRUCTURES ASSOCIATED WITH GAS HYDRATES NEAR THE SEA FLOOR: INITIAL RESULTS

Thomas M. McGee<sup>1\*</sup>, Carol Blanton Lutken<sup>1</sup>, Vaughn S. Goebel<sup>2</sup>, and J. Robert Woolsey<sup>1</sup>, <sup>1</sup>Mississippi Mineral Resources Institute and Center for Marine Resources and Environmental Technology, University, MS, 38677, and <sup>2</sup>Lookout Geophysical Company, Dillon, CO 80435

Obtaining very-high-resolution seismic images of structures immediately below the sea floor in deep water is problematic. The conventional approach involves towing a

subbottom profiler near the sea floor. However, in water a kilometer or more deep, restraints in vessel speed and maneuverability increase dramatically and energy levels of seismic sources deployed at these depths are so restricted that subbottom penetration is limited to tens of meters. Research at the University of Mississippi, designed to overcome these difficulties utilizing various seismic sources and receivers and special software to process the data, has produced seismic images of structures near the sea floor in deep water of the Gulf of Mexico. With the objective to image structures associated with gas hydrates, seismic profiles have been produced demonstrating decimeter-scale resolution near the sea floor in a kilometer of water. One profile, with resolution better than three meters, crosses a well in which shallow flowing sand had been encountered at about 300 m depth. Several profiles cross what are apparently mud diapers with one documented to contain gas hydrates; others display intriguing patterns within the shallow sediment layers. Data analyses reveal the acoustic structure of one such pattern and provide a basis for interpretation.

#### MABEN FIELD GAS PRODUCTION FROM THE ORDOVICIAN STONES RIVER IN OKTIBBEHA COUNTY, MISSISSIPPI

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

Maben Field is located in northeastern Mississippi on the southwestern flank of the Black Warrior Basin, approximately 10 miles west of Starkville in townships T18N-R12E and T19N-R12E, northwestern Oktibbeha County, Mississippi. It is one of only three fields which have produced oil or gas from the Ordovician Stones River Dolostone or "Knox-Ordovician" in Mississippi. Maben Field was discovered in July 1971 with the completion of the Texaco Inc., #1 Clyde Q. Sheely well, located in Section 28, T19N-R12E. The #1 Sheely was drilled to a total depth of 17,442 feet. The well was completed flowing 599 MCFGPD on a 9/64-inch choke with 1,000 lbs. psi flowing tubing pressure from perforations at 14,690–784' and 14,904–15,036'. The Stones River Dolostone in the #1 Sheely well is approximately 420 feet thick; the top is picked at 14,670 feet and the base at 15,090 feet. In December 1997, cumulative gas production at Maben Field was over 1.1 BCF of gas. In September of that same year Fina Oil & Chemical began a drilling program, which has resulted in the completion of four Stones River gas wells and a dramatic increase in production. As of 12/31/2000, cumulative gas production for the field was over 7.8 BCF. The new producing wells are fault separated from the original well and production is believed to be enhanced by fault-induced fractures present in the Stones River

reservoir. In October 2001, Fina was actively drilling or testing two new wells and had two additional locations permitted.

#### HEALTH SCIENCES

Chair: Ibrahim O. Farah, Jackson State University

Vicechair: Hamed Benghuzzi, University of Mississippi Medical Center

#### THURSDAY MORNING

Gulf Hall

#### 10:00 3D ORIENTATION AND DYNAMICS OF PRIMARY SEMICIRCULAR CANAL AFFERENTS IN THE RHESUS MONKEY

Asim Haque\*, Dora E. Angelaki, and J. David Dickman, Alcorn State University, Alcorn State, MS 39096; Washington University, St. Louis, MO 63110; and, Central Institute for the Deaf, St. Louis, MO 63110

Neural signals from primary afferents in three rhesus monkeys were recorded during rotational motion using a 3-axis system. Each afferent was characterized as a posterior, horizontal, or anterior fiber using rotations in different planes. Next, the responses to sinusoidal stimuli at frequencies ranging between 0.02–4 Hz were obtained. Out of 72 afferents recorded, the directions of maximum sensitivity and response dynamics were determined for 13 posterior, 14 anterior, and 8 horizontal afferents. For regular (n=21), intermediate (n=3), and irregular (n=5) firing afferents, the average sensitivities at 0.5 Hz were  $0.6 \pm 0.3$  spikes $\times$ s<sup>-1</sup>/deg $\times$ s<sup>-1</sup>,  $1.7 \pm 0.6$  spikes $\times$ s<sup>-1</sup>/deg $\times$ s<sup>-1</sup>, and  $0.8 \pm 0.4$  spikes $\times$ s<sup>-1</sup>/deg $\times$ s<sup>-1</sup>, respectively. The average phase leads relative to head velocity were  $9.4 \pm 4.4E$ ,  $24.0 \pm 9.3E$ , and  $31.4 \pm 5.5E$  respectively. Regular firing afferents had response dynamics that consisted of flat gains and constant phase advances across stimulus frequencies. Irregular firing afferents had pronounced gain increases and increased phase advances as stimulus frequency increased. The maximum sensitivity vector for each afferent was calculated from the responses to rotations in different planes. The vectors were plotted in the head-fixed coordinate system, defined by the alignment of the horizontal semicircular canals with an earth horizontal plane, using direction cosines. Other than a small yaw component for vertical canal afferents, the direction vectors tended to be orthogonally oriented to each other. Technical assistance was provided by Bennie Harris, Jesus Loya, and Quinn McHenry. This work was supported in part by NIH

EY10851 and NASA NAG2-1204.

#### 10:15 INTERACTION OF HUMAN COMPLEMENT FACTOR H WITH PSpC

Corunda T. Pruitt<sup>1\*</sup>, Sandhya Dave<sup>2</sup>, Joseph A. Cameron<sup>1</sup>, and Larry S. McDaniel<sup>2</sup>, <sup>1</sup>Jackson State University, Jackson, MS 39217, and <sup>2</sup>University of Mississippi Medical Center, Jackson, MS 39216

*Streptococcus pneumoniae* can evade the host immune system by a variety of mechanisms. The pneumococcal polysaccharide capsule and various surface proteins can prevent complement mediated opsonophagocytosis. PspC is one of the multi-functional pneumococcal surface proteins capable of eliciting an antibody response in mice. PspC consists of three domains: N-terminal  $\alpha$ -helical domain, proline-rich domain, and choline-binding domain. We observed that PspC binds human Factor H (FH), a regulatory protein of the alternative complement pathway. The binding was demonstrated by Western blot analysis. Binding of FH to PspC on viable pneumococci was confirmed by flow cytometry and fluorescence microscopy. FH consists of 20 short consensus repeat (SCR) domains, with each domain containing approximately 60 amino acids. The sites of interaction between FH and PspC have not been previously localized. We used a series of FH truncated mutants to localize the region of FH that binds to PspC. The PspC truncated mutants were used to localize the region of PspC that binds FH. The site of FH that binds to PspC is located within the SCR 6–10 of FH. We have also localized the corresponding binding region on PspC to the first 225 amino acids of the  $\alpha$ -helical domain.

#### 10:30 SELECTIVE TOXICITY TO HEPG2 AND RAT PRIMARY LIVER CELLS BY 2,3 BUTANEDIONE

Ibrahim O. Farah\* and Ali B. Ishaque, Jackson State University, Jackson, MS 39217

2,3 Butanedione (diacetyl) is the buttery flavor naturally found in dairy products, fermented meat and beverages. This chemical is ubiquitous in its production and use. Its uses include the production of diones, dienes and oximes; analytical and pharmaceutical reagents. It is employed as starter in chemical reactions; in modification of proteins; photo initiation in polymers; and is a known preservative and additive for flavor enhancement in food production. Although its antimicrobial activity is well documented in literature, its effects on mammalian cells are not known. The objectives of this study are (1) to evaluate the survival response of mammalian HepG2 and Wistar Rat liver cells to diacetyl and (2) to evaluate its toxicity, inactivation mode and dose response trends. Since these responses were not known, expectations on adverse chronic

outcomes are beyond the scope of this study. Cell culture techniques and chemical exposure protocols for concentrations ranging from 490 to 250,000 ppm (serial dilutions; DMEM-Hyclone) were incorporated. Surviving cells following a 24 hour exposure period were measured using an Accent Fluoroskan at 485/538 nm. HepG2 and rat liver cells showed a toxicity index LC-50 of 530  $\pm$ 35 and 3400  $\pm$ 354 ppm respectively. Both cell types showed a dose response to diacetyl with rat liver cells being less sensitive (6 fold increase in LC50). Interesting inactivation trends warranting further studies were seen, however, the study is promising with regards to the selective toxicity of diacetyl.

#### 10:45 DOES NEONATAL METHYL PARATHION (MP) ALTER BRAIN ACETYLCHOLINESTERASE AND WITHDRAWAL FROM MORPHINE DEPENDENCE IN ADULT RATS?

Robin W. Rockhold<sup>1\*</sup>, A. Lampton<sup>2</sup>, J. Lee<sup>3</sup>, D. Yokum<sup>4</sup>, and He Zhu<sup>1</sup>, <sup>1</sup>University Mississippi Medical Center, Jackson, MS 39216-4505; <sup>2</sup>Murrah High School, Jackson, MS 39202; <sup>3</sup>St. Andrew's Episcopal High School, Ridgeland, MS 39157; and <sup>4</sup>St. Joseph Catholic School, Madison, WI 39110

The effects of repeated administration of MP, an organophosphate insecticide, on brain cholinesterase activity and motor function were investigated in neonatal rat. Pups were treated dermally with 0, 1, 3, or 5 mg/kg of MP daily for 21 days after birth. Cholinesterase activity decreased dose-dependently after MP. Pups exposed to MP, 5 mg/kg, showed signs of intoxication, e.g. slight tremor, and (cortex, hippocampus) cholinesterase activities were 20% of control. However, neither body weight nor locomotor function (open field tests) were reduced. In adult rats, three months after neonatal MP treatment, cholinesterase activities had returned to normal. To test whether neonatal exposure to MP altered the development of opioid dependence, adult rats were made dependent by continuous intracerebroventricular (i.c.v.) infusion of morphine (26 nmol/ml/h) for 3 days. Withdrawal was precipitated after three days of infusion by an opioid antagonist, naloxone (48 nmol/5 ml, i.c.v.). Eight withdrawal behaviors were scored. Although the rats that were treated with 5 mg/kg MP exhibited a higher opioid withdrawal score compared to the control group, the involvement of neonatal cholinergic modulation in opioid dependence still remains to be determined. (Sponsored by the Howard Hughes Medical Institute and RO6-CCR419466-01)

#### 11:00 TRANSMISSION GENETICS OF MACHADO-JOSEPH DISEASE FAILS TO SUGGEST MALE MEIOSIS MEIOTIC DRIVE

Kim A. Parker, Millsaps College, Jackson, MS 39210

The purpose of this project was to determine the transmission rate from affected males and females of the expanded CAG sequence in the MJD1 gene at 14q32.1 which causes Machado-Joseph disease (MJD), a neurological disease. Previous research projects have suggested a favored transmission from affected fathers to their offspring. Thirteen extensive pedigrees detailing history of affected family members were examined. The number of transmissions from affected males and females were recorded. The offspring of 64 affected individuals (34 male, 30 female) were evaluated. Of 303 offspring (150 male, 153 female) who were evaluated, 137 (62 male, 75 female) were affected by Machado-Joseph disease. The research shows no distortion in transmission ratios that would suggest a meiotic drive in male meiosis. Current observations suggest that there is no favored transmission and the rate that offspring inherit the disease from affected males and affected females operates in accordance with traditional Mendelian ratios.

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## THURSDAY AFTERNOON

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Gulf Hall

1:00 Divisional Poster Session

### INFLUENCE OF LEAD ON ENERGY LEVELS AND METAL SEQUESTRATION IN THE BRAIN, LIVER, AND KIDNEY OF ADULT RAT

D. Jones<sup>1\*</sup>, B. Rajanna<sup>1</sup>, J. Butler<sup>1</sup>, D. Donald<sup>1</sup>, L. Davis<sup>1</sup>, S. Rajanna<sup>1</sup>, K. Kumar<sup>2</sup>, S. Shirisha<sup>2</sup>, Neelima<sup>2</sup>, and Y.P. Rao<sup>2</sup>, <sup>1</sup>Alcorn State University, Lorman, MS 39096, and <sup>2</sup>Andhr University, India

Lead (Pb) is a potent toxicant and it disturbs cellular energy metabolism of the brain as well as the liver and the kidney. The objective of this study was to determine the energy levels of different regions of the brain, as well as the liver and the kidney of adult rats exposed to Pb. Lead as lead acetate (500 ppm) was administered through drinking water to male (Wistar strain) rats weighing 125–150 g for 8 weeks and the controls received similar doses of sodium acetate. Rats were sacrificed at intervals of 1, 4, and 8 wks. The whole brain tissue was separated into four regions. Tissues were individually dried at 80°C for 48 h and then homogenized into dry powder, which was used to estimate total carbohydrates, proteins and lipids. The resulting data was converted into energy levels by using specific constants. Estimation of Pb content was done in the dry tissue powder. The results indicated that Pb decreased energy levels in the liver and kidney as well as in all regions of the brain. The concentration of Pb was higher in

all tissues tested. A significant correlation was observed between these two parameters in all tissues. The influence of Pb on energy levels followed a pattern of region specificity and exposure period. The results suggest the Pb interferes in the cellular energy metabolism in different tissues studied. (Supported by NIH/FIC/MIRT #TW00132, NIH/MBRS-SCORE #GM55356)

### REGRESSION OF HYPERTROPHY BY CARDIO-SPECIFIC INHIBITOR OF METALLOPROTEINASE IN CHRONIC HEART FAILURE IN MICE

Urseline A. Hawkins\* and Suresh C. Tyagi, University of Mississippi Medical Center, Jackson, MS 39216

Left ventricle hypertrophy (LVH) is the hallmark of chronic heart failure (CHF). Previous studies have suggested decreased levels of cardiac inhibitor of metalloproteinase (CIMP) in heart failure. To test the hypothesis that decreased levels of CIMP lead to LVH, and that increased levels of CIMP ameliorate LVH in CHF, we sought to purify and characterize CIMP from mouse hearts. The heart extracts were prepared, and samples were then loaded onto a preparative continuous gel electrophoresis column. The fractions were collected and analyzed for protein by the SDS-PAGE as well as by the Western blot analysis using a CIMP antibody. Fractions with single bands on the SDS-PAGE, and on the Western blot analysis were identified as being positive for CIMP. To create CHF, an arteriovenous (AV) fistula was created in normal wild type C57BL/J6 mice. The CIMP protein transfer (40 micrograms/day) was performed by a minipump for 4 weeks. The heart weights were measured. The results suggested an increase in heart weights in the AV fistula mice. The heart weight was significantly decreased in AV fistula mice treated with CIMP. These results suggest that CIMP protein transfer decreases heart weight, thereby decreasing hypertrophy in CHF mice.

### COMPARISON OF EXTRACTION METHODS AND PROCEDURAL DEVELOPMENTS FOR DRUGS OF ABUSE ANALYSIS IN SERUM USING EMIT®

Kirk C. Eddleman\*, Arthur S. Hume, Patrick B. Kyle, J. Lee Spencer, and Christine M. Purser, University of Mississippi Medical Center, Jackson, MS 39216

A comparison of three different methods using methanol, acetone, and acetonitrile as extracting solvents for drugs of abuse in serum was conducted. The purpose of this study was to determine which of these methodologies is the most effective in the analyses of serum for drugs of abuse. The extracts were analyzed by enzyme-multiplied immunoassay technique (EMIT® II Plus, Syva Company, Dade Behring, Inc.). Seven urine assays were used: amphetamine, barbiturate, benzodiazapine, cannabinoids,



cocaine, opiate, and phencyclidine (PCP). A control with a known concentration of each drug and a drug free control were prepared and processed through each extraction procedure. The sensitivity of each method was determined by comparing the absorbance differences in the positive and negative controls. For our applications, the acetonitrile method proved to be the most efficient extraction method. The development of cutoff values and concentrations for the controls was then conducted based on the toxic and lethal levels of the selected drugs. One from each drug class was selected at a specific concentration to be used in the positive control for routine analytical testing. Cutoff values for the drugs in the positive control were designated as d-amphetamine-50 ng/ml, butalbital-300 ng/ml, oxazepam-200 ng/ml, carboxytetrahydrocannabinol-30 ng/ml, benzoylecgonine-50 ng/ml, oxycodone-50 ng/ml, and phencyclidine-25 ng/ml.

#### DRUGS DETECTED BY IMMUNOASSAY DRUGS OF ABUSE SCREENS VS. GAS CHROMATOGRAPHY/MASS SPECTROSCOPY IN SUSPECTED PEDIATRIC INGESTIONS

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Rapid and accurate analytical testing can be of great value when determining treatment for pediatric patients suspected of ingesting an unknown chemical. Though the patient's condition may potentially deteriorate into coma or death, clinicians often overlook gas chromatography/mass spectroscopy (GC/MS) as a valuable resource in toxicology testing. This report relates that analysis by GC/MS offers more significant information about the toxicological exposure of the pediatric patient than immunoassay drug screening. In a recent 24-month period, the University of Mississippi Medical Center Analytical Toxicology Laboratory tested 139 urine samples referred for STAT toxicology screening from the hospital's Pediatric Emergency Department. Most patients exhibited symptoms such as ataxia, seizures, and unresponsiveness. Toxicology testing was ordered to confirm or rule out a chemical ingestion. When tested by immunoassay (Dade Behring EMIT<sup>®</sup> II Plus), 17.3% of the samples were positive for a drug of abuse. When analyzed by GC/MS (Thermoquest GC<sup>®</sup>), drugs were detected in 88.5% of the samples. Caffeine and theobromine accounted for 21.1% of the positive samples by GC/MS. A total of 64 different pharmaceuticals were identified by GC/MS with an average of 2.21 drugs per sample. In conclusion, analysis by GC/MS offers the clinician a more comprehensive view of exposure patterns of pediatric patients presenting with an unknown chemical ingestion.

#### THE VALUE OF BENZODIAZEPINE CONFIRMATIONS IN A VETERAN POPULATION

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As the cost of analytical testing continues to rise, many hospitals order drug screen confirmations only as directed by the patient's physician rather than automatically. While this may appear adequate in some clinical settings, confirmatory testing is often required in possible medico-legal situations when the presence of drugs may have serious implications in the workplace or courts of law. In a recent 12-month period, a local Veterans Affairs Medical Center referred 409 urine samples to the UMMC Analytical Toxicology Laboratory for benzodiazepine confirmations. All samples had screened positive using the Abbot AxSYM<sup>®</sup> immunoassay analyzer. A second screen was performed with the ROCHE<sup>®</sup> MIRA<sup>®</sup> S using Dade Behring Emit<sup>®</sup> II Plus reagents. Confirmations were performed utilizing a Waters<sup>®</sup> high pressure liquid chromatograph equipped with an ultraviolet photodiode array detector and a computerized library established in house. Of the 409 samples tested positive by the AxSYM<sup>®</sup>, 382 (93.4%) generated positive results when tested by the MIRA<sup>®</sup> S. Benzodiazepines were confirmed in 322 (78.7%) of the samples. The AxSYM<sup>®</sup> generated 87 (21.3%) false positives while the MIRA<sup>®</sup> S generated 71 (17.4%) false positive results respectively. Oxaprozin was identified as the causative agent in 42 of the false positive samples. Finally, discontinuation of benzodiazepine confirmations would result in inclusion of a significant amount of false information in the medical files of some patients, resulting in negative consequences affecting patient treatment, drugs rehabilitation, parole compliance, etc.

#### CYTOKINE PROMOTER GENE POLYMORPHISM IN ASSOCIATION WITH CYTOKINE EXPRESSION IN PATIENTS WITH HYPERTENSION

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Hypertension is the number one public health problem in the United States, particularly among African Americans. It can cause a stroke, cardiovascular disease, and kidney failure. Many aging Americans experience elevated blood pressure with age. Overall prevalence of hypertension is 25% and is 35% in African Americans. A number of biological factors contributes to an elevated blood pressure, including growth factors, cytokines and hormones. The effective role of cytokines and growth factors contributing to the induction of hypertension is unknown. It was demonstrated in our recent study that

TGF- $\beta$ 1 was hyperexpressed in African-American patients with renal transplant, and majority of these patients had suffered from hypertension. Therefore, the goal was to investigate the possible association between cytokine gene polymorphism and clinical characteristics of hypertension. We have analyzed DNA samples from 160 well-characterized African-American patients with known hypertension and 77 African-American individuals from the normal pool with no evidence of elevated blood pressure. Cytokine gene polymorphism was tested by cytogene protocol using a polymerase chain reaction based sequence specific polymorphism (SSP) detection method. DNA was amplified for identification of TNF- $\alpha$ , TGF- $\beta$ 1, IL-10, IL-6 and IFN- $\gamma$ . A high TGF- $\beta$ 1, T/C G/G genotype was found in 40% of African-American patients with hypertension as compared with 27% of African-American controls,  $p = 0.03$ . A low IFN- $\gamma$  genotype was increased 67.5% in hypertension group, compared with 57% in non-hypertension group ( $p = 0.03$ , RR = 1.18) indicating a new mediator of hypertension. This data demonstrates TGF- $\beta$ 1 and IFN- $\gamma$  genotype polymorphism in concert may contribute to the elevated level of blood pressure in African-American.

**AFFERENT INNERVATION PATTERNS OF THE HORIZONTAL CRISTA AMPULLARIS IN PIGEONS**  
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Primary afferents that innervate receptor cells of the semicircular canal neuroepithelium have generally been characterized based upon their regional innervation patterns. The avian labyrinth is of particular interest because of recent evidence showing that both hair cells and their innervating afferents regenerate after death produced by ototoxic insult. In the present study, biotinylated dextran amine (BDA) tracer was injected into the vestibular nuclei of pigeons (*Columba livia*) for retrograde transport by canal afferents in order to visualize individual fiber innervation patterns. After post-injection survival, the labyrinth was exposed followed by fixative perfusion, subsequently harvested, reacted in whole mount, embedded in plastic, sectioned, and mounted on glass slides. Serial reconstructions were performed with visual imaging and 3D reconstruction software. In four pigeons, the horizontal canal neuroepithelium was examined and traced. Out of 135 identifiable horizontal semicircular canal afferents, sufficient labeling was present to reconstruct 70 units, including 24 calyces, 25 dimorphic, and 21 bouton units. The lateral portion of the neuroepithelium was innervated primarily by bouton type afferents where only type II cells were present. Dimorphic afferents were spread throughout

the intermediate and medial portions of the crista. Calyx type afferents were mostly observed in the medial portions of the crista. In the transverse plane of the crista, calyces, boutons, and dimorphs were located throughout the epithelium from the apex to both edges. However, type I cells were concentrated near the apex and type II cells near the peripheral edge. This work was supported by funds from the NIDCD (DC02386).

**THE EFFECTS OF TRI-CALCIUM PHOSPHATE (TCP) CERAMICS SINTERED AT DIFFERENT TEMPERATURES ON THE PROLIFERATION OF MRC-5 FIBROBLASTS**

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Calcium phosphate ceramics have recently been used as dental implants, drug delivery systems, and models for studies on bone remodeling. Although their use has been very successful, problems such as aseptic loosening, coagulation, fibrous tissue formation, and inflammation have been noted. The objective of the study was to investigate the effects of tri-calcium phosphate (TCP) ceramics sintered at different temperatures on the proliferation and cellular alteration of MRC-5 fibroblasts like cells. This was accomplished by light microscopy morphologic analysis, measurements of MDA (a measure of cell damage), total protein, and cell counts. A total of 96 TCP ceramics were divided into 4 groups of 24, with each group being assigned a different sintering temperatures of 800, 1000, 1200, or 1400EC. Each temperature group was then further divided into 8 ceramics per phase of 24, 48 and 72 hours. All data were analyzed using Sigma Stat software. The data collected from this study provided useful information pertaining to the optimum manufacturing conditions that produce high proliferation rates with minimal cellular damage. At 72 hours (the phase simulating chronic conditions), cell counts and MDA analysis showed that the cells incubated with the TCP sintered at 1200EC had the greatest proliferation and least damage when compared to the other groups. Morphological, MDA and protein analysis showed the cells incubated with the 1400EC TCP capsules to have undergone obvious cellular adaptations or other extreme cellular alterations. Overall, the data collected revealed a marked alteration in cellular function and morphology over the range of sintering temperatures that were tested.

**RECOVERY OF RAW 264.7 PHOSPHATIDIC ACID FROM THIN LAYER CHROMATOGRAPHY AFTER STIMULATION WITH LIPOPOLYSACCHARIDE**

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Lipopolysaccharide (LPS) is an endotoxin that has been shown to stimulate the release of inflammatory mediators from RAW 264.7 cells. Ethanol inhibits LPS mediated events as well as changes the profile of the phospholipids on the surface of the cell. The objectives of this experiment were to (1) identify the changes in phosphatidic acid (PA) in RAW 264.7 cells stimulated with LPS or in the presence of LPS and ethanol; and (2) to quantitate the recovery of PA by thin layer chromatography (TLC). RAW 264.7 cells were labeled with [<sup>3</sup>H]-palmitic acid overnight. The cells were then treated with LPS, ethanol, or both for thirty minutes. Following exposure, phosphatidic acid was isolated by TLC. The tritium-labeled phosphatidic acid band was identified by comparison to a PA standard. The PA region of the plate was scraped and placed in 5 mL of scintillation cocktail. Quantitation of PA was carried out by scintillation counting. The results show addition of 2&#61549 g of LPS stimulated RAW 264.7 cells, as evidenced by a 173% increase in PA within 30 minutes. Also, the addition of 20 mM ethanol prior to stimulation with LPS inhibited the formation of PA by 163% in just 30 minutes. The combination of LPS and ethanol resulted in an 11% increase in PA compared to control cells and a 162% decrease in PA from LPS stimulated cells. The efficiency of recovering the fraction of PA after TLC separation ranged between 10 and 27%. In conclusion, phosphatidic acid is significantly increased in LPS stimulated cells, and TLC separation and extraction allows for sufficient amounts of PA which can be analyzed further by techniques such as mass spectrometry.

#### PROLIFERATION AND MORPHOLOGICAL TRANSFORMATION OF RMK CELLS EXPOSED TO HYDROQUINONE CONTAINING IONOMERS

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Recent research in our laboratories have been directed towards the development of ionic polymers and monomers for use in biomedical applications such as adhesives, controlled release matrices and tissue scaffolds. The curing reactions are based on free radical chemistry that require a radical scavenger, hydroquinone (HQ) to adjust working and setting times and shelf-life stability. The few studies published on HQ have suggested that high dosages of HQ may stimulate apoptosis as well as an increased cellular leakage, however the effect of HQ on the biocompatibility is unknown. Therefore the objectives of this study were to measure the functional capacity, cell proliferation and structural integrity of Rhesus monkey

kidney epithelial (RMK) cells exposed to ionomer formulations containing 4 different levels of HQ. A total of 90 tubes of RMK (40,000 cells per tube) cells were divided equally into five equal groups. Group I served as a control and groups II–V were subjected to ionomers containing 0, 500, 1000, and 2000 ppm HQ. Cell numbers, morphology, cellular and supernatant MDA levels, and total protein analysis were performed. The results suggest: (i) All ionomer groups increased cellular proliferation except for the 2000 ppm HQ group; (ii) MDA levels were increased in cells containing 2000 ppm HQ at 24 hours; and 0 ppm at 48 hours whereas the other ionomer treated groups exhibited decreased MDA levels. It may be concluded that HQ concentrations over 1000 ppm may adversely effect biocompatibility.

#### THE ROLE OF DHEA ON THE VIABILITY OF UV RADIATED A549 CELLS

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Dehydroepiandrosterone (DHEA) is a hormone with antioxidant properties that is endogenously produced in the body, which declines with age. DHEA was shown to protect epithelial cells from direct UV damage. Therefore, the objectives of this study were: (1) to evaluate the effect of cell proliferation and viability after UV exposure, and (2) to determine the effectiveness of DHEA treatment prior to or following UV exposure. A549 cells (n = 96) were divided randomly into 4 equal groups. Control (untreated), UV exposed, DHEA added prior to exposure and DHEA added following exposure. Eight tubes from each group were terminated at 24, 48, and 72 hours, and cell counts, protein and MDA levels, as well as, morphology were analyzed. The results revealed exposure to UV light for 30 minutes significantly reduced cell number at 24, 48, and 72 hours. DHEA added prior to or after UV exposure caused a slight increase in cell number over UV exposed cells, but was significantly less than the untreated group at 24–72 hours. DHEA added after UV exposure began to offer protection at 48 hours and by 72 hours the cell numbers began to approach those seen in untreated cells. MDA levels were elevated in all UV exposed groups at 24 hours, and by 72 hours the MDA levels in the DHEA treated groups were not statistically different from the control. In conclusion, the use of antioxidants such as DHEA after UV exposure resulted in minimal cellular damage, suggesting that DHEA is more affective when used as a treatment.

#### CYTOPATHOLOGICAL EVALUATION OF THE FEMALE REPRODUCTIVE TRACT EXPOSED TO SUSTAINED DELIVERY OF DHEA OR DHEA E IN RATS

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The specific objective of this investigation was to investigate the cytopathological changes associated with sustained delivery of DHEA alone or in combination with estrogen (E) using adult intact female rats as a model. A total of nine adult rats allocated for this study (BW 220–250 g). The animals were divided into three equal groups (G1 = control, G2 = DHEA (2–5 ng/ml), DHEA E (10 pg/ml). At the end of 21 days post-treatment the reproductive organs (ovaries, cervix, fallopian tube, uterus and vaginal tissue) were retrieved and subjected to two different extensively used stains (H & E and PAP stains). The results of this study demonstrated that: (1) the use of H & E staining procedure is considered favorable in tissues like ovaries, tubes, and uterus. In contrast, the use of PAP staining is recommended for the cervix and vaginal tissue, (2) no significant difference was observed in ovaries, uterus, and fallopian tubes compared to the control group, (3) treatment with DHEA induced nuclear hyperchromasia of cervical cells compared to DHEA E and control, (4) the use of DHEA alone or in combination induced an increase in mitotic ability of the vaginal tissue in comparison to the control, and (5) the treatment with DHEA or DHEA E resulted in occasional hyperchromatic nuclear condition compared to the control group.

#### THE EFFICACY OF TCPL AS E PLUS P REPLACEMENT THERAPY MODEL USING OVARIECTOMIZED RATS AS A MODEL

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Tricalcium phosphate lysine (TCPL) delivery system was used to deliver various organic compounds at sustained levels in many different models. The specific aim of this investigation was to utilize TCPL delivery system as a model for estrogen (E) plus progesterone (P) replacement therapy in post-ovariectomized adult rats mimicking a postmenopausal condition. 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 E (20 mg loaded TCPL), and OVX plus E (TCPL, 20 mg) plus P (TCPL, 60 mg) treatment. Group 4 animals (n = 4) served as intact control group. Blood samples were collected biweekly for 33 days. Vaginal smears were taken and screened daily during the entire investigation. The total serum levels of E, P, luteinizing hormone (LH), and follicle stimulating hormone (FSH) were measured by means of radioimmunoassay

procedure. Data obtained from this investigation suggest the following: (I) OVX resulted in an increase in total serum levels of LH and FSH within 2 days post-ovariectomy, (II) TCPL were capable of releasing sustained levels of E (10–40 pg/ml) and P (2.30–3.75 ng/ml) at the end of second day and continued until the 33<sup>rd</sup> day, (III) the sustained levels of E plus P were able to suppress the post ovariectomy rise of LH and FSH to almost undetectable levels, (IV) sustained delivery of E resulted in maturation of vaginal epithelium and the smears exhibited the estrus phase throughout the investigational period (V) E P treatment induced no estrus and the epithelial changes resembled the OVX group.

#### CYTOPATHOLOGICAL AND BIOCHEMICAL EVALUATION OF A549 CELLS TREATED WITH MINERAL AND GLUCOCORTICOIDS

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The synergistic interaction of aldosterone and cortisol on respiratory cells has not been fully investigated. The objectives of this study were: (1) to determine the role of aldosterone and cortisol on the viability of A549 cells and (2) to evaluate the morphology of the cells treated with aldosterone and cortisol. A549 cells (147 tubes) were divided into seven equal groups, (control, vehicle control, aldosterone 0.015 pg, 0.033 pg, and 0.066 pg, cortisol and cortisol aldosterone (0.033 pg) (A C)). Cells were incubated for 24, 48, and 72 hours and analyzed for cell number, morphology and biochemical markers. Neither cortisol nor aldosterone increased cell numbers during the entire experiment. However, addition of A C caused significant decreases in cell number (at 24 and 48 hours) that was not evident at 72 hours of exposure. Cellular protein concentrations were similar for all groups at 24, 48, and 72 hours. Cellular MDA levels were increased in treated groups at 24 hours. Morphological evaluation revealed the following: (1) treated cells were hyperchromatic with lower nuclear/cytoplasmic (N/C) ratio at 24 & 48-hours, (2) aldosterone treated cells appeared anucleated, vacuolated, with increased N/C ratios 24 & 48-hours, (3) cortisol increased spindle-shapes and cells with foamy cytoplasm, (4) cortisol and A C caused vacuolization, enlarged nuclei and cellular degeneration at 48 & 72 hours. Overall, the data suggest cells have either adapted to their environment or have metabolized the hormones. Future studies should include continuous hormone supplementation and compared with cells given a bolus dose.

#### THE EFFECTS OF TRICALCIUM PHOSPHATE CERAMICS WITH AMINO ACID BINDERS ON THE PROLIFERATION AND VIABILITY OF MRC-5 CELLS

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Ceramic material interacts with surrounding tissue. Therefore, ceramics can serve as scaffolds for tissue growth. The objective of this study was to determine if ceramics formulated with amino acid binders can enhance and support cell growth. A total of 147 tubes containing  $1 \times 10^5$  MRC5 cells were divided into seven equal groups. Group I served as control, Groups II-VI were incubated with ceramics containing amino acid binders (ASP, CYS, HIS, LYS, or SER, respectively) and Group VII served as ceramic without binder. Equal numbers of tubes were terminated at 24, 48, and 72 hours. Cell numbers, morphology and damage were determined at each time point. At 24 hours, cell numbers were increased in experimental groups, and MDA levels were increased in the control. Cell numbers at 48 hours were increased in all groups with the exception of HYS. HYS treated cells also had higher MDA levels. In addition to cell number, cellular adhesion was also increased in the experimental groups at both 48 and 72 hours. At 72 hours total cell number was increased in CYS and LYS groups. Cells exposed to ceramics with SER as a binder showed decreased cell numbers as well as increased MDA levels at 72 hours. Morphological evaluation of the cells showed amino acid binders with acidic side chains caused an increase in the presence of spindled shaped cells, neutral side chains resulted in cells with elongated appearances, and basic side chains caused the cells to be less elongated. In conclusion, amino acid binders are able to induce the cells to adhere, proliferate and affect their morphological appearance as early as 24 hours.

#### LOCALIZATION OF IL-6 ON VENTRICULAR TISSUES EXPOSED TO SUSTAINED DELIVERY OF AED, T, AND DHT USING A RAT MODEL

Shontell Credit<sup>1\*</sup>, Hamed Benghuzzi<sup>2</sup>, Joseph A. Cameron<sup>1</sup>, and Michelle Tucci<sup>2</sup>, <sup>1</sup>Jackson State University, Jackson, MS 39204, and <sup>2</sup>University of Mississippi Medical Center, Jackson, MS 39216

Interleukin-6 has been shown to play a potential role in myocardial injury. This complication can result from normal postreperfusion injury as well as reduced oxygen levels as seen in congestive heart failure. It has been shown in rats that androgen therapy improves coronary blood flow and increases both fractional shortening and peak myocardial oxygen consumption,

thereby improving cardiac function. The objectives of this study were: (i) to morphologically (H & E) evaluate the cellular alternations associated with sustained delivery of testosterone (T), dihydrotestosterone (DHT), and androstenedione (AED), and (i) to localize cytokine production mainly interleukin-6 (IL-6) in the ventricular tissues exposed to sustained levels of T (5 ng/ml), DHT (2 ng/ml) and EAD (2 ng/ml). A total of 16 rats were divided into four equal groups. Animals in group I served as control and animals in groups II-IV were implanted with drug delivery systems containing T, DHT, and EAD, respectively. At the end of 90 days post treatment, the animals were euthanized and the tissues were retrieved and fixed for histological procedures. Representative apical ventricles were sectioned and immunostained for IL-6 producing cells. The results revealed that (i) the exposure of sustained levels of androgenic hormones exhibited myocardial hypertrophic condition compared to the control animals, and (ii) the control animals had a two-fold increase in IL-6 production over T treated animals and approximately five-fold increase over DHT and AED treated animals. In conclusion, IL-6 production is decreased in animals given androgenic steroids and this decrease can be explained by a possible increase in blood flow, resulting in an increase in oxygenation of the myocardium.

#### BIOCHEMICAL AND STRUCTURAL CHANGES ASSOCIATED WITH SUPPLEMENTATION OF ANTIOXIDANT TO MRC-5 FIBROBLAST CELLS EXPOSED TO UVR

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The long-term goal of this study is to provide an effective preventative mode as well as treatment/cure for skin damage mediated by exposure to radiation. The specific aims of this project were: (i) to evaluate the morphological changes of MRC-5 fibroblast cells exposed to ultraviolet radiation (UVR) at various time periods, (ii) to investigate the pathophysiological responses associated with ultraviolet radiation exposure to MRC-5 fibroblast cells, (iii) to evaluate the response(s) of UV exposed MRC-5 fibroblast cells to antioxidant supplementation as a treatment measure, (iv) to evaluate the effects of supplementation of antioxidants to MRC-5 fibroblast cells before exposure to ultraviolet radiation as a preventative measure. A total of 115 vials (100,000 Cells/Vial) of MRC-5 fibroblast cells were used, the MRC-5 fibroblast cells were treated with UVR from a standard light bulb at various time intervals (24, 48, and 72 hours) and in the second phase the cells were treated with vitamin E (0.04 U/ml) to assess the antioxidants effect. Proliferation rate,

biochemical marker changes (total protein, MDA, GTH) and morphological evaluations were performed following standard laboratories protocols. The results of the project revealed that UVR induced significant effect on the proliferation rate of MRC-5 fibroblast cells upon the exposure duration of 45 and 60 minutes. Structural and biochemical changes were noted throughout the experimental phases (24, 48, and 72 hours) among the UVR exposed groups compared to control cells. However, treatment with Vitamin E prior and post exposure provided a protective role by demonstrating lower levels of MDA ( $P < 0.05$ ) as well as normal structural appearance.

#### THE GENDER EFFECT ON THE VIABILITY AND PROLIFERATION OF MRC-5 CELLS INCUBATED WITH LIPOPROTEINS

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Increasing evidence reveals that low-density lipoprotein (LDL) and gender are significant risk factors in the development of cardiovascular disease. The specific aims of this investigation include: (1) to evaluate the effect of estrogen (E) and testosterone (T) on the proliferation of MRC-5 cells, (2) to investigate the role of E and T on the viability of MRC-5 cells exposed to physiological and supraphysiological levels of LDL, and (3) to evaluate the morphological changes associated with E, T, and LDL, alone or in combination, on MRC-5 cells. MRC-5 cells exposed to T and LDL resulted in increased proliferation rates and remarkable cellular damage. In contrast, E exposure induced decreased levels of MDA compared to T exposure. Results from this investigation suggest that the development of collagen matrix post cardiovascular necrosis can be attributed to the presence of T. This response could be triggered directly at the fibroblast level or by altering the physiochemical characteristics of LDL.

#### MORPHOMETRIC ANALYSIS OF CUBOIDAL EPITHELIUM IN THE VENTRAL PROSTATE DURING EARLY DEVELOPMENT OF BENIGN PROSTATIC HYPERPLASIA

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This study was designed to provide broader insights into the preventative measures to be considered in interfering with the development of benign prostatic hyperplasia (BPH). To accomplish this, Sprague Dawley rats (16, 250–300 g) were divided into four equal groups. Three treatment groups were each implanted with ceramic drug delivery devices designed to deliver continuous

physiologic doses of testosterone (T), dihydrotestosterone (DHT), or androstenedione (AED). Morphometric analysis of epithelial cells lining the tubules of the ventral prostate in these rats gave an indication of pre-clinical manifestation as seen at the cellular level during early development of BPH. Using Image Pro software, the total cell area, nuclear area and cell length were measured. Also counted the number of cells per high power field and calculated the nucleus to cytoplasm ratio (n/c). The results of this study demonstrated that the number of cells counted was not significantly different between the treatment and control groups ( $p < 0.05$ ), and the control tissues showed a larger cell area and cell length than the three treatment groups. The T and DHT groups showed larger nuclear area than the control. All three treatment groups showed a larger n/c ratio than the control group ( $p < 0.05$ ). In conclusion, the changes occurring at the cellular level of the prostate during early development of BPH due to sustained delivery of androgens are directly related to adaptive responses (hyperplasia and hypertrophy) of the prostatic tissues to injury. This was evidenced by changes in which are primarily seen in the increased nuclear area and increased n/c ratios. These results suggest that a possible genomic stimulation occurred as a response to irritation caused by the delivery of androgens.

#### SYNERGISTIC ROLE OF VITAMINS ON OF A549 CELLS EXPOSED TO CORTISOL

Letitia Veals\*, Hamed Benghuzzi, Michelle Tucci, and Zelma Cason, University of Mississippi Medical Center, Jackson, MS 39216

A549 cells are Type II pneumocytes, which can proliferate and be maintained for long-term survival in culture media. The objective of the present study was to determine if antioxidants with cortisol increase viability and metabolic functions of A549 cells. A total of 105 tubes of A549 cells were divided into six equal groups. Group 1 served as control and Groups II-VI were incubated with cortisol, vitamin E, vitamin C, vitamins E C, and vitamin E C cortisol. Seven tubes per group were terminated at 24, 48, and 72 hours. Total cell numbers, morphology, and cell damage (MDA level) was determined. Exposure of A549 cells to physiological levels of cortisol as well as E, C, or E C did not induce any untoward responses as indicated by cell proliferation rate. However, the exposure of cortisol demonstrated a decrease in supernatant MDA levels compared to cortisol or Vitamin C exposure alone. The data suggests that E C treatment plays a major role in protecting membrane integrity (MDA) compared to the use of Vitamin E alone. A possible synergistic effect within the genome could be a possibility and should be fully investigated. Overall conclusion, this investigation suggests that the use

of antioxidants such as Vitamin E and C play a major role in minimizing the cellular damage and optimizing functional capacity of A549 cells exposed to physiological levels of cortisol.

#### EXERCISE TRENDS AT WORK

Michelle L. Hawkins<sup>1\*</sup>, Macolm Wimbish<sup>2</sup>, and Babu P. Patlolla<sup>1</sup>, <sup>1</sup>Alcorn State University, Alcorn State, MS 39096, and <sup>2</sup>United States Army Corps of Engineers, Vicksburg, MS 39180

A large percentage of America's workforce is getting older. Affectionately known as the baby boomers, they were nutritionally maintained on a high fat, cholesterol, and carbohydrate diet with little regard to exercise. Decades later, emphasis is being placed on the body and its relationship between diet and exercise. In the present study 222 individuals were selected from a work place and are registered online. The activities included were walking, free weights, treadmill, stationary bikes, cross trainers, elliptical riders, ab-doers, and aerobics. Some of the participants selected more than one activity. Questionnaires revealed that those continued for six weeks had decrease in blood pressure, gained muscle tone and high self esteem. In conclusion, as America's workforce gets older, the consequences of poor diet and little exercise will become more evident. It is likely that the health care system will observe more cardiovascular related illnesses, and the consequences.

**A QUESTIONNAIRE TO DETERMINE FACTORS ASSOCIATED WITH PLANNING FRUITS AND VEGETABLES IN THE CHILD AND ADULT CARE FOOD PROGRAM: A FOCUS GROUP TECHNIQUE**  
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The purpose of this research project was to develop a questionnaire that would collect data on multiple factors that have been shown to influence decisions that affect the inclusion of fruits and vegetables on childcare menus. Previous studies demonstrate the value of focus group techniques when conducting qualitative research. Participants were identified by the researchers and the Mississippi Department of Education, Child Nutrition Program office, which administers the Child and Adult Care Food Program (CACFP). The researchers served as the focus group facilitator and recorder. Participants included a Head Start Program director, two school nutrition program directors responsible for feeding pre-school children in the school setting, a representative of the state Department of Education, and a child development expert and a registered dietitian with child care research experiences. Focus group techniques described by Kruger

and King were used. The results of an extensive literature search formed the basis of the content discussion. The outcome of the focus group discussion was the development of a comprehensive questionnaire, which explored purchasing and menu planning factors associated with fruits and vegetables. This questionnaire was sent to childcare agencies and centers, participating in the CACFP. Approval of the focus group discussion was obtained from the Internal Review Board, Mississippi State University.

3:30 Divisional Business Meeting

#### HISTORY AND PHILOSOPHY OF SCIENCE

Chair: Paula Smithka, University of Southern  
Mississippi

Vicechair: Maritza Abril, University of Southern  
Mississippi

#### THURSDAY MORNING

Caprice Room

9:00 MOLECULAR BIOLOGY: THE REALITY OF  
HUMAN FREEDOM

Hellen Ransom, University of Southern Mississippi,  
Hattiesburg, MS 39406

The questions concerning human freedom and its influences are concepts that have plagued humankind. Newton's physics introduced the ideas of determinism, which developed the concept that the universe is mechanistic. This mechanistic theory is that with a given set of antecedent causes the outcome could be reliably predicted. The relational effect of molecules established the ideas of determinism, that spread to the realm of human behavior. Freedom versus determinism is at the center of many debates. Some like Elliott Sober have argued that the precedence of human freedom is established by the genome, and therefore human beings are indeterministic creatures and have no free will. R. David Cole and others like him have opted for the influential balance of genes and environment for the establishment of human freedom. The idea of freedom is an illusion that allows humans to forget molecular processes. In relation to the choices made in everyday life, the core of these operations lies in the gene. Genes are the building blocks for the formulation of human beings, and their influence encompasses all human actions, including behavior and decision-making. Thus, genetic influence on humans cannot be ignored, and therefore

freedom has to be seen for what it is—a false impression.

9:30 WHAT IS MATHEMATICAL KNOWLEDGE?  
AN EXAMINATION OF MATHEMATICAL  
EPISTEMOLOGY

Charles D. Redmond, University of Southern Mississippi,  
Hattiesburg, MS 39406

Since the beginning of mathematics, the question has been asked: What exactly is it we are doing? Formalists have likened mathematics to a mental game; Platonic idealists (realists) have argued it is an exploration of a mind-independent world. Both have approached mathematics as a source for absolute, indubitable truths. I argue that mathematics is indeed a human mental practice much like that of any other scientific endeavor. It is constantly being revised as our understanding of the world around us increases. In essence, mathematics is quasi-empirical. Currently, philosophers of science, like Hilary Putnam and Reuben Hersh, are pushing for an epistemology in mathematics that likens mathematical discovery to that of scientific discovery. The key to mathematics is not a formalized procedure (i.e., logic, set theory, etc.), and it does not lie in an objective reality outside human experience. Instead, I argue, mathematics is indeed an ever-evolving process of discovery, riddled with probabilities and potential falsifiers.

10:00 Break

10:15 LINNAEAN CLASSIFICATION SYSTEM VS.  
PHYLOGENETIC SYSTEM OF HIERARCHY:  
COMPATIBLE INSTRUMENTS OR  
SCIENTIFIC REVOLUTION?

Jason R. Busch, University of Southern Mississippi,  
Hattiesburg, MS 39406

Over the past several years, the Linnaean classification system has come under increasing scrutiny by both philosophers and biologists. It is widely recognized that the Linnaean system suffers from serious shortcomings, including problems of efficacy as well as erroneous theoretical assumptions upon which the system is based. For these and a variety of other reasons, many biologists and philosophers have called for its modification or for its replacement by a new system. The primary alternative system is the phylogenetic system of hierarchy which is derived from cladism, and includes aspects both divergent and compatible with the Linnaean system. This paper addresses the debate concerning these two systems, and argues that the replacement of the Linnaean hierarchy by the phylogenetic system of hierarchy will not represent a scientific revolution according to the definition established by Thomas Kuhn.

10:45 WHAT'S WRONG WITH NATURAL KINDS  
AND SETS? DISPELLING THE MYTH OF A  
PRIORI SPECIES

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

Various criticisms have been advanced against claims by both philosophers and biologists that species are epistemic natural kinds or sets. Much of this criticism is the result of attempts to avoid the “sins” of so-called Aristotelian essentialism or to provide an historical (or diachronic) perspective to species concepts—a perspective which is said to be missing from a natural kinds or sets approach. We contend that much of the debate present in the literature is the result of confusing the a priori with the a posteriori in generating type hierarchical systems, such as the Linnaean classification system. Despite the overt claims made by W.V.O. Quine, Hilary Putnam, and Richard Boyd, for example, that such schema are empirically based, many contemporary philosophers of biology and biologists, such as Elliott Sober, David Hull, and Michael Ghiselin, seem to presuppose that such hierarchical systems are a priori established.

11:15 Divisional Business Meeting

11:30 SPECIES TAXA AND SPECIES CATEGORIES:  
THE CLASH OF ONTOLOGY AND  
EPISTEMOLOGY

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

The species taxon is that group of individual organisms to which biologists apply a binomial Latin name, e.g., *Homo sapiens*. The species category is that rank in a hierarchical system to which a species taxon is referred. The species taxon is ostensibly described from a set of characters derived from individual members of what is taken to be a species. The species taxon itself, so named, is then seen to be an historical individual characterized by a genealogical lineage not grounded in an essential quality. The species category is an epistemological entity, necessarily part of a hierarchical system, that corresponds to the notion “concept of species.” The nature of the species category is closely associated with the nature of the species taxon. One possible interpretation of the relationship is the acknowledgment that species taxa evolve while the species category is a fixed mark that might suggest description in essentialist terms. Another interpretation acknowledges the pluralistic nature of species taxa and extends this pluralism to the species category. An extreme interpretation of species pluralism would deny the species category altogether. Acknowledging the species category demands acknowledgment of higher categories, e.g., the genus



category. A tentative ontological relationship might exist between the species taxon and the species category, but to extend that relationship from the species taxon to genus and higher categories implies that those categories can also be associated with species taxa. If higher categories cannot be justified in terms of species taxa, the existence of the species category itself should be brought into question.

#### 12:00 ARE SCIENTISTS RESPONSIBLE FOR 9/11 IN ANY WAY?

S. Kant Vajpayee\* and T.M. Parchure, University of Southern Mississippi, Hattiesburg, MS 39406-5137 and US Army ERDC, Vicksburg, MS 39180

In the beginning, it was all abstract philosophy. Later came “applied” version to seek to understand the tangible nature, rather than the intangible spirit. It next evolved into science—a knowledge domain based on data-driven hypotheses and/or experimental verification. Scientific facts pertaining to the material world led to engineering and technology, which in turn produced the tools that enabled the horrendous crime of 9/11. Had the philosophers continued to acquire the wisdom of only the abstract, we would not have the Boeings, aviation fuel, or the WTC! Consequently, a 9/11 would have been much less severe. Are we scientists, as applied philosophers, responsible for 9/11 in some way, at least indirectly? Why do we indulge so much in scientific research? Notwithstanding that science in itself is not bad—nor the scientists—there are several philosophical questions. Is it the scientists’ own appetite for knowledge? Why are they knowledge-hungry? Are they born with this hunger? Or, do we as a society in the name of progress under democracy and free market induce this hunger in them? Is it because we worship the Gates’ and laugh at the Gandhis? These questions entangle philosophy, science, culture and religion, social sciences, government policies, and many other disciplines. We shall attempt the answer to the question posed in the title by studying the case of Ford-Firestone controversy.

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### FRIDAY MORNING

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Deer Isle Room

#### 9:00 CHARLES DARWIN: LESSONS IN THE PROCESS OF SCIENCE

Maritza Abril, University of Southern Mississippi, Hattiesburg, MS 39406

Charles Darwin has left us a rich legacy in the process of science. His theory of evolution can be disassembled into many hypotheses that can be tested both by observational science and by experimental science.

These hypotheses may require direct empirical evidence or they may require inferential evidence. But science does not occur in isolation from its social context. The process of science is explored here in the context of Charles Darwin’s life and Victorian England. One aspect of the social context is the ethical dilemma that Darwin faced when he realized that Alfred Russel Wallace had developed the same general theory of evolution and was about to tell the world. Darwin was in a position to suppress that information, but he agreed to have the information presented along with his own. This forced Darwin to publish his own ideas earlier than he had anticipated.

#### 9:30 THE DESIGNERS OF “INTELLIGENT DESIGN”

John D. Davis, St. Andrews Episcopal Middle School, Ridgeland, MS 39157

The “Intelligent Design” movement (ID) is often associated with the lawyer Phillip E. Johnson, creationists, and politically conservative journalists. However, no less a figure than Francis Crick has proposed a non-theistic variant he calls “Directed Panspermia” to account for the origin of life on earth. Developments in cosmology such as a firm establishment of a definite moment of “creation” (Big Bang) and the alleged “fine tuning” of several universal constants to produce intelligent life (Strong Anthropic Principle) are also invoked to support ID. The theistic community supporting “intelligent design” includes both young-earth creationists and those who accept cosmological and biological evolution guided by some supreme being ID is also promoted by a variety of other belief systems, including the Raelian “flying saucer” cult. Evolution of the “Intelligent Design” concept will be traced through the eighteenth-century theologian William Paley, nineteenth-century biologist St. George Mivart and a recent revival by such thinkers as the mathematician William Dembski and microbiologist Michael Behe. Reasons why ID will have no influence on mainstream research but may become a force in North American science education will be discussed.

10:00 Break

#### 10:15 THE IMPACT OF JOHN DEWEY’S PHILOSOPHY ON SCIENCE EDUCATION

Byram D. McKinzie\* and Carey L. Ford, Alcorn State University, Lorman, MS 39096

John Dewey was an educator and a distinguished philosopher who introduced in education the concept of learning by doing. In the early 1900’s, John Dewey was known for his educational philosophy that centered on pragmatism. He introduced a new philosophy of teaching,

which included a theory centered on student needs, interests, teaching concepts utilizing problem solving strategies and practical applications for classroom instruction and laboratory experiments. His philosophy is known as pragmatism and is integrated in agricultural science curricula throughout the country. John Dewey was a dynamic educator who shaped the way we teach agriculture science principles in both secondary and college agriculture programs. He believed that the scientific methods of thinking are control, using experiments and testing the instructional objectives. He believes that a teacher must be gifted. He believed that the environment in which students are taught must be conducive to learning. He believed that when a student could duplicate or redo what he/she has been taught, then the student has learned. It is very important to understand his conception of science to fully understand his philosophy of education. Dewey believed in problem solving methods of teaching includes defining and testing hypotheses for solutions. Dewey strongly believed in democracy and that schools should teach democracy by using democratic principles.

10:45 ROBERT LOWER: PIONEERING EXPERIMENTS IN TRANSFUSION MEDICINE

Carolyn E. Beck, University of Southern Mississippi, Hattiesburg, MS 39406

The English scientist Robert Lower (1631–1691) is well known for his contributions to both anatomy and physiology. Lower worked at Oxford with the group of scientists that surrounded Robert Boyle including Thomas Willis, John Locke, William Petty, and Christopher Wren. His first success came as an assistant to Willis during their studies on the structures of the central nervous system. Willis acknowledged Lower as an outstanding vivisectionist and an expert at dissection. Lower then began his own studies of the structure and function of the heart and is today considered a pioneer in cardiology. In addition to these successes, Lower the physician established a very active and profitable medical practice that flourished in London. Less well known are Lower's contributions to transfusion medicine. Included in these efforts are his early experiments in pharmacology in which he injected various substances into the circulatory systems of animals and observed changes that occurred. Lower then determined that transfusion of blood between animals might be a beneficial therapy. He conducted a series of animal to animal transfusions culminating in 1667 with the transfusion of sheep blood to a human at a Royal Society meeting. While not the first in the world to perform human transfusion, he was the first in England. Perhaps of more importance, he developed the techniques and equipment necessary for injections and transfusions during his many

years of animal experimentation.

11:15 Break

11:30 THE PHILOSOPHY OF BOOKER TALIAFERRO WASHINGTON REGARDING SCIENTIFIC METHODS AND EDUCATION

Sonja L. Bullock\* and Carey L. Ford, Alcorn State University, Alcorn State, MS 39096

Booker T. Washington was the foremost black educator of the late 19<sup>th</sup> and early 20<sup>th</sup> centuries. He was the first president of Tuskegee University, a historically Black College located in Alabama. Dr. Washington was known as an innovative leader who encouraged business leaders and government agencies to support the training of students at Tuskegee University. He was very instrumental in developing agricultural research programs and thousands of students were educated because of his leadership. During his tenure at Tuskegee University, the annual farmers conference was established and thousands of farmers throughout the south attended to learn new technologies and principles for growing agriculture crops. He also believed in developing the whole community including technical programs such as home economics, industrial training, and trades. He emphasized industrial training as a means to self-respect and economic independence. Dr. Washington was a spokesman for blacks, and he organized numerous philanthropic funds for education. He once stated that nothing could be achieved without the hard work and knowledge.

12:00 GEORGE WASHINGTON CARVER'S CONTRIBUTIONS TO AGRICULTURE SCIENCE AND EDUCATION

Joe A. Barnes\* and Carey L. Ford, Alcorn State University, Lorman, MS 39096

George Washington Carver was an outstanding agriculture researcher during the twentieth century. He developed more than 300 products from the use of peanuts once considered an insignificant crop. Through his hard work, peanuts became a multi-billion dollar industry in the United States. During his tenure at Tuskegee Institute, Carver revolutionized the scientific study of farming by increasing crop yields among vegetables and row crops. Carver practiced preservation throughout his life while inventing the science of Eratz or substitutes. He developed many new products from waste materials such as recycled oil, paints and stains and taught his students to never throw anything away because it can be used again. He also encouraged his students to always keep their eyes open for new knowledge. During the early 1900's in the poverty stricken south, he assisted farmers in improving their

standard of living. Carver introduced the extension concept to farmers in rural Alabama and Georgia, which included demonstrations to improve farming practices. He introduced crop rotation a practice that is still widely utilized today.

### MARINE AND ATMOSPHERIC SCIENCES

Chair: Alan M. Schiller, University of Southern Mississippi

Vicechair: Patricia Biesiot, University of Southern Mississippi

## THURSDAY MORNING

Deer Isle Room

### 8:30 EFFECTS OF TEMPERATURE, SALINITY, AND FEEDING RATE ON BUDDING OF *DRYMONEMA DALMATINUM* SCYPHISTOMAE

Brian Ortman<sup>1\*</sup>, W. Monty Graham<sup>2</sup>, and Patricia M. Biesiot<sup>1</sup>, <sup>1</sup>University of Southern Mississippi, Hattiesburg, MS 39406, and <sup>2</sup>Dauphin Island Sea Lab, Dauphin Island, AL 36528

*Drymonema dalmatinum*, a large non-indigenous scyphozoan jellyfish, appeared in the northern Gulf of Mexico during fall 2000. Planulae, shaken from the brooding structures of adult medusae caught in the field, settled and metamorphosed into scyphistomae in the lab and were maintained in culture. Individual polyps were placed into separate wells in six-well tissue culture plates to monitor asexual budding for two weeks. Combinations of four temperatures (15, 20, 24, 30EC), three salinities (15, 25, 35 ppt), and two feeding regimes (newly-hatched *Artemia* nauplii either once or three times per week) were used, for a total of 24 treatments with two replicates per treatment. The number of scyphistomae in each well was counted three times per week to determine colony size. Budding did not occur in any of the 15EC or 15 ppt treatments. Although budding occurred among scyphistomae fed once a week at the higher salinity and temperature combinations, colony sizes were small (2 or 3 polyps) and the results were not significantly different among treatments. Colony size was significantly greater (4 or 5 polyps) among scyphistomae fed three times per week in all treatments at the higher salinities and temperatures. Scyphistomae of *D. dalmatinum* appear to require temperatures greater than 15EC, salinities greater than 15 ppt, and frequent feeding for successful colony growth.

### 8:45 GEOGRAPHIC ASSESSMENT OF BLUE CRAB *CALLINECTES SAPIDUS*: EMBRYO SIZE, FECUNDITY, AND BIOCHEMICAL COMPOSITION

Kristin N. Ealy\* and Patricia M. Biesiot, University of Southern Mississippi, Hattiesburg, MS 39406

The present study was conducted to determine if embryo size, fecundity, and the biochemical composition (protein, carbohydrate, lipid, ash) of embryos and ovaries varied among populations of blue crab *Callinectes sapidus* Rathbun over its range in U.S. waters. Ovigerous crabs were obtained during summer 2000 from coastal sites in three biogeographic provinces: Virginian, Carolinian, and Louisianian. Mean embryo diameter per female ranged from 243–309 Fm and mean individual embryo dry weight ranged from 2.3–2.9 Fg; neither measure was significantly different among the provinces. Fecundity was estimated using a direct count/dry weight method and ranged from 1.6–6.2 million embryos per crab; larger females exhibited greater fecundity. Mean fecundity was greatest for Carolinian crabs (3.5 million embryos per female) followed by Louisianian (3.1 million) and Virginian crabs (2.2 million) and was significantly different only between Virginian and Carolinian crabs ( $P = 0.030$ ). There were no significant relationships between embryo diameter and female body size or between embryo diameter and fecundity. Although no significant differences were observed in embryo biochemical composition among the provinces, there were significant differences in ovarian composition between Virginian and Carolinian crabs for carbohydrate ( $P = 0.026$ ) and for ash ( $P = 0.006$ ). Minor differences in embryo size, fecundity, and biochemical composition occur among blue crabs from the three provinces but the variations are not predictable and likely do not indicate geographic influence.

### 9:00 VIABLE BUT NONCULTURABLE *ESCHERICHIA COLI*: A STUDY COMPARING THE DIRECT VIABLE COUNT PROCEDURE WITH MEMBRANE FILTRATION FOR TOTAL *E. COLI* AGAR ENUMERATION

Andrea M.B. Phillips<sup>1\*</sup>, D. Jay Grimes<sup>1</sup>, and Judith L. Williams<sup>2</sup>, <sup>1</sup>Gulf Coast Research Laboratory, University of Southern Mississippi, Ocean Springs, MS 39566, and <sup>2</sup>University of Southern Mississippi Gulf Coast, Long Beach, MS 39560

*Escherichia coli*, a common fecal coliform bacterium, is used as a biological indicator species for the detection of fecal pollution in marine waters. Viable but nonculturable *E. coli* are living cells, which are dormant and cannot be cultured using current EPA standard microbiological enumeration methods. This inability to

culture the cells is thought to result from low nutrient sources, temperature and salinity fluctuations, and/or other environmental factors. However, the Direct Viable Count (DVC) procedure allows for the microscopic enumeration of all living or viable bacteria in the marine environment by incubation with an anti-microbial agent and a nutrient food source that collectively bring the bacteria out of dormancy. Nalidixic acid (NA) is used as the anti-microbial agent; it is a gyrase inhibitor that prevents DNA synthesis by disallowing septum formation and thus, prohibiting cell division. Yeast extract (YE) as the food source allows the cells to continue metabolizing nutrients, meanwhile growing elongated or fattened during incubation. To quantify the exact number of viable but nonculturable cells in a given sample, the DVC number has to be compared to the mTEC method (EPA 1103.1) for total *E. coli*, by the membrane filtration procedure. Results thus far have yielded a significantly higher amount of *E. coli* detected using the DVC method over the mTEC method suggesting that the present *E. coli* detection methods may be under estimating true numbers and needs to be reevaluated.

9:15 ACOUSTIC SEAFLOOR CHARACTERIZATION IN ONSLOW BAY FROM EM 121A HYDROPHONE DATA

Frank W. Bentrem\* and John Sample, Naval Research Laboratory, Stennis Space Center, MS 39529

Acoustic inversion of Simrad EM 121A multibeam sonar data is presented for seafloor sediment classification in Onslow Bay. The sonar hydrophone data is beamformed and calibrated and transformed into backscattering strength vs. grazing angle. The Mourad-Jackson backscatter model is used to invert the data via simulated annealing to obtain mean sediment grain size. The inversion results agree with the ground truth sediment type (sand) along the entire shiptrack and closely agrees with the ground truth in grade of sand (i.e., very fine, fine, medium, coarse, very coarse) in areas with significant sediment layers (deeper than one meter).

9:30 ANALYSIS OF TEMPERATURE AND SALINITY VARIABILITY IN THE MISSISSIPPI SOUND BASED ON NGLI CTD DATA

Sergey Vinogradov\*, Nadya Vinogradova, Vladimir Kamenkovich, and Dmitri Nechaev, University of Southern Mississippi, Stennis Space Center, MS 39529

The analysis of interannual, seasonal and daily variations of temperature and salinity for the region of Mississippi Sound has been performed using the Northern Gulf of Mexico Littoral Initiative (NGLI) in-situ data. The results of physical and numerical analysis of six CTD

(conductivity-temperature-salinity) surveys, R/V Pelican cruises in February, May, November 1999 and January/February, May, August/September 2000, will be represented in this report. The data of 25-hour stations have been used to analyze temperature and salinity daily variations and identify underlying physical mechanisms. Estimation of seasonal and interannual variances of temperature and salinity fields is important for ocean modeling systems. It has been applied in calibration and validation of the operational numeric model, ECOM (Estuarine, Coastal and Ocean Model) in the region of the Northern Gulf of Mexico.

9:45 BAROTROPIC AND BAROCLINIC CIRCULATION PATTERNS WITHIN THE INDONESIAN SEAS

William H. Burnett\* and Vladimir Kamenkovich, University of Southern Mississippi, Hattiesburg, MS 39406

An extensive series of numerical experiments using a non-linear, high-resolution ocean model centered over the Indonesian Seas are performed to investigate the fundamental dynamics of the Indonesian Seas Through-flow. The model is initialized with seasonally varying prescribed transports through four open ports that simulate the Pacific and Indian Ocean major currents. Atmospheric coupling is accomplished with local monthly wind stresses from the Hellerman and Rosenstein climatology. Results from the barotropic experiment with no wind forcing reveal that the Mindanao Current splits towards the Makassar Strait, the Malucca Sea, and the Halmahera Sea and exits via the Lombok, Sumba, Ombai Straits, and the Timor Sea. Barotropic experiments with local wind forcing reveal that the majority of the Mindanao Current transport flows toward the North Pacific Ocean during the southeast boreal monsoon, and towards the Celebes Sea during the northwest boreal monsoon. Results from the baroclinic, high-resolution model with and without wind forcing will also be discussed.

10:00 Break

10:15 DIURNAL FEEDING HABITS OF FLORIDA POMPANO (*TRACHINOTUS CAROLINUS*)

Kersten Wheeler\*, Richard W. Heard, and Chet F. Rakocinski, USM-Gulf Coast Research Laboratory, Ocean Springs, MS

Florida pompano are well known for being sought after by commercial and recreational fishermen for their delectable flesh. Relatively little information is available on the feeding habits of Florida pompano (*Trachinotus carolinus*) from the northern Gulf of Mexico. Previous studies on pompano have speculated that these fish are diurnal

feeders without any confirmation. We conducted a diel feeding study over a 24 hour period during the summer of 2001 on a protected barrier island beach in Alabama. This study was conducted in order to determine any shifts in diet preferences over the course of a day and to determine pompano diel feeding chronology. Fish were collected every 4 hours for gut content analysis. We found that pompano were feeding in the early morning hours and in the afternoon. We were unable to determine if pompano were actively feeding at night but future research may be able to conclude whether pompano are truly diurnal feeders.

#### 10:30 HABITAT UTILIZATION BY JUVENILE FISHES IN THE WESTERN MISSISSIPPI SOUND

Ramsey Wash\*, Kirsten M. Larsen, Harriet Perry, and Christine Trigg, Cooperative Internship Program, Mississippi Gulf Coast Community College-Jackson County Campus, Gautier, MS 39553, and J.L. Scott Marine Education Center and Aquarium, The University of Southern Mississippi, Biloxi, MS 39530

Estuarine habitats contribute substantially to the productivity of selected fishery species. The link between the amount of vegetated habitat and fishery production is well established in the Gulf of Mexico. Most of the information on fish species inhabiting near-shore areas in Mississippi coastal waters is from the central and eastern Mississippi Sound; there is little data available for the western Sound. Knowledge of habitat utilization by juvenile fishes is especially critical for the western Mississippi Sound because this area is heavily influenced by freshwater intrusion from Lakes Pontchartrain and Borgne. In years with heavy rainfall and/or snowmelt, spillways along the Mississippi River open and floodwaters are diverted into the Mississippi Sound. In this study, marsh edge and open water habitats were sampled using a drop sampler. The sampler consisted of a bottomless fiberglass cylinder one meter in diameter which enclosed 0.78 m<sup>2</sup> of bottom. The samples were taken weekly from March through July. Juvenile fishes were removed from samples, measured to the nearest millimeter and weighed to the nearest 0.1 gram. Determination of the distribution and abundance of juvenile fishes will identify critical habitat and provide information necessary for assessment of changes that may occur as a result of freshwater diversion activities.

#### 10:45 CHEMICAL ANALYSIS OF FISH TANKS

Ryan Pew\*, Cherie Pringle\*, and Rick Kastner, Cooperative Internship Program, Mississippi Gulf Coast Community College-Jackson County Campus, Gautier, MS 39553, and J.L. Scott Marine Education Center and Aquarium, The University of Southern Mississippi, Biloxi,

#### MS 39530

Our project was to test the water quality in the tanks in the J.L. Scott Marine Education Center and Aquarium. The parameters included: pH, salinity, oxygen content, and temperature to determine the optimal range for marine life. An oxygen meter was used to find the levels of oxygen that is present in the water. A pH meter was used to determine the pH and the temperature. A pH meter tests the level of hydrogen ions that are present within the water. Each week tests were administered on the tanks to determine changes in pH, oxygen content, salinity, and temperature. This data was then recorded each week on a chart for analyses. We will present the result of our study.

#### 11:00 A SURVEY OF THE CHEMICAL HYDROLOGY OF THE ST. LOUIS BAY ESTUARY

Amanda McPeek\*, Jeremy Bell, Christine Trigg, Faye Mallette, and Harriet Perry, Cooperative Internship Program, Mississippi Gulf Coast Community College-Jackson County Campus, Gautier, MS 39553, and J.L. Scott Marine Education Center and Aquarium, The University of Southern Mississippi, Biloxi, MS 39530

The St. Louis Bay watershed is one of four major estuaries of the Mississippi Sound and has traditionally been considered relatively pristine in water quality. Recent population growth and expanding industrial development have placed increased pressure on the natural resources of our coastal estuaries. Hydrological sampling of St. Louis Bay was conducted as a part of a larger study examining the environmental health of the Mississippi Sound (Gulf of Mexico Estuarine Inventory and Study, Mississippi, 2001). Surface and bottom water samples were collected using a 2.5 L Niskin bottle. Seven stations were sampled starting upstream in the Jourdan River, extending through the St. Louis Bay, and into the Mississippi Sound. Water temperature, salinity, and dissolved oxygen were measured in the field using a YSI dissolved oxygen meter. Ammonia, nitrite, nitrate, orthophosphate, and total phosphate concentrations were measured in the laboratory using standard methods of chemical analyses. Sampling was conducted in the fall and winter of 2001. Hydrological data were compared seasonally and with historical data from the study area.

#### 11:15 A SURVEY OF THE HYDROLOGY OF BAYOU CASOTTE

Jeremy Bell\*, Amanda McPeek, Christine Trigg, Faye Mallette, and Harriet Perry, Cooperative Internship Program, Mississippi Gulf Coast Community College-Jackson County Campus, Gautier, MS 39553, and J.L. Scott Marine Education Center and Aquarium, The

University of Southern Mississippi, Biloxi, MS 39530

Bayou Casotte is a heavy industrialized bayou of the Mississippi Sound and has traditionally been considered less pristine than other coastal areas. Recent population growth and expanding industrial development have placed increased pressure on the natural resources of our coastal estuaries. Hydrological sampling of Bayou Casotte was conducted in conjunction with a larger study examining the environmental health of the Mississippi Sound (Gulf of Mexico Estuarine Inventory and Study, Mississippi, 2001). Surface and bottom water samples were collected using a 2.5 L Niskin bottle. Seven stations were sampled starting from the upper reaches of Bayou Casotte to its mouth in the Mississippi Sound. Water temperature, salinity, and dissolved oxygen were measured in the field using a YSI dissolved oxygen meter. Ammonia, nitrite, nitrate, orthophosphate, and total phosphate concentrations were measured in the laboratory using standard methods of chemical analysis. Sampling was conducted in the fall and winter of 2001. Hydrological data were compared seasonally and with data from another study conducted simultaneously in St. Louis Bay.

11:30 Divisional Business Meeting

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#### THURSDAY AFTERNOON

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Deer Isle Room

1:00 IMPACT OF AGRICULTURAL PESTICIDES WITHIN WEEKS BAY, A NATIONAL ESTUARINE RESEARCH RESERVE

Julia S. Lytle\* and Thomas F. Lytle, Gulf Coast Research Laboratory, University of Southern Mississippi, Ocean Springs, MS 39566

Spiraling releases of pesticides in coastal watersheds have impacted our Gulf estuaries. Baldwin County, Alabama is historically dominated by agricultural activities; Fish and Magnolia Rivers drain the watershed that empties into Weeks Bay National Estuarine Research Reserve, located in Baldwin County. A study was designed to trace the transport of pesticides through the watershed, measure loads, and assess fate and impact of these pesticides on Weeks Bay. Sixty-seven sites within the rivers, Weeks Bay and Mobile Bay were chosen for sampling water, sediment and macrophytes. Samples were collected both routinely as well as after heavy rain events. Pesticides measured in highest concentrations within Weeks Bay were simazine, atrazine and 2,4-D. Results of this three-year study showed that transport of pesticides was pronounced near the source and that each river had pesticide profiles that were unique to the agricultural

practices in those drainage regions. Once riverine input reached Weeks Bay, the high flushing rates within the shallow estuary homogenized bay sediments, losing the distinctive fingerprints of each of the river inputs. Toxicity tests using sediment and pore water indicated a minimal impact within the Bay while some sites within the rivers showed slightly higher toxicity. High suspended sediment loads possibly transports pesticides into Mobile Bay where they are dispersed.

1:15 MARSH PLANTS: VALUABLE ALLIES IN COMBATING ESTUARINE POLLUTION BY PETROLEUM HYDROCARBONS

Thomas F. Lytle\* and Julia S. Lytle, Gulf Coast Research Laboratory, University of Southern Mississippi, Ocean Springs, MS 39566

The marsh plant, *Juncus roemerianus*, possesses properties that may uniquely qualify it to aid in efforts to decontaminate sites with problematic levels of sedimentary hydrocarbons, e.g. military installations. In collaboration with environmental officers of Keesler Air Force Base sites of hydrocarbon contamination populated by this plant were examined to determine potential of use of this plant for sediment clean up. It was found that in contrast to *J. roemerianus* found at uncontaminated sites or to other marsh plants, *J. roemerianus* growing in contaminated sediments produced large quantities of soap-like substances in the rhizosphere. This suggested that our previous observations of ability of this plant to uptake virtually insoluble hydrocarbons may have stemmed from a contaminant response in the plant to release surfactants into surrounding soil to aid in dissolution of hydrocarbons. In examining the leaves from these plants it was found that both aliphatic and aromatic hydrocarbons occurred in levels very similar to that found in the sediments and much higher than in plants growing in clean areas. Most intriguing was the modification that occurred to aromatics in leaves during translocation process indicating extensive reworking or degradation of the aromatics. Additional work is underway to determine how this plant is able to solubilize hydrocarbons and whether the unique soil bacterial community participates in this process. Also studies have begun to determine whether ecotypes of *J. roemerianus* have developed in long-term contaminated sites that would be better candidates for cloning plants for use in phytoremediation.

1:30 REMOTE SENSING ALGORITHMS BY NUMERICAL INVERSION OF RADIATIVE TRANSFER MODELS: NEURAL NETWORK AND OPTIMIZATION METHODS COMPARED

David Hughes<sup>1\*</sup>, R.J. Holyer<sup>1</sup>, and Z.P. Lee<sup>2</sup>, <sup>1</sup>University of

Southern Mississippi, Hattiesburg, MS 39406, and <sup>2</sup>University of South Florida, Tampa, FL

The purpose of this research is to conduct the first direct quantitative comparison between two widely used bathymetric tools concerning Case 2 waters. The optimization method and the neural network method are compared using two hyperspectral images (HyMap of Ship Island, Mississippi, and AVIRIS of Tampa Bay, Florida). Both methods attempt to solve the inverse optics problem where the optimization method utilizes forward solutions provided by a semianalytical method and the neural network utilizes HYDROLIGHT. The analysis of the respective inversion procedures and results is accomplished using sensitivity analysis, error distribution analysis, and observations on convergence. The methods are compared on the basis of accuracy, efficiency, robustness, and extension to the aforementioned complex coastal environments. The final product of this research is a quantitative comparison to show the robustness and applicability of the two methods to two varied bathymetry cases. It is shown that the neural network method exhibits more robustness and efficiency than the optimization method whereas the optimization method shows greater accuracy for selective images.

1:45 ONTOGENY OF CULTURED LARVAE OF RED SNAPPER *LUTJANUS CAMPECHANUS* WITH EMPHASIS ON DEVELOPMENT OF THE DIGESTIVE SYSTEM

David Chiluiza\*, Rena A. Krol, Nancy J. Brown-Peterson, John T. Ogle, and William E. Hawkins, The University of Southern Mississippi, Ocean Springs, MS 39566

During culture of red snapper *Lutjanus campechanus*, high mortalities occur at 3–5 days post-hatch (DPH) and 17–19 DPH. To investigate this problem, we examined the ontogeny of the digestive system using serial, thin-sectioned tissues and high-resolution light microscopy. Larvae were sampled daily from hatch to 30 DPH, fixed in Bouin's solution, embedded in methyl n-butyl methacrylate medium and sectioned at 1.0 or 2.0  $\mu\text{m}$ . At hatching, the digestive system is composed of a simple straight gut lying dorsal and posterior to the yolk sac. During the first 3 DPH, gut differentiates and all its related organs develop. These changes represent a high-energy demand that the larvae obtained through yolk consumption, which was depleted by day three. From day four onward, morphological changes were mostly related to the increasing size and specialization of organs, and mainly, to the formation of a pseudostomach from the midgut. Morphological characteristics, particularly those related to the ontogeny of the digestive system, could reflect the quality of red snapper larvae and, therefore, the likelihood of their survival. Knowledge of the

development of the digestive system could help to identify when the fish are ready to accept food, to determine the optimal diet, and to find solutions to rearing problems by determining an appropriate ontogenic feeding schedule. (Supported in part by Grant NA86FL0476 from NOAA).

2:00 PATHOLOGY, ECOLOGY, AND TAXONOMY OF BLOOD FLUKES (SANGUINICOLIDAE) FROM HEARTS OF FISHES IN THE GULF OF MEXICO

Stephen A. Bullard\* and Robin M. Overstreet, University of Southern Mississippi, Gulf Coast Research Laboratory, Ocean Springs, MS 39566

Adult blood flukes infect marine and freshwater fishes and are usually reported from the heart, branchial vessels, or mesenteric vessels. Little is known on blood fluke diversity, host ranges, geographic ranges, and pathogenicity. Only four adult sanguinicolids have been reported from 6 Gulf of Mexico fishes, an adult blood fluke has not been described from a Gulf fish in 46 years, none has been described from the northern Gulf west of Mobile Bay, a study on the distribution or seasonality of a blood fluke in a Gulf fish population has not been conducted, and there are few details of wild host-parasite relationships. We examined the vascular system of roughly 1,300 fishes of 153 species, 92 genera, 52 families, and 15 orders from the Gulf of Mexico, Caribbean Sea, Eastern Pacific Ocean, and Western North Atlantic Ocean. Collections included specimens of *Selachohemecus* sp. from blacktip sharks (*Carcharhinus limbatus*), *Cardicola* sp. 1 from red drums (*Sciaenops ocellatus*), *Cardicola* sp. 2 from black drums (*Pogonias cromis*), a new species in a new genus from red snappers (*Lutjanus campechanus*), and *Psettaroides* sp. from cobias (*Rachycentron canadum*). Drum flukes were collected throughout the year, and most flukes were collected from a single host species. These blood flukes utilize homologous morphological features in different ways and different degrees to attach and locomote within their hosts. We also examined sections of infected tissues to gain insight on the host response to blood flukes. (Supported by NOAA/NMFS No. NA96FL0358 and Mississippi-Alabama Sea Grant Consortium).

2:15 Break

2:30 SPECTRAL ANALYSIS OF OBSERVED AND SIMULATED GULF STREAM TRANSPORT IN THE FLORIDA STRAITS

Kevin McKone<sup>1\*</sup>, Vladimir Kamenkovich<sup>1</sup>, Tammy Townsend<sup>2</sup>, and Harley Hurlburt<sup>2</sup>, <sup>1</sup>University of Southern Mississippi, Stennis, MS 39529, and <sup>2</sup>Naval Research Laboratory, Stennis, MS 39529

Multiple methods of spectral and cross-spectral analysis, using both parametric and non-parametric methods, are used to validate signals in observed and simulated Gulf Stream transport time series. Signal strength and frequency of observed transport from cable voltage measurements in the Florida Straits at 27EN are looked at and compared to the signal strength and frequency of simulated transport time series signals from the Naval Research Laboratory (NRL) Layered Ocean Model (NLOM). Simulated transport time series are taken from the Old Bahama Channel (OBC), transport between Key West, Florida, and Havana, Cuba, Florida Straits at 27EN, and the Northwest Providence Channel. These time series are short, averaging only 13 years in length. With signals including, but not limited to biennial, seasonal and six month, the problem of choosing a method of signal analysis becomes nontrivial. Qualitative comparisons of signal strength and frequency have been made on individual time series. If all methods used show similar strength and frequency for a particular signal, the signal is then taken as real. This same method has also been used to compare signals between time series using a similar qualitative approach with multiple methods of cross-spectral analysis.

2:45 STOMACH CONTENT ANALYSIS OF PIN-FISH, *LAGODON RHOMBOIDES*, FROM WIDGEON GRASS BEDS, *RUPPIA MARITIMA*, IN THE GRAND BAY NERR

Kenneth J. Brookins<sup>1\*</sup>, Donna Drury<sup>2</sup>, and Chet F. Rakocinski<sup>2</sup>, <sup>1</sup>Jackson State University, Jackson, MS 39219, and <sup>2</sup>University of Southern Mississippi, Gulf Coast Research Laboratory, Ocean Springs, MS 39566

Pinfish, *Lagodon rhomboides*, were collected from within widgeon grass, *Ruppia maritima*, in the Grand Bay National Estuary Research Reserve (NERR) in June and July 2001 to evaluate their trophic role. Sampling for fish and available prey in the area were conducted using a seine and a kick net respectively. Water parameters (D.O., salinity, and temperature) were measured using a YSI multi-parameter meter. Captured fish ranged in size from 33 mm to 73 mm. A total of nine prey types were observed in the stomachs of the fish; including amphipods, copepods, fish, shrimp, and crabs. Plant material consisting of *Ruppia maritima* and epiphytes, as well as spartina detritus were also observed in the stomachs. In terms of prey contribution by volume, amphipods (15%–95%) and copepods (35%) dominated. Fish < 50 mm consumed mainly amphipods (55%) and copepods (35%); whereas, fish > 50 mm consumed amphipods (35%) and plant material (40%). This ontogenetic shift from primarily carnivorous diet to an omnivorous one is consistent with results of previous

studies. Our study suggests that the trophic role of pinfish in widgeon grass beds may be more complex than other investigations have reported.

3:00 THE USE OF CHLOROPHYLL FLUORESCENCE LIFETIME TO ASSESS PHYTOPLANKTON PHYSIOLOGY WITHIN THE MISSISSIPPI RIVER PLUME

Callie M. Hall<sup>1\*</sup>, Donald G. Redalje<sup>2</sup>, Richard L. Miller<sup>1</sup>, and Salvador Fernandez<sup>3</sup>, <sup>1</sup>NASA, Stennis Space Center, MS 39529; <sup>2</sup>University of Southern Mississippi, Stennis Space Center, MS 39529; and <sup>3</sup>Ciencia, Inc.

Although discrete measurements of phytoplankton carbon fixation provide some of the ancillary information needed for ocean color algorithm development, such measurements are often difficult to make (due to sample manipulation and artefacts common to the procedure) and do not provide real-time information on phytoplankton physiology. Measurements of chlorophyll fluorescence lifetime, however, provide a non-intrusive assessment of phytoplankton photochemical conversion and can be used to estimate parameters directly related to phytoplankton primary productivity. The increased spatial and temporal coverage of chlorophyll fluorescence lifetime measurements, compared to classical incubation-based techniques used to estimate carbon fixation, provides a meaningful snapshot of photosynthetic efficiency within environments which are physically variable at relatively small spatial and temporal scales, i.e., river-dominated environments. Chlorophyll fluorescence lifetime was used to assess phytoplankton photosynthetic efficiency within the horizontal and vertical mixing gradients within the Mississippi River Plume. Extensive research has addressed the seasonality and magnitude of primary production attributed to Mississippi River outflow within the Gulf of Mexico, but few studies have gauged the photosynthetic efficiency of phytoplankton along this estuarine continuum. Environmental data (nutrient and chlorophyll concentrations, temperature, salinity, and light transmission) were collected during periods of increased and decreased river discharge (spring and fall, respectively) to examine the impact on fluorescence lifetime.

3:15 VARIATIONAL INTERPOLATION METHOD FOR COMPARING CTD OBSERVATION DATA WITH PRINCETON OCEAN MODEL DISTRIBUTIONS OF THE TEMPERATURE AND SALINITY FIELDS IN MISSISSIPPI SOUND

Nadya Vinogradova\*, Sergey Vinogradov, Dmitri Nechaev, and Vladimir Kamenkovich, University of Southern Mississippi, Stennis Space Center, MS 39520



During 1999–2001 in the course of Northern Gulf of Mexico Littoral Initiative project (NGLI) five CTD surveys were performed in Mississippi Sound. At the same time the distribution of temperature and salinity were calculated using a version of Princeton Ocean Model (PDOM). The goal of this paper is to propose a method that allows comparing these observations and the distribution obtained from modeling. The method of variational interpolation has been proposed, developed and implemented for the analysis of temperature and salinity observations. The interpolation is based on the minimization of the cost function which takes into account the spatial correlations and error variances of the observed fields. The method allows taking into account the influence of coastlines, island boundaries and bottom topography on the correlation structure in the observed fields. A series of experiments have been conducted to tune the statistical parameters of the interpolation. The horizontal distribution for the temperature and salinity fields at two depth layers (0.5–2.0 m and 2.0–4.0 m) has been recovered from the observations on the curvilinear grid of PDOM. Though the interpolation technique was designed for the validation of the model versus the CTD data, the obtaining temperature and salinity distribution and the error observation maps also allow to perform circulation analysis for Mississippi Sound.

### 3:30 Divisional Poster Session

#### DETERMINATION OF THE LD50 OF THE TAURA SYNDROME VIRUS (TSV) ON THE SHRIMP, *LITOPENAEUS VANNAMEI*

Jonathan E. Watkins<sup>1\*</sup>, Andy Soto<sup>1</sup>, and Jeffery Lotz<sup>2</sup>,  
<sup>1</sup>Jackson State University, Jackson, MS 39217, and  
<sup>2</sup>University of Southern Mississippi-Gulf Coast Research Laboratory, Ocean Springs, MS 39566

Taura Syndrome Virus (TSV) is the most economically significant disease affecting the shrimp industry in the Americas. TSV, first noticed infecting shrimp on farms in Ecuador and Colombia in the early 1990's, has now spread throughout the shrimp-growing regions of the world. We conducted experiments using shrimp weighing between 2 and 3 g to determine the LD50 of TSV on *L. vannamei*. In the first experiment 80 shrimp were injected with a cell-free shrimp homogenate containing TSV. The shrimp were divided into groups of twenty and were assigned to treatments of 1:10<sup>-1</sup>, 1:10<sup>-2</sup>, 1:10<sup>-3</sup>, and 1:10<sup>-4</sup> (w/v) dilutions of tissue from shrimp known to have died of TSV, with distilled water. In the second experiment, the homogenates consisted of a 1:10<sup>-4</sup>, 1:10<sup>-6</sup>, 1:10<sup>-8</sup>, 1:10<sup>-10</sup>, 1:10<sup>-12</sup> (w/v) dilutions. We injected the homogenate (0.02 ml/g body weight) into the muscle of

the third abdominal segment of each shrimp. Ten *L. vannamei* were injected with a virus-free homogenate of the 10<sup>-4</sup> dilution as negative control for both experiments. Each shrimp was placed in a 1 L jar. The jars were then supplied with an air stone and placed in a water bath maintained at 29°C. The shrimp were fed and kept in the jars for five days. Shrimp mortality ranged from 100% at 1:10<sup>-1</sup> virus dilution to 0 at 1:10<sup>-12</sup>. The data suggest that the LD50 of TSV on *L. vannamei* is about 1:10<sup>-5</sup>.

#### HEMATOLOGICAL AND SERUM BIOCHEMICAL CHANGES IN *CYPRINUS CORPIA* IN RESPONSE TO ENDOSULFAN TOXICITY

F. Jenkins<sup>1\*</sup>, J. Smith<sup>1</sup>, B. Rajanna<sup>1</sup>, U. Shammem<sup>2</sup>, U.D. Kandalam<sup>2</sup>, S. Vardhanapu<sup>2</sup>, and R. Madhavi<sup>2</sup>,  
<sup>1</sup>Alcorn State University, Lorman, MS 39096, and  
<sup>2</sup>Andhra University, India

Endosulfan, an organochlorine pesticide used extensively as an agricultural pesticide is a known toxin to fish as well as human upon exposure. This study was conducted to investigate effects of endosulfan on hematological and serum biochemical changes and immunosuppressive activities in Carp (*Cyprinus carpio*) cultured on a large scale in India. Carps were exposed to sub lethal (5 ppb) and lethal (10 ppb) doses of endosulfan for 30 d and 96 h respectively. Blood samples were analyzed for various hematological and serum biochemical parameters. Endosulfan at all concentrations reduced RBC (Red Blood Cells) and enhanced WBC (White Blood Cells) counts. This trend was more pronounced at 14 d.p.e (days after post exposure) and continued till 30 d.p.e. However, the reduction in the hemoglobin and hematocrit values were not significant. Significant reductions in protein, albumin, globulin and enzymes such as; alkaline phosphatase, glutamate oxaloacetate transaminase, glutamate pyruvate transaminase indicated that the fish was under severe metabolic stress. These results suggest that even a very low concentration of the pesticide may induce alterations in the general hematological profile and serum biochemistry in Carp. (Supported by: NIH/FIC/MIRT #TW00132 and MBRS-SCORE #GM55356)

#### POROSITY AND TORTUOSITY OF SANDY MARINE SEDIMENTS: FORT WALTON BEACH, FLORIDA

Kenneth J. Curry<sup>1</sup>, Conrad W. Curry<sup>2</sup>, Maritza Abril<sup>1\*</sup>, Ann Curry<sup>1</sup>, Richard H. Bennett<sup>2</sup>, and Matthew H. Hulbert<sup>3</sup>,  
<sup>1</sup>University of Southern Mississippi, Hattiesburg, MS 39406; <sup>2</sup>SEAPROBE, Inc., Picayune, MS 39466; and  
<sup>3</sup>Research Dynamic Co., West Chester, PA 19380

Diver marine sediment cores were collected off Fort Walton Beach, Florida, and were stabilized on board the research vessel by gently pouring liquid agar into each

core and allowing it to solidify. Subsamples were subsequently embedded with Spurr's (ERL 4206) epoxy resin which stabilized the three-dimensional fabric. Porosity was measured using known (measured) densities of the sand grains ( $\gamma_s$ ) and embedding material ( $\gamma_p$ ) using the relation  $n = (\gamma_t - \gamma_s)/(\gamma_p - \gamma_s)$  where  $\gamma_t$  is the bulk density of the sample measured using Archimedes' Principle. Porosity of the marine sediments ranged from 41 to 52%. Tortuosity was determined by sanding and polishing a sediment surface, capturing an image of that surface with incident light from a half-silvered mirror, and using image analysis software to measure the shortest pathway through the pores. Both vertical and orthogonal horizontal aspects were measured for tortuosity. Values of tortuosity in any plane ranged from 1.03 to 1.27. This work was supported by the Office of Naval Research.

#### PRODUCTION OF A HIGHLY TOXIC SUBSTANCE, TBT, FROM AN INOCUOUS SUBSTANCE, DBT, IN COASTAL WATERS

Thomas F. Lytle<sup>1\*</sup>, Julia S. Lytle<sup>1</sup>, Steve Manning<sup>1</sup>, and William Walker<sup>2</sup>, <sup>1</sup>Gulf Coast Research Laboratory, University of Southern Mississippi, Ocean Springs, MS 39566, and <sup>2</sup>USEPA, Gulf Breeze, FL

Dibutyltin (DBT) is used in the plastics polymerization process, as catalyst in PVC products and is primary degradation product of tributyltin (TBT), an antifoulant in marine paint. DBT and other organotin compounds make their way into the environment through antifoulants, PVC processing plants, and PVC products maintained in water and water handling systems. A flow-through saltwater life-cycle toxicity test was conducted to determine the chronic effect of DBT to sheepshead minnow (*Cyprinodon variegatus* Lacepede), an estuarine species. Embryos were monitored through hatch, maturation, growth, and reproduction in concentrations of 158, 286, 453, 887, and 1510 Fg DBT/L. Progeny were monitored for survival as embryos and fry/juveniles, and growth for 30 days post-isolation. Mean length of parental generation fish was significantly reduced on day 30 at concentrations > 887 Fg DBT/L. The lowest observable effect concentration (LOEC), 887 Fg DBT/L, and no observable effect concentration (NOEC), 453 Fg DBT/L, were based on effects on the mean length of parental generation. Fecundity, as egg viability, was significantly reduced at the LOEC. Survival of parental and progeny generation embryos was not significantly affected by concentrations < LOEC. The mean length, wet weight and dry weight of progeny generation juveniles were not significantly affected at concentrations < LOEC. TBT, a ubiquitous impurity in DBT, was also monitored throughout study; chronic effects relative to the measured TBT concentrations reflected a

similar response pattern to results of an earlier TBT life-cycle study with *C. variegatus* and suggest TBT as a likely source of some gross biological effects in this study.

#### SIZE AND WEIGHT RELATIONSHIPS FOR THE GREEN PORCELAIN CRAB, *PETROLISTHES ARMATUS*, FROM THE MISSISSIPPI SOUND WITH SOME NOTES ON GROWTH

Kirsten M. Larsen\*, Christine Trigg, and Harriet Perry, Gulf Coast Research Laboratory, University of Southern Mississippi, Ocean Springs, MS 39566

*Petrolisthes armatus* is a porcellanid crab commonly found on oyster reefs in the Gulf of Mexico. Interest in this porcellanid crab has increased in recent years due to its migration north along the Atlantic coast. Prior to 1990 records for this species did not exist north of the Indian River, Florida. However, large numbers of this species began appearing in tidal oyster reefs along Georgia in the mid 1990s, and it has since moved into both North and South Carolina. Little information exists on this species and none has been found to date on its morphometrics. This study examined the morphometric characteristics of *P. armatus* collected from the Mississippi Sound. Carapace length, carapace width, and weight relationships were determined for 150 crabs held in captivity. Crabs were measured (0.01 mm), weighed (1 mg), and placed in individual habitats until they molted. Molting data were collected on 30 crabs and growth (percent increase in carapace length) was calculated.

#### DISSOLVED RARE EARTH ELEMENTS IN TWO CONTRASTING FLUVIAL SYSTEMS: THE LOWER MISSISSIPPI RIVER AND THE LOCH VALE WATERSHED

Alan M. Shiller, University of Southern Mississippi, Stennis Space Center, MS 39529

The rare earth elements (REEs) form a unique chemical set wherein the gradual decrease in ionic radius across the series leads to systematic changes in geochemical behavior. The properties of the REEs make them particularly useful tools for inquiring into processes that mobilize elements during weathering and transport. Herein, dissolved REE time series from two very different fluvial systems (the Mississippi River and the Loch Vale watershed) are contrasted. In the lower Mississippi (a large flood plain river), there is enrichment of heavy REEs relative to light REEs and also a significant Ce anomaly. These results are in accord with previous observations of transition elements in the lower Mississippi River which suggested the importance of redox processes within the river system in controlling seasonal concentration variability. In contrast, in the Loch Vale system (a small

seasonally snow-covered catchment), both light and heavy REEs show a ~5-fold seasonal variability. In this case, an abrupt increase in REE concentrations occurs during early spring when the beginning thaw flushes organic-rich soil water from the watershed. Overall, the results suggest that the greater pH of the Mississippi (~7.8 versus 6.4 for Loch Vale) may result in the differing REE behaviors of these two systems: redox-affected sorption behavior dominating in the Mississippi and organic complexation dominating in Loch Vale.

#### PALEOCEANOGRAPHY OF A COOL-WATER CARBONATE RAMP DURING THE PAST 130,000 YEARS

Charlotte A. Brunner\*, David M. Anderson, and Miriam S. Andres, University of Southern Mississippi, Stennis Space Center, MS 39529; NOAA, Boulder, CO 80305; and ETH-Zentrum, CH-8092 Zurich, Switzerland

The cool-water carbonates of the Great Australian Bight (GAB) were produced by a heterozoan fauna that flourished during the Quaternary, sequestering huge amounts of carbonate on the adjacent slope. The biogenic carbonate was deposited in prograding clinofolds at rates exceeding 50 cm/1000 y, matching or exceeding top rates downslope from large coralgal reefs. Despite the importance of such cool-water carbonate systems to the carbon cycle, the hydrographic conditions that nourished the verdant growth remain poorly known. In this work we examine watermass conditions, specifically paleotemperature, during the last 130,000 years at ODP Site 1127 on the upper slope. Age control is provided by oxygen isotope stratigraphy and AMS <sup>14</sup>C dating. Paleotemperatures are estimated from planktonic foraminifer assemblages using the Modern Analog Technique. Paleotemperatures range from 9E to 18EC ±1.4EC in the cool season and 12E to 24EC ±1.9EC in the warm season. During the period of vigorous bryozoan mound building of MIS 3, paleotemperatures remained below 14EC during the austral winter and below 20EC during the summer. An underlying control, like upwelling, likely affected both paleotemperature and heterozoan production at this time.

#### MATHEMATICS, COMPUTER SCIENCE AND STATISTICS

Chair: Joseph Kolibal, University of Southern Mississippi

Vicechair: Walter Brehm, Keesler Air Force Base

#### THURSDAY AFTERNOON

#### Caprice Room

#### 1:00 HIGH-SCHOOL GPA AND ACT SCORES AS PREDICTORS FOR STUDENT SUCCESS FOR THE FALL OF 1999 FIRST-TIME FRESHMEN AFTER ONE YEAR OF STUDY IN THE FALL 2000 AT JACKSON STATE UNIVERSITY

Elgenaid I. Hamadain\*, Okoye Steven, Lauren Jones, Jonathan Rodarte, and Wutasha Taylor, Jackson State University, Jackson, MS 39217

Data of 437 incoming freshmen after one year of study in Fall 2000 at Jackson State University were obtained from the Office of Institutional Research. The data contained information on students' high school GPA, ACT score, and college GPA. Several SAS procedures were used to analyze the data. Results indicated that data on all three variables were normally distributed. The three variables were moderately and positively correlated with each other. Based from multiple regression analysis, high school GPA and ACT score were significant. Individual simple regression analysis confirmed these results. Although the variables were not strongly correlated with each other, high school GPA and ACT scores appeared to be good predictors of college success (GPA). Two sets of samples (61 students each) were taken randomly and systematically using SAS. Descriptive statistics, regression and correlation analysis were performed for each set. Multiple regression model indicated that high school GPA and ACT Scores are good predictors of College GPA. High school GPA seems to be more important in determining college success (p-value = 0.0002), than ACT score (p-value = 0.3063). Descriptive statistics generated by random sampling seem identical to the one obtained through systematic sample. Mean high school GPA was significantly higher than that of college GPA, however; college GPA was more variable than high School GPA, according to t-test.

#### 1:20 VISUAL REPRESENTATION OF INFORMATION NEEDS IN CARTOGRAPHIC INFORMATION RETRIEVAL USING GIS TECHNOLOGY

Lixin Yu, Alcorn State University, Alcorn State, MS 39360

Library catalogs for map collections are not well developed in most libraries. The cartographic information source differs from other kinds of information in that maps are usually rectangular in shape and defined by the coordinates of the four map corners. This coordinate information is difficult for an average person to use, unless certain user interface is designed and knowledge discovery in database algorithms are implemented. System with such an interface and algorithms can perform powerful queries

that an ordinary text-based information retrieval system cannot. This presentation demonstrates a prototype system—GeoMatch, which allows users to interactively define geographic areas of interest on a background map. It also allows users to define, qualitatively or quantitatively, the relationship between the user-defined area and the map coverage. Two measurements, coverage and exclusiveness, are introduced for users to precisely represent their information needs. Three librarians were interviewed to study the feasibility of the new system. The MARC record format is also discussed to illustrate that retrospective conversion of cartographic material records from an existing library online catalog system to GeoMatch can be done automatically.

1:40 APPLICATION OF ARTIFICIAL NEURAL NETWORKS FOR THE CLASSIFICATION OF REMOTE SENSING SPECTRAL REFLECTANCE DATA OF STRESSED SOYBEAN LEAF

Abdullah Faruque\*, Raj Bahadur, and Gregory A. Carter, State University of West Georgia, Carrollton, GA 30118; Mississippi Valley State University, Itta Bena, MS 38941; and Earth System Science Office, NASA, Stennis Space Center, MS 39529

This research paper describes the application of artificial neural networks as a superior pattern recognition tool for the classification of remote sensing spectral reflectance data of stressed soybean leaves. The objective of this study funded by National Aeronautics Space Administration (NASA) at Stennis Space Center was to record and classify the spectral reflectance differences of leaf stress caused by drought, fungal disease, and lead contamination of the soil. Reflectance spectra of drought stressed, lead contaminated and fungal infected leaves were measured using GER1500 Spectroradiometer for 512 spectral bands with 1.52 nm intervals from 308 nm to 1089 nm. Multi-layer feed-forward neural network model was used to train and predict the different classes of stressed leaves from their spectral signature. Network parameters and architectures were optimized to obtain maximum network classification performance. The classification performance of neural networks was compared to K-nearest neighbor and other statistical pattern recognition techniques. The superior classification capability of neural networks refined with an additional research can be used to monitor more precisely the signs of damaging stress due to different factors on economic crops.

2:00 A SELF-TUTORING INTERACTIVE MODULE  
Kanchan Manaktala, Alcorn State University, Lorman, MS 39096

This is the first of a sequence of six interactive modules in analytic geometry that I am developing under the activities of the NSF project WELCOME awarded to Mathematics Association of America. The objective of this interactive module is to create a self-tutoring resource on the concept of a point. MathWright, a powerful mathematical authorware is used to develop this module. The module teaches and tests the plotting of points, finding distance between two points, checking co-linearity of three points, and determining the equation of a line passing through two points. The feedback is instant and the questions are generated randomly, giving the user numerous monitored examples to master the concepts.

2:20 Break

2:40 EXPLORING MATHEMATICAL THINKING  
Garfield Burke, Jr., Mississippi Valley State University, Itta Bena, MS 38941

Mathematical thinking is much more than performing arithmetical computations with speed and accuracy. It involves reasoning and problem solving. Reasoning involves activities such as deciding if an answer is correct and/or defending the result. When reasoning is part of all mathematical activities, students learn that mathematics is not a collection of arbitrary rules but a system that makes sense and can be figured out. Problem solving is much more than finding an answer to a given problem. It requires analyzing, selecting and applying an appropriate strategy or combinations of strategies to an unfamiliar problem at hand. It also requires justifying solutions and if possible, transferring or generalizing knowledge gained from a problem-solving experience to similar situations. The purpose of this paper is to introduce the reader to some of the basic concepts and techniques centered around mathematical thinking/problem-solving activities and to illustrate how these concepts and techniques may be used to solve problems.

3:10 A DYNAMIC TOOL FOR CREATING MATHEMATICAL MODELS

Ravinder Kumar, Alcorn State University, Alcorn State, MS 39096

The objective of this work is to develop a dynamic tool for creating mathematical models that use the technique of linearity. MathWright, a powerful authorware which blends CAS (Computer Algebra system) with multimedia tools, is used for the purpose. In many situations data collected renders itself to modeling by linearity. Typically, this happens when parameters or some functions of the parameters are connected by direct variation. This can be done in two ways: either manually fit

a line of best fit in the scatter diagram of the (modified) data or use the technique of least squares to create a line passing through the origin that fits best in the (modified) data. If the resulting line is of the form  $y = kx$ , then  $k$  is the desired constant of proportionality. This dynamic tool allows the user to create a line of best fit through the origin in both ways. There are two built in examples and three examples for further exploration. Among the examples considered are fishing derby, panic stop, weight of the heart of birds. These examples are taken from Giordano's book on Mathematical Modeling (FR Giordano, MD Weir, and W. Fox, A First Course in Mathematical Modeling (Second Edition) Brooks/Cole, 1997.)

3:30 Divisional Business Meeting

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## FRIDAY MORNING

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Caprice Room

9:00 Divisional Poster Session

### MATHEMATICAL PRINCIPLES OF RSA CRYPTOGRAPHY

Tancia Boone\* and Przem Kranz, University of Mississippi, University, MS 38677

Cryptography is considered an art or science of secret messaging. It is a scientific method with usage of mathematical functions to encode and decode message. All messages have to be converted into a form that is only understood by the intended recipient. The two elements that make up a cryptosystem is encryption and decryption. Encryption is the process that plain text is converted to, to make the coded message (cipher text). Decryption is the process of the cipher text being converted back into original formation by the intended audience. In the world today, the usage of this coding process includes ATM machines for electrical transfers, protects tapping in cell phone calling, encodes and decodes data entry while using the Internet, etc. However, the only secure form of cryptography known today is RSA (named for the three inventors-Ronald Rivest, Adi Shamir and Leonard Adleman) Cryptography. The purpose of this system is to create a one-way function system; a system that computes a function easily but makes inverting almost impossible. Suppose  $p$  and  $q$  are large prime numbers (numbers that are divisible by 1 and itself) containing 500 digits each. The results  $n = pq$  is a 1000 digit composite number. On a typical computer the multiplication takes under a second to compute. The variables  $p$  and  $q$  are considered private keys. The person decoding the message should know the private keys,

whereas the general public knows the public key, which is  $n$ . Instead of given the primes,  $p$  and  $q$ , one is given the product  $n$ . From the number assigned to  $n$ , the two prime factors are to be founded. Using trail division to factor  $n$  would take centuries to factor.

### MISSISSIPPI CENTER FOR SUPERCOMPUTING RESEARCH (MCSR) USER ADVISORY GROUP

Faculty and graduate student researchers will describe their research projects that involve HPC and the use of MCSR resources. IHL faculty and graduate students, with an interest in HPC and/or MCSR facilities and services, are also invited to attend. A meeting of the MSUAG meeting will follow in the afternoon. IHL faculty and graduate students, with an interest in HPC and/or MCSR facilities and services, are also invited to attend.

### PARALLEL COMPUTING PROJECTS AT UNIVERSITY OF SOUTHERN MISSISSIPPI

Luis A. Parra, Jun Xie, Huiqian Yang, and Dexuan Xie, University of Southern Mississippi, Hattiesburg, MS 39406

### DEVELOPMENT OF THE PARALLEL TURBO CODE

Jenping Chen, Mississippi State University, Mississippi State, MS 39762

### VALIDATION OF MODAS-NRLPOM FORECASTING SYSTEM

Germana Peggion, University of Southern Mississippi, Stennis Space Center, MS 39522

### LOW-ORDER SCALING METHODS FOR DYNAMICAL ELECTRODE CORRELATION

Svein Saebo, Mississippi State University, Mississippi State, MS 39762

### P4 CLUSTER PERFORMANCE MEASURING AND TUNING

Andy Yaquan Xu and Haibo Wang, University of Mississippi, University, MS 38677

### PARALLEL COMPUTING WITH NWCHEM AND MPQC

Haibo Wang, University of Mississippi, University, MS 38677

### USE OF PARALLEL RESOURCES AT MCSR FOR THREE-DIMENSIONAL RECONSTRUCTION OF PROTEIN STRUCTURES

Mona T. Norcum, University of Mississippi, University, MS 38677

## EXPERIENCE WITH PARALLEL DATABASE SERVERS ON DISTRIBUTED COMPUTING PLATFORM

Yanhai Sun and Haibo Wang, University of Mississippi, University, MS 38677

### Divisional Talks Resume

9:30 A DYNAMIC AND INTERACTIVE MODULE ON PERMUTATIONS AND COMBINATIONS  
Shomari Mosi, Alcorn State University, Lorman, MS 39096

Mathwright, a mathematical authoring software, is used to create an interactive and dynamic module on the topic of permutations and combinations. It allows the user to experiment with permutations and combinations and conjecture formulas through the animations created. Permutations and combinations are useful in probabilistic considerations. Usually, students have difficulty in differentiating between permutations and combinations. This module shows through the use of animations the difference between the two. The module is interactive subject to some limitations since a computer screen cannot contain a large number of objects. The module also randomly generates examples in probability and solves them step by step.

9:50 ASYNCHRONOUS CONVERGENCE OF ITERATIVE SOLVERS

Rochelle Jenkins\* and Joseph Kolibal, University of Southern Mississippi, Hattiesburg, MS 39406

We exam the rates of convergence associated with relaxation methods such as Jacobi and Gauss-Seidel in which the iteration is modified to allow for asynchronous convergence, i.e., in which the selection of nodes to be updated is done randomly. The purpose is to investigate the parallelization of these algorithms, and to consider techniques for improving the rates of convergence.

10:10 A METHOD FOR OVERCOMING DISCONTINUITY BETWEEN NEIGHBORING UTM ZONE GRIDS

Chad A. Steed, Naval Research Laboratory, Stennis Space Center, MS 39529

The Universal Transverse Mercator (UTM) projection is ideally suited for use with large-scale geographic data. The Naval Research Laboratory at Stennis Space Center (NRLSSC) has investigated the UTM projection in support of the Naval Air Systems Command. In the investigation of the UTM grid, the properties and construction of the UTM projection have been analyzed to identify advantages and disadvantages in the system. A

major disadvantage of the system is the lack of continuity between neighboring UTM zone grids. This problem is most apparent when dealing with an area of interest that spans multiple UTM zones. To alleviate this problem, the concept of flexible zone boundaries for UTM zones has been developed and applied to two specific situations in UTM area of interest processing. The first situation involves the creation of a single UTM grid from the grids of neighboring UTM zones in a defined area of interest. The second is the extraction of native UTM zone grids from a single UTM grid that spans multiple UTM zones.

10:30 Break

10:50 THE DESIGN AND DEVELOPMENT OF GRAPHICAL USER INTERFACES TO CONSOLIDATE MANAGEMENT TASKS ASSOCIATED WITH NAVY AIRCRAFT OPTICAL DISKS

Stephanie A. Myrick\*, Marlin L. Gendron, and Michael E. Trenchard, Naval Research Laboratory, Stennis Space Center, MS 39529

This paper presents the design and development of a series of Graphical User Interfaces (GUI) that are used to build and manage aircraft optical disk images by U.S. military aircraft mission planners, requirements officers, and aircrew. The Naval Research Laboratory at the Stennis Space Center (NRLSSC) has created this product in support of the Naval Air Systems Command Hornet and Harrier Programs (PMA-265 and PMA-257, respectively). The GUIs are a component of NRLSSC's Moving-Map Composer (MMC) software that performs a wide variety of mission planning and aircraft image functions including the design and build of Mission Planning System Compact Disk Images and Aircraft Optical Disk (AOD) images. These images are comprised of user-specified digitized charts, static, non-georeferenced dataframes containing emergency checklist procedures and reconnaissance photographs. MMC is an X Windows/Motif GUI and low-level C language application written by NRLSSC scientists, and implemented on a Compaq Alpha computer running OpenVMS. The Navy and Marine Corps employ a large number of AODs in support of their various missions and requires a system to manage, build, and edit the images they contain. This paper will address the GUI design and development issues raised during this project and the methods that were developed for their resolution.

11:10 THE DEVELOPMENT OF SOFTWARE TOOLS FOR SCANNING PAPER CHARTS INTO GEO-TIFF IMAGE FILES

Marlin L Gendron\*, Stephanie A. Myrick, and Michael

Trenchard, Naval Research Laboratory, Stennis Space Center, MS 39529

This paper presents the design and development of software tools that scans paper charts, converts the charts into digital raster images, geo-references the images, and outputs GeoTIFF-compliant image files. The GeoTIFF file format is an extension of the popular TIFF raster file format and defined by a tightly controlled specification. Sets of tags (i.e., information) are added to the TIFF file format and describe all cartographic information associated with the TIFF scanned map imagery. These tags describe such information as map projection, datum and geographic location. Many standard commercial and government applications, including moving-map programs, utilize GeoTIFF files. The Naval Research Laboratory at the Stennis Space Center (NRLSSC) has created a set of software tools in support of the Naval Air Systems Command Hornet and Harrier Programs (PMA-265 and PMA-257, respectively). NRLSSC scientists have written low-level C routines that geo-reference digital charts and convert them to GeoTIFFs. Graphical User Interfaces (GUIs) written in the X-Window System/Motif language were also developed for displaying charts during the scanning process and choosing geographic control points on a scanned image. Other GUIs designed allow the user to clip or remove undesirable areas on the charts and display the final registered raster images.

#### 11:30 MISSISSIPPI CENTER FOR SUPERCOMPUTING RESEARCH (MCSR) USER ADVISORY GROUP MEETING

David G. Roach\* and Germana Peggion, University of Mississippi, University, MS 38677, and University of Southern Mississippi, Stennis Space Center, MS 39522

The Mississippi Center for Supercomputing Research was established in 1987 by the Mississippi Legislature and the Institutions of Higher Learning (IHL) in order to provide high performance supercomputing (HPC) support for research and instruction at all state universities. The Mississippi Supercomputer User Advisory Committee (MSUAG) was established by the IHL Research Consortium to provide user input and advice to MCSR management and technical staff on policies and procedures for the Center's operations. It includes member representatives from all IHL institutions. The Advisory Group will meet at this MAS conference. Mr. David G. Roach, Director of the MCSR, and Dr. Germana Peggion, MSUAG Chair and Professor at USM Stennis, will conduct the meeting. The agenda includes an update on MCSR HPC facilities and services, introduction of new MCSR staff members, and site reports and ongoing research updates by MSUAG representatives. A Poster Session will

follow the MSUAG meeting in which faculty and graduate student researchers will have the opportunity to describe their research projects that involve HPC and the use of MCSR resources. IHL faculty and graduate students, with an interest in HPC and/or MCSR facilities and services, are also invited to attend.

#### PHYSICS AND ENGINEERING

Chair: Amed A. Kishk, University of Mississippi  
Vicechair: T.M. Parchure, US Army Engineers

Chandeleur Room

8:30 Divisional Poster Session

Chair: Atef Z. Elsherbeni, The University of Mississippi, University, MS 38677

#### APPLICATION OF THE FAST FOURIER TRANSFORM FOR PERFORMANCE CHARACTERIZATION OF AN IF-DIGITAL CONVERTER

Andy Harrison, Raytheon Electronic Systems, Forest, MS 39074

In this work, the Fast Fourier Transform (FFT) is used to characterize the performance of a TPQ47 radar IF-Digital Converter (IFDC). The IF to digital converter consists of two channels each of which provides down conversion and filtering of the IF frequency, attenuation control for gain leveling and radar gain control, and 12-bit A/D conversion. Features of the FFT-based spectrum include harmonic content, spurious content and noise floor level. These combined effects are reflected in the IFDC's rms signal to noise ratio that can be derived from the FFT magnitude spectrum. Ideally, the frequency spectrum of the output signal would be a single line that represents a pure sine wave input and is free from distortion generated by the circuitry of the IFDC. Since the FFT assumes that the record repeats with a certain period, sharp discontinuities at the points where the start of one record joins the end of the preceding record cause the spectral components to be spread or smeared. The smearing, called leakage, can be reduced by multiplying the data in the record by a windowing function that weights the points in the center of the record heavily while smoothly suppressing the points near the ends. Many different windowing functions were studied that offer various tradeoffs of amplitude resolution versus frequency resolution.

#### COPLANAR WAVEGUIDE FED BOW-TIE APERTURE ANTENNA

Guiping Zheng\*, Atef Z. Elsherbeni, and Charles E. Smith,

The University of Mississippi, University, MS 38677

The coplanar waveguide (CPW) fed aperture antenna consists of an aperture that is etched from a ground plane having a bow-tie shape and a CPW feed line that protrudes through the aperture. This antenna exhibits characteristics similar to a dipole antenna. A prototype of the CPW aperture antenna is designed at a central frequency around 10 GHz and the computed input impedance is approximately 50  $\Omega$  similar to the characteristic impedance of the feed transmission line. A finite difference time domain (FDTD) simulation is performed using a developed MATLAB program and verification is obtained using the Ansoft High Frequency Structure Simulation (HFSS) program. With the approximately matched CPW aperture antenna, the return loss at the designed frequency is less than 20 dB. The gain and the radiation efficiency are also improved by taking advantage of this load matching property. The FDTD simulation results demonstrate that the CPW aperture antenna behaves more like a dipole antenna rather than a microstrip patch antenna, specially when the width of the aperture is comparable to a dipole length of  $\frac{1}{2}$ . The characteristics of this bow-tie aperture antenna that include small return losses, appropriate resonant frequencies, matched loading, and moderate gain, indicate that it has many features required to build a phased antenna array in a variety of actual applications.

#### CHARACTERISTICS OF COPLANAR BOW-TIE PATCH ANTENNA

P.L. Chin\*, Atef Z. Elsherbeni, and Charles E. Smith, The University of Mississippi, University, MS 38677

This paper introduces a new concept of coplanar patch antenna (CPA), which consists of a bow-tie shaped patch surrounded by a closely spaced ground conductor and a coplanar waveguide (CPW) feedline. The solid and wire bow-tie antenna configurations have been used in many applications over the past years because of their broadband characteristics. In this case, the characteristics of small aperture between the bow-tie patch and the surrounding ground plane are similar to that of the dual of a wire type bow-tie antenna. Yet it possesses some features characteristic of a patch antenna. To study the structure, the finite difference time domain (FDTD) technique is employed to design and to simulate this type of CPA and bow-tie patch with operation at 10 GHz with 50  $\Omega$  input impedance. Numerical results for return loss, radiation pattern, and gain are presented, and validated using the Ansoft High Frequency Structure Simulation (HFSS) program. Although the patch bow-tie antenna exhibits a somewhat narrow bandwidth for small aperture widths as compared to the solid cone bow-tie antenna, more

broadband operation can be obtained with wider aperture widths. In addition, the characteristics of this configuration can be further extended using loading due to the ease in adding impedance-type loads to the aperture/patch and the ground plane. This type of antenna is proposed for use as an element of a phased array antenna specifically designed for transmit/receive (TR) modules for radar systems.

#### COPLANAR PATCH ANTENNAS WITH ENHANCED BANDWIDTH

Brad N. Baker\*, Atef Z. Elsherbeni, and Charles E. Smith, University of Mississippi, University, MS 38677

Since the inception of the idea of coplanar patch antennas, their popularity has been growing due to their ease of construction as well as their simple design. One potential problem with coplanar antenna geometries, however, is their relatively limited bandwidth. The coplanar patch antenna, like the microstrip patch antenna from which it was derived, suffers from a narrow bandwidth of approximately 3 percent. In this paper, finite difference time domain (FDTD) analysis was used to parametrically analyze a coplanar patch antenna operating at 10 GHz. The effect of the coplanar slot width on the resonant frequency of the antenna is investigated. Two techniques to broaden the functional bandwidth of the 10 GHz coplanar patch antenna are then investigated. Slots are added to the coplanar patch antenna for the possibility of combining the resonances of the slot and the main patch together to broaden the bandwidth. Parasitic patches were also used experimentally to broaden the bandwidth and to provide a better match to the feeding network. The results of these experiments are analyzed to suggest optimum configurations for wideband coplanar patch antennas.

#### FINITE ELEMENT ANALYSIS OF THE PRESSURE BEHAVIOR DURING THE PULTRUSION OF COMPOSITES

Tabious Hayes\* and Tyrus McCarty, University of Mississippi, University, MS 38677

A common problem associated with the manufacture of composites is the formation of voids in the final product. The voids in the composite adversely affect the strength of the final product. A high pressure rise in the die inlet region can eliminate the voids. The elimination of voids can lead to a better quality final product. The purpose of this research is to determine the effect that various process control parameters have on the pressure rise during the pultrusion process. A numerical approach referred to as the finite element method is employed in this study. Finite element analysis is used to investigate the effect of the process control parameters of pull speed, fiber diameter, and fiber volume fraction on the pressure rise in the



pultrusion die region.

#### COMPUTER SIMULATION OF EARTH/SATELLITE(S) FOR REMOTE SENSING APPLICATIONS

Edward Woo\*, Atef Z. Elsherbeni, and Charles E. Smith, The University of Mississippi, University, MS 38677

A software package for the simulation of earth/satellites relative positions and land coverage for remote sensing applications is developed. This package provides a visualization tool to help in improving the analysis and design of radar systems and the techniques for collecting data for synthetic aperture radar (SAR) systems. This simulation will also allow users to get a better understanding of radar technology, global positioning systems, and basic remote sensing principles. Users will be able to input orbital parameters (shape and position) and satellite parameters (number, position, and speed). The distance between the satellites (while moving around the earth) and earth spot coverage area will be computed and displayed to the user in a window with a 3-dimensional dynamic view of the earth/satellites movements. A better understanding of the earth/satellites dynamic relationship will assist in solving many of the technical problems of today's satellites global coverage systems.

Divisional Talks Begin; Engineering Session

Chair: Ahmed A. Kishk, University of Mississippi, University, MS 38677

#### 10:00 INVESTIGATION OF THE RF PERFORMANCE OF A HYBRID ACTIVE ARRAY ANTENNA SUBARRAY MODULE

Andy Harrison\* and Rick Rollenhagen, Raytheon Electronic Systems, Forest, MS 39074

In this work, the RF performance of a TPQ47 radar hybrid active array antenna subarray module (SAM) is analyzed. Transitions and discontinuities in the RF path were investigated in both time and frequency domains. The SAM provides RF transmit and receive signal paths from the feed network to free space, transmit and receive beam steering control, receive signal amplification and element gain leveling, as well as array temperature reporting. The SAM consists of two microwave integrated circuits (MIC), two digitally controlled ferrite phase shifters, three micro-controllers, one RF circuit board and associated connectors. All electrical components are mounted on one side of the printed wiring board (PWB) and the RF trace is attached to the opposite side. The RF trace is comprised of six dipole elements. RF transmit and receive functions operate on two, three element in line arrays (3 Pack). In transmit, the SAM receives a single RF input that is split to drive both 3 packs. A ferrite phase shifter provides phase control of the

transmit signal for each path. In receive, the SAM provides two RF outputs each fed by a 3 pack. Each receive path is driven by a MIC that provides amplitude and phase control.

#### 10:20 BROADBAND SPATIAL POWER COMBINERS: FULL-WAVE ANALYSIS AND MODELING TECHNIQUES

Milan V. Lukich\*, Alexander B. Yakovlev, Atef Z. Elsherbeni, and Charles E. Smith, University of Mississippi, University, MS 38677

Spatial power combiners are used for power amplification at microwave and millimeter-wave frequencies from an array of solid-state devices. In contrast to traditional power combining techniques, which utilize waveguide and transmission line junctions, free space spatial power combining enables to achieve increased power output levels and power combining efficiencies. In this paper we present a waveguide-based spatial power combining system for operation at millimeter-wave frequencies. The system consists of several interacting antenna arrays placed at dielectric interfaces of an oversized multilayered waveguide. Uniform amplitude and phase excitation to the antennas is provided by a hard-horn with a dielectric sidewall loading. Signal collected by antenna arrays is coupled to the amplifier array through a ground plane with slots and the amplified signal is then reradiated into free space through slots of another ground plane. Generalized scattering matrix approach is adopted to model the entire amplifier system by decomposing it into smaller modules and cascading the modules using these matrices. A method of moments integral equation formulation is presented for the full-wave analysis of multilayered waveguide with embedded antennas. In order to increase frequency band and efficiency of the system and provide operation in multiple band regimes, resonant U-slot patch, microstrip loop, tapered meander line, triangular slot antennas, and their modifications are used. Numerical results for several representative antennas are given to illustrate advantages of their utilization in a power combining system.

#### 10:40 IMPLEMENTATION OF THE ASYMPTOTIC BOUNDARY CONDITION IN THE FDTD METHOD

Andrew Simon\* and Ahmed A. Kishk, University of Mississippi, University, MS 38677

Geometry description in the FDTD method is a somewhat tedious task especially when the geometry contains fine details. If the FDTD code is based on the use of cubic cells, this adds further constraints on the cell size and we may be forced to use excessive number of cells to simulate the required geometry. This will increase the

memory requirements and also processing time of the problem. For example, if we have a surface loaded with conducting strips that needs to be modeled in a FDTD code, the description of that will be tedious, as each strip has to be described and paid attention to. As an alternative, we propose the use of the asymptotic boundary condition (ABC) as a way to avoid dealing with such a problem. The ABC is an isotropic averaging type of boundary condition that does not require a detailed description of the strips. This boundary condition can be easily implemented the same way we implement the perfectly conducting surfaces and dielectric materials in the FDTD method. It has to be mentioned that the ABC is accurate when dealing with conducting strips as long as the number of strips per wavelength is large, typically more than 10 strips per wavelength. However, experimental data has shown that the ABC still holds for certain cases that have as little as 4 strips per wavelength. Another type of structure that can be modeled using the ABC is the corrugated structure where the corrugations can be easily modeled without the need for their detailed description. With the ability to classify the corrugated region as a homogenous region, we enable the division of cubic cells to be employed fully for the problem at hand. The method of implementing these boundary conditions in the FDTD method will be presented together with some applications.

11:00 ANALYSIS OF TRANSMISSION AND REFLECTION LOSSES FROM A CLASS OF COPLANAR WAVEGUIDE STRUCTURES

Abdelnasser A. Eldek\*, Atef Z. Elsherbeni, and Charles E. Smith, The University of Mississippi, University, MS 38677

In this paper, several geometries of a class of grounded coplanar waveguide (GCPW) are investigated using the finite difference time domain (FDTD) method, and their losses are computed. A uniform GCPW structure is used as a reference case for the other non-uniform geometries. First, this reference case, four geometries are proposed to study the transmission and loss effect of replacing parts of the dielectric substrate with free space. Afterwards, two new geometries are simulated to study the effect of reducing the feed line width in a limited section (step), and the introduction of a gap in the microstrip feeding line, with and without a bridge that connects the two parts of the microstrip feeding line separated with the gap. The effect of adding a perfect electric conductor (PEC) cap above the microstrip feeding line, and connecting the two side ground planes, is also studied. The conductor attenuation, power losses and the input and output impedances are studied for the proposed geometries. The results show that adding more free space in the substrate

improves transmission, decreases power losses and increases both input and output impedances. It is also found that the relative power losses and conductor attenuation are increasing with frequency, while a PEC cap improves the transmission and adding a PEC bridge over a gapped feed line improves both transmission and return loss coefficients.

11:20 ANALYSIS OF DUAL TAPERED MEANDER SLOT MICROSTRIP ANTENNA

Cuthbert M. Allen\*, Atef Z. Elsherbeni, and Charles E. Smith, University of Mississippi, University, MS 38677

The objective of this paper is to examine the performance of a dual tapered meander slot microstrip antenna using the FDTD technique. The antenna is to be designed to work at three pre-determined frequencies in the X-band or over the entire X-band region of frequencies. A computer code is developed to automatically create the antenna geometry for any angle, number of turns, width of slot, and spacing between slots. Such flexibility in geometry parameters is essential to easily analyze different configurations of the antenna. In order to have a complete analysis, certain characteristics of the antenna must be studied. Among these characteristics are the return loss, the input impedance, and the far field pattern. There has been no known work published on such an antenna structure. However, there have been numerous papers written on other forms of spiral or meander line antennas. These antennas have been very useful in broadband applications since they are very much frequency independent. Hence this gives motivation for the development of the dual tapered meander slot microstrip antenna. In the analysis of this antenna, the return loss is first computed and comparison made using an independent solution. The antenna is shown to work over a very large portion of the entire X-band.

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THURSDAY AFTERNOON

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Chandeleur Room

1:00 ANALYSIS OF MODIFIED MICROSTRIP LOOP ANTENNAS

Matthew J. Inman\*, Atef Z. Elsherbeni, and Charles E. Smith, The University of Mississippi, University, MS 38677

The characteristics of ordinary loop antennas are well known and documented in the literature. However, this paper intends to explore methods to reduce the physical size of rectangular printed loop antennas by introducing a ground plane into the structure as well as to study its effects on the antenna parameters. With the introduction of the ground plane into the antenna structure, the relationship

between the dimensions of the modified loop will also be explored to achieve the design goals. This type of antenna is analyzed using the finite difference time domain (FDTD) technique and is then verified by other numerical simulation packages. Differences in the radiation characteristics obtained from the full (unmodified) loop antennas and the modified antennas are examined. Optimization of bandwidth, gain, directivity, and operational bands are also investigated. By manipulating the dimensions of the modified antenna it is possible to adjust its parameters to achieve maximal operation at a specific frequency band, or in some cases at several different bands concurrently. Reducing the physical size of the antenna allows for more commercial uses in mobile transceiving platforms. Design examples of this type of antennas for radar applications and personal communication devices are presented.

1:20 BANDWIDTH ENHANCEMENT OF THE DIELECTRIC RESONATOR ANTENNA BY ADDITION OF MAGNETIC MATERIALS

Swee H. Ong\* and Ahmed A. Kishk, University of Mississippi, University, MS 38677

The dielectric resonator antenna has been widely investigated in recent years for its high efficiency and mechanical flexibility. Here, the monopole antenna is loaded with a multi layer dielectric material acting as a dielectric resonator. The dielectric loading has two significant effects: first, it reduces the size of the antenna and second, it improves the antenna matching bandwidth significantly. Last year, results of this antenna with dielectric loading were presented. This year, homogeneous magnetic materials with small permeability constants are added to the dielectric materials. It is believed that these new materials can be obtained by adding the magnetic materials with the dielectrics, in a powder form, with a specific ratio, to achieve the required permittivity and permeability. It is observed that the radiation patterns of the monopole were not affected by the loading. Careful selection of the resonator material can result in wider bandwidths. Numerical results presenting the effects of different permittivity and permeability on an antenna for a cellular communication system will be shown. Results will show that a significant increase in the bandwidth, reaching 40%, can be obtained. This is achieved by the combination of different materials, including the use of homogeneous magnetic materials, which lowers the resonant frequency as compared with dielectric loading.

1:40 DESIGN, CONSTRUCTION, AND VERIFICATION OF AN AUTOMATED MOVEABLE INDOOR ANECHOIC CHAMBER

FOR ANTENNA MEASUREMENTS

Brian T. McDaniel\*, Ahmed A. Kishk, and Charles E. Smith, The University of Mississippi, University, MS 38677

This paper presents the design and construction of a moveable anechoic chamber for use in RF, wireless, and microwave education and research applications. The instrumentation used for anechoic chamber measurements is a system consisting of an Agilent/HP 8530 Microwave Receiver, 8530B Sweep Generator, 8714B S-Parameter Test Set, and a computer-controlled rotator for antenna pattern measurements, designed at The University of Mississippi. This computer-controlled system allows for single frequency measurements as well as swept frequency techniques. The operation of the antenna rotator is automated, using a stepper motor, with user selected rotation angles and signal sampling intervals. Furthermore, the measured antenna pattern and antenna position data is acquired using a PC, providing real-time pattern display of raw or processed data and simple data storage. The design of the anechoic chamber is presented which includes necessary parts, setup, calibration methods (for single or swept frequency measurements) and the construction is described. The verification of the useable quiet zone for measurement is studied, and a detailed presentation of two anechoic chamber figure-of-merit methods (Antenna Pattern Comparison and VSWR) is presented, along with examples of collected antenna pattern measurements from the University of Mississippi Indoor Anechoic Chamber. Using these techniques, The University of Mississippi has implemented an efficient way to measure, evaluate and characterize experimental antennas and scattering systems in an anechoic chamber whose electromagnetic properties are known.

2:00 HYDRAULIC SCALE MODELS

T.M. Parchure, US Army Engineer Research and Development Center, Vicksburg, MS 39180

Hydraulic scale models have been extensively and successfully used over the past century for solving a variety of engineering problems for which analytical solutions were not available. The objective of scale model study is to physically simulate the relevant natural conditions and to operate the model for predicting the effect of proposed changes. The theory of modeling is based on the similitude criteria. Construction and operation of scale models requires expertise and experience. Two types of models are used: a. geometrically similar, in which the horizontal and vertical scales are the same, and b. vertically exaggerated, in which the two scales are different. Once the two scales are carefully selected, the other scales are fixed by mathematical relationships. Scale models may be two-

dimensional or three-dimensional. Almost every hydraulic model needs field data for verification. After a model is verified for a certain set of parameters, it is assumed that it will also behave consistently for a new set of values. Hence they are used as predictive tools. Hydraulic models offer not only qualitative but also quantitative answers to a large number of problems. Numerous examples of past projects reveal that large projects constructed without adequate prediction of their effect have proved to be not only expensive mistakes but have also caused irreversible ecological damage in some cases. Such mistakes can be easily avoided through advance modeling, in which several alternatives and options can be investigated at a fraction of the cost of project. In conclusion, hydraulic models offer a valuable tool in achieving success and economy for engineering projects. Theory of scale modeling and practical examples of problems will be presented.

2:20 THE ACCURACY OF KEYSTROKE INTERVAL MEASUREMENTS IN A WINDOWS ENVIRONMENT

Marcus Parks\* and Mark Tew, University of Mississippi, University, MS 38677

Psychological experiments were once held in isolated and controlled environments, but now thousands of researchers in fields such as cognitive psychology are conducting experiments over the web. Timing accuracy is of perennial concern to researchers conducting reaction time studies, especially for those using computers that are not dedicated to attaining millisecond accuracy. The following equipment was used during the research: Desktop computer, lap-top computer, keystroke generator, National Instruments DAQPad, and key interface box. Two programs were also used during this research "Key Interval" and "Digital Waveform." This research was held under the following four environments: Default, Experiment Only, Experiment with web traffic, and Experiment with time killer. These four conditions were tested through an executable file and over the web through a web browser. The results from the executable file were compared to the results of the web delivered file. Next, the web browser's results were compared between Internet Explorer and Netscape. Finally, the program was executed through an E-Prime player where these results were compared with the previous results that were executed through an Authorware plug-in. A final conclusion could not be drawn at this point and time in the research. The research in which I participated is an ongoing experiment and much more data will be needed. In conclusion, Authorware and E-Prime were found to be capable of acceptable accuracy in measuring keystroke intervals. This held true in the default environment, experiment only

environment, and with light web traffic in the background.

2:40 Divisional Business Meeting

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FRIDAY MORNING

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Chandeleur Room

Physics and Engineering Session

Chair: T.M. Parchure, US Army ERDC, Vicksburg, MS 39180

8:30 EXPLANATION OF THE BIRTH OF THE UNIVERSE

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

The four important observations, namely, expansion of the Universe, cosmic background microwave radiation, formation of light nuclides, and formation of galaxies and large-scale structure, prove that the universe has a starting point. According to the general theory of relativity, the universe is expanding because space-time itself expands. Edwin Hubble's observations show a linear relationship between the distance to galaxies and their recession velocities (redshifts), and the age of the universe is estimated about  $1.5 \times 10^{10}$  years. The 3 K primordial microwave radiation, predicted by George Gamow using quantum physics, has been discovered and accurately measured recently. The lumps detected in the cosmic microwave radiation, confirm that the primordial lumpiness caused due to slight temperature fluctuations at the very early age, has been carried over into modern times. The galaxies were formed due to fluctuations in matter density. The particle physicists speculate that intensive hot dark matter, consisting of high energy particles like neutrinos, tends to form very large structures. Cold dark matter seems to form smaller structures such as galaxies and clusters of galaxies. Inflation could have increased to large gravitational fields powerful enough to form galaxies and clusters. Using nuclear and sub-nuclear physics, the make up of the universe is: protons, neutrons and electrons 5%, dark matter 30%, "dark energy" 65%. We have reason to believe that physics, cosmology, astronomy, and technology will take us  $1.5 \times 10^{10}$  years back in time to see the birth of our universe.

8:50 UNDERSTANDING THE FATE OF THE UNIVERSE

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

According to the inflation theory, and general theory of relativity, the Universe is flat, and expanding with a decelerating rate. In 1998, two international teams of

astronomers working independently announced that the distant supernovae are dimmer than they should be in a decelerating universe, indicating that the expansion of the Universe is accelerating. It is believed that the universe is filled with “antigravity,” a concept originally proposed by Einstein. This force or “dark energy” dominates over gravity, and causes the universe not only to expand, but also accelerate the expansion. The equations of quantum physics independently suggest that the apparently vacuum space in the universe is filled with a form of energy that would act just like Einstein’s antigravity. The dark energy is a function of space, and as the distance between galaxies increases more and more dark energy is created filling the space, becoming stronger than the gravity. The recent detection of the primordial lumpiness in the cosmic background radiation confirms that dark energy is real. As the universe will continue to have accelerated expansion, stars will die out, and the universe will become cold and black. Astronomers and physicists caution that the discoveries about dark matter, dark energy, accelerated expansion, and flatness of space-time must be confirmed before accepting them without reservations. We might expect surprises in the future. The cosmological constant, could even change direction to reinforce the gravity. Therefore, a closed universe, and hence a Big Crunch, is possible.

#### 9:10 UNDERSTANDING THE CREATION OF MATTER

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

According to the Standard Model, the behavior of the fundamental particles, quarks and leptons—the building blocks of matter—and their interactions can be described through the strong, weak and electromagnetic forces. The basic forces are transmitted between the quarks and leptons by a third family of fundamental particles, called gauge bosons. Each force is carried by a different type of gauge boson. Photons carry the electromagnetic force; gluons carry the strong force; charged particles, and neutral particles, carry the weak force. (A particle called the graviton, is believed to carry force of gravity.) The quarks, leptons and gauge bosons acquire their masses through the interaction with a member of another new family of fundamental particles, known as Higgs bosons, and it is the strength of this interaction that gives the particles their masses. The experimental results from the large Electron Positron Collider and the predictions of the Standard Model agree only if there are three types of neutrinos. As the energy of electron-positron is expected to be doubled, the experiment will be able to study in detail the charged Higgs bosons  $W^-$  and  $W^+$ . In the Large Hadron

Collider, the proton energies will reach ten times greater, and will provide an opportunity to have a glimpse of the early Universe. The interactions of the hadrons will produce the Higgs bosons or it will explain whatever mechanism Nature employs to create matter.

#### 9:30 I FELT LIKE GILBRETH!

David Loflin\* and S. Kant Vajpayee, The University of Southern Mississippi, Hattiesburg, MS 39406

Frank and Lillian Gilbreth made significant contributions to industrial engineering in its infancy. It is interesting to know how Frank applied what can only be called common sense to improve a brick layer's productivity threefold. Even today, the practice of industrial engineering—unlike the other disciplines such as civil engineering, mechanical engineering, or electrical engineering—draws a lot from common sense. Or, shall we say uncommon sense for if it were common sense it could not be engineering. Recently, the first author went through a realization probably similar to that of Frank Gilbreth, while working part-time as a student at a local golf course. What he did as part of his job was simply applying common sense. Later when he began his studies at The University of Southern Mississippi as an industrial engineering technology major, he began to interact with the second author. Slowly he began to learn what industrial engineering is all about. The presentation will describe his feelings of Eureka when he realized that the common-sense approach to the task of distributing golf carts had the seeds of industrial engineering. We wonder what Gilbreth, the industrial engineer, might have felt later in his life about the spark generated by his now famous, common-sense-based improvements in the brick laying process. In the present case, the golf carting was completed efficiently, thoroughly, error-free, and in time. And these are the measures for evaluating industrial engineering projects.

#### 9:50 THE ISO 9000 BEGAN IT ALL!

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

The world-wide quality revolution began in the 1970s with the culmination of ISO 9000. Following this, and in response to a growing concern for the environment, the ISO developed ISO 14000—a family of environment management standards—in 1996. The structure and the concept behind these two standards are the same; both aim at improvement—the former of the product and service quality, and the latter of the environment. Several sectors of the industry have developed their own standards based on ISO 9000 structures and concepts to suit their specific needs. The Big Three US auto makers established QS 9000 in 1994 as requirements for their 13,000 first-tier suppliers.

As a supplement, they also developed TE 9000 for their 50,000 suppliers of production equipment and tooling. The aerospace industry, led by Boeing, has adopted a similar standard called AS 9000. Another important industry impacted by these global standards is telecommunications. Its TL 9000 serves the same purpose as the QS 9000 for the auto industry. Other issues in the "pipeline" to undergo a similar impact are occupational health and safety, handling of customer complaints, worker welfare, and personal finance planning. Thus, ISO 9000 has proven to be "revolutionary." The US accepted ISO 9000 rather hesitantly, as obvious from an ex-Ford chief's statement: "I told people we can either adopt the ISO standard and build on it, or we would spend the rest of our lives telling people why we didn't. We figured it just made sense." But as the wisdom set in, we moved fast and are today one of its strong proponents.

10:10 Break

10:30 COMPUTER SIMULATION OF THE THERMAL MANAGEMENT

Nichalos L. Jeffries\* and Tyrus McCarty, University of Mississippi, University, MS 38677

The trend in packaging electronic systems has been to reduce the size of devices by placing more functions in smaller packages to increase their performance. This has contributed to higher heat densities, requiring that thermal management be given a high priority in the design cycle in order to maintain system performance and reliability. In this study the analysis involved the thermal management of an electronically packaged system associated with a radar subsystem. A computer simulation of the heat transfer in the radar subsystem was performed to test the effectiveness of several specified design conditions. A computational numerical technique was employed to solve the basic equations that governed the physical processes occurring in the radar subsystem. This study focused on the utilization of heat pipe/heat sink technology for cooling the electronic components associated with this subsystem. The results of this study are vital because they provide several effective ways of insuring that the electronic components are operated in a failure-safe environment.

10:50 ACOUSTICAL INVESTIGATION OF SOIL LAYERS

Wheeler B. Howard\*, Craig J. Hickey, and James M. Sabatier, University of Mississippi, University, MS 38677

In soils containing a fragipan horizon, the rate of soil erosion and crop yield are directly related to the depth and condition of the fragipan layer. The objective of this study is to develop a technique for delineation of the

fragipan horizon through use of acoustic to seismic (a/s) coupling. This method utilizes the seismic energy coupled into soil by an impinging airborne acoustic wave to determine the layer depth and velocities in the soil. A site in North Mississippi with a known fragipan horizon was chosen as the test site for our experiment. Two locations with physical depths to the fragipan of about 30 cm and 1 m were selected. Conventional techniques including the shallow refraction survey and Rayleigh wave survey were utilized to determine the "seismic" depth to the fragipan and the seismic speeds of the soil layers. The data obtained from the a/s coupling survey are compared to the conventional seismic and soil cores to establish the accuracy of the acoustic survey.

11:10 COHERENT BACKSCATTERING FROM COMPLEX LIQUIDS

Letemeskel Asfaw\* and Joe Whitehead, University of Southern Mississippi, Hattiesburg, MS 39406

An experimental study of coherent backscattering of light from aqueous suspension of micron sized polystyrene spheres and a bulk sample of nematic liquid crystal (NLC) is presented. Both these materials enhance multiple scattering, which is a universal phenomenon occurring in almost every branch of physics. Coherent backscattering is caused by the constructive interference of two waves traveling in opposite directions. A sharp peak in the intensity in contrast with the background appears within a narrow angular cone in the opposite direction of the incident beam. This peak is called the coherent backscattering cone. The angular width at half maximum of the enhanced backscattering peak depends on the mean free path and the wavelength of the laser light used in the experiment. We found the enhancement ratio for the polystyrene samples very close 2.0 but for NLC it is 1.67, a discrepancy is due to the anisotropic nature of nematic liquid crystals.

11:30 DEBONDING CHARACTERISTICS IN BONDED CONCRETE OVERLAYS

Hak-Chul Shin\* and David A. Lange, Jackson State University, Jackson, MS 39217, and University of Illinois at Urbana-Champaign, IL

To rehabilitate old concrete pavements for a long-term performance with only minor repairing, bonded concrete overlays are considered as a cost-effective strategy. The superior performance of bonded concrete overlays is sometimes damaged by early age surface cracking and/or debonding at the interface between old and new concrete. This early age failure is mainly due to volume changes of the overlay concrete by shrinkage and thermal changes. To understand the early age behavior of bonded concrete

overlays, an extensive experimental measurements and numerical analysis were carried out. Laboratory overlay specimens were fabricated to measure opening displacement at the interface. Debonding profiles at the interface were determined by a dye technique. A finite element model was developed to compare debonding behavior due to volume changes. From the experimental measurements and numerical analysis, it was found that bonded concrete overlays with HPC mixtures have strong tendency to debonding at the early age. The main reason for this tendency is due to high shrinkage gradient in the HPC mixtures and low bond strength at the interface.

#### 11:50 ARE INDUSTRIAL ENGINEERS REAL ENGINEERS IN THE CLASSICAL SENSE?

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

Unlike others such as civil engineers, mechanical engineers, or electrical engineers, industrial engineers are less well known as to what they do. There are two primary reasons for this. First, they are relatively a new breed. Second, they are not real engineers in the classical sense of the term. They are half engineers (professionals dealing with engineering and technical matters) and half managers (professionals focusing on optimally utilizing the resources, including people). Industrial engineers are unique as an interface between technical professionals and the management. The former have limited knowledge of what managers do, and the latter is busy mostly with non-engineering/non-technical functions. If industrial engineers are fortunate, both managers and the other engineers of the company "love" them. On the other hand, where they are not appreciated for what they do, both may attempt to "kick" them around. The adjective industrial truly describes them, because they are found in all types of industries—not just manufacturing—from health care to wealth care, from doughnut franchises to defense contractors, from shop floors to space programs. Known earlier as productivity engineers, and then as system engineers, now they are called integrators. They have eagle eyes for the forest rather than the trees. Other engineers, on the other hand, are skilled at focusing on the trees. As technology gets more sophisticated and globalization continues to make industries more complex, industrial engineers are finding themselves needed more.

### PSYCHOLOGY AND SOCIAL SCIENCE

Chair: Pamela Banks, Jackson State University  
Vicechair: Ann Marie Kinnell, University of Southern Mississippi

## THURSDAY MORNING

Caribbean Room

#### 8:30 A COMPARISON OF RACIAL IDENTITY ATTITUDES IN AFRICAN AMERICAN STUDENTS: A 10 YEAR PERSPECTIVE

Pamela G. Banks\*, Kumari A. Hardy, Thomaseo Burton, Ericka Johnson, and Christopher Curtis, Jackson State University, Jackson, MS 39217

The present study was designed to assess racial identity attitudes in two college student samples. Data was collected from students enrolled at an HBCU in 1991 (N=44) and 2001 (N=97). Participants completed the Racial Identity Attitude Scale (RIAS), developed by Helms and Parham (1981). The RIAS measures four stages of racial identity: (a) Pre-Encounter stage: Individuals have a *raceless* persona and devalue or deny their blackness; (b) Encounter stage: After a series of awakening events that challenge one's anti-Black and pro-White attitudes, individuals develop an appreciation for their blackness and becomes more anti-White; (c) Immersion/Emersion: Individuals become deeply involved in discovering their black cultural heritage and are hostile toward Whites; and (d) Internalization: The person internalizes a positive Black identity and has an acceptance of a bi-cultural identity structure. It was predicted that there would be no differences in the racial identity attitudes over the ten-year period. T-test analyses were used to compare the group means. The 2001 group showed higher agreement for statements reflecting the Pre-Encounter and Internalization stages than the 1991 participants ( $p < .001$ ). Higher agreement for Encounter stage statements was found among the 1991 group compared to the 2001 group ( $p < .01$ ). No differences were found on the scores reflecting the Immersion/Emersion stage. While the data may show contradictions in the statements endorsed on the Pre-Encounter and Internalization scales, it is conceivable that attitudes of *raceless* persona and adoption of bi-cultural ideas can co-exist. These data suggest the following: fewer challenging events to trigger blackness for the 2001 group may have occurred; no changes in militancy, anti-White

attitudes over the past 10 years, and significantly higher endorsement of positive feelings about blackness and bi-cultural ideas for the 2001 group. This research was supported by NIMH-COR Grant MH -16926.

8:50 RACE AND RECEPTIVITY: A STUDY OF WHITE MALES

Jerome Burt\*, David Magee\*, and Billy A. Barrios, University of Mississippi, University, MS 38677

Social and behavioral scientists have argued that to address the deleterious effects of modern racism we must first be able to adequately measure the phenomenon. To this end, researchers have developed several innovative procedures for the assessment of modern racism. One such promising method is the receptivity assessment paradigm. Building upon supportive initial findings obtained from adult white females, the present study tested the generality of the receptivity construct to young, adult white males. Sixty-four young, adult white males participated in a waiting-room situation with either a black male confederate or a white male confederate. Subjects were videotaped by means of a hidden camera and monitored by two independent raters for the display of five receptive behaviors (i.e., active distance, body posture, eye contact, positive affect, and verbal engagement) during the 4-minute interaction period. Extremely high estimates of interrater reliability were obtained for all the measures. In terms of the cohesiveness of the receptivity construct, all of the measures correlated in the hypothesized direction with one another and nearly all of the behaviors converged strongly with one another. As to the most critical test of the validity of the construct, the white subjects displayed more eye contact, more positive affect, more openness, more verbal engagement, and less active distance while in the presence of the white confederate than while in the presence of the black confederate. Overall, the results show the receptivity paradigm to be equally useful in the study of modern racism among white male and female college students.

9:10 RACE AND RECEPTIVITY: A GENERALIZABILITY STUDY

Martha Bynum\*, J. Olivia Bass, Susan Lockhart, and Billy A. Barrios, University of Mississippi, University, MS 38677

Among the many new methodologies developed to assess the modern form of racism is the scripted dyadic interaction paradigm. The present study examined the generalizability of the paradigm across the key dimensions of raters, stimuli, and responses. Twelve white female college students participated in three waiting room situations in which they were paired with three different black female confederates. During the 4-minute waiting

period, the confederate served as stimulus for the subject, providing the subject with opportunities to demonstrate various "receptive" behaviors of interest. From covert recordings of each assessment session, measurement of the five receptivity response elements and the four confederate performance elements were collected by two independent scorers. Estimates of the interrater reliability for the measures were all extremely high. In terms of the procedural reliability of the assessment paradigm, all confederates were near perfect in their adherence to their scripted performance and in their correspondence to one another. And in terms of the stimulus generality of the paradigm, good consistency in subjects performances across wht three confederates was found for all five receptivity measures. Finally in terms of the response generality of the paradigm, good convergence among the five response measures was obtained when collapsed across assessment occasions and confederates. In sum, the findings attest to the structural soundness and conceptual promise of the paradigm for the study of modern racism.

9:30 PREJUDICE AND FACIAL EMOTION: AN INITIAL INVESTIGATION

Ann Lange, Michelle Augustin, and Billy A. Barrios\*, University of Mississippi, University, MS 38677

At the center of most theories of racism in the United States today is the notion of Whites harboring negative affect towards African Americans. Studies employing facial electromyography methods have borne this out and have suggested that these expressions fo facial emotions may be detected by the naked eye. The present study tested this supposition. On the basis of their scores on a subtle self-report measure, fifty-seven white female undergraduates were classified as either high or low in modern racism and then assigned to one of two conditions: the presentation of an image of a fellow Caucasian participant or the presentation of an image of a fellow African American participant. Covert recordings of subjects' facial expressions to the images were collected and coded along Likert scales for the intensity of six basic emotions (i.e., anger, disgust, fear, happiness, sadness, and surprise). As hypothesized, both lowand high-prejudice participants displayed greater anger, disgust and surprise to the Black image than to the White image, with this differential emotional response being more pronounced for the high-prejudice subjects than the low-prejudice subjects. The findings provide additional support for the notion of White negative affect towards Blacks and initial support for the notion that this negative affect is noticeable to observers.

9:50 PRACTICES AND PERCEPTIONS OF RACIAL



### SOCIALIZATION AMONG AFRICAN-AMERICAN FAMILIES

Kumari A. Hardy\* and Diane Hughes, Jackson State University, Jackson, MS 39217, and New York University, New York, NY 10003

The practices and perceptions of racial socialization (RS) messages were surveyed among African-American parents (97) and children (301). This data is based on the Spring 1998 wave of a larger longitudinal study entitled The Early Adolescent Development Study (EADS). Spencer (1983) reported that parents and families are critical in constructing their child's knowledge and awareness of racial issues. Hughes and Chen (1999) divided RS messages from parent to child into four dimensions: (1) Cultural Socialization, (2) Preparation for Bias, (3) Mistrust and (4) Pluralism. They also reported that children could miss, misinterpret or ignore racial messages from their parents. Therefore, the researchers sought to answer the following questions: (1) Are parents' intended RS messages consistent with children's received RS messages? and (2) Are parents' intended messages or children's received messages associated with children's perceived unfair treatment? Overall, parents intended RS messages were inconsistent with children's received RS messages. Children's received messages of bias were correlated with parents intended messages of bias ( $r = .24$ ,  $p < .05$ ) as well as with parent's intended messages of cultural socialization ( $r = .23$ ,  $p < .05$ ). The analysis of children's perception of unfair treatment revealed that children's perception of unfair treatment was associated with their received RS messages rather than parents' intended RS messages. However, two of the dimensions, pluralism and cultural socialization were correlated with the child's perception of prejudice ( $r = -.18$ ,  $p < .01$ ;  $r = -.13$ ,  $p < .05$ , respectively). It was concluded that what parents intend to convey to their children about racial socialization is not always the message the child receives.

10:10 Break

### 10:20 A COMPARISON OF THE LENGTH OF TIME IN ROMANTIC RELATIONSHIPS AND RELATIONSHIP SATISFACTION

Janet M. Brantley\* and Pamela G. Banks, Jackson State University, Jackson, MS 39217

Previous studies have examined the association between relationship satisfaction and stability in relationships (Simpson, 1987, Gottman & Levenson, 1992, Arriaga, 2001). Several factors can contribute to breakups in relationships such as low levels of satisfaction, low levels of closeness, negative communication styles, high rates of negative interactions, and infidelity. This study was

designed to examine the levels of relationship satisfaction among individuals involved in romantic relationships for various lengths of time. The subjects were 203 African American undergraduate college students recruited from a mid-sized southern university. The subjects completed a Personal Data Questionnaire (PDQ) that assessed the length of time the subjects had been involved in their romantic relationships as well as their level of satisfaction with their relationships. Subjects were divided into three groups: (Group 1) those involved in romantic relationships 6 months or less; (Group 2) 6 to 12 months and (Group 3) 12 months or more. It was hypothesized that individuals involved in romantic relationships 12 months or longer would exhibit greater satisfaction with their relationships than those involved in relationships less than 6 months. The mean difference between Group 2 and Group 3 was not statistically significant. There was a statistically significant difference between satisfaction levels between individuals involved in a relationship 12 months or more and individuals involved in a relationship 6 months or less (One-Way ANOVA  $F(2, 200) = 3.34$ ,  $p < .05$ ). These findings revealed that individuals who remain in relationships longer than 12 months show greater satisfaction in their relationships compared to individuals whose relationships tend to be short-term. Couples who can find ways to increase satisfaction in their relationships may be able to stay together longer. The overall findings of this study have implications for counseling both married and dating couples.

### 10:35 A COMPARISON OF THE PERFORMANCE OF AFRICAN AMERICAN PRESCHOOLERS AND THE STANDARDIZATION POPULATION ON THE FLUHARTY-2 PRESCHOOL SPEECH AND LANGUAGE SCREENING TEST

Mary Langford Hall, Jackson State University, Jackson, MS 39217

The Fluharty Preschool Speech and Language Screening Test (FPSLST) was first published in 1978 and has been used widely to screen the developmental and speech and language skills of young children (Fluharty, 2001). The Fluharty Preschool Speech and Language Screening Test was revised in 2001. According to the test manual, the Fluharty-2 was normed on a sample of 705 children in 21 states. The states in which the test was normed represented each of the four major U.S. geographic regions. This present study was a pilot study conducted in Jackson, Mississippi at the Jackson State University Early Childhood Center. Jackson State University is a Historically Black University with a student population of approximately 8,000 students. The Jackson State University Early Childhood Center serves children of faculty, staff,

and students. Children from the center, ages 3 years to 6 years, were screened for hearing ability and then were administered the Fluharty-2 Preschool Speech and Language Screening Test. Twelve of the 16 children whose parents gave consent for the screenings were present for the testing. According to the Fluharty-2 manual, the General Language Quotient (GLQ), which is composed of the standard scores of the four sub-tests, should be used to determine the need for further evaluation. Based on the GLQ, 74.8% of the children in the standardization sample obtained a standard score of average or higher on the measure; whereas, 83.2% of the children in the pilot study obtained a standard score of average or higher. These findings suggest that the Fluharty-2 is a valid speech and language screening measure for African American preschoolers.

10:55 MEANING OF WORKING AND ITS RELATIONSHIP BETWEEN INDIVIDUAL VALUE SYSTEM AND RELATIVE IMPORTANCE OF VALUES, PWE AND RELIGIOUS DIMENSIONS OF WORK

Shailla Khan, Tougaloo College, Tougaloo, MS 39174

This study examined the moderating effects of individual's values on the meaning of working. The strength of PWE, religious dimensions of work and relative importance of values were also investigated. In a pilot study a questionnaire including 164 statements was administered to a group of 175 students. Following three criteria sixty statements representing twenty values were chosen for the study. The sample consisted of 101 strongly religious respondents (SRR) and 57 not strongly religious respondents. Rokeach Value Survey and 60 work related statements were administered through mailed questionnaire. A 2x2 contingency table of values against statement of meaning of work revealed significant results for six terminal and four instrumental values, 'A world of peace,' 'equality,' 'salvation,' (for SRR only), 'self respect,' 'ambitious' (for SRR only) and 'helpful' were positively related and 'pleasure,' 'salvation,' (except SRR), 'social recognition,' 'ambitious' (except SRR) 'imaginative,' and 'obedient' were negatively related to the meaning of working. The study provides strong evidence for the existence of religious dimensions of work and changes PWE beliefs. The religious and the older age groups showed strong adherence to PWE and religious dimensions of work. There were significant differences between terminal and instrumental values according to religiosity, gender, age, and education. The religious group devalued competence and valued morality. It was concluded that religious values are important in forming one's value system and for attitudes toward work. Future study in

industrial and other sectors is recommended to explore the religious value of the employee and determine motivation and reward system accordingly.

11:15 IMIDAZOLINE RECEPTORS: IMPROVED ANTISERUM-BASED BLOOD TEST FOR DEPRESSION?

Johnathan Hays<sup>1\*</sup>, John Piletz<sup>2</sup>, and He Zhu<sup>2</sup>, <sup>1</sup>Jackson State University, Jackson, MS 39217, and <sup>2</sup>University of Mississippi Medical Center, Jackson, MS 39216

Human platelets possess several properties in common with serotonergic neurons in the brain (the site of action of most antidepressant drugs). IR (imidazoline receptors) are also found on platelets and neurons; these receptors bind a class of drugs called imidazolines, which have utility for treating agitated states like mania. In previous studies, an Imidazoline Receptor binding protein (IRBP) antiserum was used to detect an increase in IR on platelets in depression. But, IRBP antiserum is expensive and difficult to obtain. Recently, using IRBP antiserum, a cDNA was cloned that encodes an imidazoline receptor named IRAS. The present study sought to characterize an alternative antiserum derived from sequencing IRAS. A peptide specific to IRAS was synthesized and used to make antiserum in a rabbit. Patients were then recruited through hospital referrals and treated as outpatients. Depression was assessed according to Research Diagnostic Criteria for Primary Major Depressive Disorder and severity was evaluated using the Hamilton Scale for Depression. Platelet plasma membranes were prepared from blood drawn from patients before and 6-8 weeks after antidepressant treatment (bupropion). Samples were electrophoresed and transferred onto nitrocellulose and detected by western blotting. Immunoreactivity was detected using IRAS-derived antiserum compared to IRBP antiserum. After eight weeks of treatment, a down-regulation of immunoreactivity was observed compared to pre-treated patients and healthy control subjects. Furthermore, preliminary studies revealed that the immunoreactive bands detected by IRAS-derived antiserum and IRBP antiserum were correlated in amount. (supported by NIMH-COR Grant MH-16926 and NIMH-RO1 Grant MH-49348).

11:35 TISSUE DEPTH ASSESSMENT IN MISSISSIPPI ADOLESCENTS

Amy L. Ford, University of Southern Mississippi, Hattiesburg, MS 39406

This study was undertaken to evaluate the results of tissue depth assessments obtained from radiographs of Mississippi adolescents. Adolescents in recent years have been shown to be maturing faster, as well as having an increased overall body weight. Thus, it was hypothesized

that the results would show significant differences from currently used thickness standards, which were generally collected in the 1980s. The sample for this study consisted of 98 subadults aged 10 to 18, and the data were obtained from orthodontic radiographs utilizing fourteen midline metric points to obtain tissue depths. Thicknesses were recorded using sliding calipers to 0.01 mm. Results of this investigation were compared with those of previous studies that utilized a variety of research methods, including radiographs, diagnostic ultrasounds, and calibrated needles. Although some measurements were closer in range than others, there was enough deviation to suggest that new standards be considered for several of the measuring points, especially those where the face is fattest. These revised tissue depths have special importance for accurate facial reconstruction in forensic anthropology.

11:55 Divisional Business Meeting

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#### THURSDAY AFTERNOON

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Caribbean Room

1:30 THE RELATIONSHIP BETWEEN LATERAL HAND BIAS AND RESPONSE TO MUSIC IN THE SMALL-EARED BUSHBABY (*OTOLEMUR GARNETTII*)

Sheree Watson\*, Willie Bingham, Adrienne Clark, and Pamela G. Banks, Jackson State University, Jackson, MS 39217

In humans, the left hemisphere of the brain is usually associated with fine motor and verbal abilities whereas the right hemisphere is associated with spatial skills. Among the spatial abilities regulated by the right hemisphere is the ability to process music stimuli. The left-hemisphere specialization for fine motor behaviors, in human beings, is manifested as lateral hand bias (LHB), or handedness, which is a frequently used surrogate measure for cerebral dominance. Prosimian primates, such as bushbabies, also exhibit LHB. Research has provided evidence for a relationship between LHB and stress reactivity in non-human primates. All primate colonies are required by the USDA to provide environmental enrichment for the residents to reduce the stress of captivity. Music enrichment is one form of enrichment that has been advocated. In a previous study, we exposed 13 bushbabies to music enrichment and measured their behavioral and physiological stress responses. The present study examined whether behavioral and physiological (cortisol) response to music in the previous study differed for animals exhibiting a left versus right LHB. Using a reaching task, handedness was assessed in 8 bushbabies

that had previously participated in a music enrichment study. Handedness data were compared to the cortisol and behavioral responses to music enrichment. After music enrichment, animals with a left LHB displayed increased rates of grooming ( $p = 0.09$ ). Strength of LHB was negatively related to amount of grooming after exposure to music enrichment ( $p = 0.01$ ). LHB was not related to cortisol levels before or after music enrichment. These results suggest that music enrichment may have beneficial effects on the behaviors of captive primates. This study was supported by NIMH-COR grant 16926.

1:50 INTERSPECIES PROXIMITY PATTERNS OF FOUR LEMUR SPECIES IN CAPTIVITY

Stacey M. Curry, The University of Southern Mississippi, Hattiesburg, MS 39406

This research was completed to study patterns of interspecies proximities in four lemur species, *Eulemur macaco macaco*, *Varecia variegata variegata*, *Varecia variegata rubra*, and *Lemur catta*, in a captive setting. In the wild in Madagascar, these lemurs are social primates, forming large intraspecies troops that usually have very little close interspecies affiliations, except in a few cases. At the Hattiesburg Zoo at Kamper Park, eight lemurs, two males in each species, were observed within the same living area for one hour a day for a total of twenty days. Every three minutes a scan was taken to survey which of the individuals were in proximity. The level of proximity was defined as two or more individuals positioned two feet apart or closer to one another and tactile interactions such as huddling and grooming. After 400 scans, results showed that individuals of these four species were in proximity with certain individuals of one or more of the other species more often than with the individuals of their own species. Interspecies, as well as intraspecies, huddling and grooming often took place between some of the individuals. In captivity, these species seem to form interspecies affiliations that show some variation by time of day. There are several possible explanations, including access to food, change in natural lighting, and temperature change. Further studies should be performed on larger samples of captive lemurs.

2:10 ACTIVITY LEVEL AND IMMUNE SYSTEM CHARACTERISTICS IN THE SMALL-EARED BUSHBABY

Kendria Holt\*, Willie Bingham, Pamela G. Banks, and Sheree Watson\*, Jackson State University, Jackson, MS 39217

An exercise program is an important part of a healthy lifestyle. Health benefits associated with exercise include improved immune system functioning. However,

the relationship between exercise and immune function is complex. Moderate exercise may enhance immune function whereas heavy exercise and sedentary lifestyles affect immune functioning adversely. Animals models of the exercise-immune system relationship have been difficult to develop because they usually involve forced exercise, which is stressful and immunosuppressive. This study evaluated the relationship between naturally occurring activity levels (as a surrogate for moderate exercise) and immune system characteristics in a nonhuman primate model, the small-eared bushbaby. Eleven small-eared bushbabies (aged 1 to 15 years) were videotaped in their home cages. Cages were visually divided into 4 sectors. The number of sector crossings, which was used to measure activity levels, was determined from the videotaped record. Median split was used to categorize animals as having low or high activity levels. Immune characteristics determined by Complete Blood Count (CBC) was compared in high and low activity animals using age as a covariate. Older bushbabies had lower levels of neutrophils ( $p = 0.05$ ) but higher levels of lymphocytes ( $p = 0.02$ ) than younger bushbabies. Bushbabies with high activity levels had significantly higher levels of circulating lymphocytes ( $p = 0.006$ ) than those with low activity levels. There were no differences in levels of circulating neutrophils or eosinophils between high and low activity animals. These results suggest that moderate exercise has a beneficial effect on immune system parameters. This research was supported by NIMH-COR Grant 16926.

2:30 THE RELATIONSHIP BETWEEN BODY WEIGHT AND GLUCOSE LEVEL IN THE SMALL-EARED BUSHBABY (*OTOLEMUR GARNETTII*)

Shawana Crawford\*, Willie Bingham, Pamela G. Banks, and Sheree Watson, Jackson State University, Jackson, MS 39217

The incidence of Non-Insulin Dependent Diabetes Mellitus, or Type II diabetes, is increasing in the United States and the age of onset is decreasing. Approximately 80% of individuals with Type II diabetes are obese. A predominant metabolic abnormality associated with Type II diabetes is excessive hepatic glucose production. Hyperactivity of the hypothalamus-pituitary-adrenal axis, resulting in increased cortisol levels, is also associated with diabetes. Research on diabetes has been hindered by the lack of a good animal model for Type II diabetes. To examine the suitability of a non-human primate model for Type II diabetes, we examined the relationship between glucose levels, cortisol levels, and body weight in a prosimian primate, the small-eared bushbaby. Body weight measurements and baseline cortisol levels were obtained for

8 male and 8 female bushbabies. Serum glucose levels were measured after a 15 hour fast. Male bushbabies were significantly heavier than female bushbabies ( $p = .008$ ). Age was significantly correlated with weight only among female bushbabies ( $p = .05$ ). Cortisol was also positively related to body weight ( $p = .01$ ). There was a tendency for fasting glucose levels to be negatively correlated with body weight among male ( $p = .1$ ) but not female bushbabies. Glucose clearance tests and direct measures of adiposity will be used in subsequent phases of this study to further evaluate the potential viability of the bushbaby as a model for diabetes. This research was supported by NIMH-COR Grant MH-16926.

2:50 THE OPIATE PRECURSOR TETRAHYRDO-PAPAVEROLINE AS A POSSIBLE CAUSAL AGENT OF ALCOHOL CRAVING IN MALE SPRAGUE-DAWLEY RATS

Chris Strawbridge\*, John G. McCoy, and Kenneth D. McMurtrey, University of Southern Mississippi, Hattiesburg, MS 39401

Previous animal models suggest that the presence of tetrahydropapaveroline (THP) in the mesolimbic dopamine (DA) reward circuit, located in the basal forebrain of mammals, to be a causal agent in the abuse of alcohol by humans. DA is normally metabolized to dopaldehyde by monoamine oxidase (MAO). Aldehyde dehydrogenase then converts dopaldehyde to dopacetic acid (DOPAC). However, acetaldehyde, the major metabolite of ethanol acts as a competitive inhibitor with dopaldehyde for aldehyde dehydrogenase. Excess acetaldehyde, which has a high affinity for aldehyde dehydrogenase, results in the condensation of dopaldehyde with intact DA to form THP, a necessary precursor in the biosynthesis of morphine in *Papaver somniferum*, the opium poppy. In this experiment, adult male Sprague-Dawley rats were screened for alcohol preference using a 12 day protocol which gradually increases the concentration of the alcohol solution that is offered. Once an alcohol preference/avoidance is determined for each rat, a perfusion cannula is installed into the lateral ventricle of each animal. This cannula allows for the intracerebraventricular (icv) perfusion of the racemic mixture of THP, as well as THP's two optical isomers, into the lateral ventricle. When this perfusate reaches the mesolimbic DA pathway, we hope to elicit a marked and permanent change in each animal's alcohol preference, however, recent results have proven contradictory to earlier experiments of this type.

3:10 Break

3:20 Divisional Poster Session

### THE EFFECT OF SELF-GENERATION MNEMONIC STRATEGY ON GIFTED SECOND GRADERS' MEMORY RECALL

Regina F. Spiers\* and Lin-Miao Lin, University of Southern Mississippi-Gulf Coast, Long Beach, MS 39560

The purpose of the present study was to investigate the effect of self-generated word association strategy on memory performance of gifted students by comparing the effectiveness of self-generation strategy with that of other-generation strategy. Participants were 20 gifted second-graders. Twelve unrelated word pairs designed by Grier and Ratner (1996) were presented in pictures as to-be-remembered items. Participants were randomly assigned to a Self-Generation (Elaboration) group or a Other-Generation (Rehearsal) group. For Self-Generation group, students were first shown pictures of word pairs ("newspaper/stone"), told how the words went together ("The newspaper showed a picture of a stone."), and then asked to generate a response to a why question concerning the relation between the two items ("Why did the newspaper show a picture of a stone? Because it fell on someone's car."). For Other-Generation group, students were presented with the why-responses generated by their peers from the Self-Generation group. An independent t-test failed to show the effect of self-generation on recall of words,  $t = .372$ ,  $p > .05$ , indicating that students in both groups performed equally well. Earlier researchers found that at-risk students who generated their own associations for unrelated word pairs performed better on recall than did their peers who only repeated the associations created by others. However, results of the present study failed to support the self-generation effect. Perhaps being expert learners, gifted students can perform well using either elaboration or rehearsal strategies. Other possible explanations (sample size and task difficulty level) for the lack of group differences on recall will be further discussed.

### DETECTING CHILD ABUSE IN THE EMERGENCY DEPARTMENT (EDs)

Seth Kunen\* and Ronda Neiderhauser, University of Mississippi Medical Center, Jackson, MS 39216

Child abuse is a major public health concern. In 1999, there were approximately 3,000,000 reports of abuse made to child protective services, of which 826,000 cases were confirmed incidents of child abuse (11.8 per 10000 children). Of those abused, 58% suffered neglect, 21% physical abuse, and 11% were sexually abused. In our review of the literature, we found few studies documenting incidences rates of child abuse diagnoses in EDs. Because Federal Law requires health care professionals to report suspected cases of child abuse and neglect, we would expect EDs to record fairly high rates. We surveyed three hospital

EDs to determine whether these health care providers are detecting a significant portion of the know child abuse cases. We examined all ICD-9 diagnoses of abuse given to children 17 and younger over a six-month interval. Using a conservative estimate of 11.8 per 1000, we should have observed at least 230 cases of abuse. These results suggest that more than 80% of child abuse cases in these EDs were missed. Historically, EDs have viewed their mission as primarily brief emergency care. However, the current use patterns of EDs demand that this focus be changed. For example, in 1999, 102 million people utilized EDs in the U.S., which included more than 12 million children. (CDC, 2001). It is clear that EDs need to start conceptualizing themselves not only as emergency care providers, but as public health screening agencies.

### THE INVISIBLE BOUNDARY: AN INVESTIGATION OF PERSONAL SPACE USAGE AMONG AFRICAN AMERICAN MEN & WOMEN

Rani Wesley\* and Amy Chasteen, University of Southern Mississippi, Hattiesburg, MS 39401

The purpose of this study was to contribute to the existing literature on sex differences in proxemic behavior. In addition to examining interpersonal distance, the researcher also studied receptiveness of touch by males and females. To examine proxemic behavior within the context of gender, the researcher focused on a particular contact situation: people greeting one another and conversing in public places. In order to isolate the effect of gender on such situations, the study was confined to a relatively homogeneous group: African Americans in a mid-sized town. Observational methods common to the field of proxemics were utilized to examine gender differences in body language and spatial distancing. Observations occurred in three local businesses catering to African American clientele: a hair salon, a barber shop, and a nightclub. The women observed in this study generally maintained less interpersonal distance than men when interacting with each other. Women also seemed to react positively more often than men when touched during interaction. Female spatial behavior differed somewhat in different contexts. Male spatial behavior remained the same regardless of setting. Females being more receptive to touch and touching more often than men during interaction may be a result of gender socialization. Homophobia and sanctions that discourage men from having too much physical contact may have encouraged a tendency to maintain large interpersonal distances and remain unaffected when touched.



**SCIENCE EDUCATION**

Chair: Howard Walkers, University of Southern Mississippi

Vicechair: Willie R. Heard, University of Southern Mississippi

**THURSDAY MORNING**

Atlantic Room

8:30 Special Joint Session with the Science Education Division Held in the Emerald Room

Introduction; Howard D. Walters and Roy J. Duhé, J.L. Scott Marine Education Center and Aquarium, Biloxi, MS 39530, and University of Mississippi Medical Center, Jackson, MS 39216

8:45 **STRUCTURE VISUALIZATION IN BIOCHEMISTRY EDUCATION: SEEING IS BELIEVING**

Robert Bateman, University of Southern Mississippi, Hattiesburg, MS 39406

With the advent of powerful desktop and laptop personal computers has come a wealth of computational tools that can aid in the understanding of chemical and biochemical concepts. This talk will survey several of the free structure visualization software packages that are currently used in biochemistry instruction. The emphasis will be on the most effective uses of these tools both inside and outside the lecture classroom.

9:30 **RESEARCH PROBLEMS CONDUCTED BY SECONDARY STUDENTS**

Betsy A. Sullivan, Mississippi Museum of Natural Science, Jackson, MS 39202

The Mississippi Junior Academy of Science (MJAS) is sponsored by the Mississippi Academy of Science. Each year, the MJAS conducts a research paper competition at which secondary students submit reports on their research agendas. Students submitting research must compile their work into a specific written guideline. The competition has three phases: (1) Written Paper, (2) Oral Presentation, and (3) Overall Competition. The overall winner, second place winner and honorable mention of the Overall Competition go on to represent Mississippi at the American Junior Academy of Science (AJAS). The 2002 winning papers will be presented during this session.

9:45 **QUANTITATIVE TANK AND FISH INVENTORY**

Kenny Shell\*, Sara Pelleteri, and Rick Kastner, Cooperative Internship Program, Mississippi Gulf Coast Community College-Jackson County Campus, Gautier, MS 39553, and J.L. Scott Marine Education Center and Aquarium, The University of Southern Mississippi, Biloxi, MS 39530

The purpose of the Fish and Tank Inventory Project was to quantify the aquatic stock at the J.L. Scott Marine Education Center and Aquarium in Biloxi, Mississippi. Data collected for each tank included (1) the common name of each species, (2) the scientific name and family, (3) the total count in each tank, and (4) the tank capacity, salinity and estimated biomass. Aquarists, educators, and administrators will use this information to best allocate and plan new marine education programs.

10:00 **SOUTHEAST REGIONAL AQUATIC NUISANCE SPECIES EDUCATION AND OUTREACH NETWORK**

Howard D. Walters, J.L. Scott Marine Education Center and Aquarium, Biloxi, MS 39530

In 2000, the author and colleagues at Dauphin Island Sea Lab in Alabama, and the University of Florida were funded through EPA, the National Sea Grant College and Mississippi-Alabama Sea Grant to implement a series of workshops for middle and high school classroom teachers incorporating population ecology concepts and principals with the latest research for Aquatic Nuisance Species and invasive organisms. This effort has been expanded to include the southeast region of the US. Current funding includes 17 additional formal workshops for elementary, middle, and high school teachers and informal education leadership. Additionally, funding will support 57 informal, school-based workshops and three research and curriculum publications over the next two years. This presentation will address results of the first year's effort, methods and materials from the workshops, and address issues related to needs assessment for similar education and outreach efforts on ANS topics in this country.

10:15 Break

10:30 **AN INFORMATIVE VIDEO GUIDE ON THE PLANT AND ANIMAL CELL ALONG WITH AN INSTRUCTIONAL PORTION ABOUT THE MICROSCOPE**

Jonathan J. Balentine\*, L. Hollis Melton, and Doug Mansfield, Cooperative Internship Program, Mississippi Gulf Coast Community College-Jackson County Campus, Gautier, MS 39553, and J.L. Scott Marine Education

Center and Aquarium, The University of Southern Mississippi, Biloxi, MS 39530

An updated form of an instructional video on the proper usage of the microscope was needed for students absent during the class in which the instruction was given. Also needed was an updated version of an informative segment guiding the students through the plan and animal cell lab for Honors Biology. A script was created along with a storyboard for the video. The video was filmed and edited at the Mississippi Gulf Coast Community College-Jackson County Campus.

#### 10:45 PROJECT MARINE DISCOVERY: MISSION MANATEE

Jennifer Hale, J.L. Scott Marine Education Center and Aquarium, Biloxi, MS 39530

The Scott Aquarium has recently begun offering exciting and educational field trips to Crystal River, FL. During these excursions, students are introduced to the importance and aesthetics of freshwater spring ecosystems. Because the springs flow at a constant temperature, the Florida manatee finds refuge in these springs during the cold winter months. The Florida manatee is among many marine mammals that are endangered. Students are afforded the opportunity to experience first-hand these graceful and massive animals that may very well become extinct during their lifetime. In addition to this once in a lifetime encounter with manatees, students also have the opportunity to see wildlife up close and personal. The freshwater spring systems are abundant with numerous species of flora, fish and fowl not found in our immediate areas. Please join us for information on how your school can become involved in PMD: Mission Manatee. It is an experience you will never forget.

#### 11:00 COMPUTER FACILITATED EXPERIMENTAL DESIGN IN THE HIGH SCHOOL SCIENCE LABORATORY: A COOPERATIVE PROJECT BETWEEN MISSISSIPPI GULF COAST COMMUNITY COLLEGE AND STONE COUNTY SCHOOL DISTRICT

Clayton Cowart\* and Sarah Tringle, Mississippi Gulf Coast Community College, Perkinston, MS 39573, and The Mississippi Space Grant Consortium, University, MS 38677

The high school science laboratory is an ideal place to introduce the use of the computer in performing real time computer facilitated experiments. The ubiquitous presence of computers makes students in this age group more computer literate than older age groups. To capitalize on this computer literacy, the project partners a student from the Mississippi Gulf Coast Community College with

the Stone County High School science program. The goal of the project is to implement an experimental series utilizing the application of computer interfaces and sensors in the high school science classroom. Methodology includes set-up of classrooms for the use of hardware, a series of on-site instruction and familiarization modules for the high school science teachers with software application, and the resourcing of hands-on experimental activities for the high school teachers and their students using Vernier LoggerPro software and LabPro interfaces and sensors.

#### 11:15 INTRODUCTION OF GROUP LEARNING ACTIVITIES IN A CLINICAL MICROBIOLOGY COURSE

Mary F. Lux, University of Southern Mississippi, Hattiesburg, MS 39406

Introduction of group activities into a structured, traditional lecture course may represent a shift in style for both the instructor and student. Clinical microbiology, a senior-level professional course in the baccalaureate medical technology program at the University of Southern Mississippi, has been taught with a traditional lecture format. The course presentation format was altered to include various group learning activities such as short in-class group discussions and writing assignments. Group evaluation activities included quizzes as well as group efforts on a portion of three major tests. As one might predict, the performance on group quizzes produced higher grades than the standard individual quiz format of previous years. Likewise, performance on the group portion of the tests was higher when compared with individual efforts from previous years. The group interaction allowed students to discuss and reinforce among their groups, and their response to the group activities was enthusiastic. The average final grades in the classes with group activities did not vary greatly from previous classes in which students worked as individuals although student satisfaction was greater in the classes with group activities.

11:30 Divisional Business Meeting

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### THURSDAY AFTERNOON

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Atlantic Room

#### 1:30 PROJECT MARINE DISCOVERY: ON THE ROAD

Rebecca Espey, J.L. Scott Marine Education Center and Aquarium, Biloxi, MS 39530

The University of Southern Mississippi College of Marine Sciences invites schools in Mississippi, Louisiana, and Alabama to bring the ocean estuaries to their students

for hands-on experiences with marine life and wildlife. Instructors bring coastal animals and activities to schools to give K-12 students “up-close and personal” experience with the marine environment. During interactive sessions, students will learn about endangered and threatened sea turtles, human impacts on the environment, coastal reptiles, and the essential role wildlife has in our coastal habitats. Students and teachers take home an increased awareness and understanding of marine and aquatic environments, a more positive attitude about these fragile areas, and a renewed sense science is fun! Information will be provided on how your school can be involved with Project Marine Discovery: On the Road.

1:45 A MODEL FOR BEGINNING EDUCATION OF THE NATURAL SCIENCES AT THE PRE-KINDERGARTEN LEVEL

Joan Elder\* and Martha Cooper, Mississippi Museum of Natural Science, Jackson, MS 39202

In focusing on the education of three through pre-kindergarten five-year-olds, the Mississippi Museum of Natural Science Preschool Discovery Room was designed to introduce nature in a non-threatening manner. Children are able to interact with an educator in a variety of hands-on activities which are designed to eliminate any fear of the unknown world. Multiple activities have been developed for interaction with children and have been highly successful in achieving specific goals which were developed from the preschool curriculum. The preschool curriculum was developed from the following guidelines: 1. National Association for the Education of Young Children (NAEYC), 2. Mississippi Department of Education, and 3. Mississippi Museum of Natural Science.

2:00 DEVELOPMENT OF AN ONLINE UNDERGRADUATE COURSE ABOUT EVOLUTION

Beth Dunigan\*, Karen Ng, Sheila Hendry, and Kenneth J. Curry, University of Southern Mississippi, Hattiesburg, MS 39406

An online undergraduate course about evolution was developed over an academic year by a team consisting of a professor and three students pursuing graduate degrees in Science Education. The process first entailed becoming familiar with the software, WebCT. Decisions about the intent of the course had to be made, such as goals, objectives, and target group. Then came the process of actually uploading materials to the online site for use by the students. Oral mini-lectures of the various topics of evolution were put onto a CD which was intended to be a supplement to the textbook and to substitute in part for in-class lectures. A 5-question multiple choice quiz and an

asynchronous discussion on an online bulletin board were created for each chapter of the text. Included in the design were three examinations based on the discussion topics in the bulletin board. The course was taught in the summer semester of 2001.

2:15 EXECUTION OF AN ONLINE UNDERGRADUATE COURSE ABOUT EVOLUTION

Sheila Hendry\*, Karen Ng, Beth Dunigan, and Kenneth J. Curry, University of Southern Mississippi, Hattiesburg, MS 39406

During the summer semester of 2001, an online undergraduate course about evolution was conducted by a team consisting of a professor and three students pursuing graduate degrees in Science Education. The initial enrollment consisted of 42 undergraduate students from Mississippi and other states, including Texas and Iowa. Some students took advantage of a CD on which various aspects of the topic of evolution were discussed as oral mini-lectures. A 5-question multiple choice quiz on each chapter ensured that the chapters were read, resulting in fairly meaningful asynchronous discussions of various topics on the online bulletin board. Three examinations were given with questions based on the topics used in the asynchronous discussions. We discovered that some students paid little attention to good grammar and to proofreading their responses. The principal advantages of the course included convenience of scheduling and convenience of grading, since the software, WebCT, automatically graded the quizzes and posted the grades. Another noticeable advantage was that the writing and grammar skills of the students improved. Some of the disadvantages included a tremendous grading load, hardware and software technical problems, difficulties of timely feedback to correct misconceptions, and the uncertainty of sending responses to faceless people.

2:30 Divisional Poster Session

GULF COAST RESEARCH LABORATORY AND MISSISSIPPI ACADEMY OF SCIENCE: FIFTY-FIVE YEARS OF SCIENCE ON THE GULF COAST

Stacy Miller\* and Joyce Shaw, Cooperative Internship Program, Mississippi Gulf Coast Community College-Jackson County Campus, Gautier, MS 39553, and J.L. Scott Marine Education Center and Aquarium, The University of Southern Mississippi, Biloxi, MS 39530

The relationship of the Gulf Coast Research Laboratory (GCRL) and the Mississippi Academy of Sciences (MAS) spans over half a century. Originally, early members of MAS who worked tirelessly for its



establishment conceived GCRL. From its beginning, the scientists at GCRL have contributed to MAS at many levels. Four GCRL scientists have been elected president of MAS and others have held leadership roles on the division level. This project examines the relationship between GCRL and MAS by tracking the work presented by a scientist at the MAS Annual Meeting and published in the Journal of the Mississippi Academy of Sciences (JMAS). The abstracts written by GCRL scientists who were published in JMAS were entered into a bibliographic database. A list of GCRL scientists who have held significant positions with MAS was compiled. Other archival materials owned by Gunter Library were examined for references to GCRL and MAS interactions. Results of the project will be presented in a poster format at the 2002 MAS Annual Meeting in Biloxi, MS.

#### SULFA DRUGS AND THEIR EFFECTS ON THE HUMAN POPULATION

Merri Doretha Ellison and Anil K. Sharma\*, Mississippi Valley State University, Itta Bena, MS 38941

Sulfa drugs are a common name applied to a group of chemotherapeutic agents that are effective against a number of infectious diseases. In 1935, the German chemist, Gerhard Domagk, discovered that an azo dye, Prontosil, cured streptococcal infections in mice. The active principle in Prontosil was found to be para-aminobenzene-sulfonamide, commonly known as sulfanilamide. Sulfa drugs are used to treat fungal and urinary infections, leprosy, and ulcerative colitis, but resistant strains of microorganisms (streptococci, meningococci, and shigella) have made the drug less effective. Antibiotics have largely replaced sulfa drugs in the treatment of bacterial infections. This research will investigate what sulfa drugs are, the pros and cons of the drug, and the studies that were done on sulfa drugs and its effects on the human population.

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### FRIDAY MORNING

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#### Atlantic Room

#### 9:00 DEVELOPMENT OF A DIGITAL ARCHIVE FOR PRESENTATION OF 35 MM SLIDES

Leslie Flynn\*, Lacey White\*, Rebecca Espey, Jennifer Hale, Jeannie Flint, and Willie R. Heard, Cooperative Internship Program, Mississippi Gulf Coast Community College-Jackson County Campus, Gautier, MS 39553, and J.L. Scott Marine Education Center and Aquarium, The University of Southern Mississippi, Biloxi, MS 39530

This project entailed scanning and converting 35 mm slides into JPEG files on a computer. These slides are for various projects and presentations and the slides vary in

age. Due to advancement in technology, slides are becoming antiquated, but the information need to be preserved. Once scanned, these images were organized by content and then authored on CD-ROM. These authored CDs will eventually be distributed to different departments or other educational facilities as a resource for teaching or formal presentations. These files saved in the highly versatile JPEG format can be used in other projects and programs, such as future use in Microsoft Power Point presentations or in a website.

#### 9:15 DEVELOPING AN EDUCATIONAL VIDEO ON SAFETY IN THE CHEMISTRY LAB

Kari Bloodsworth\*, Steve Manis\*, and Doug Mansfield\*, Cooperative Internship Program, Mississippi Gulf Coast Community College-Jackson County Campus, Gautier, MS 39553, and J.L. Scott Marine Education Center and Aquarium, The University of Southern Mississippi, Biloxi, MS 39530

Safety in the chemistry laboratory is a serious matter, which could prevent accidents and save lives. Many students have an unclear knowledge about safety in the laboratory; therefore, they sometimes struggle with successfully completing experiments within the allotted time frame. The purpose of this project was to produce an educational video on safety in the chemistry laboratory. This video was designed to highlight the most common safety violations in an entertaining and educational manner.

#### 9:30 AQUATIC EROTICA: SEX IN THE SEA

Linda S. Flint, J.L. Scott Marine Education Center and Aquarium, Biloxi, MS 39530

A study of reproduction among aquatic and marine animals provokes natural interest and provides information on various species. A look at some mating instincts help to understand why some species become endangered or extinct because their nesting habitats are preserved.

#### 9:45 HOW TO INCREASE MINORITY PARTICIPATION IN SCIENCE AND ENGINEERING IN SIX WEEKS

Sharon Walker\* and Willie R. Heard, J.L. Scott Marine Education Center and Aquarium, Biloxi, MS 39530

The Secretary of the Navy Engineering and Science Residential Program was initiated in 1977 with an overarching goal of augmenting the number of students who pursue a science and/or engineering field, enhancing their content knowledge, stimulating interest in the Navy as a possible career choice, and providing these pre-college students with three hours of undergraduate, college credit. Come hear how your students can get financial assistance,

scientific mentoring and college credits.

10:00 Break

10:15 TRANSFORMING A TRADITIONAL FUNGAL LABORATORY

Aimee T. Lee\* and Alan Niven\*, University of Southern Mississippi, Hattiesburg, MS 39406

For the last several years we have been transforming our traditional “cook-book” style laboratories in our freshman program to be more interactive, allowing the students’ to engage and explore the topics more thoroughly. A traditional diversity laboratory consists of specimens arranged around the room for students to observe. Students generally perform each lab by following directions without being challenged to think. The transformations made to this freshman-level fungal laboratory are based on BSCS constructivist model: engagement, exploration, explanation, elaboration, and evaluation. We will describe the activities associated with each phase and how technology has been incorporated. We will also describe how the student-designed mini-investigation on spore dispersal, which we have recently implemented, is an application of the exploration phase. The students generate a hypothesis, make predictions, and design an experiment using fungal cultures and Rose-Bengal Chloramphenicol (RBC) agar plates. The following week the students evaluate their experiment, draw conclusions and answer questions associated with the results obtained in their experiment.

10:30 BASE PAIR “SOAR”S WITH HELP FROM THE NATIONAL SCIENCE FOUNDATION (NSF)

Robin W. Rockhold<sup>1</sup>, S. Bender<sup>2\*</sup>, Tiffany Scarff<sup>3</sup>, D. Chambliss<sup>3</sup>, F. Allen<sup>4</sup>, N. Fahmy<sup>4</sup>, and A. Srinivasan<sup>4</sup>, <sup>1</sup>University of Mississippi Medical Center, Jackson, MS 39216; <sup>2</sup>Jim Hill High School, Jackson, MS 39204; <sup>3</sup>Teacher Resource Center, Jackson Public School District (JPSD), Jackson, MS 39206, and <sup>4</sup>Tougaloo College, Tougaloo, MS 39174

Base Pair, a biomedical research mentorship program that pairs high school students and teachers with research faculty from UMC, has been supported from the Howard Hughes Medical Institute since 1994. In 2000, Base Pair entered a collaborative effort with personnel from JPSD and faculty from Tougaloo College, that was funded under the K-12 Higher Education Partnership (KHEP) initiative from the NSF. The primary objective for the KHEP award was to establish the academic framework for creation of high school-based Student Oriented Academic Research (SOAR) laboratories that would support student inquiry-based learning and enhance achievement in science

and mathematics. To this end, 19 JPSD teachers were recruited and engaged in a series of Saturday workshops on the Tougaloo campus, where focus was centered on techniques and tactics for delivering improved mathematics instruction and offering innovative science activities. Subsequently, teachers participated in an intensive four-week Summer Research Institute, in conjunction with the Base Pair summer activities on the UMC campus. Several SOAR sites are being established, the most advanced of which is in place at Jim Hill High School, where an “Outdoor (environmental) Classroom” is the focus for activities. (Sponsored by the Howard Hughes Medical Institute and the NSF.)

10:45 THE CUMULATIVE NATURE OF LEARNING IS ENHANCED THROUGH THE CORRELATION OF HANDS-ON SCIENCE EDUCATION TO COMPETENCIES FROM STATE SCIENCE STRUCTURE

Martha Cooper, Joan Elder\*, Betsy A. Sullivan\*, and Heather Sullivan\*, Mississippi Museum of Natural Science, Jackson, MS 39202

Formal and informal education programs at the Mississippi Museum of Natural Science are designed to build on the cumulative nature of learning, the strengthening of prior knowledge and the interrelationships that occur between the learning environments of school and the Museum. Hands-on programs are correlated to competencies from the State Science Structure and help teachers meet specific classroom objectives and goals. Special programs for children three through college age help build positive attitudes toward science by giving students opportunities for exploration, manipulation, and acquisition of new information.

11:00 DEVELOPING A DOCUMENTARY OF THE COOPERATIVE INTERNSHIP PROGRAM AT MISSISSIPPI GULF COAST COMMUNITY COLLEGE FOR PUBLIC USE

Bridget Thompson\*, L. Hollis Melton, and Doug Mansfield, Cooperative Internship Program, Mississippi Gulf Coast Community College-Jackson County Campus, Gautier, MS 39553, and J.L. Scott Marine Education Center and Aquarium, The University of Southern Mississippi, Biloxi, MS 39530

This project resulted in the creation of a video documenting the Cooperative Internship Project. The film covered the intern’s, and the mentor’s responsibilities, and shows some of the projects completed. The film includes a brief history of the program, interviews with current and past interns, and interviews with some of the mentors and instructors.

11:15 A HISTORICAL ANALYSIS OF THE GRAND BAY NATIONAL ESTUARINE RESEARCH RESERVE

Lisa Benezue\* and Jennifer Buchanan, Mississippi Gulf Coast Community College-Jackson County Campus, Gautier, MS 39553, and Grand Bay National Estuarine Research Reserve/Mississippi, Biloxi, MS 39530

The Grand Bay National Estuarine Research Reserve was the setting for a study which analyzed land use changes within the general vicinity of the reserve during the 20<sup>th</sup> Century using both historical accounts received through one-on-one interviews with senior citizens as well as interpretation of aerial photography. The researchers identified elder members of the community who have lived most of their lives in proximity to the reserve, developed an appropriate standardized survey that was used to interview these older members of the nearby community, interviewed the seniors and documented with audio tape their historical accounts, surveyed areas near the reserve vicinity to document current land uses, and drafted land use maps in Arcview to document land use changes over time.

11:30 STUDY OF GASOLINE BY GAS CHROMATOGRAPHY INSTRUMENT (GC)

Sabrina Caldwell\*, Mudlagiri B. Goli, and William C. Mahone, Mississippi Valley State University, Itta Bena, MS 38941

There is a general feeling that higher-octane number may be good for your automobile. Keeping that in the mind, we have studied the GC profiles of various gasolines of different octane numbers (87, 89, and 93) sold in the region to find the characteristics of that gasoline. One can use those GC patterns as a fingerprint of a gas. One should be able to easily distinguish 87 from that of 89 and 93. Theoretically, one may be able to predict the GC profile of 89 brand provided 87 and 93 gases were mixed to make such a brand. In-depth report on such an analysis will be presented.

**ZOOLOGY AND ENTOMOLOGY**

Chair: Timothy C. Lockley, USDA APHIS PPQ IFA  
Vicechair: Alex D.W. Acholonu, Alcorn State University

**FRIDAY MORNING**

Petit Bois Room

9:00 WALKING ON WATER: THE EVOLUTION OF

NEUSTONIC LOCOMOTION IN SPIDERS

Gail E. Stratton\*, Patricia Miller, and Robert Suter, Mississippi University, University, MS 38677; North West Community College, Senatobia, MS; and Vassar College, Poughkeepsie, NY

The specialized rowing gait of *Dolomedes* (Pisauridae) on the water surface is well-studied and differs from walking in that legs I are held parallel and anterior, legs II and III are moved in parallel, and legs IV are held parallel and posterior. In contrast, while walking, the members of each pair of legs alternate. We mapped two characters, hydrophobicity and ability to row, on cladograms of Araneae and Lycosoidea. We present a comparison of 581 individuals in 192 species with representatives from 34 families of mostly North American spiders. Six of the 34 families of spiders examined have species that adopt a Dolomedes-like gait when on the water surface. The majority of rowers were found in the Lycosoidea, from the families Ctenidae (1 of 3 species studied), Pisauridae (8 of 8 species), Trechaleidae (1 of 1 species), and Lycosidae (27 of 48 species). Other families that have species that can row include Salticidae (1 of 12 species) and Thomisidae (1 of 4 species). A quantitative means of scoring shows that there is very little variability in the rowing of Pisauridae and Trechaleidae. In Lycosidae, variability is much higher both within and between species. Examination of the distribution of the ability to row suggests it evolved in the Lycosoidea. Differences in the variability of rowing suggests there may be selection pressures present for spiders that are more consistently near water.

9:20 METABOLIC RATES OF ADULT AND LARVA STAGES OF *TENEBRIO MOLITOR*

Julius O. Ikenga, Mississippi Valley State University, Itta Bena, MS 38941

This research was designed to measure the metabolic rates of adult and larva stages of *Tenebrio molitor* using a direct respirometric technique. *T. molitor* is an important pest of commercial and household stored-grains and grain products. Both the adult and larva stages are popular fish baits. They are also used as food for many small pets. The biology and characteristics of *T. molitor* suggest that the species holds a great promise as a cheap source of proteins for humans. Twenty-five *T. molitor* adults were used in this research. These beetles were randomly taken from the stock that has been raised and maintained in our laboratory. Each beetle was brushed clean with a camel hairbrush and collectively weighed before depositing them in a 250 ml respirometer that was tightly fitted with a Vernier oxygen gas sensor. The latter was interfaced to a desktop computer with a Vernier LabPro. Four samples per minute were collected over a 30-

minute period at 26EC. The above procedures were repeated using 25 *T. molitor* larvae and with no *T. molitor* in the respirometer. Analysis of preliminary data showed a metabolic rate of 12.6 ppm O<sub>2</sub>/hr for the adult beetles and 9.6 ppm O<sub>2</sub>/hr for the larvae. These results parallel the level of activity exhibited by the adult and larva stages tested.

9:40 ACUTE TOXICITY AND ANTI-ESTERASE ACTIVITY OF FIVE ORGANOPHOSPHORUS INSECTICIDES AGAINST *HELIOTHIS VIRESCENS* (F.) AND *HELICOVERPA ZEA* (BODDIE)

Elgenaid I. Hamadain, Jackson State University, Jackson, MS 39217

Susceptibility of laboratory strains of tobacco budworm (TBW) and corn earworm (CEW) to five organophosphorus insecticides (OP) was investigated using standard topical application procedure. The insecticides were methyl parathion, parathion, chlorpyrifos methyl, chlorpyrifos, and profenofos. In vivo inhibition of acetylcholinesterase and aliesterases by the five compounds was determined for both species. In vitro inhibition of the two enzymes by the corresponding oxons was also determined. All insecticides, except profenofos had lower LD50 values for CEW than for TBW. The tolerance ratios range from 1.3 for profenofos to 18.3 for chlorpyrifos. All oxons, but not profenofos, were more potent inhibitors of CEW acetylcholinesterase than TBW acetylcholinesterase, indicating that the target enzyme in TBW is less sensitive to inhibition by the OPs than that of CEW. Paraxon, chlorpyrifos oxon and profenofos were more effective inhibitors of aliesterases than acetylcholinesterase. Methyl paraxon and chlorpyrifos methyl oxon showed a reverse pattern. Although profenofos was the most toxic insecticide to both species, it had extremely high in vitro LD50 values against the target site, acetylcholinesterase for both species. Profenofos was considerably more potent against aliesterases than acetylcholinesterase in both species. Methyl paraxon was unique in having a very poor anti-aliesterase potency. The target site, acetylcholinesterase of TBW appears to be less sensitive to inhibition by OPs than that of CEW. This may explain partially why TBWs are harder to kill by OPs than are CEWs.

10:00 A COMPARATIVE STUDY OF THE SEASONAL DISTRIBUTION OF POLLUTANTS IN EAGLE LAKE AND CHOTARD LAKE IN WARREN COUNTY, MISSISSIPPI

Chadric O. Neal\* and Alex D.W. Acholonu, Alcorn State University, Alcorn State, MS 39096

Contaminants alter the ecological conditions of

many lakes. The present study was conducted on two lentic bodies of water, Eagle Lake and Chotard Lake in Warren County, Mississippi, to compare their habitat profiles, the seasonal distribution of pollutants in them, and to find out if they meet the Mississippi water quality standards. During the period, February 2001 to October 2001, water samples were collected in three replicates from three sites in each of the two lakes and taken to the laboratory. They were tested according to the methods indicated by the manufacturer of LaMotte pollution test kits and the results were analyzed. The parameters tested for each of the winter, spring, summer, and fall seasons were ammonia, total alkalinity, carbon dioxide, silica, phosphate, chloride, sulfide, nitrate-N, and pH. The surface and bottom water temperatures were also recorded. There were significant differences in some physical and chemical parameters tested, both between the two lakes and seasonally. However, Eagle Lake and Chotard Lake met the Mississippi water quality standards for ephemeral water bodies.

10:20 A CHARACTERIZATION OF THE EPHEMEROPTERA, PLECOPTERA AND TRICHOPTERA FAUNA FROM HEADWATER STREAMS ON THE CAMP SHELBY TRAINING SITE IN SOUTH MISSISSIPPI

Amanda L. Wilberding\* and Fred G. Howell, University of Southern Mississippi, Hattiesburg, MS 39406

Mayflies, stoneflies and caddisflies are pollution sensitive aquatic insects in their immature stages and make up the Ephemeroptera-Plecoptera-Trichoptera (EPT) Index, often used to characterize the "environmental health" of streams. The number of distinct taxa within these orders determines the EPT Index of a sample collection; the numerical value of this index increases as water quality increases. In our area, many of these taxa are associated with woody material. Results for quarterly collections taken from seven headwater streams at Camp Shelby's National Guard Training Site, between August 1999 and May 2001, indicated considerable seasonal and spatial variation among the EPT taxa. While some of the variation may be due to sampling error, other sources of variation might include impacts of heavy rains and their tendency to displace woody materials and associated macroinvertebrates, particularly at the "hard bottom" sites. Although the bottom substrate varies slightly from stream to stream, channels of four of the streams (Poplar, Pierce, Cypress, and Hickory) are made of predominately Hattiesburg clay formation and are regularly "scoured" by runoff from locally heavy rainfall. This phenomenon may be limiting the amount of suitable habitat to support many of the EPT taxa.

10:40 Divisional Business Meeting

## SPECIAL PRESENTATIONS

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### THURSDAY MORNING

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Emerald Room

8:45    **STRUCTURE VISUALIZATION IN  
BIOCHEMISTRY EDUCATION: SEEING IS  
BELIEVING**

Robert Bateman, University of Southern Mississippi,  
Hattiesburg, MS 39406

With the advent of powerful desktop and laptop personal computers has come a wealth of computational tools that can aid in the understanding of chemical and biochemical concepts. This talk will survey several of the free structure visualization software packages that are currently used in biochemistry instruction. The emphasis will be on the most effective uses of these tools both inside and outside the lecture classroom.

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### THURSDAY AFTERNOON

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Gulf Hall

5:00    **Dodgen Lecture: Vaccine Controversies: Past  
and Present**

**Stephanie Cave, MD**

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### FRIDAY MORNING

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Caribbean Room

9:00–11:00

**PROTECTION OF HUMAN SUBJECTS: THE  
EXPANDING ROLES OF THE INSTITUTIONAL  
REVIEW BOARD**

Reid Jones\*, Georgene Clark\*, and Jane Weare\*, Delta  
State University, Cleveland, MS 38733

More intensive scrutiny and new policies by the federal Office of Human Research Protections have affected Institutional Review Boards (IRBs) at colleges and universities. The two-hour workshop began with an overview of basic IRB principles and composition, referencing classic studies and prevailing regulations. Recurring issues were reviewed including informed consent, confidentiality, research on minors, appearance of

coercion, undue inducement, deception, and cost-benefit analysis. Review of new federal policies for principal investigators (PIs) and IRBs included a discussion of education requirements for the PI and federal certification of the IRB. Controversial policy decisions are reviewed in a case study format including recent university sanctions and the new issue of “third party informed consent.” Members of the audience were selected and participated in a mock IRB Review of these cases. An annotated bibliography of text and web-based materials was distributed. The workshop was designed to partially satisfy PI education requirements and to provide the basis for further study. There was no charge for the workshop unless participants wished to register CEU’s.

Caprice Room

9:00    **Poster Presentation  
MISSISSIPPI CENTER FOR SUPERCOMPUTING  
RESEARCH (MCSR) USER ADVISORY GROUP**

Faculty and graduate student researchers will describe their research projects that involve HPC and the use of MCSR resources. IHL faculty and graduate students, with an interest in HPC and/or MCSR facilities and services, are also invited to attend. A meeting of the MSUAG meeting will follow in the afternoon. IHL faculty and graduate students, with an interest in HPC and/or MCSR facilities and services, are also invited to attend.

11:30    **MISSISSIPPI CENTER FOR SUPERCOM-  
PUTING RESEARCH (MCSR) USER  
ADVISORY GROUP MEETING**

David G. Roach\* and Germana Peggion, University of Mississippi, University, MS 38677, and University of Southern Mississippi, Stennis Space Center, MS 39522

The Mississippi Center for Supercomputing Research was established in 1987 by the Mississippi Legislature and the Institutions of Higher Learning (IHL) in order to provide high performance supercomputing (HPC) support for research and instruction at all state universities. The Mississippi Supercomputer User Advisory Committee (MSUAG) was established by the IHL Research Consortium to provide user input and advice to MCSR management and technical staff on policies and procedures for the Center’s operations. It includes member representatives from all IHL institutions. The Advisory Group will meet at this MAS conference. Mr. David G. Roach, Director of the MCSR, and Dr. Germana Peggion, MSUAG Chair and Professor at USM Stennis, will conduct the meeting. The agenda includes an update on MCSR HPC facilities and services, introduction of new MCSR staff members, and site reports and ongoing research



updates by MSUAG representatives. A Poster Session will follow the MSUAG meeting in which faculty and graduate student researchers will have the opportunity to describe their research projects that involve HPC and the use of

MCSR resources. IHL faculty and graduate students, with an interest in HPC and/or MCSR facilities and services, are also invited to attend.



2003 Annual Meeting  
February  
(dates to be announced)  
Hattiesburg, Mississippi

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