

MISSISSIPPI ACADEMY OF SCIENCES



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**SCHEDULE****WEDNESDAY, FEBRUARY 16, 2005**

<u>TIME</u>	<u>EVENT</u>	<u>LOCATION</u>
4:00 PM to 6:00 PM	Board of Directors Meeting	Oxford Train Depot

THURSDAY, FEBRUARY 17, 2005

<u>TIME</u>	<u>EVENT</u>	<u>LOCATION</u>
7:30 AM to 6:00 PM	Registration	Lobby Gallery
8:00 AM to 6:00 PM	Exhibits	Lobby Gallery
8:00 AM to 12:00 PM	Divisional Programs	See Pages 39–121
8:00 AM to 9:00 AM	Symposium: Influences on Biota and Bio-geochemical Processes in Coastal Waters	Oak Room A
12:00 PM to 1:30 PM	Opening Symposium & Presentation of Awards; The Earthquake Hazard in Mississippi: Counting the Costs	Assembly Hall
1:30 PM to 3:00 PM	Divisional Programs	See Pages 39–121
1:30 PM to 3:00 PM	Symposium: Drug Delivery	Auditorium
3:00 PM to 4:00 PM	2005 Dodgen Lecture—Bruce Alberts	Assembly Hall
4:00 PM to 4:30 PM	MAS Business Meeting	Assembly Hall
4:00 PM to 6:00 PM	Reception and Poster Session	Lobby Gallery
6:00 PM to 7:30 PM	Dr. Alberts' Dinner with Students	Location To Be Announced

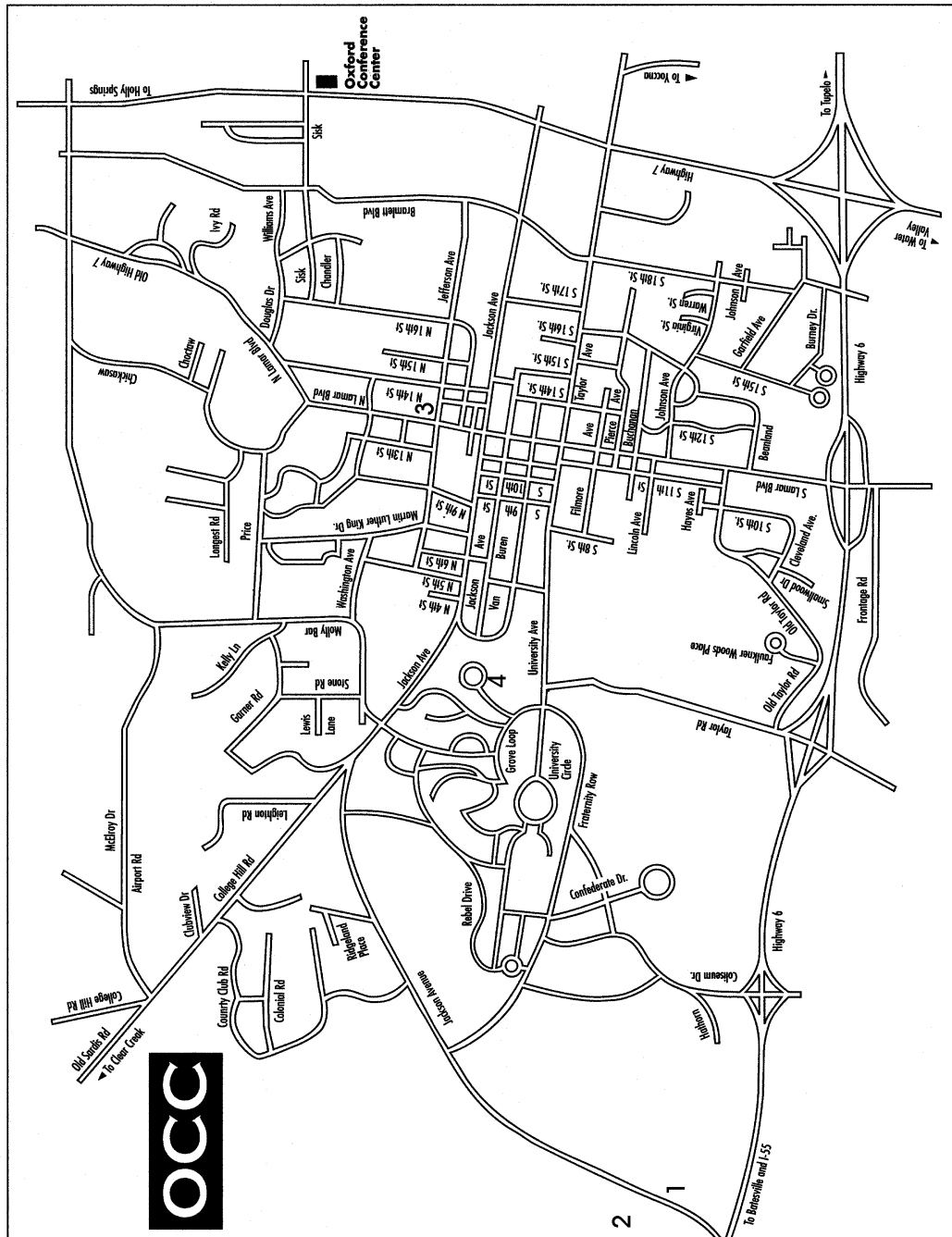
FRIDAY, FEBRUARY 18, 2005

<u>TIME</u>	<u>EVENT</u>	<u>LOCATION</u>
7:15 AM to 8:00 AM	Past-Presidents' Breakfast	Conference Center Board Room
7:30 AM to 2:00 PM	Registration	Lobby Gallery
8:00 AM to 12:00 PM	Exhibits	Lobby Gallery
8:00 AM to 5:00 PM	Divisional Programs	See Pages 39–121
8:00 AM to 9:30 AM	Mississippi Center for Supercomputing Research	Magnolia A
9:00 AM to 12:00AM	Symposium: Rainwater Astronomical Observatory	Magnolia B
11:15 AM to 12:00 PM	Workshop: Teaching Students to Collect, Analyze and Interpret Genomic Data	Oak Room B
12:00 PM to 3:00 PM	Biotechnology Symposium: Planting the Seeds of a Bioscience Industry in Mississippi	Cedar Room
1:00 PM to 2:00 PM	Symposium: Advances in Clinical Health Sciences	Auditorium
1:00 PM to 2:00 PM	Workshop: Academic Service Learning in Teaching the Sciences	Oak Room B
2:00 PM to 3:00 PM	Workshop: Biotechnology for the Classroom	Oak Room B

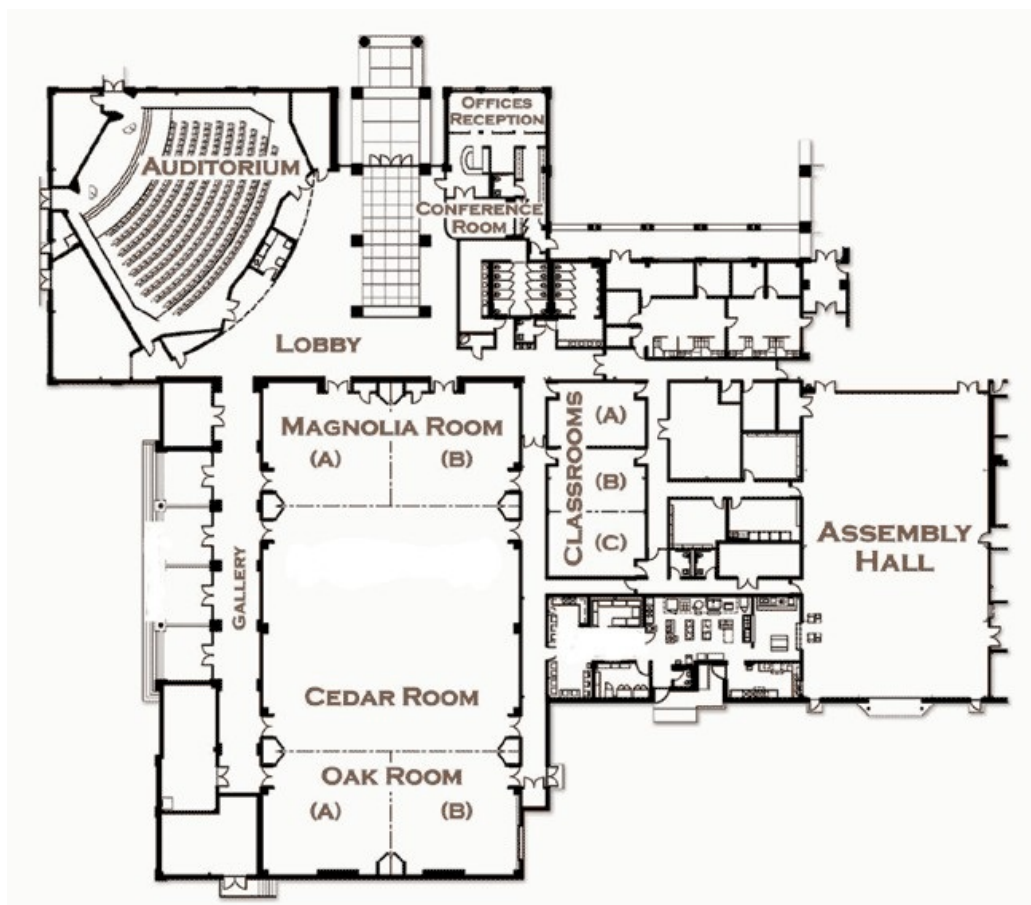


MISSISSIPPI ACADEMY OF SCIENCES MEETING OVERVIEW

	Lobby Gallery	Auditorium	Cedar Room	Oak Room A	Oak Room B	Magnolia A	Magnolia B	Classroom A	Classroom B	Classroom C	Assembly Hall
THURSDAY MORNING	Registration Exhibits	Health Sciences	Cellular, Molecular and Developmental Biology	Marine and Atmospheric Science	Science Education	Mathematics, Computer Science and Statistics	Physics and Engineering	Agriculture and Plant Science	Zoology and Entomology	Geology and Geography	Chemistry and Chemical Engineering
THURSDAY NOON	Registration Exhibits										Awards Special Symposium
THURSDAY AFTERNOON	Registration Exhibits	Health Sciences	Cellular, Molecular and Developmental Biology	Marine and Atmospheric Science	Science Education	Mathematics, Computer Science and Statistics	Physics and Engineering	Agriculture and Plant Science		Geology and Geography	Chemistry and Chemical Engineering
THURSDAY EVENING	Poster Session and Reception										Dodgen Lecture
FRIDAY MORNING	Registration Exhibits	Health Sciences	Cellular, Molecular and Developmental Biology	Marine and Atmospheric Science	Science Education	Mathematics, Computer Science and Statistics: Supercomputing Session	Physics and Engineering	Ecology and Evolutionary Biology	Psychology and Social Sciences	History and Philosophy of Science	Chemistry and Chemical Engineering
FRIDAY NOON	Registration Exhibits		Special Symposium								
FRIDAY AFTERNOON		Health Sciences	Cellular, Molecular and Developmental Biology		Science Education		Physics and Engineering	Ecology and Evolutionary Biology	Psychology and Social Sciences	History and Philosophy of Science	Chemistry and Chemical Engineering



Oxford Conference Center Floor Plan



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The Mississippi Center for Supercomputing Research (MCSR) provides free, high performance computing cycles and consulting in support of research and instruction, for all interested students, faculty, or researchers associated with any of Mississippi's eight publicly funded institutions of higher learning. The MCSR actively supports the Mississippi Academy of Sciences with regular participation in the Mathematics, Computer Science, and Statistics Division. Please visit <http://www.mcsr.olemiss.edu>, email assist@mcsr.olemiss.edu, or call 662-915-3922 to inquire about how we might support your HPC research or instructional computing projects at your university. Or, simply apply for an account today at <http://www.mcsr.olemiss.edu/accounts>.

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and the
Howard Hughes Medical Institute
present the

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Develop the skills to perform biomedical research with a faculty mentor at the University of Mississippi Medical Center and earn high school graduation credit. The ***BasePair*** program (<http://basepair.library.umc.edu>) accepts students enrolled at Murrah High School for activities that begin with the onset of the fall semester. Selection takes place each spring for the following year. Academic excellence, self-determination, computer prowess and interest in a science or health career drive the selection process.

Contact Rob Rockhold, Ph.D., professor of pharmacology and program director (rrockhold@pharmacology.umsmed.edu) at the University of Mississippi Medical Center or Roy Brookshire, principal, Murrah High School (rbrookshire@jackson.k12.ms.us) for application information.

Dodgen Lecturer for 2005 Annual Meeting of the Mississippi Academy of Sciences

Dr. Bruce Alberts

Lecture will be delivered in the Assembly Hall on Thursday at 3:00 PM



Bruce Alberts, president of the National Academy of Sciences in Washington, D.C., is known for his work both in biochemistry and molecular biology, in particular for his extensive study of the protein complexes that allow chromosomes to be replicated. Alberts graduated from Harvard College and earned a doctorate from Harvard University in 1965. He joined the faculty of Princeton University in 1966 and after ten years moved to the Department of Biochemistry and Biophysics at the University of California, San Francisco, where he became chair. He is one of the original authors of *The Molecular Biology of the Cell*, through 4 editions the leading advanced textbook in this important field. His most recent text, *Essential Cell Biology* (2003), is intended to present this subject matter to a wider audience. Dr. Alberts has long been committed to the improvement of science education, dedicating much of his time to educational projects such as City Science, a program that seeks to improve science teaching in San Francisco elementary schools.

For the period 2000 to 2005, Dr. Alberts is the Co-chair of the InterAcademy Council, a new advisory institution in Amsterdam governed by the presidents of the science academies of 15 different nations.

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.



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Mississippi Junior Academy of Science

<http://www.mjas.org/>

2005 Competition Information

The annual MJAS competition will be held on February 11, 2005, at Hinds County Community College – Raymond Campus in Raymond, MS. Please encourage high school students currently conducting research at your university to submit to this competition. If you are interested in serving as a judge for this competition, please contact Aimée Lee at (601) 266-6374 or aimee.lee@usm.edu or visit the new MJAS website: www.mjas.org.

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Board Members:	none

What is the Competition?

The most important thing to remember about the MJAS Annual Research Paper Competition is that the paper must be based on a scientific study where students manipulate variables in order to develop data.

There are two classes into which competitors are divided: Class I is 9th and 10th grade students; Class II is 11th and 12th grade students. Papers are then grouped into appropriate divisions based on the topics of research.

The annual research paper competition has three phases: 1) written paper competition, 2) oral presentation competition in divisions, and 3) overall competition.



The Written Paper Competition is the first phase of the competition. In order to make a presentation at the annual meeting of the Mississippi Junior Academy of Sciences, participants must submit their research papers for review. This part of the competition is based on the quality of the research paper. Because of this, it is important to know what the judges look for in a paper. Be sure to include the following in the paper: title page, abstract, purpose, method, results, conclusions, and references.

The judges will look for a clearly identified research problem and a thorough description of the experimental procedures. Quantitative data should be neatly arranged and easy to understand. Qualitative data should be explained clearly. Results of the experiment should be interpreted in a discussion of the significance of the results. In addition, a literature review is also recommended.

From the submitted written papers, the judges select those that are to be presented at the oral presentation competition.

The Oral Presentation Competition judging criteria are based on the professional aspect of the presentation, including the support material and poise of the presenter. Supporting materials include, but are not limited to, the following: slides, posters, transparencies, models, computer generated presentations, etc. The effective use of audio-visual materials is instrumental in the oral presentation.

In this phase of the competition, judges do not consider the written paper, only the presentation itself. Judges look for confidence in the presenter, the ability of the presenter to maintain audience interest, appropriate voice level, appearance, clarity of diction, and enthusiasm for the topic.

The Overall Competition brings together the divisional winners of Class II. These students present their papers before their peers and another panel of judges. Again, the judges select the Clyde Sheely Award winner and the Second Place winner based on the students presentation alone. The written work is not considered in this phase of the competition.

The Convergence of Science and Technology in Mississippi:

I. Advancing the Frontiers of Biomedicine¹

Roy J. Duhé^{2,3}, Fazlay Faruque⁴, Larry A. Walker⁵, Joe C. Files⁶, and Andy Taggart⁷

³University of Mississippi Medical Center, Jackson, MS 39216; ⁴Geographic Information Systems, University of Mississippi Medical Center, Jackson, MS 39216; ⁵National Center for Natural Products Research, University of Mississippi, University, MS 38677; ⁶University of Mississippi Medical Center Cancer Institute, Jackson, MS 39216; and ⁷Mississippi Technology Alliance, Ridgeland, MS 39157

Science and technology have always been closely interrelated, and major advances in one area are intricately related to innovations in the other. Over the past two decades, scientific and technological breakthroughs have dramatically revolutionized the broad field of biomedicine, and continued progress is anticipated in this field for the foreseeable future. However, the generation of these exciting technical advancements demands a significant and sustained investment of intellectual and economic resources. Current data suggest that a “critical mass effect” leads to significant regional variation in the creation of scientific discoveries and technological innovations. These data also illustrate that scientific endeavors in Mississippi have not yet attained the level of scientific productivity associated with leading scientific regions of the nation. We suggest that improvements in the quality of scientific activities in Mississippi will lead to economic improvements and to improvements in Mississippi’s quality of life. In this article, we will discuss two major research initiatives in Mississippi that are creating opportunities for unprecedented scientific and technological advancement in biomedicine. The National Center for Natural Products Research (NCNPR) serves as a model for building a research center that can capitalize on pre-existent scientific and technological expertise. The University of Mississippi Medical Center Cancer Institute (UMMCCI) presents an opportunity to build a nationally competitive research program in an area in which Mississippi must strengthen its scientific expertise. We propose that intellectual capital is the most important investment for the success of both the NCNPR and the UMMCCI.

IS THERE A DIFFERENCE BETWEEN SCIENCE AND TECHNOLOGY?

Anyone who has ever judged a school science fair knows that the line between science and technology is often blurred to the point of invisibility in the minds of the general public, yet a clear distinction exists between the two. Science is a philosophical approach to understanding the underlying basis of reality. Technology is the means by which humanity successfully manipulates reality.

History has shown that progress in either science or technology can lead to unanticipated

outcomes. Although some outcomes have occasionally been detrimental, it is generally accepted that advancements of science and technology lead to an overall improvement in the quality of life. Scientific and technological advancements are indisputably responsible for the dramatic extension in human life expectancy, which has linearly increased by approximately four decades over the past 16 decades (Oeppen and Vaupel, 2002). Science and technology have generally advanced in tandem, and these advances often profoundly affect society. For example, Galileo’s technological breakthrough, the telescope, allowed him to glimpse four moons of Jupiter (Gali-

¹Editorial note: This is the first of an occasional series of articles jointly authored by members of the Mississippi Academy of Sciences and the Mississippi Technology Alliance to examine contemporary issues in science and technology.

²Correspondence and requests for reprints to R. J. Duhé, Department of Pharmacology and Toxicology, University of Mississippi Medical Center, Jackson, MS, 39216-4505, USA. Tel. (601) 984-1625; Fax (601) 984-1637; e-mail: RDUHE@pharmacology.umsmed.edu

lei, 1610). This observation inspired his outrageous and enduring scientific proposal of heliocentric orbits, overturning thousands of years of belief in geocentric orbits in our solar system (Galilei, 1632).

How can one plot the course of science and technology? The metrics that gauge the success of technology account for the fact that technology is a tool. The assessment of success versus failure is simply based on whether or not a given technology can accomplish the task for which it was designed. If this primary assessment shows that a technology is successful, then secondary measures of relative success are assessed through other questions: How efficient is the technology? How effective is the technology? How convenient is the technology to use? How accessible is the technology? How reliable is the technology?

In a free market economy, these secondary questions are reflected in the market demand for that technology. There are rare exceptions in which market demand may not accurately measure technological success, such as technologies which are governmentally restricted, technologies with highly specialized applications, or technologies which incur prohibitive monetary, societal, or environmental costs⁸. Historically, technological success has been closely tied to wealth creation, at both individual and societal levels. A successful technologist, such as Thomas Alva Edison or John Craig Venter, often becomes a wealthy individual.

In contrast, the measure of scientific success lies within the essence of empirical scientific philosophy, namely, the testable hypothesis. The scientific success of a hypothesis is based on its capacity to predict an experimental outcome. In scientific disciplines unsuitable for experimental manipulation, the success of a hypothesis is judged by its capacity to consistently explain a broad range of observations. Since the successful scientist is rewarded with knowledge, but not necessarily with wealth, one might have to rely on non-economic parameters to measure the relative scientific success of individual scientists, scientific organizations or geographic regions.

So can we “measure” biomedical science and technology, and can we “measure” the relative success of Mississippi in these areas? Can we

identify strategies for growth, improvement and development? What benefits might one expect if Mississippi became an international leader in advancing the frontiers of biomedicine, as judged by objective metrics?

It is difficult to directly count the number of innovative scientific discoveries or the number of validated hypotheses generated by all scientists, and nearly impossible to find any single method that yields results that can be compared across disciplines. Various agencies have compiled a large set of indicators to provide an assessment of the “scope, quality and vitality” of the scientific activity within a given region. Some of these indicators are shown on a state-by-state basis in Table 1. One data source is the biennial issuance of the “Science Indicators” report (National Science Board, 2002), a comprehensive document providing statistical information on elementary, secondary and higher education, technically skilled workforce status, private and public funding for scientific activities, and other indicators of U.S. competitiveness in the broad area of science. The National Science Foundation’s Division of Science Resource Statistics publishes other reports summarizing state-by-state data from various sources (Payson, 1999; National Science Foundation, 2003). The Mississippi Innovation Index (Mississippi Technology Alliance, 2004) provides an objective measurement of Mississippi’s innovation-related activities in comparison to its neighbors in the southeastern USA. The Mississippi Innovation Index is computed from a matrix of parameters such as wealth creation, technology business development, statewide research capability, industrial productivity, university research and development activity, technological workforce development, business research and development activity, as well as investment capital.

The data examined in the National Science Foundation studies and the Mississippi Innovation Index relate to both research and development, which intermingles both scientific and technological activities. Because these studies primarily focus on economic data, they are more reflective of technology rather than science. In order to measure the quantity and quality of biomedical scientific activity, we also sought data from the scientific peer review process itself. This process is designed to assess objectively either scientific merit, in instances of research publications or of funding proposals, or scientific accomplishment, in instances of awards or honors.

⁸Manned space flights are technologically successful, although the number of rocket dealerships in any given city would hardly be indicative of this success.

Table 1. Selected indicators of scientific activity in the U.S.A. These data were derived from the following sources as follows. PubMed citations from the inclusive period of 1990 through 2000 were attributed to each state via the affiliation search field tag [ad] and “high profile” citations were further restricted to the journal titles listed in the text via the journal title search field tag [ta]. The statewide distribution of National Academy of Science members was obtained from the NAS website (<http://www4.nationalacademies.org/nas/naspub.nsf/urllinks/NASLocation?OpenDocument&count=500000>) on March 18, 2004. New NCI research grant data from the inclusive period of 2000 through 2003 were collected from the CRISP database (http://crisp.cit.nih.gov/crisp/crisp_query.generate_screen) with the limitations of “new” in the “award type” field and “research grants” in the “activity” field. The statewide census data on PhD scientists (2001), PhD engineers (2001), population (2002), gross state product (2000), per capita income (2001) and utility patents were derived from the “Science and Engineering State Profiles: 2000–2001” (<http://www.nsf.gov/sbe/srs/nsf03324/tables/table1.xls>) compiled by the National Science Foundation’s Division of Science Resources Statistics. The statewide census of nonfederal physicians was derived from the Henry J. Kaiser Family Foundation’s State Health Facts Online database (<http://www.statehealthfacts.org>).

STATE	“High profile” PubMed citations (1990–2000)	PubMed citations (1990–2000)	Current NAS members (March 2004)	2002 population (thousands)	2001 per capita income	2000 total R&D performance (billion \$)	2000 gross state product (billion \$)	2001 utility patents	2001 PhD scientists	2001 PhD engineers	2002 Nonfederal physicians	New NCI research grants (2000–2003)
Alabama	161	13398	2	4487	24589	1.73	120	382	5040	1340	9365	89
Alaska	12	682	0	644	30936	0.196	28	50	1350	80	1341	3
Arizona	239	11762	26	5456	25872	3.107	156	1540	6720	2000	11912	79
Arkansas	23	5084	0	2710	22887	0.454	68	180	2670	370	5468	16
California	5731	124274	579	35116	32702	55.093	1345	18598	70650	21040	90671	752
Colorado	414	16445	30	4507	33470	4.23	168	1927	12150	2070	11357	121
Connecticut	370	17516	72	3461	42435	4.888	159	1853	9620	1410	12742	63
Delaware	20	2904	4	807	32472	1.532	36	382	3530	840	2173	7
Florida	208	25902	24	16713	28947	4.663	472	2649	16330	3080	42892	88
Georgia	163	19984	10	8560	28733	2.796	296	1370	11860	1780	18403	61
Hawaii	60	2997	5	1245	29002	0.291	42	95	2550	310	3609	22
Idaho	8	972	1	1341	24621	1.434	37	1697	2090	570	2305	1
Illinois	482	34728	82	12601	33023	12.767	467	3640	20680	3940	35415	177
Indiana	163	16083	13	6159	27783	3.252	192	1358	9080	1790	13463	52
Iowa	172	16768	8	2937	27331	1.017	90	751	4500	560	6186	39
Kansas	63	10486	2	2716	28565	1.42	85	312	4170	550	6270	17
Kentucky	52	9106	0	4093	24923	0.866	119	481	4950	450	9232	29
Louisiana	37	11146	4	4483	24535	0.627	138	520	5270	870	11658	28
Maine	23	1714	6	1294	26723	0.319	36	145	2120	280	3748	7
Maryland	726	52221	90	5458	35188	8.634	186	1483	22150	3440	21018	245

Table 1. (cont'd)

STATE	“High profile” PubMed citations (1990–2000)	PubMed citations (1990–2000)	Current NAS members (March 2004)	2002 population (thousands)	2001 per capita income	2000 total R&D performance (billion \$)	2000 gross state product (billion \$)	2001 utility patents	2001 PhD scientists	2001 PhD engineers	2002 Nonfederal physicians	New NCI research grants (2000–2003)
Minnesota	281	26036	12	5020	33101	4.299	185	2635	10680	1950	13540	136
Mississippi	7	4546	0	2872	21750	0.513	67	166	2930	660	5145	3
Missouri	193	19851	22	5673	28226	2.583	179	841	8850	1440	15024	87
Montana	22	1438	1	909	23963	0.17	22	145	1730	100	2049	3
Nebraska	52	7344	3	1729	28886	0.439	56	215	2820	330	4084	21
Nevada	32	1482	10	2173	29897	0.377	75	313	1790	540	4085	5
New Hampshire	26	2410	10	1275	34138	0.775	48	598	2350	650	3350	38
New Jersey	359	15981	110	8590	38506	13.133	363	3869	20660	4690	28799	85
New Mexico	55	5030	10	1855	23155	3.085	54	376	6800	2340	4214	29
New York	2960	102498	198	19158	36019	13.556	799	6349	42610	6490	76567	512
North Carolina	478	33023	38	8320	27514	5.045	282	1946	16780	2340	20455	198
North Dakota	2	1189	0	634	25902	0.146	18	97	1150	130	1497	2
Ohio	170	35213	12	11421	28816	7.662	373	3274	18580	4780	31841	219
Oklahoma	70	6952	1	3494	25071	0.66	92	576	4240	920	7072	14
Oregon	341	11481	15	3522	28165	2.116	119	1259	7260	1460	8961	50
Pennsylvania	794	51443	74	12335	30720	9.842	404	3534	24630	4650	41301	364
Rhode Island	34	4673	9	1070	30215	1.501	36	287	2370	500	3835	68
South Carolina	44	7867	2	4107	24886	1.126	113	565	5030	980	9234	42
South Dakota	0	794	0	761	26664	0.085	23	76	1160	90	1608	4
Tennessee	165	16544	9	5797	26988	2.057	178	813	8680	1660	14858	130
Texas	1150	66912	46	21780	28581	11.552	742	6371	28610	8910	47201	336
Utah	235	9843	7	2316	24180	1.361	69	715	4700	1220	4797	36
Vermont	51	3734	1	617	28594	0.465	18	453	1800	240	2181	11
Virginia	205	24939	14	7294	32431	5.069	261	1115	16960	3400	18953	100
Washington, DC	158	16929	16	571	40150	2.296	59	67	13410	1150	3938	86
Washington	1372	48196	58	6069	32025	10.516	220	1969	14540	2610	15761	224
West Virginia	5	3189	0	1802	22881	0.457	42	148	1980	380	4554	7
Wisconsin	382	23761	41	5441	29270	2.693	173	1837	8520	1610	13746	71
Wyoming	5	791	1	499	29416	0.061	19	51	940	100	928	3

One way to measure regional research productivity is simply to count the number of retrievable scientific publications in the PubMed database (<http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?db=PubMed>). Just as a prospective employer is cautious about evaluating only the number of publications, but not the substance of these publications, when evaluating an individual scientist's *curriculum vitae*, so too should we be cautious when utilizing PubMed citations as a metric tool for assessing regional scientific performance. Statewide publication tallies derived from the PubMed database are presented in Table 1.

In an attempt to quantify scientific productivity, one should also attempt to quantify the quality of the scientific product. Most scientific databases are not designed for the purpose of regional comparisons, so any individual dataset should be viewed cautiously. The PubMed database was re-examined, and only the manuscripts from a handful of "high profile" journals were counted (Table 1). These journals were *Science*, *Nature*, *Cell*, *The Proceedings of the National Academy of Sciences*, and *The New England Journal of Medicine*. It should be noted that some would view these as the highest profile science journals out of a field including several hundred journal titles and that some of these five journals do not restrict their content to the area of medical science. To visualize the statewide distribution of "high profile" scientific output (as a surrogate for high quality scientific output), we replotted these data in cartographic fashion. Because of space limitations, only data representations that are statistically meaningful (see below) will be shown. Figure 1 is a map showing the statewide distribution of "high profile" publications per total PubMed citations. This is a rational basis for normalization in order to reflect the quality of scientific output, and as will be shown below, these are two strongly correlated parameters.

Occasional problems arise from regional analysis of the PubMed database due to inaccuracies in the address field (e.g., some state names are incorporated into street addresses and therefore attributed to the wrong state; other articles are attributed to multiple states even though the address field should be restricted to the first author of any given article). In order to corroborate our initial assessment of regional output of high-quality scientific work, we queried other databases, such as the membership of the National Academy of Sciences

(Table 1). Members of the National Academy of Sciences are "elected in recognition of their distinguished and continuing achievements in original research". Although this list includes a much smaller database than does PubMed, the regional attributes have little, if any, error. The statewide distribution of National Academy of Sciences members, normalized to the total number of advanced technical degrees (MDs, PhD scientists and PhD engineers) in that state, is shown in Figure 2.

Comparison of Figures 1 and 2 suggest that the geographic patterns of the "quality" of science converge to the same loci. Similar plots (not shown) reveal a remarkable consistency in the convergence of both scientific and technological productivity when other parameters, such as the number of new utility patents, are examined. These data appear to support the hypothesis that high performance in science and technology is an outcome of attaining a "critical mass" of human and infrastructural resources. This hypothesis proposes that scientific discoveries and technological developments are unlikely to occur where human and infrastructural resources are sparse, but that the probability of scientific and technological breakthroughs occurring in a given area increases as the overall scientific and technological activities intensify. This seems intuitive, as are other correlates of this hypothesis. The presence of several internationally prominent, well-funded researchers at a given institution will attract highly motivated students, post-doctoral candidates and junior faculty to that institution. If the science and engineering departments of an academic institution are highly attractive, and the surrounding community has a highly desirable quality of life, then there will be an accumulated labor pool of highly talented and well-educated individuals, which in itself becomes an attractive feature for seed capital investment and for start-up technology firms seeking a specialized workforce.

To assess this hypothesis more critically, we analyzed the raw data in Table 1 using the Spearman rank order correlation. In this analysis, paired variables with positive correlation coefficients and P values below 0.050 are related and tend to increase together; P values greater than 0.050 are not statistically significant. A "perfect" correlation would have a Spearman correlation coefficient (r_s) of 1.000 and a P value of 0.000. Assume that the number of "high-profile" scientific publications and the number of members in the National Academy of Sciences

reflects the quality of science, and that the number of total scientific publications, scientific PhDs, engineering PhDs, and non-federal MDs reflect the quantity of science. Which other parameters, such as population, economic output, per capita income, etc., are most closely related to a high quality of science⁹?

The absolute number of “high-profile” scientific manuscripts is most closely correlated with the total number of scientific manuscripts ($r_s = 0.922$, $P = 0.000$). This is also closely associated with the number of new NCI research grants ($r_s = 0.908$, $P = 0.000$) and the number of NAS members and the number of PhD scientists (both have $r_s = 0.902$, $P = 0.000$). Interestingly, there is a much stronger correlation between the absolute number of “high-profile” scientific manuscripts with either the total R&D performance ($r_s = 0.888$, $P = 0.000$) or by the gross state product ($r_s = 0.861$, $P = 0.000$), than with the normalized ratio of these economic parameters, referred to as “research intensity” ($r_s = 0.579$, $P = 0.000$).

If one normalizes the “high-profile” scientific publications to the total number of publications, then one observes the strongest correlation with the highest “quality” of highly trained technical personnel (defined here as the percentage of NAS members relative to the total number of scientific PhD, engineering PhD and non-federal MDs). This correlation ($r_s = 0.731$, $P = 0.000$) is surprisingly much higher than that observed between total R&D performance ($r_s = 0.486$, $P = 0.000$), gross state product ($r_s = 0.382$, $P = 0.00592$), or with research intensity ($r_s = 0.426$, $P = 0.00192$).

What does this mean? The simplistic, and perhaps correct, interpretation is that high quality scientific productivity is more dependent on a pool of highly talented individuals than upon research funding alone. This provides a modicum of hope for a poor state such as Mississippi, because it provides insight into how we can improve our scientific standing. It is easy to illustrate the fundamental concept using the team sports analogy. Every ath-

letic director knows that the quality of a school’s football program is not determined by the amount of money spent on helmets, jerseys and transportation to travel to away games. Granted, there is a critical spending threshold that must be exceeded if one wants to have a football team, but the key ingredients are the athletes. Good athletes, not good helmets, win games and define themselves as good teams. One great athlete does not constitute a great team. Excellent teams find it easier to recruit excellent athletes. These truisms are accepted throughout the Southeastern Conference and other collegiate conferences in the south. Yet despite their obvious nature, the data suggest that these concepts have not been applied towards building strong scientific programs in the southeastern United States.

At some point, the “critical mass” hypothesis becomes self-fulfilling and begins to influence private policy decisions. For example, there are several private research funding agencies that fund researchers from a list of invited institutions. “The Searle Scholars Program makes grants to selected universities and research centers to support the independent research of exceptional young faculty in the biomedical sciences and chemistry” (quoted from the Searle Scholars website, <http://www.searlescholars.net/index.html>). None of the 123 institutions invited to nominate Searle Scholars is located in Mississippi (http://www.searlescholars.net/apply/participating_inst.html). Furthermore, the density of Searle Scholar awardees fits neatly into the recurring geographic distribution patterns of other scientific performance parameters, such as National Academy of Science memberships, as shown in Figure 3.

This pattern is repeated in the Pew Scholars Program in the Biomedical Sciences (<http://futurehealth.ucsf.edu/pewscholar.html>), which “is designed to support young investigators of outstanding promise in the basic and clinical sciences relevant to the advancement of human health.” None of the 132 institutions invited to nominate investigators for the Pew Program is located in Mississippi (<http://futurehealth.ucsf.edu/biomed/institutions.html>). More significant than the distribution of invited institutions is the geographic distribution of the Pew Scholars (Figure 3), which is strikingly similar to that of the Searle Scholars. If the private sector that voluntarily rewards scientific innovators tends to avoid Mississippi entirely, how can one realistically expect the private sector that invests in technological innovators to be attracted to Mississippi?

⁹The Spearman rank order correlation provides only a simple pairwise analytical approach and is used here to stimulate thought and discussion; cluster analysis might provide a more meaningful understanding of how multiple interacting factors can contribute to an environment that fosters high quality science. Indeed, that very cluster building and analysis strategy is being pursued as a key component of the work of the Mississippi Technology Alliance.

We began the first half of this article with an attempt to objectively measure the collective scientific performance of Mississippi. In the course of this effort, we uncovered evidence that a non-uniform geographic distribution of scientific activity arises from a self-reinforcing mechanism which benefits

“high-quality” activities and penalizes “low-quality” activities. In the remainder of this article, we will try to address how Mississippi scientists and Mississippi policy makers can exploit this hypothesis to set a course through the uncharted future of biomedicine.

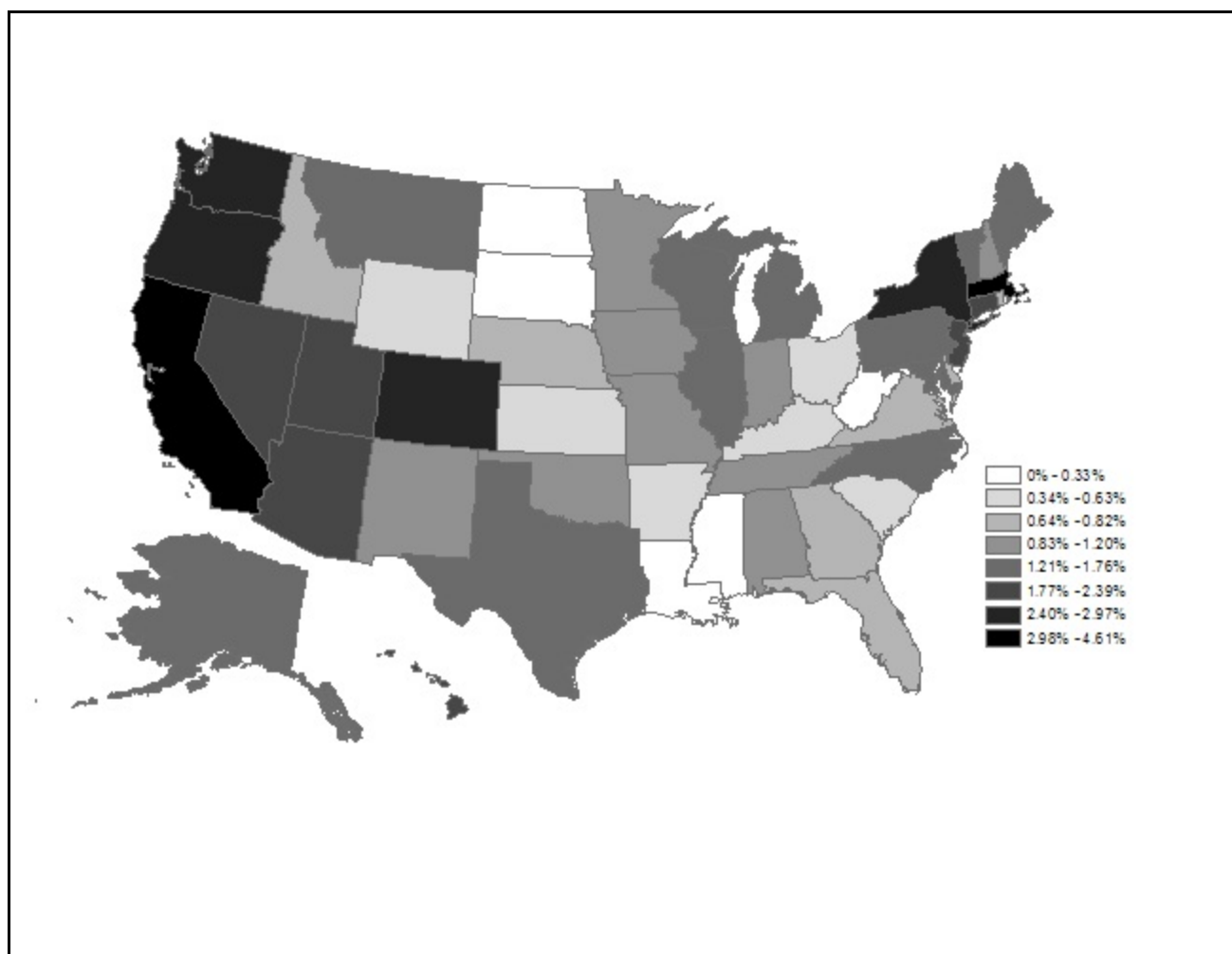


Figure 1. Statewide distribution of “high profile” PubMed citations as a percentage of total PubMed citations. The map was generated by normalization of the publication data from the years 1990 through 2000, as listed in Table 1. Data for each state was sorted into 8 performance classes ranging from low (white includes 0% to 0.33%) to high (black includes 2.98% to 4.61%), with intermediate grayscale values as indicated.

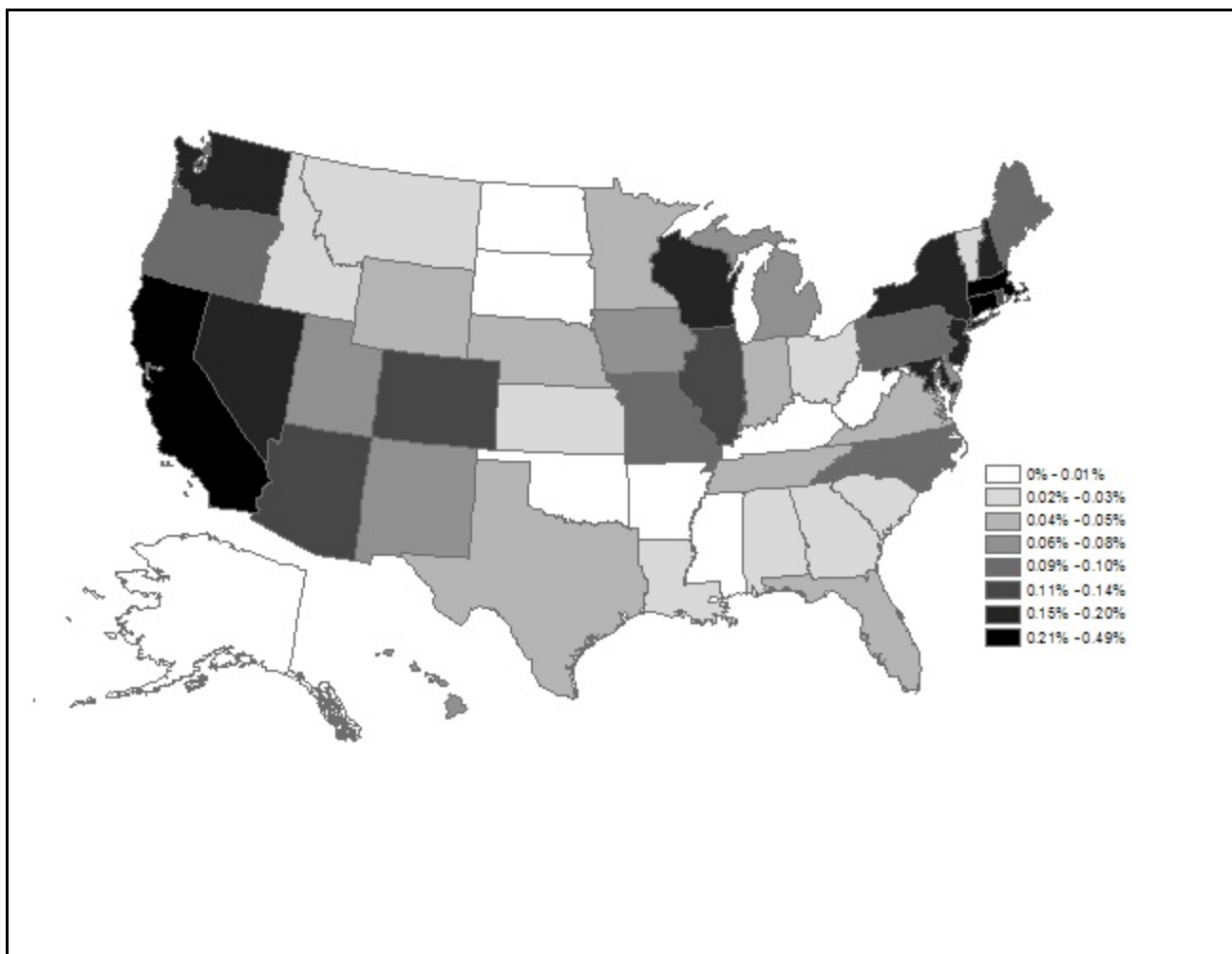


Figure 2. Statewide distribution of National Academy of Science members as a percentage of the number of residents with advanced technical degrees. The map was generated by normalization of the personnel data listed in Table 1. Data for each state was sorted into 8 performance classes ranging from low (white includes 0% to 0.01%) to high (black includes 0.21% to 0.49%), with intermediate grayscale values as indicated.

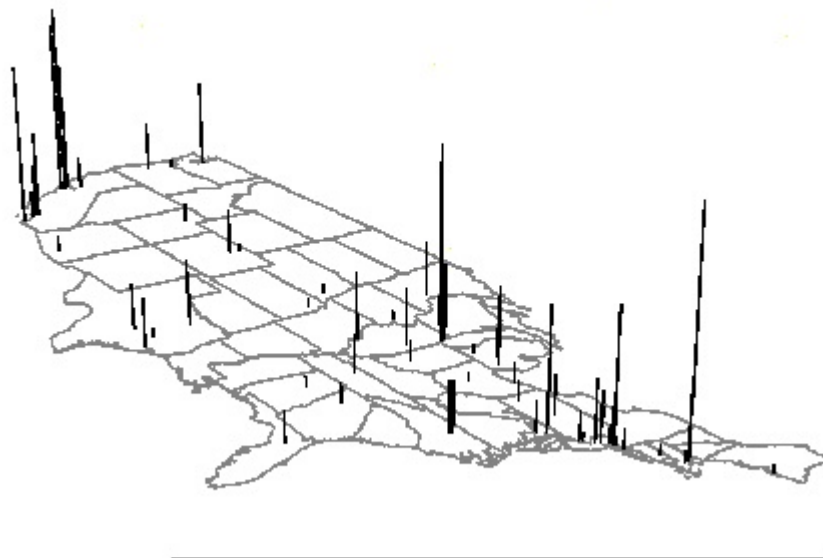
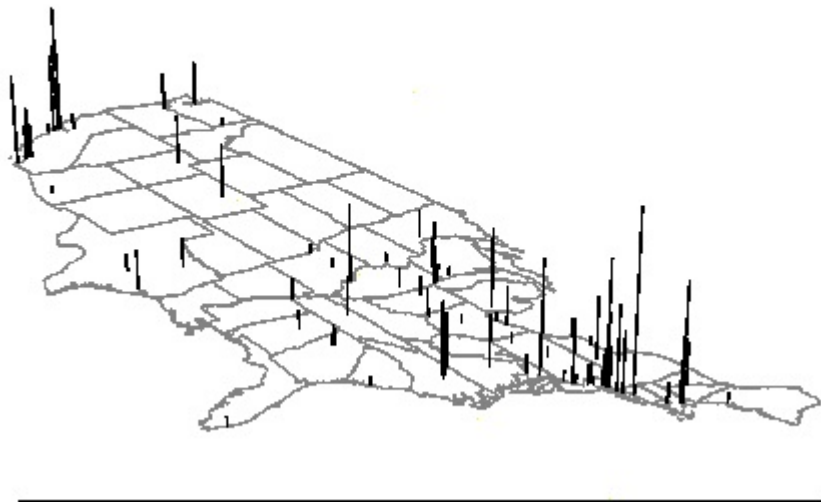


Figure 3. Geographic distribution of research scholars recognized by private foundations. The number of Pew Scholars (top) and Searle Scholars (bottom) in various institutes around the nation are shown. The vertical bar height is proportional to the number of scholars per institute.

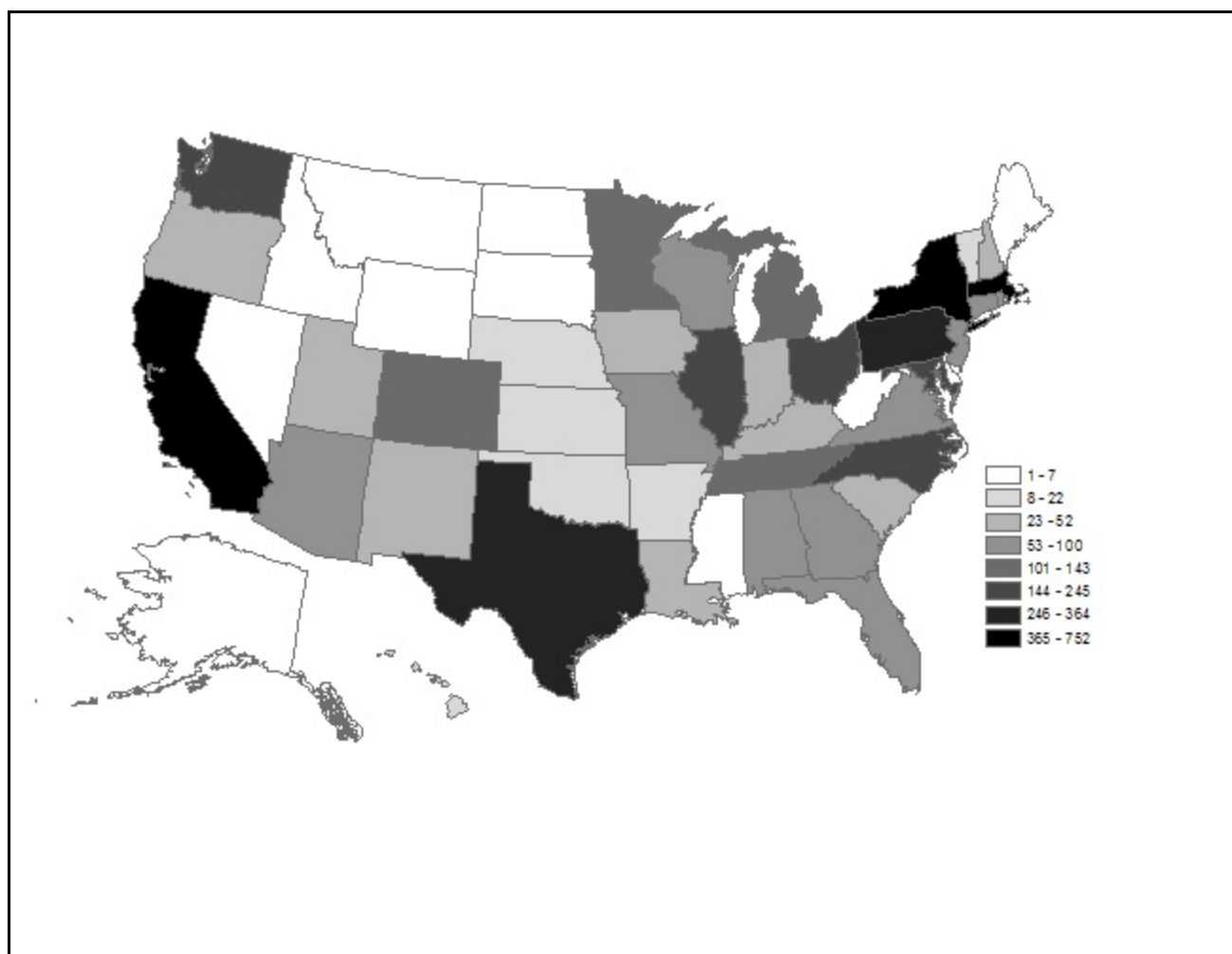


Figure 4. Statewide distribution of new National Cancer Institute-funded research grants. The map was generated from the number of new NCI-funded research grants awarded over the years 2000 through 2003, as listed in Table 1. Data for each state was sorted into 8 performance classes ranging from low (white includes 1 to 7) to high (black includes 365 to 752), with intermediate grayscale values as indicated.

THE NATIONAL CENTER FOR NATURAL PRODUCTS RESEARCH

The dilemma facing Mississippi's biomedical research community is a classic "catch-22" problem: how can we improve research productivity, and thereby attract more research infrastructural resources, if more resources are required to improve research productivity? Obviously, we start with what we have. One of Mississippi's unique resources is the National Center for Natural Products Research (NCNPR), based at the School of Pharmacy at the University of Mississippi's Oxford campus. The NCNPR is housed in the Thad Cochran Research Center, a state-of-the-art facility that provides pivotal infrastructure for a school-wide research enterprise. Currently, approximately 120 full-time research personnel are employed, including 35 federal employees of the U.S. Department of Agriculture's Agricultural Research Service (USDA/ARS). Also integral to the Center's research programs are 25 academic faculty of the School of Pharmacy, who have joint appointments in NCNPR. For the purpose of our article, the NCNPR brings two important perspectives: (1) the history of the NCNPR is instructive in terms of implications for building new capacity and infrastructure and improving research productivity; and (2) with regard to the research program, it can serve an important role in the growth of related science and technology in Mississippi.

The development of the NCNPR illustrates how an essential combination of vision, leadership, state and university support, a creative scientific community, long-term commitment, and an investment in infrastructure can lead to successful scientific and technological enterprises.

In the 1960s Charles Hartman, Dean of the School of Pharmacy at the university, had a vision for Mississippi that incorporated the state's pharmacy research leadership with its agricultural economy and resources. He carried his idea to the state legislature, and in 1962 the Research Institute of Pharmaceutical Sciences (RIPS) was created. It was a small step and a modest investment, and its charter called for an institute that would discover, develop and bring to the market pharmaceuticals based on natural products. Over the 1970s and 1980s, the RIPS program grew steadily. Another significant development was the decision to maintain Pharmacognosy as a distinct program at the School of Pharmacy. Pharmacognosy is the science that deals with drugs derived from natural sources, including

plant, animal and microbial sources. During a time when many schools were eliminating or merging their Pharmacognosy departments, and removing much of this content from their curricula, Ole Miss not only maintained, but strengthened the program, recruiting research leaders to the department. The University of Mississippi is one of only twenty institutions in the United States that offers a graduate degree in Pharmacognosy or Natural Products Chemistry. The latter half of the 20th century was 'the age of chemistry,' and the focus in new pharmaceutical discovery shifted considerably away from crude botanical drugs and more toward synthetic chemistry; it was widely regarded that the cure for most diseases would be realized in the laboratory design and synthesis of new 'magic bullets.' When many universities were closing or merging their pharmacognosy programs, the University of Mississippi continued a major emphasis in pharmacognosy, developing a world-wide reputation in this discipline.

For more than 25 years, these sustained efforts to build a research enterprise, recruit and retain research leaders, and maintain the educational focus in pharmacognosy, have required extraordinary vision, leadership, persistence, and a significant investment in research infrastructure. The commitments from the state, the university, and the school were critical investments, and ultimately afforded an opportunity, in partnership with the U.S. Department of Agriculture, to establish the National Center for Natural Products Research.

Research activities at the NCNPR cover a broad range of activities that include a natural products discovery and development program, with both pharmaceutical and agrochemical applications. In addition, a medicinal plant research program is aimed at studying botanical, agronomic, chemical, and pharmacological aspects of plants that are sources of pharmaceuticals, or of botanical dietary supplements. The research efforts at the NCNPR apply to medical research that is within the scope of this article, but also to non-medicinal ventures that have tremendous importance to the agricultural sector of Mississippi's economy. There are two aspects of the NCNPR that are particularly relevant to future biomedical research ventures in Mississippi. First, the NCNPR was specifically instituted with a mission to commercialize products or technologies developed by the Center. This includes the capability to protect intellectual property developed, to manage an intellectual property portfolio, to develop license agreements with the private sector, and to prepare technology dossiers

that will support investigational new drug (IND) applications.

As a result of its research activities, the NCNPR has six active license agreements as of July, 2004, and four of these agreements currently generate revenue for the center. This includes license agreements for such products as Immulina, an algal-derived immunostimulant formulation, and dronabinol hemisuccinate, a plant-derived anti-emetic which can be administered orally or in suppository form to prevent nausea and vomiting in cancer patients. Eleven additional patent applications are pending. Several other products are in pre-approval or pre-clinical development phases. These include an 8-aminoquinoline derivative under pre-clinical evaluation for the treatment of malaria, leishmania and pneumocystis pneumonia. Also, a natural product-derived algaecide is undergoing testing in catfish ponds to prevent blue-green algae from adversely affecting the flavor of catfish; catfish is Mississippi's fourth largest agricultural commodity. The comparable capability to translate basic research into clinically useful and potentially marketable technologies will be extremely important for the University of Mississippi Medical Center Cancer Institute (UMMCCI) to develop, as discussed below.

The second aspect relevant to future biomedical research ventures is that the NCNPR has accumulated both capital-intensive core research instrumentation and talented personnel required to productively exploit this instrumentation. The NCNPR has a central repository containing over 20,000 natural product samples, including a variety of extracts and pure isolates. These materials can be manipulated for high-throughput screening assays and related purposes with robotic workstations that integrate archival retrieval, sample processing and assay readout functions. The central instrumentation facilities, which serve both the Center and the School of Pharmacy, are equipped with nuclear magnetic resonance spectrometers with operating frequencies of 400, 500, and 600 MHz. These facilities also have a Fourier-transform ion cyclotron resonance (FT-ICR) high resolution mass spectrometer, liquid chromatography mass spectrometers, and a full complement of additional chromatographic and structure elucidation instruments. The biological screening facilities permit cellular, biochemical, and microbiological assays that can be conducted in a relatively high throughput fashion. The greenhouses, experimental beds, field plots, and analytical labs afford infrastructure for detailed agronomic or

horticultural studies of medicinal plants. Finally, facilities for scaling up extraction and isolation procedures allow developmental studies for commercial applications. In short, the NCNPR and the associated departments in the School of Pharmacy have virtually any technological component required in the study of the chemistry and biology of natural products, and are staffed by a cohort of creative and highly motivated faculty and scientists in pharmacognosy, medicinal chemistry, pharmacology, and pharmaceuticals. The NCNPR is an excellent example of how one can intentionally design a research facility in Mississippi to further build upon an area of existing expertise. This model began with a pre-existing pool of talented researchers with an established reputation for excellence, and then added capital resources to allow these researchers to continue conducting the highest quality research possible. While state funding for the NCNPR is still at the 1995 level, the operating budget has increased approximately four-fold, and the staff has increased from 24 employees in 1995 to 85 employees today. Furthermore, two private businesses are now operating in Oxford largely because of the NCNPR's attractive "critical mass" quality, and several other biotechnology, pharmaceutical and start-up companies are seriously contemplating a decision to locate their businesses in Oxford. Thus, this research center has a positive impact on the local economy, both directly and indirectly. So now we move on to the next question: How do we build a nationally competitive research program in an area in which Mississippi has limited expertise?

THE UNIVERSITY OF MISSISSIPPI MEDICAL CENTER CANCER INSTITUTE

The University of Mississippi Medical Center Cancer Institute (UMMCCI) is a bold new initiative which proposes to remedy the statewide problem of cancer by forging new therapies from scientific discoveries yet to be made. It is estimated that 15,120 Mississippians will be newly diagnosed with cancer (excluding basal and squamous cell skin cancers and non-bladder carcinomas *in situ*) in 2004, and that 6,230 people in our state will die from cancer in 2004 (American Cancer Society, 2004). The total economic burden of cancer on the nation was \$143.5 billion in 1996 (National Cancer Institute, 2004). Cancer provides the best example of how science and technology converge in biomedicine, because so many scientific and engineering disciplines must be

seamlessly integrated in the effort to understand, prevent, diagnose and treat cancers. The recognition that cancer is a disease rooted in genetic instability came after years of collaborative research conducted by geneticists, biophysicists, developmental biologists, analytical chemists and epidemiologists. Pharmacologists, molecular biologists, medicinal chemists, oncologists, X-ray crystallographers, and veterinarians have worked together as teams to develop novel molecularly-targeted drugs such as imatinib (Gleevec®), the first small molecule targeted protein-tyrosine kinase inhibitor to be used in cancer chemotherapy (Smith et al., 2004). The development of advanced technology used to diagnose and treat cancer patients, such as positron emission tomography (PET), required the work of nuclear physicists, materials scientists, electrical engineers, computer scientists and mathematicians in cooperation with biological scientists. The “high technology” of physics will continue to improve cancer therapy, as illustrated by new technologies being developed at the UMMC. These include computer tomography (CT)-guided radiofrequency ablation of lung tumors (Steinke et al., 2004) and magnetic resonance image-guided cryoablation of renal tumors (Sewell et al., 2003).

The UMMCCI should not only become the state’s preeminent site of cancer-related science and technology development, but a competitive national force as well. If Mississippians can identify the critical scientific questions that have not been successfully answered, and develop new and broadly affordable diagnostic and therapeutic technology, then our state can lead the field of oncology in the 21st century. Here are a few of the challenges that face Mississippi’s cancer research community.

- (1) How can we effectively and affordably diagnose all cancers at their earliest identifiable stage?
- (2) How do we predict the therapeutic regimen that will most likely lead to a successful outcome for any given patient?
- (3) How can we overcome therapeutic (i.e., chemotherapy or radiation) resistance mechanisms?
- (4) How can we prevent metastasis?
- (5) How can we prevent cancers?

A few points should be considered to put these questions into the proper perspective. Each

unique human genetic script is written in 3 billion DNA base pairs on 46 chromosomes (22 pairs of autosomal chromosomes and 2 sex chromosomes). As a fertilized human egg divides and differentiates into the approximate 50 trillion cells that comprise the adult human body, the genetic script is selectively expressed in these individual cells. Accordingly, the identity of each cell is largely defined by a network of approximately 30,000 to 40,000 proteins which must function together in a well-coordinated fashion. Given the magnitude of events that must be carefully orchestrated for a human to properly develop and live healthfully, there are numerous possible molecular defects that can serve as entry points for the development of cancer (Kinzler and Vogelstein, 1996; Hanahan and Weinberg, 2000).

With such a dizzying array of possible molecular causes of cancer, how does one begin to address the five major challenges listed above? One unifying answer may be found in the area of molecular diagnostics, which relates to the field of functional genomics. Gene microarray technology (Skena, et al., 1995) is based on the simple and well-established principle of complementary DNA strand hybridization (Perry et al., 1964). The application of multi-color fluorescent labels, together with improvements in microfluidics, high-speed robotics, high spatial resolution image analysis, and the availability of a well-annotated human genome have combined to make it possible to determine simultaneously the relative expression pattern of over 19,000 characterized and unknown human ESTs (expressed sequence tags). One of the immediate applications of this technology was to determine the changes in gene expression upon the experimental suppression of tumorigenicity in a human melanoma cell line (DeRisi et al., 1996). Since then, approximately 37% of the nearly 5,000 manuscripts discussing gene microarray experiments have been related to cancer research.

This genomic information can be further enriched by combining it with data from proteomic experiments (Liotta and Petricoin, 2000). In contrast to the well-established use of complementary DNA hybridization as the fundamental consensus technology for genomics, the technology of choice for proteomics is still evolving. The future of proteomics may involve immobilized microchip arrays of monoclonal antibodies or polynucleotide aptamers as sensitive and selective biosensors (Brody et al., 1999), or it may involve the analysis of mass spectroscopy ion signatures (Geho et al., 2004; Schwartz

et al., 2004). Protein profiles taken from peripheral blood samples may soon provide new ways to detect early-stage cancers. The identification of novel tumor markers from proteomic studies may lead to the development of novel monoclonal antibodies for immunohistochemical confirmation of suspected tumor biopsies or for cancer therapy. Another likely outcome of proteomic studies of early stage cancers will be the development of marker-specific radio-tracers for positron emission tomography (PET) imaging (Collier et al., 2002) to locate the tumor and assess the extent of disease.

In the opinion of the authors, Mississippi has some of the most dedicated and talented medical personnel that can be found anywhere in the nation. However, because Mississippi has so few basic scientists involved in well-funded cancer research, the model for building a successful basic research program at the UMMCCI cannot simply follow the model of the NCNPR. The recruitment and retention of human resources, in addition to the acquisition of technological hardware, is vital to the success of the UMMCCI. A key milestone will be to increase substantially the amount of peer-reviewed research activities funded by the National Cancer Institute. The statewide distribution of new NCI grants is presented in Figure 4, and there is a tremendous chasm between the low (one grant) and high (752 grants) values. Spearman correlation analysis of the data in Table 1 provides an interesting twist to the patterns observed thus far. The number of new NCI grants is most strongly correlated to the total number of PubMed citations ($r_s = 0.942$, $P = 0.000$) and to the number of PhD scientists ($r_s = 0.927$, $P = 0.000$). The correlations to number of “high profile” publications ($r_s = 0.908$, $P = 0.000$) and current NAS members ($r_s = 0.857$, $P = 0.000$) are both marginally weaker. One must exercise caution when interpreting these results. For example, highly respected specialized cancer research journals might provide a stronger Spearman correlation value than the “high profile” journals we selected. Similarly, the number of National Academy of Sciences members with oncology-related scientific disciplines might have provided a stronger correlation value than the analysis based on all NAS members. With such caveats in mind, it appears that the amount of scientific effort might be the most important factor in the procurement of peer-reviewed NCI grants.

This observation does not imply that shoddy efforts will receive peer-reviewed funding. It does suggest that we can pursue the goal of establishing

the UMMCCI’s basic science program concurrently with our efforts to raise the caliber of scientific activity within our state. It is important to remember that the “quality” of human endeavors is not a fixed determinant, but that “quality” is malleable and can change over time. For this reason, researchers who have a reputation of producing high quality research can never rest on their laurels, and less-acclaimed researchers can dramatically improve their reputations by designing clever experiments which yield novel discoveries.

The basic research program of the UMMCCI will require a substantial investment of capital equipment and facilities in order to provide the technological resources to conduct competitive research. Whole animal imaging systems, laser capture microdissection tools, high-throughput DNA sequencing capability, and cell and tissue repositories will be needed by cancer researchers regardless of their individual specialties. Yet the most important component of building the basic research program will be an aggressive, multi-level personnel development effort. The UMMC has a relatively small, but exceptionally talented pool of clinicians who provide a pre-existent collection of potential collaborators for translational research projects. In order for the translational bridge to be completed, however, the pillars of basic cancer research must be equally well-grounded. While Mississippi has many excellent basic scientists, many have left the state for more lucrative positions elsewhere. Those expatriate scientists often left with an intact and active research program in tow, so the “brain drain” must be corrected or we will continue to lose some of our most talented individuals. Moreover, new investigators must be given an adequate start-up package, including equipment, support staff, “protected time” for research and a reasonable budget for materials and supplies that will provide them with a few years of productive research to become competitive researchers. Finally, we must recruit a small cluster of nationally recognized, high-quality researchers. Such individuals will not only be essential to rapidly building a well-funded basic science program, but they will also serve as magnets to attract other researchers at the post-doctoral and graduate student level. The late Arthur C. Guyton, an exceptionally distinguished researcher and educator who was once president of the Mississippi Academy of Sciences, was such a magnet in the Department of Physiology and Biophysics at the University of Mississippi Medical Center (Hall et al., 2003). The presence of

such individuals will make it easier to recruit other nationally competitive researchers, because they will stand as proof of Mississippi's commitment to high quality research, and they will also serve as the epicenter of the UMMCCI's critical scientific mass.

CONCLUDING REMARKS

It is incumbent upon the scientific community (i.e., the membership of the Mississippi Academy of Sciences) to raise public awareness as to why it is in the best interests of the State to support high quality scientific ventures. As scientists, we are obligated to present our arguments truthfully and without distorting the facts to curry support. We must do a better job of raising the level of scientific literacy in Mississippi to improve statewide public support for science, and we must redouble our efforts to attract private sector support. But perhaps most importantly, we should not forget that we, the scientific community, are the most important ingredient in any recipe for the advancement of science in Mississippi. When planning for Mississippi's future in biomedicine, we should remember that the finest incubator in the world won't hatch any chickens if we forget the eggs. This is as true for science as it is for poultry farming.

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AGRICULTURE AND PLANT SCIENCE

Chair: O.P. Vadhwa, Alcorn State University
Vice-chair: David Kingery, Mississippi State
University

THURSDAY MORNING

Classroom A

8:30 RESPONSE OF SOIL MICROBIAL COMMUNITIES AND PROCESSES TO WINTER FLOODING

Melanie Patterson^{1*}, Robert M. Zablotowicz¹, Mark A. Weaver¹, Clifford H. Koger¹, and Joseph Wahome², ¹USDA-ARS, Stoneville, MS 38776 and ²Mississippi Valley State University, Itta Bena, MS 3894

Flooding of rice fields following harvest has potential to enhance rice straw degradation, control weeds, provide waterfowl habitat, and reduce soil loss. This study assessed the effects of winter flooding of a rice field on soil microbial communities and processes. Flooded plots maintained 10 cm of standing water from October 2003 to March 2004 and were compared to non-flooded plots receiving only rainfall. Soils (0 to 2.5 cm) were sampled monthly and were analyzed for extractable anions, total carbon, and nitrogen. Biological parameters evaluated included two soil enzyme assays (fluorescein diacetate hydrolysis (FDA) and triphenyl tetrazolium chloride dehydrogenase) and soil community analysis by fatty acid methyl ester (FAME). Following flooding, soil redox potential in flooded plots was below -100 mV and greater than 100 mV in non-flooded plots. Nitrate was rapidly depleted in flooded soils with subsequent accumulation of acetic acid, indicating fermentative metabolism of organic substrates. Flooded soil dehydrogenase activity was 51 to 330% greater ($p > 0.01$) than non-flooded soil, while FDA activity was greater in flooded soil in only three of seven sampling dates. Microbial community structure (FAME analysis) indicated a significant shift in response to flooding, e.g., decreased fungal and gram-negative biomarkers, and increased gram-positive FAMES. In April only 30% of the straw in the non-flooded plots was degraded compared to 60% in flooded plots. These data indicate that winter flooding rapidly alters microbial populations and activity while enhancing straw degradation. The role of anaerobic microbial processes accelerating straw degradation is being further investigated.

8:45 A WATER QUALITY SURVEY OF THE UPPER PEARL WATERSHED IN EAST-CENTRAL MISSISSIPPI

Mary Love Tagert^{*}, Joseph H. Massey, David R. Shaw, and M. Cade Smith, Mississippi State University, Mississippi State, MS 39762

To assess the current level of impairment by pesticides and sediment in the Upper Pearl River Basin (UPRB), grab samples were collected for pesticide analysis at seven United

States Geological Survey (USGS) gauged locations within the watershed. Depth-integrated water samples were also collected at three sites to be analyzed for total dissolved solids (TDS). Samples for pesticide analysis were collected weekly from May through August 2002, and monthly thereafter through May 2003. Samples for TDS analysis were collected from September 2001 through January 2003. Pesticide samples were extracted via Solid Phase Extraction (SPE), and analyzed for fifteen different pesticides using GC-MSD: triclopyr, 2,4-D, tebuthiuron, simazine, atrazine, metribuzin, alachlor, metolachlor, cyanazine, norflurazon, hexazinone, pendimethalin, DDT insecticide degradation product p,p'-DDE, diuron, and fluometuron. TDS samples were analyzed using a gravimetric method. Hexazinone was the most frequently detected compound, with 171 out of a possible 181 detections, followed by metolachlor, tebuthiuron, and atrazine. Metribuzin was the least detected compound, with 11 detections out of a potential 181 detections. TDS concentrations were highest at the Carthage site, which drains the largest area of the three sites sampled. Most concentrations were below Environmental Protection Agency (EPA) standards for pesticides and TDS in drinking water, and most were below current toxicity thresholds set for freshwater aquatic organisms.

9:00 RELATIONSHIPS BETWEEN PHOSPHORUS CONCENTRATIONS AND SOIL PROPERTIES IN AN AGRICULTURAL WATERSHED

Rachel Stout^{1*}, W.L. Kingery¹, M.S. Cox¹, P.D. Gerard¹, M. Lilly², and S. Depew², ¹Mississippi State University, Mississippi State, MS 39762 and ²USDA-NRCS, Jackson, MS 39269

Watershed characterization is central to the formulation of Total Maximum Daily Load (TMDL) parameters and simulation model parameters. The objective of this study was to combine Soil Survey Geographic Database (SSURGO) data with field data to determine correlations between soil phosphorus and soil properties such as clay percentages, slope, and permeability. Soil samples were collected along transects and across grids over approximately 600 acres at the Pontotoc Ridge/Flatwoods Branch Experiment Station. Detailed profile descriptions and basic soil characterizations were made for each transect core. Grid samples were collected at 0 to 6-inch depth and analyzed for weak acid-extractable, base-extractable, and total phosphorus (P). Acid-extractable P concentrations ranged from 0.7 to 985 mg P/kg soil, and from 1 to 289 mg P/kg soil for base-extractable P. Simple regression was used to correlate soil properties to P levels. The influence of land use/land cover and management history will also be presented.

9:15 TESTING THE EFFICACY OF NATURAL-BASED FUNGICIDES IN PLANTA

Maritza Abril^{1*}, Kenneth J. Curry¹, David E. Wedge², and Barbara J. Smith³, ¹University of Southern Mississippi, Hattiesburg, MS 39406; ²Natural Products Utilization Research Unit; USDA-ARS, University, MS 38677; and ³USDA-ARS, Small Fruits Research Station, Poplarville, MS 39470

Detached leaf trials were conducted challenging *Colletotrichum fragariae* isolate CF-75 with the experimental fungicides sampangine and CAY-1 and the commercial fungicide azoxystrobin all at concentrations of 625, 1250, and 2500 ppm. Leaves collected from strawberry (cv. Chandler) were

maintained by inserting the petiole into a small test tube containing water and inoculated either 24 hr before (pre) or 24 hr after (post) application of test compounds. Leaves were incubated at 100% RH for 48 hrs and evaluated for disease development 5 days after inoculation. The data were analyzed statistically using Statistical Analysis Systems (SAS) software. The pre-inoculation experiments generally did not stop disease symptoms from appearing. In the post inoculation treatments, Sampangine and azoxystrobin were effective at all concentrations, and CAY-1 was effective at 1250 and 2500 ppm only. Screening procedures are commonly assessed at the macroscopic or whole plant level while frequently neglecting the microscopic or (whole) fungal level. We developed a leaf-clearing technique to establish reproducible germination conditions. Most treatments in the pre-inoculation experiments showed large numbers of appressoria on the leaf surfaces as expected, since the fungi germinated before the fungicides were applied. Most of the post-inoculation treatments showed reduced numbers of germinated fungal spores. These three fungicides apparently stop fungal germination, but would not be effective as a curative fungicide against a fungus that had already invaded its host plant..

9:30 ASSESSMENT OF THE SENSITIVITY OF NATURAL-BASED AND COMMERCIAL FUNGICIDES AGAINST TARGETED PHYTOPATHOGENIC FUNGI

Maritza Abril¹*, David E. Wedge², and Kenneth J. Curry¹,
¹University of Southern Mississippi, Hattiesburg, MS 39406 and ²Natural Products Utilization Research Unit, USDA-ARS, University, MS 38677

The sensitivity of natural-based (sampangine, 4-bromosampangine, 4-methoxysampangine, benzo[4,5]sampangine, liriodenine Mel AMC-XIII-103, onychine, cryptolepine, and liriodenine CDH-II-37) and commercial fungicides (captan, kresoxim-methyl, fenhexamid, iprodione, benomyl, fenbuconazole, and cyprodinil) against economically important plant pathogenic fungi (*Botrytis cinerea*, *Colletotrichum acutatum*, *C. fragariae*, *C. gloeosporioides*, *Phomopsis obscurans*, and *P. viticola*) was determined by *in vitro* microtiter assays. The effects of these fungicides on the morphology of spore germination, germ tube elongation, and mycelial growth of all the fungal isolates challenged was analyzed by microscopic germination and morphology observations. Data obtained from the microtiter assays was supported by the results from the germination and morphology observations. Sampangine was the most effective compound of all the experimental fungicides tested. It inhibited fungal germination and further growth of *B. cinerea*, *C. acutatum*, *C. fragariae*, *C. gloeosporioides*, and *F. oxysporum*. *Colletotrichum acutatum* was the most resistant species and *C. gloeosporioides* was the most sensitive species to all the sampangine analogs tested. *Botrytis cinerea* was the most sensitive species to all the commercial fungicides tested. Sampangine efficacy is comparable to that of commercial fungicides and it also shows low phytotoxicity in strawberry plants. Potential benefits and broad spectrum antifungal activity exhibited by the natural-based fungicide, sampangine, makes it a promising candidate for further greenhouse testing and field studies.

9:45 FACTORS INFLUENCING RUNOFF OF PESTICIDES FROM WARM SEASON TURFGRASSES

Peter Ampim¹*, Joseph H. Massey¹, Barry Stewart¹, M. Cade Smith¹, Ashley Andrews¹, Alton Johnson², and Kelvin Armbrust³, ¹Mississippi State University, Mississippi State, MS 39762; ²Alcorn State University, Alcorn State, MS 39096; and ³Mississippi State Chemical Laboratory, Mississippi State, MS 39759

There is growing concern over the environmental fate of pesticides applied to turfgrasses. Of key interest is that pesticides used to maintain golf courses, home lawns etc., will pollute drinking water sources and impact human health. In addition, there is the possibility that elevated amounts of pesticides in water systems could impact the ecology of surface waters and health of wildlife. Understanding the fate of turf applied pesticides and predicting possible environmental concentrations requires knowledge of the factors affecting their movement or transport. This study was conducted using 2, 4-D (2, 4-dichlorophenoxy acetic acid), flutolanil (trifluoro-3'-isopropoxy-o-toluanilide) and chlorpyrifos (O, O-diethyl hexahydro-4, 7-methanoindene) applied at maximum label rates to two turfgrasses maintained as golf course and residential lawn on Brookville silty clay (fine montmorillonitic, thermic Aquic Chromudert). The turf species used were Tifway 419 bermuda grass (*Cynodon dactylon* [L] Pers. X *Cynodon transvalensis* Burt-Davy) and Meyer zoysia grass (*Zoysia japonica*). The plots were 3.65 m x 9.14 m in size and sloped at 3%. The plot arrangement is a split design. Simulated rainfall was applied to the plots to generate runoff within 24 hours of pesticide application. Runoff from the plots was collected at 5 minutes intervals for each simulation event. The average rates of rainfall applied in the two events under consideration were 4 and 1.87 ml h⁻¹ respectively. Water solubility of pesticide, sorption and runoff have been identified as factors influencing pesticide runoff from preliminary data obtained. It is expected other factors will be identified in future simulations.

10:00 DETECTION AND PREVENTION OF RASPBERRY CROWN BORER IN BLACKBERRIES

Edward Heard¹*, Frank Matta¹, and Blair Sampson¹, Mississippi State University, Mississippi State, MS 39762

The purpose of this research is to provide blackberry growers with effective methods of early detection and control of raspberry crown borer (RCB). Objectives are to trap male RCB adults using pheromone bait, monitoring populations of RCB living in soil outside infested crowns, and prevent spread of RCB from infested to nearby non-infested blackberries using applications of insecticide and entomopathogenic nematodes. Detailed procedures in conducting the experiment are outlined and initial test results are presented.

10:15 BREEDING VALUE AND ADOPTION OF DOMESTICATED TRAITS IN CULTIVATED CAPSICUM SPP

Ravi R. Chinthakuntla¹*, Frank Matta¹, Daniel Peterson¹, O.U. Reddy², and M.S. Rao³, ¹Mississippi State University, Mississippi State, MS 39762; ²West Virginia State University, Institute, WV 25112; and ³Alabama A&M University, Normal, AL 35762

The objectives of this research are to identify superior

pepper types with respect to horticultural characteristics, such as insect and disease resistance, yield and fruit characteristics, and to evaluate breeding germplasm by genotyping using microsatellites for estimation of diversity index. Preliminary results show that crossing success was higher within species compared to crossing between species. *Capsicum annuum* and *C. chinense* produced greater fruit yield. Most F1 progeny were more vigorous and produced greater yield than either parent. Southern blight was negligible on most F1 progeny, parent lines, and accessions. Microsatellite genotyping to estimate genetic diversity and validation of markers that are linked to various traits is in progress.

10:30 Break

10:45 DISTRIBUTION OF PHYTOPARASITIC NEMATODES OF COTTON IN THE YAZOO MISSISSIPPI DELTA

Julie A. Blessitt* and Gabe L. Sciumbato, Mississippi State University DREC, Stoneville, MS 38776

The three main parasitic nematodes of cotton in the Mississippi Delta are root-knot (*Meloidogyne incognita*), reniform (*Rotylenchulus reniformis*), and lance (*Hoplolaimus*). The root-knot nematode has traditionally been the most important. However, the reniform has increased in importance. Leflore, Sharkey, Coahoma, Tunica, Bolivar, Tallahatchie, Desoto, Marshall, Quitman, Sunflower, Washington, Humphreys, Holmes, Panola, and Yalobusha counties cotton acreage was randomly surveyed (approximately 10%) for nematodes. Soil samples were collected and their location referenced by GPS for future location. Nematodes were extracted using an elutriator with sugar flotation. Nematodes were identified and counted. Percent infestations of root-knot nematode ranged from 2% in Sharkey county to a high of 26% in Desoto county. Percent infestations of reniform nematode ranged from 3% in Desoto county to a high of 87% in Sharkey county. The lance nematode was found in a few locations. The acreage infested with the reniform nematode continues to increase from previous surveys. There are no commercial cotton varieties which are resistant to this nematode. Increased reniform infestation levels may in part explain "yield stagnation" recently observed in cotton production.

11:00 DEVELOPMENT OF MICROSATELLITE MARKERS FOR *ABIES FRASERI* FIR, THE COMMERCIAL CHRISTMAS TREE

Joseph A. Bowen¹*, C. Dana Nelson², Judith Williams¹, and Glen Johnson², ¹University of Southern Mississippi, Gulf Coast Research Laboratory, Ocean Springs, MS 39564 and ²Southern Institute of Forest Genetics, Harrison Experimental Forest, Saucier, MS 39574

The *Abies fraseri* fir and *A. balsamea* are two of the most important commercial fir trees (Christmas trees). In recent years they have come under extreme ecological and environmental pressure and as a result their populations are in decline. The objective of this study was to examine the potential benefits that DNA markers offer in the development of resistant fir species. These markers originated from cloned intershort sequence repeat polymerase chain reactions (PCR), which enrich medium to highly repetitive DNA sequences. In total, 20

markers were isolated, eighteen of which were polymorphic or monomorphic. These markers can subsequently be applied to study populations of *Abies fraseri* fir. The aim of this project was therefore to develop co-dominant DNA markers that would make it possible to analyze populations of the fir at considerably higher levels of resolution than was previously possible. This technique makes possible screening for cloned intershort sequence repeat polymerase chain reactions (PCR) an unknown number of loci. Genomic DNA was extracted from sixteen *A. fraseri* fir needle samples, and an intershort sequence repeat (ISSR) polymerase chain reaction was performed on extracted DNA using twenty different ISSR primers. Amplification products were used to isolate specific microsatellite DNA. Specific primers were designed to flank medium repetitive sequences present in several inserts, and were used to amplify the loci from genomic DNA of the original *Abies fraseri* fir. In this study, we have succeeded in developing eighteen primer sets that amplify loci from *A. fraseri* fir and *A. balsamea*. All eighteen of these primer sets have been used to amplify polymorphic and monomorphic loci from genomic DNA of *A. fraseri* fir and *A. balsamea*.

11:15 RESISTANCE OF ENTRIES IN THE MISSISSIPPI SOYBEAN VARIETY TRIALS TO PURPLE POD ROT CAUSED BY *CERCOSPORA KIKUCHII*

Bonnie B. Cook* and Gabe L. Sciumbato, Mississippi State University, DREC, Stoneville, MS 38776

Cercospora kikuchii attacks the seed, leaves, and pods of soybean plants leading to decreased seed quality and potential yield losses. A variety may be resistant to leaf attack but susceptible to pod or seed disease. Pod disease can completely rot pods under warm, humid environmental conditions. Extended rainfall in 2002 during pod fill for Maturity Group IV soybeans proved very favorable to the development of pod disease. Entire fields of disease susceptible varieties were destroyed. A method was developed to determine the resistance of soybean varieties to purple pod rot caused by *Cercospora kikuchii*. Entries in the Mississippi Soybean Varietal Trials were evaluated for resistance to purple pod rot. Disease free pods in the R6 growth stage were detached, surface disinfected with sodium hypochloride, washed with sterile water, and placed in moist chambers. Ten pods were sprayed with sterile water as a check, and ten were sprayed with a suspension of *Cercospora kikuchii* for each variety. Pods were incubated at 30°C for seven days and evaluated for pod disease. Two hundred seventy-seven varieties were evaluated. Thirty-one varieties were susceptible to purple pod rot, while 185 varieties were resistant. Sixty-one varieties were moderately resistant to moderately susceptible to pod disease. Varieties having moderately resistant to susceptible ratings could have significant yield losses due to disease under the right environmental conditions.

11:30 Divisional Poster Session

DUPLICITY OF PLANTS IN NUTRIENT UPTAKE WITHIN AGRICULTURAL DRAINAGE DITCHES

Robert Kroger^{1*}, Marjorie M. Holland¹, Matt T. Moore², and Charlie M. Cooper², ¹University of Mississippi, University, MS 38677 and ²USDA-ARS, National Sedimentation Laboratory, Oxford, MS 38655

Agriculture drainage ditches are primary intercept wetlands in the amelioration of nutrient pollution from agricultural fields. Amelioration of nutrient pollution has wide reaching consequences on receiving water pollution and possibly implications for aquatic community structure and Gulf of Mexico hypoxia. Drainage ditches, as integral components of the agricultural landscape, remove surface run-off and act as major conduits of nutrients from agricultural lands to receiving waters. These ditches are prolifically abundant in wetland plants, providing additional surface area for microbial interactions as well as acting in a small, yet important assimilatory capacity. However, their assimilatory function is negated in winter with seasonal die-back and the release of assimilated nutrients into the system. The additional lack of cover, in a winter rainfall area allows faster water movement in the ditch. We tested the hypotheses of whether plants given the opportunity will firstly assimilate higher concentrations of nutrients, such as nitrogen and phosphorus, and whether with subsequent decomposition these concentrations are released back into the water column. Given the opportunity *Leersia oryzoides*, a dominant wetland ditch plant species, will assimilate significantly higher concentrations of nitrogen ($p > 0.05$) and phosphorus ($p > 0.001$) in above and belowground biomass. Subsequently, the senescence of aboveground biomass yields significantly higher levels of phosphorus and for longer periods of time. However, there were no significant differences in nitrate and nitrite levels which suggests that denitrification and microbial processes were removing these products from the system.

IMPROVING WATER USE EFFICIENCY IN RICE PRODUCTION USING MULTIPLE-INLET PLUS INTERMITTENT IRRIGATION HAS ENVIRONMENTAL BENEFITS

Ashley Andrews^{1*}, Joseph H. Massey¹, M. Cade Smith¹, Alton Johnson², Jim Thomas¹, and Peter Ampim¹, ¹Mississippi State University, Mississippi State, MS 39762 and ²Alcorn State University, Alcorn State, MS 39096

The depth of the alluvial aquifer in the Mississippi Delta has been declining, on average, 27 cm yr⁻¹ (10.5 in yr⁻¹) due primarily to the irrigation of row crops. Conventional rice irrigation involves flooding each rice paddy individually. As one paddy fills with water, the water overflows into the next lower paddy. This approach results in less rain holding capacity and the potential for water, as well as pesticides, to runoff the field. A new irrigation approach being investigated in this project involves multiple-inlet distribution of irrigation water coupled with intermittent irrigation techniques first investigated in Asia. Multiple-inlet irrigation allows each paddy to be filled at the same time and the water levels to be more closely regulated. Unlike conventional rice irrigation techniques, intermittent irrigation actually allows water levels in the rice paddies to naturally decline until one-half of the soil surface is

exposed in the upper portions of the paddies. Preliminary field studies show that multiple inlet plus intermittent irrigation reduces water use in rice by ca. 50% with little difference in yield. By increasing the rainfall holding capacities of rice paddies, non-point source pollution from rice fields should also be reduced. As rice irrigation practices are made more efficient through careful planning and management, a number of environmental benefits could also occur.

FEEDING FREQUENCY, MULTIPLE STOCKING DENSITIES, AND THE EFFECT ON CELL GROWTH RATE OF TAHITIAN *ISOCHRYSIS* SP.

Jill Zednick* and Jeffrey M. Lotz, University of Southern Mississippi, Hattiesburg, MS 39406

The primary objective in culturing algae for aquaculture is to obtain the highest density in the shortest period of time. *Isochrysis* sp. is a popular alga in aquaculture because of its nutritional qualities allowing many marine animals to be grown to high densities in mass culture. The growth of an algal culture is denoted as a 'growth cycle' and is usually described by a sigmoid curve. The University of Southern Mississippi Department of Coastal Sciences executes mass cultures of Tahitian *Isochrysis* sp. at their Cedar Point aquaculture facility as food for *Acartia tonsa*. A two part experiment was conducted over a 14 day period to determine if there was any effect of number of feedings per day on Tahitian *Isochrysis* sp. cell density and if various inoculation densities resulted in different cell mass over a seven day period. Algal culture vessels used in these experiments consisted of 20L food grade plastic bags. Culture vessels were exposed to continuous lighting consisting of fluorescent and metal halide. Aeration was also continuous with the addition of carbon dioxide at a rate of approximately 5–10 PSI every five minutes for a seven second duration. Temperature and salinity were maintained at 22 ± 2 °C, and 25 ± 1 ppt respectively. The effect of number of feedings on cell density was determined as not significantly different from the control (ANOVA: ($F_{2,5} = 1.142$, $p = 0.390$) and the observed division rates for each of the three inoculation densities generated similar trends in growth over the seven day study period.

EFFECT OF OZONE ON THE QUALITY OF MINCED CHUB MACKEREL

Susan DeBlanc* and L.S. Andrews, Mississippi State University, Mississippi State, MS 39762

Chub Mackerel (*Scomber japonicus*) is an abundant and underutilized fish in North America. It may have potential for production of mince-based products or surimi. The primary objective of this study was to evaluate the effects of ozone treatments at varying time intervals. We compared the composition, color and microbial quality of fish mince treated with an ozonizer. Moisture content was higher (80%) in ozone washed mince than (77%) raw mince. The protein and fat contents were lower in ozone washed 60 minutes mince compared to raw mince (18% and 1.7% vs. 20% and 2.2%). The ash content was higher (2.3%) in raw mince than in ozone treated (.2%–.3%). The color of raw mince (Hunter color meter model CR10) L-value 30.1, a-value 3.4, and b-value of 6.1 vs L-value 48.8, a-value 1.1, and b-value of 11.8 for ozone washed mince of 40 minutes. Microbiological quality, growth of spoilage bacteria,

was slightly reduced with ozone washed 40 minutes over the raw fish mince using aerobic plate counts (APC) and psychrotrophic plate counts (PPC). Studies will continue on the effect of pH and ozone on fish mince to lighten color to improve consumer acceptability.

ROLE OF *RHIZOCTONIA SOLANI* AND *PYTHIUM* SP. IN THE SEEDLING DISEASE COMPLEX OF COTTON AND EFFICACY OF DIFFERENT METHODS OF FUNGICIDE APPLICATION FOR THEIR CONTROL

Brewer Blessitt^{1*}, Gabe L. Sciumbato¹, and Allen Henn², ¹Mississippi State University, DREC, Stoneville, MS 38776 and ²MCES, Starkville, MS 39769

Cottonseed, (variety DP45 1 BR) were inoculated at planting with *Rhizoctonia solani*, *Pythium* sp. and a combination of both fungi. Three different methods of fungicide application (seed treatment Baytan, Thiran, Lorsban 30FL, Apron-FL; hopper-box DeltaCoat 11.75 oz/cwt; and in-furrow Terraclor Super X 18.8 G, 7 lb/A) were evaluated for their efficacy in control of diseases. Experimental design was a randomized complete block with factorial arrangement of treatments. Treatments were replicated four times. Stand counts were made 4 weeks after planting and yield data were collected. Plots which were not inoculated had the highest average seedling stands (78.9% at 4 weeks) and seed cotton yields (3634 lb per acre) of the inoculation factor plots. In the 2 years, trial inoculation with *Rhizoctonia* reduced stands by an average of 65.2% and seed cotton yields by an average of 865 lb/A. *Pythium* reduced stands by an average of 29.8% and seed cotton yield by an average of 171 lb/A. Untreated seed had the lowest average stand counts at 40.3% at 4 weeks and the lowest seed cotton yields of 2844.2 lb/A. followed by the fungicide seed treatment only. The hopper-box had the next lowest stand count at 55.2% and a yield of 3636.9 lb seed cotton/A. The in-furrow, of the fungicide factor plots, had the highest stand at 63.7% and a yield of 3634.8 lb seed cotton/A. This research has shown that inoculation with *Rhizoctonia solani* or a mixture of both fungi causes highest stand losses and in-furrow sprays are the most effective method of controlling the diseases.

ESTIMATION OF FLAVONOL AND FLAVONE CONTENT OF WATERLEAF, PURSLANE, BASIL, CARROT, AND CORN USING ALUMINUM CHLORIDE COLORIMETRIC METHOD AND HPLC

Sandra L. Barnes*, Sheila A. Sanders, Johnnie Gibbs, Peter B. Ojung, and Shashank Kulkarni, Alcorn State University, Alcorn State, MS 39096

The flavonoid content of many vegetable crops has not been reported. In this study, the aluminum chloride colorimetric method was used to determine the total flavonol and flavone content of six vegetable crops or herbs: waterleaf, purslane, basil, carrot, and corn. High performance liquid chromatography (HPLC) was used to determine the presence or absence of specific flavonols (quercetin and kaempferol) and flavones (apigenin and leuteolin). Results show that waterleaf contains a very large amount of total flavonols and flavones, 25-31% dry weight. Purslane, basil, carrot, and corn contained 6.5-6.9%, 5.6-6.9%, 3.4-4.1%, and 1.2-1.8%, respectively. High amounts of quercetin were found in waterleaf, purslane, and carrots by HPLC.

CHELATE-INDUCED PHYTOEXTRACTION OF LEAD-CONTAMINATED SOILS BY TALL FESCUE (*FESTUCA ARUNDINACEA* SCHREB.)

Gloria Miller*, Maria Begonia, Gregorio Begonia, and Darla C. Gilliard, Jackson State University, Jackson, MS 39217

Preliminary studies indicated that tall fescue (*Festuca arundinacea* cv. Spirit) can tolerate and accumulate significant amounts of lead (Pb) in its shoots when grown in Pb-amended sand. To further evaluate the suitability of this species for phytoextraction, a study was conducted to determine whether the addition of ethylene-diamine-tetra-acetic acid (EDTA) alone or in combination with acetic acid can further enhance the translocation of Pb to the shoot. Seeds were planted in plastic pots containing soil, peat, and sand spiked with various levels (0, 1000, 2000 mg Pb/kg dry soil) of lead. Six weeks after planting, aqueous solutions (0.5 mmol/kg dry soil) of EDTA and acetic acid were applied to the root zone, and all plants were harvested a week later. Results revealed that tall fescue was relatively tolerant to moderate levels of Pb as shown by nonsignificant differences in root and shoot biomass among treatments. However, there was a slight reduction in root and shoot biomass of plants exposed to the highest Pb level in combination with the two chelates. Root Pb concentrations increased with increasing levels of soil-applied Pb. Further increases in root Pb concentrations were attributed to chelate amendments. Translocation index was significantly enhanced with chelate addition especially when both EDTA and acetic acid were used. Chelate-induced increases in translocation indices led to higher shoot Pb concentrations.

EVALUATION OF DIFFERENT CULTIVARS OF EGG-PLANT (*SOLANUM MELONGENA*) FOR PRODUCTION POTENTIAL

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Six Different cultivars of eggplant (*Solanum melongena*) were evaluated for their production potential. Cultivars included were Nisha, Preeti, Kokila and Krishna from India. A Japanese cultivar, Ichiban, and American eggplant, Black Beauty, were also included in this study. Eggplant seeds were planted in the greenhouse and the seedlings produced were planted in the field on May 11, 2004. Seedlings were planted .60 meter apart in rows which were set .9 meter apart. Five plants per plot for each cultivar were used to collect yield data. Each treatment was replicated four times. Maximum yield was produced by cultivar Krishna, followed by Nisha, Black Beauty, and Kokila. Japanese cultivar, Ichiban, was least productive. First harvest of eggplants was July 6, 2004 (55 days after transplanting) and last harvest was Nov. 11, 2004.

RICE YIELD RESPONSES TO NITROGEN FERTILIZATION RATES APPLIED AT EARLY VEGETATIVE GROWTH STAGES

B.C. Owens^{1*}, W.L. Kingery¹, and T.W. Walker², ¹Mississippi State University, Mississippi State, MS 39762 and ²Delta Research and Extension Center, Stoneville, MS 38776

Rice response to nitrogen fertilization is affected by soil type and crop management. Furthermore, rice has been

shown to respond to nitrogen applications at two important growth stages, namely early vegetative and reproductive. This study was conducted to determine the optimum rate of nitrogen that should be applied at the early vegetative stage. This corresponds to the period prior to the normal cultural practice of flooding the rice crop. Yield response curves were developed using four pre-flood nitrogen application rates on plots established on two different soil types in the Mississippi 'Delta.' Four rice varieties were evaluated. Treatment effects and the influence of soil and climatic factors on yield will be presented.

RELATIONSHIPS BETWEEN IRON CONTENT, SOIL MORPHOLOGY AND WATER TABLE DEPTH FOR AN ALFISOL IN THE MISSISSIPPI RIVER ALLUVIAL FLOODPLAIN

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Groundwater levels and water table fluctuations are routinely estimated by soil scientists from a soil's morphology, mainly the soil color. A significant portion of soil colors are related to the presence or absence of iron. Gray colors are associated with saturated and chemically reducing soil environments, while yellowish-brown colors are due to aerobic and chemically oxidizing conditions. Soils without excess water during the year usually are aerated and yellowish-brown-colored. Those with high water tables during some part of the season exhibit gray coloration at the depth of the high water mark and below. In order to evaluate the usefulness of soil classification for assessing the soil-water state, water table measurements were made in an alfisol in the Mississippi River alluvial floodplain. Soil profile descriptions, including redoximorphic features, were performed. Total, ammonium oxalate-extractable, and dithionite-citrate-extractable iron concentrations were measured on soil samples collected at 7.5-cm intervals from the surface to a depth of 2 meters. This paper describes the relationships between water table depths and duration, soil colors and the distribution of iron content. Environmental conditions affecting soil color formation and implications of soil morphological criteria in determining water table characteristics will be discussed.

A NOVEL APPROACH TO DETERMINE ATTACHMENT STRENGTH OF SELECTED FOODBORNE PATHOGENS

Taejo Kim* and Juan L. Silva, Mississippi State University, Mississippi State, MS 39762

Most methods for quantifying viable cells in biofilms use swabbing, shaking or mild sonication. These result in large errors. The objective of this study was to measure the in vitro attachment of selected pathogenic microorganisms by a novel method. The Blot succession method used coverslips colonized with pathogens in tryptic soy broth that were blotted onto a tryptic soy agar plate for one minute. The process was repeated through a succession of agar plates. The mini-column method used colonized glass beads that were packed in a column. The packed column was attached to a fraction collector with 10 test tubes (10 fractions) and filled with PBS buffer (pH 7.0). In all instances, the number of recovered colonies per plate or fraction decreased exponentially with plate succession number. It is our proposition that the removal exponent from both

methods could be used as a simple, inexpensive and effective measure of the strength of attachment grown under different environmental conditions. These methods will prove useful in the design of treatment regimes for surface hygiene and in the selection of suitable materials.

PATHOGENS AND SPOILAGE BACTERIA OF CATFISH FILLETS AS AFFECTED BY LOW-DOSE X-RAY IRRADIATION

Somsamorn Gawborisut* and Juan L. Silva, Mississippi State University, Mississippi State, MS 39762

A number of researchers have reported that low-dose irradiation could improve safety and shelf-life of various species of fish. X-rays are commonly used in hospitals, but this technology has recently been developed with enough intensity and penetration to process a variety of foods on a commercial scale. The effect of low-dose, x-ray irradiation (0, 2, and 3 kGy) on inoculated pathogens (*Listeria monocytogenes*, Lm and *Salmonella* Thyphimurium, ST) and natural spoilage bacteria (psychrotrophic bacteria: PPC, anaerobic bacteria: AA, and lactic acid bacteria: LAB) of catfish fillets was studied over the experimental period of 24 d. The irradiation doses of 2 and 3 kGy eliminated Lm and ST which were inoculated onto catfish fillets at levels of 4.8 and 4.7 log CFU/g, respectively. There was no recovery of either pathogen from fillets for the experimental period. Doses of 2 and 3 kGy reduced populations of psychrotrophs by 46%, aerobes by 62%, and lactic acid bacteria by 68%. Further post-irradiation reductions of spoilage bacteria were observed. This might be attributed to further death of injured cells. Spoilage bacteria, which were enumerated from catfish fillets treated with 2 kGy irradiation, regained their growth after 16 d of storage, but those obtained from catfish fillets exposed to 3 kGy could not restore their growth throughout the experimental period. Shelf-life of catfish fillets exposed to 2 or 3 kGy irradiation could be extended by more than 24 d at 2 °C, with the added safety of possibly eliminating pathogens.

HIGH TEMPERATURE STORAGE SHELF-LIFE OF FRESH CATFISH FILLETS

Youkai Lu*, Juan L. Silva, and Taejo Kim, Mississippi State University, Mississippi State, MS 39762

Temperature abuse is the main factor responsible for shelf-life and spoilage of catfish fillets. Including handling abuse due to temperature in shelf-life models is very important. The objective of this experiment was to study the shelf-life and spoilage pattern of fresh catfish fillets stored at 10 °C and 20 °C. Fresh catfish fillets were packed in polyethylene bags and stored at 10 °C and 20 °C. Each six to twelve hours, microbiological quality, sensory assessment and water holding capacity of stored fillets were examined. Aerobic (APC) and psychrotrophic (PPC) plate counts of fresh catfish fillets stored at 10 °C had a lag phase of 24 h. The APC and PPC of fillets stored at 20 °C had no lag phase and grew immediately. Sensory descriptions indicated that fresh catfish fillets stored at 20 °C lost acceptability in 18–24 h whereas those stored at 10 °C lost acceptability in 72 h. Spoilage of catfish fillets stored at both temperatures was reached when APC and PPC levels reached 10⁸ CFU/g. The percentage of shrinkage of fillets increased with storage time (lower water holding capacity), but the values

varied greatly on individual fillets.

THURSDAY AFTERNOON

Classroom A

2:00 OFF-FLAVOR INTERVENTION FOR PROCESSED CATFISH FILLETS

Chonthida Kaewplang*, Juan L. Silva, and Taejo Kim, Mississippi State University, Mississippi State, MS 39762

2-methylisoborneol (MIB) (musty) and geosmin (earthy), which are fat-soluble off-flavor compounds found throughout catfish (*Ictalurus punctatus*) muscle, reduce consumer acceptability of catfish products. About 50% of the ponds could be off flavor during the warm months. The objective of this experiment was to decrease or eliminate off-flavor in catfish during processing. Diffusion studies, using 0.5% H₂O₂ as the oxidation substance (dipping, injecting and tumbling) showed that there were no differences ($p > 0.05$). Thus, dipping was selected as the simplest method to carry out the screening of off-flavor reducing substances. The effect of carbonated drinks (Sprite Seven-up and commercial carbonated water) on off-flavor of catfish fillets was investigated then. Sensory evaluation, based on intensity of off-flavor was performed utilizing a 5-point hedonic scale. For smell of fresh fillets, control and commercial carbonated water were not significantly different, while Sprite and Seven-up lowered off-flavor ($p > 0.05$). Similar results were observed on cooked fillets. Seven-up provided the best ($p < 0.05$) result compared to control, commercial carbonated water, and Sprite. The high intensity citrus aroma (lemon, lime), was noted in Seven-up followed by Sprite and helps mask the off flavor while adding a pleasant flavor. Therefore, Seven-up (or a formulation derived from it) can be used to decrease the off-flavor of catfish fillets.

2:15 USING RESPONSE SURFACE METHODOLOGY TO OPTIMIZE A CATFISH PRODUCT

John McGillivray*, Juan L. Silva, Taejo Kim, Mark W. Scilling, Youkai Lu, Chonthida Kaewplang, Somsamorn Gawborisut, Jelena Stojanovic, Wei-chun Chen, and Sovann Kin, Mississippi State University, Mississippi State, MS 39762

Utilizing catfish (*Ictalurus punctatus*) nuggets and catfish mince, less popular parts of the catfish to make a reformed product will enhance the value of catfish. The objective of this research was to use response surface methodology to formulate a fish patty with optimum quality that consists of minced catfish and catfish nuggets. Frozen catfish nuggets were finely chopped for less than 10 sec. Both the mince and the nuggets were thawed and then mixed at ratios of 0, 50, and 100% (mince to nugget). These raw materials were then combined with 0%, 0.5%, 1% whey protein isolate (WPI), and mixed for 2, 4, 6 min in a food mixer along with 1% salt (NaCl) and 0.3% sodium tripolyphosphate (STPP). The patties were hand made with a patty maker mold so that each patty weighed approximately 70 g. Color, texture (shear and compression), water holding capacity, cook yield, and sensory ratings were collected based on a central composite design. The color of the patties tended to be lighter with higher WPC, and

patties mixed for six minutes tended to have higher shear and compression forces. Long mixing times increase extraction of salt-soluble proteins which in turn give strength to reformed muscle meat products.

2:30 SSR AMPLIFICATIONS FOR PEPPER GENOME CHARACTERIZATION

Preeti Kumar*, Umesh Reddy, and Padmavathi Nimmakayala, University of Mississippi, University, MS 38677 and West Virginia State University, Institute, WV 25112

Abundance of polymorphism in repeat motifs of genome is well documented in several plant and animal species. Such motifs, known as SSRs (Simple Sequence Repeats) or microsatellites, can be easily exploited as potential markers using modern PCR technologies. Saturation of *Capsicum* genetic maps with the SSRs will speed up mapping and further isolation of genes that are governing important traits. To date, microsatellites have not been used extensively in pepper, in part because of the complex and labor-intensive methods identifying microsatellites from large genomes. The genus *Capsicum* comprises > 30 species, among which, five major cultivated species (*C. annuum*, *C. chinense*, *C. frutescens*, *C. baccatum* and *C. pubescens*) are well known. In the present study we used 20 SSRs to detect polymorphisms between these types. The objective of the study is to understand the extent of gene flow with in the domesticated forms. Our study identified distinct diagnostic SSR alleles to identify various cultivated and wild taxa. The average number of alleles per microsatellite being 2 (range 2–4 alleles per locus), this class of markers appears to be highly polymorphic. Allelic diversity and polymorphism among various pepper types will be discussed.

3:00 Divisional Business Meeting and Awards

CELLULAR, MOLECULAR AND DEVELOPMENTAL BIOLOGY

Chair: Mary L. Haasch, University of Mississippi

Vice-chair: Stephen I.N. Ekunwe, Jackson State University

THURSDAY MORNING

Cedar Room

8:00 THIOESTERASE RIBOZYMES

Danning Huang* and Faqing Huang, University of Southern Mississippi, Hattiesburg, MS 39406

The theory of RNA World tries to describe an intermediate period between living system and non-living system. In a hypothesized RNA world, all essential biochemical reactions would have to be catalyzed by RNA enzymes, or so-called ribozymes. Many ribozymes with different activities have been isolated during the past decade. In our work, we are trying to link different ribozyme activities to construct metabolic pathways—RNA-based metabolic pathways. A series of

ribozyme activities involving coenzyme A (CoA) have been demonstrated in our laboratory. The current work expands such CoA-centered pathway by generating new ribozymes that can catalyze the hydrolysis of thioesters of CoA. Many different RNA sequences have been isolated that show thioesterase activities. These newly isolated ribozymes increase ribozyme repertoire, and demonstrate the plausibility of complex metabolic systems in the RNA world.

8:20 QUANTITATIVE ANALYSIS OF THE INTERACTION BETWEEN A CYCLIC AMPHIPATHIC PEPTIDE WITH LIPID MEMBRANES

Kelley Counts¹*, Peter Butko¹, Maria Ngu-Schwemlein², and Oluyemisi Adeyemi¹, ¹University of Southern Mississippi, Hattiesburg, MS 39406 and ²University of South Alabama, Mobile, AL 36688

In this work we studied the interaction of a synthetic amphipathic cyclic octapeptide Octa-1 with model lipid membranes. The hypothesis of this study is that the positively-charged Octa-1 will interact with membranes and that this interaction will be more significant with the membranes containing negatively-charged lipids. The hypothesis was tested using small unilamellar vesicles (SUV) made of egg 1,2-diacyl-sn-glycero-3-phosphocholine and L- α -phosphatidylglycerol in ratios of 10:0, 9:1, and 3:1. Octa-1 contains a single tryptophan residue, which was employed to determine the strength of the interaction, location and orientation of the membrane-bound peptide by fluorescence spectroscopy. Quantitative analysis of the data yielded values of the association constants for the peptide-lipid interaction. It was found that binding to the 10:0 and 9:1 SUV is well described by a single association constant, whereas binding to the 3:1 SUV requires two association constants. The second binding constant can be due to hydrophobic interaction between the nonpolar part of the peptide and the core of the lipid bilayer or due to aggregation of the peptide on the membrane. There is a strong correlation between the values of the association constant and the mole fraction of the negatively charged lipid. Results confirm that the electrostatics play a dominant role in the peptide-lipid interaction and provide a quantitative insight into the binding.

8:40 INTERACTION OF THE BT TOXIN Cyt1A WITH A LIPID MONOLAYER

Shalawn Clark¹*, Marianne Pusztai-Carey², and Peter Butko¹, ¹University of Southern Mississippi, Hattiesburg, MS 39406 and ²Case Western Reserve University, Cleveland, OH 44106

Cyt1A is a protein produced by *Bacillus thuringiensis* var. *israelensis*. In vitro, it exhibits cytolytic activity against a range of insect and mammalian cells; in vivo it acts specifically on cells of Diptera larvae. Previously we put forward a hypothesis that, interacting with phospholipids, Cyt1A may act as a detergent rather than a pore former. We used monolayers of 1,2-diacyl-sn-glycero-3-phosphocholine isolated from egg (PC) at air/water interface to monitor toxin-lipid interaction. Specifically we examined by Langmuir trough if Cyt1A inserts into the lipid monolayer, insertion is required for pore formation. As a positive control we used alpha-hemolysin, a toxin that, upon lowering the pH, is known to insert into the membrane and form pores. When alpha-hemolysin was placed in the subphase of the PC monolayer a 115% increase in the surface pressure

was observed upon lowering the pH, indicating the toxin inserted into the monolayer. A similar experiment was performed with Cyt1A injected into the subphase at the same toxin/lipid molar ratio and the same initial surface pressure of the lipid monolayer. An approximately 50% increase in the surface pressure was observed, with slower kinetics. No increase was observed with the negative control – cytochrome c. The slight increase in surface pressure from Cyt1A may be due to penetration between the lipid polar headgroups and not by insertion into the lipid monolayer.

9:00 UNKNOWN CALCIUM STORES IN MURINE MESENTERIC ARTERIOLE SMOOTH MUSCLE CELLS

Tamara Williams* and Sean M. Wilson, Mississippi University for Women, Columbus, MS 39701 and University of Mississippi, University, MS 38677

Calcium plays many important roles in cellular and bodily health including working as an intracellular signal for muscle contraction, secretion, and cell proliferation. Though much is known about calcium's role in the cell, much has yet to be learned. Antidotal evidence suggests that there are unstudied Ca^{2+} stores in mouse mesenteric arteriole smooth muscle cells. Data was collected and analyzed to determine the percentage of cytosolic calcium that is released from intracellular stores and how the store's Ca^{2+} release changes with aging. Cytosolic calcium was measured using techniques developed by Grynkiewicz et al. 1985. Isolated smooth muscle cells were loaded with Fura-2 AM, a fluorescent dye that binds to diatomic ions and has a high affinity for Ca^{2+} . A xenon arc lamp was used to illuminate the dye at wavelengths of 340 and 380 nm. Upon excitation, the cells emitted light that was collected by a CCD camera, which is part of a fluorescent imaging system mounted to an inverted microscope. The appropriate equations were then used to determine the amount of Ca^{2+} stored in various organelles of the cell. We found that Ca^{2+} from these potentially unstudied sources were present in the cell, and in older cells, the Ca^{2+} content was significantly greater than in younger cells.

9:20 Break

9:40 INHIBITION OF THE PALMITOYLATION OF THE RAS ONCOGENE IN YEAST CELLS

Tonya Dement¹*, Cheryl Budde², and Robert J. Deschenes², ¹Mississippi University for Women, Columbus, MS 39701 and ²University of Iowa, Iowa City, IA 52242

Saccharomyces cerevisiae is an excellent model organism for the study of the activation of the Ras oncoprotein. Yeast cells activate Ras through farnesylation, proteolysis, methylation, and palmitoylation in the same manner as multicellular organisms. Palmitoylation is the final step in the Ras processing pathway before activated Ras is transported to the cell membrane where it signals tumor growth. To test the hypothesis that inhibiting Ras palmitoylation would inhibit Ras signaling, we constructed heat-sensitive and galactose-sensitive Ras yeast in which heat shock and galactose, respectively, induce Ras-mediated cell death. We then tested the ability of 2-bromopalmitate to inhibit palmitoylation of the Ras oncoprotein in these strains. Inhibition of Ras palmitoylation should disrupt

the activation of Ras in the yeast which in turn should reduce the ability of activated Ras to confer heat-sensitivity and galactose-sensitivity in these strains. We have not as of yet found appropriate conditions that allow heat shock to discriminate between cells expression wild type and activated Ras proteins. However, we have seen signs of 2-bromopalmitate inhibition of Ras-mediated cell death in the galactose-sensitive Ras cells, but we are still in the process of working out the optimal conditions for maximizing inhibition.

10:00 AMYLOID β EXPRESSION REDUCES THE ACTIVITY OF cAMP RESPONSE ELEMENT-BINDING PROTEIN (CREB) IN HIPPOCAMPUS OF TRANSGENIC MICE MODELS OF ALZHEIMER'S DISEASE

Yanan Xu*, Evan Comeaux, and Yuan Luo, University of Southern Mississippi, Hattiesburg, MS 39406

Amyloid β -peptide (A β), the aberrant product of A β precursor protein (APP), represents the hallmark of Alzheimer's disease (AD). Its continuous deposition and accumulation are thought to cause degeneration of neuronal cells and subsequent cognitive impairment. Transgenic animal model over-expressing A β exhibits learning and memory impairments. A molecule implicated in neuronal plasticity and long-term memory is the cAMP responsible element binding protein (CREB). In this study, we investigated the possibility of whether the activity of CREB is affected in different brain regions using the double (APP/PS1) transgenic mice model of AD and the effect of EGb 761 treatment, a standardized *Ginkgo biloba* extract known to improve age-dependent dementia. We found that the activity of CREB (phosphorylated) is dramatically reduced in the hippocampus of the double transgenic mice (APP/PS1) compared to the wild type controls. The phosphorylation of CREB is also decreased in the cortex of the double transgenic mice, although not as remarkable as that in the hippocampus. No changes of phosphorylated CREB were observed in the cerebellum of the mice. The expression level of total CREB level remains the same in all brain regions tested. And besides the A β oligomers are attenuated in hippocampus, cortex and cerebellum of the brain after the treatment of EGb 761. These observations suggest that brain-region-specific toxicity of A β may be accompanied by its interferences with activity of CREB and EGb 761 have effects on the ameliorating the amyloid toxicity.

10:20 EGb 761, AN EXTRACT OF *GINKGO BILOBA* LEAVES, ALLEVIATE TOXICITY INDUCED BY AMYLOID-BETA EXPRESSION IN THE TRANSGENIC *C. ELEGANS* MODEL

Yanjue Wu*, Zhixin Wu, Astrid Gutierrez, and Yuan Luo, University of Southern Mississippi, Hattiesburg, MS 39406

Alzheimer's disease (AD) is associated with pathological features such as amyloid- β (A β) deposits, neurofibrillary tangles, plaques and degeneration of neurons in the brain. Although the pathogenesis of AD is not fully understood, A β aggregation has been postulated to link oxidative stress and neurodegeneration in AD. This hypothesis remains controversial because the relationship between A β aggregation, oxidative stress indicators and cell toxicity has not been defined in vivo. We have previously reported that the standardized *Ginkgo*

biloba extract Egb 761 inhibited A β aggregation in solution and in an A β -expressing neuroblastoma cell line. In this study, we use an inducible A β -expressing transgenic *Caenorhabditis elegans* strain (CL4176) to correlate A β expression with its toxicity and with the levels of reactive oxygen species (ROS) in the organism. Our results demonstrated that the A β expression-induced paralysis was delayed in the *C. elegans* fed with EGb 761 (100 mg/ml). We also found A β deposits in pharyngeal region of another strain CL2006, which constitutively expresses high levels of human A β , were significantly decreased in EGb 761 treated *C. elegans* compared with those untreated controls. A β oligomers and dimers were the aggregate species inhibited by EGb 761 in both strains. The inhibitory activity of EGb 761 against A β deposition and paralysis correlates with its ability to attenuate hydrogen peroxide in the transgenic *C. elegans*. These findings together with our previous observation suggest that oligomerization of A β is crucial for A β toxicity, and the herbal extract EGb 761 has a clear therapeutic potential for prevention and treatment of AD, at least in part, via its anti-oxidative and anti-oligomerization activities.

10:40 MODULATION OF OXIDATIVE FREE RADICALS AND LOCOMOTIVE MOVEMENT BY EGCG AND RESVERATROL IN TRANSGENIC *C. ELEGANS* MODEL

Marishka K. Brown^{1*}, Julie Smith², and Yuan Luo¹, ¹University of Southern Mississippi, Hattiesburg, MS 39406 and ²Louisiana State University, Baton Rouge, LA70803

Experimental data implicate the beneficial effects of antioxidant therapies to negate the detrimental consequences of elevated free radical levels, a possible contributing factor in both the aging process and the development of neurodegenerative pathologies such as Alzheimer's disease (AD). Previous data have shown the neuroprotective effects of the green tea constituent epigallocatechin gallate (EGCG) and the red wine constituent resveratrol on rat hippocampal neurons against amyloid- β (A β) induced neurotoxicity. In this study, EGCG and resveratrol were applied in an in vivo model of AD using a transgenic strain of *Caenorhabditis elegans* nematodes with constitutive expression of human A β ₁₋₄₂. Both EGCG and resveratrol are shown to significantly attenuate elevated levels of free radicals. Combined treatment with EGCG and resveratrol did not show any additive effect. The degree of attenuation by EGCG is much more profound than that of *Ginkgo biloba* extract previously demonstrated. The anti-oxidative effects of EGCG correlate with an enhancement of locomotive behavior. These results suggest that the antioxidant effect of EGCG and resveratrol against A β toxicity may have important therapeutic value in slowing down the progress, or even preventing AD.

11:00 AN *IN VITRO* APPROACH TO CHARACTERIZE STATE-SELECTIVE JANUS KINASE 2 INHIBITORS

Kanakadurga Kundrapu*, Kiranam Chatti, and Roy J. Duhé, University of Mississippi Medical Center, Jackson, MS 39216

Janus kinases are cytoplasmic protein tyrosine kinases with crucial physiological roles. The binding of various class II cytokines to their receptors initiates JAK activation, which

in turn causes proliferation or differentiation in cells of various lineage. Uncontrolled JAK2 activity may contribute to the progression of certain cancers. Considerable interest exists in developing JAK-targeted inhibitors. We are currently using an in vitro approach to identify and characterize selective inhibitors of rat JAK2 activity. Several approaches to develop a quantitative biochemical assay for rJAK2 activity have been under way in our laboratory. One of our novel findings has been that rJAK2 exists in at least two distinct states of activity. The phosphorylation of tyrosines within the activation loop of rJAK2 appears to increase its autocatalytic efficiency with respect to ATP, with highest activity when its activation loop is phosphorylated and lower activity when the activation loop is unphosphorylated. We are determining whether this implied difference in ATP binding affinities between the two states of rJAK2 also extends to a difference in affinities for the acceptor substrates, such as the STATs. Based on our demonstration of the differential behavior of these two states towards ATP, we propose that a JAK2 inhibitor(s) could selectively distinguish between these two activity states. State-selective inhibitors of JAK tyrosine kinase activity would represent a novel class of potential therapeutic agents.

THURSDAY AFTERNOON

Cedar Room

1:40 CHARACTERIZATION OF NOVEL VIRULENCE FACTORS IN *STAPHYLOCOCCUS AUREUS*

Karthik Sambanthamoorthy* and Mohamed O. Elasri, University of Southern Mississippi, Hattiesburg, MS 39406

Staphylococcus aureus is an extraordinarily versatile pathogen causing a wide variety of infections ranging from superficial infections (skin abscess, wound infections), to toxic syndromes (food poisoning) to life threatening conditions (osteomyelitis, endocarditis). *S. aureus* has developed resistance to an array of antibiotics like methicillin and vancomycin, forcing the need for development of new drugs to combat staphylococcal infections. *S. aureus* expresses a wide variety of virulence factors such as cell bound proteins (e.g., adhesins) or exoproteins (toxins). The cell bound proteins are expressed early to establish infection and repressed after colonization whereas the exoproteins are repressed early and expressed late during the infection. The coordination of the expression of virulence factors is under the control of two global regulatory systems, the accessory gene regulator (*agr*) and the staphylococcal accessory regulator (*sarA*). The *agr* system is a quorum sensing system in which the *S. aureus* cells communicate with each other to coordinate expression of virulence factors. *sarA* regulates the virulence factors via two pathways, an *agr*-dependent pathway in which *sarA* activates *agr* at the transition between the exponential and post exponential growth phase and an *agr*-independent pathway in which *sarA* regulates virulence factors directly. There is evidence for the existence of important upstream and downstream factors that modulate *sarA* function. Our goal is to identify and characterize these new factors which represent potential new therapeutic targets for the prevention and treatment of Staphylococcal infections.

2:00 THE ROLE OF NOVEL QUORUM SENSING IN THE REGULATION OF STAPHYLOCOCCAL VIRULENCE FACTORS.

Cassie R. Crenshaw* and Mohamed O. Elasri, University of Southern Mississippi, Hattiesburg, MS 39406

Staphylococcus aureus is an opportunistic pathogen responsible for a myriad of infections including endocarditis, osteomyelitis, toxic shock syndrome, and food borne illness. *S. aureus* produces numerous virulence factors. These virulence factors can be grouped into two categories: cell bound proteins (adhesions) and secreted proteins (exotoxins). Cell bound proteins are expressed in the early stages of infection when cell density is low. Secreted proteins are expressed in the late stages of infection when cell density is high. Expression of many virulence factors is coordinated by the *agr* quorum sensing system. Recently a new quorum sensing system, *luxS*, has been discovered. Our goal is to determine the role of *luxS* in the regulation of staphylococcal virulence factors. To do this, we have mutated the *luxS* gene. We will analyze expression of *agr* regulated virulence factors in the mutant and compare with the wild type.

2:20 REGULATION OF VIRULENCE FACTORS IN *STAPHYLOCOCCUS AUREUS*

Antony Schwartz* and Mohamed O. Elasri, University of Southern Mississippi, Hattiesburg, MS 39406

Staphylococcus aureus is a gram-positive bacterium that causes a large number of community-acquired and nosocomial infections. Quorum sensing system allows *S. aureus* to regulate expression of virulence factors according to cell density. In this study, we are evaluating the role of *luxS*, a novel quorum sensing system in the regulation of virulence factors. Also, we are investigating possible crosstalk between two known global regulators, the accessory gene regulator (*agr*) and the staphylococcal accessory regulator (*sarA*) and the *luxS* system. *luxS* expression will be studied in the *sarA*⁻, *agr*⁻, and the *sarA*⁻/*agr*⁻ strains. Likewise, *sarA*⁻ and *agr*⁻ expression will be studied in the *luxS*⁻ system. The ultimate goal of this study is to elucidate the intricate virulence regulatory systems in *S. aureus*, providing for novel therapeutic target areas.

FRIDAY MORNING

Cedar Room

8:00 Divisional Poster Session

ANALYSIS OF HYPOXIA INDUCIBLE FACTOR IN GRASS SHRIMP BY DNA MICROARRAY

Donald Sittman¹*, Tiandao Li², and Marius Brouwer², ¹University of Mississippi Medical Center, Jackson, MS 39216 and ²University of Southern Mississippi, Gulf Coast Research Laboratory, Ocean Springs, MS 39564

A pilot study was initiated to identify the hypoxia inducible factor from the grass shrimp, *Palaemonetes pugio* by DNA microarray technology to determine if the changes in the expression levels can serve as indicator of dissolved oxygen stress in Gulf of Mexico. Eighty clones from grass shrimp were chosen for PCR amplification and digestion. Purified cDNA

and control clones were spotted in duplicate arrays on Ultra-GAPS coated slides using the VersArray ChipWriter. Total RNA was extracted from normoxic shrimp and hypoxic shrimp (Day 3, Day 7, and Day 14). The RNA was labeled with Amino-Allyl-dUTP. Slides were hybridized with the RNA from normoxic and hypoxic shrimps. Hybridized arrays were scanned with the VersArray ChipReader using TIGR Spotfinder for initial spot finding. Raw data was imported into R and analyzed for normalization. Different microarray tools were involved for clustering, visualization, classification, statistical analysis and biological theme discovery. DNA microarray technology is a powerful technology that will substantially increase the speed of molecular biological research, and hypoxia inducible factor will be used as bioindicators of hypoxia-related stress in marine environment.

IMMUNOHISTOCHEMICAL ANALYSIS OF PLACENTAL CYTOKINE RECEPTORS IN A REDUCED UTERINE PERFUSION PRESSURE (RUPP) MODEL OF PREECLAMPSIA IN SPRAGUE-DAWLEY RATS

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Preeclampsia is a hypertensive disease that affects approximately 5-7% of all first pregnancies, and is one of the leading causes of maternal and neonatal morbidity and mortality worldwide. Although the cause of preeclampsia is still unknown, it is hypothesized that a lack of blood flow to the placenta causes an increase in the release of placental cytokines such as interleukin-1 β (IL-1 β), interleukin-6 (IL-6), interleukin-10 (IL-10), and tumor necrosis factor (TNF- α). Inflammatory cytokines are then thought to mediate endothelial dysfunction in the blood vessels of the kidney, reflected by an increased production of vasoconstrictive factors. This mechanism may explain the etiology of preeclampsia in human pregnancy. Placental tissues were obtained from control pregnant rats and those undergoing experimentally reduced uterine perfusion (RUPP). Immunohistochemical analysis were performed by standard ABC staining techniques utilizing five micrograms of primary antibody specific for the placental cytokine of interest. Slides were examined for immunohistochemical staining by light microscopy (40X). Increased staining for the IL-6 and IL-10 receptors was observed in placentas from animals undergoing the RUPP procedure when compared to controls. This increased expression of placental cytokine receptors could contribute to the increased cytokine protein production and subsequent endothelial dysfunction that occurs in women with preeclampsia

CLONING AND ANALYSIS OF THE CYSTEINE DIOXYGENASE (CDO1) GENE FROM THE DIMORPHIC PATHOGENIC FUNGUS *HISTOPLASMA CAPSULATUM*.

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The dimorphic fungus *Histoplasma capsulatum* is the etiologic agent of histoplasmosis, a disease which afflicts an estimated 500,000 Americans each year. *Histoplasma* grows in soil in a differentiated form as a multicellular, filamentous mold. After inhalation of spores or mold fragments, the organism de-differentiates into a single-celled budding yeast.

This mold-to-yeast conversion is an absolute requirement for pathogenesis. Sulfhydryl metabolism is known to be involved in this dimorphic process. The yeast morphotype, but not the mold morphotype, has cysteine dioxygenase activity, which converts cysteine into cysteine sulfinic acid. Toward our goal of understanding the molecular basis of this dimorphism, we have isolated the cysteine dioxygenase gene (CDO1) from *Histoplasma capsulatum* strain G186AS. The *Histoplasma* CDO1 coding sequence shows strong similarity to a hypothetical CDO protein from the fungus *Neurospora crassa* and weak, but significant, similarity to human and rat CDO genes. Preliminary analyses indicate the gene is differentially regulated in yeast and mold cells. Studies are underway to quantify CDO1 mRNA levels in yeast and mold morphotypes of several strains of *Histoplasma* to better elucidate the role of this gene in dimorphism.

CHARACTERIZATION OF THE MOLD-SPECIFIC M46 GENE IN THE DIMORPHIC PATHOGENIC FUNGUS *HISTOPLASMA CAPSULATUM*.

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Histoplasma capsulatum, a dimorphic fungus, is the infectious agent responsible for the respiratory disease histoplasmosis. The fungus, grows as a multicellular mold in the soil. Once the soil is disturbed, spores are released and inhaled into the lungs. In the lungs, the fungus converts to the unicellular yeast morphotype. This mold-to-yeast conversion, which is a requirement for pathogenesis, can also be accomplished in the lab by switching incubation temperature from 25 °C to 37 °C. To understand the molecular basis of dimorphism we have isolated several mold-specific and yeast-specific genes. The subject of this study, the M46 gene, is mold-specific. Recent data have shown that M46 is expressed in the mold morphotype of G186AS and Downs strains, but is transcriptionally silent in G184AS and G217B strains. To determine the reason for this lack of transcription in the latter strains we have compared the genomic sequence for the M46 locus in all four strains. Preliminary analysis indicates that the non-expressing strains have a large sequence rearrangement at the M46 locus. Work is ongoing to determine the extent of this rearrangement and the effect of this mutation on M46 promoter function.

BACTERIAL ACQUISITION OF ANTIMICROBIAL RESISTANCE IN FRESHWATER WETLAND ENVIRONMENTS

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The aim of this study was to select Enterobacteriaceae, potential human and animal pathogens from pristine wetlands, and assess virulence factors that allow microorganisms to cause an infection. Assessed virulence factors include antibiotic resistance, presence of plasmids and capsules. Enteric bacteria were analyzed using classical microbiological tests, API20E, 16S RNA sequencing, and their susceptibility to a panel of antibiotics assessed using NCCLS protocols. Z prime statistical analysis method was employed to determine the assay/screen quality. The 16S rRNA sequences and antibiotic resistance

genes were analyzed using the algorithms BLAST (National Center for Biotechnology Information [http://www.ncbi.nlm.nih.gov]) and ClustalX. *K. pneumoniae*, *Enterobacter cloacae*, and *E. asburiae*, known human pathogens, were identified. *K. pneumoniae* 16S rRNA gene sequence showed the significant hit ($E < 0.001$) with the unculturable bacteria obtained from feces of elderly individuals (accession no. AB099804) when sequences from Genbank database were used. The rate of antibiotic resistance was high for ampicillin and cephalosporins for all strains tested. Capsules were present in all enteric strains tested but presence of plasmids was not determined. We are currently assessing a genetic linkage between antibiotic resistant and virulent genes. The antibiotic resistance of assessed strains and presence of capsules (protect microorganisms from phagocytosis) suggest that tested environmental bacteria present potential pathogens. It is not clear yet if there is a genetic linkage of resistance and virulence. However, plasmids were not detected in investigated bacteria. These results suggest that there is a little chance for the transmission of virulent factors to other environmental bacteria.

ENVIRONMENTAL INDUCTION OF CYP1A-, CYP2M1-, AND CYP2K1-LIKE PROTEINS IN TROPICAL FISH SPECIES BY PRODUCED FORMATION WATER ON THE NORTHWEST SHELF OF AUSTRALIA

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Normal operation of oil well platforms results in the discharge of "produced formation water" (PFW). The expression of CYP1A, CYP2M1- and 2K1-like proteins was examined in Gold-Spotted Trevally (*Carangoides fulvoguttatus*) and Bar-Cheeked Coral Trout (*Plectropomus maculatus*) as possible biomarkers of PFW impact. The results of this pilot study indicated PFW contamination near the Harriet A platform may contribute to induction of CYP1A- and 2M1-like proteins in Trevally, while other contaminants may induce a CYP2K1-like protein. In a 2003 caged fish study, Striped seaperch (*Lutjanus carponotatus*) were caught at a clean site, then distributed to three caging sites: A (near field), B (far field) and C (reference site). Fish were sampled at time (T) zero, T = 3 and T = 10 days. Significant increases of CYP1A, one CYP2K1- and two CYP2M1-like proteins were noted at Site A at T = 10. For the other CYP2K1-like protein, a significant increase was observed at site A only at T = 3, but not at T = 10. Prevailing winds switched during sampling, moving the surface water due west, therefore exposing the fish to different components of PFW that may possibly induce this CYP2K1-like protein. These results indicate that CYP1A protein is sensitive to PFW exposure and may act as a good biomarker. Importantly, statistically significant environmental induction of both CYP2M1- and CYP2K1-like proteins in tropical fish due to PFW exposure has not previously been described and represents possible new biomarkers (other than CYP1A) of PFW fraction-specific contamination.

ENHANCING TOXICITY OF TOPOISOMERASE II INHIBITORS USING A c-MYC INHIBITING POLYPEPTIDE

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Topoisomerase II inhibitors are widely used in cancer chemotherapy. However, their use is limited by severe adverse effects to normal tissues, including cardiotoxicity. One approach to reduce the cytotoxicity in normal tissues may be to sensitize cancer cells to the toxicity of these agents, allowing them to be administered in a lower and safer dose. Here, we report that pretreatment of cells with a polypeptide which inhibits c-Myc transcriptional function causes cells to be more susceptible to the topoisomerase II inhibitors doxorubicin and etoposide. Inhibition of c-Myc and Max dimerization by this polypeptide leads to as much as a two-fold reduction in the doxorubicin and etoposide IC₅₀ in three different cell lines tested. Furthermore, the c-Myc inhibitor enhances doxorubicin or etoposide induced accumulation in G2 or M phase of the cell cycle. We have shown that this effect is not due to enhanced drug accumulation or inhibited drug efflux. Rather, it is likely due to the transcriptional consequences of c-Myc inhibition, specifically reduction in the levels of the polyamine synthesizing enzyme ornithine decarboxylase. Polypeptides which inhibit c-Myc transcriptional function may prove to be a useful tool in combination therapy with topoisomerase II inhibiting drugs.

TNF-ALPHA INDUCED ENDOTHELIN PRODUCTION BY ENDOTHELIAL CELLS; INFLUENCE OF ESTROGEN AND PROGESTERONE

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We previously reported that chronic infusion of TNF- α , at concentrations mimicking plasma levels in preeclamptic women, increased blood pressure and decreased renal function in pregnant rats. In sharp contrast, TNF- α had no effect in virgin rats. These data suggest that the hormonal environment of pregnancy may influence the vascular actions of TNF- α . To test this hypothesis, we examined the effects of TNF- α on endothelin production by endothelial cells in the presence of estrogen (E) and/or progesterone (P). HUVECs were exposed to varying concentrations of TNF- α with or without hormone for eight hours. The cell culture supernatant was examined using elisas specific for endothelin (ET-1) and soluble intercellular adhesion molecule (sICAM). We found that TNF- α caused a dose-dependent increase in production of ET-1. In the presence of E or P, TNF- α increased ET-1 production, however, not significantly greater than what is achieved with TNF- α alone. In contrast, the combination of E and P significantly enhanced expression and secretion of sICAM by TNF- α . We conclude that the enhanced blood pressure response to TNF- α during pregnancy is not likely due to enhanced TNF- α -induced production of ET-1 by sex steroids. However, estrogen and progesterone may play a role by increasing TNF- α stimulated expression of adhesion molecules, leukocyte activation, and superoxide production.

EFFECT OF EARLY INHIBITION OF THE RENIN ANGIOTENSIN SYSTEM ON THE DEVELOPMENT OF HYPERTENSION IN A MODEL OF LOW BIRTH WEIGHT INDUCED BY REDUCED UTERINE PERFUSION IN THE PREGNANT RAT

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Low birth weight (LBW) is a suggested risk factor for development of hypertension. We previously reported that reduced uterine perfusion initiated at day 14 of gestation in the pregnant rat results in LBW offspring that develop hypertension. The purpose of this study was to determine if early, short-term blockade of the renin angiotensin system (RAS) would prevent the development of hypertension in this model of LBW. Weight at birth was significantly reduced in offspring from pregnant rats with reduced uterine perfusion as compared to offspring from control pregnant rats (5.9 ± 0.2 vs. 6.6 ± 0.2 grams, $P < 0.05$; growth restricted vs. control, respectively). At two weeks of age, animals were randomly assigned to either an untreated or treated group (angiotensin converting enzyme inhibitor, enalapril, 10 mg/kg/day, administered by gavage for two weeks). Mean arterial pressure (MAP) was measured at four, eight and twelve weeks of age in conscious chronically instrumented animals. In the untreated group, MAP was elevated in growth restricted offspring relative to control offspring at 4, 8, and 12 weeks of age. Early blockade of the RAS did not decrease blood pressure in control offspring at 4, 8 or 12 weeks of age. Early blockade of the RAS initially attenuated hypertension in growth restricted offspring at 4 weeks of age, a decrease of 10 mm Hg, however this attenuation did not persist at 8 or 12 weeks of age. These results suggest that the RAS may play a role in the development of hypertension in this model of LBW induced by reduced uterine perfusion.

TESTING THE BIOCOMPATIBILITY OF SC3 HYDROPHOBIN-COATED PARMAX

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Evaluations of a Class I fungal protein was done to test the biocompatibility of a high performance polymer. Sc3 hydrophobins are Class I fungal self-assembling proteins that when coated on a polymer makes them more adhesive to hydrophobic and hydrophilic counterparts. Sc3 hydrophobin-coated Parmax is the high performance polymer that was utilized in this project. Cellular adhesion and quantitation tests using rat Neuroblastoma and Pheochromocytoma cells were performed to access the biocompatibility of the Sc3 coated Parmax. Parmax is derived from chlorobenzene and is based on a string of substituted and unsubstituted phenylene rings that produce a rigid structure. This polymer can be made into small and transparent films that make them easy for biocompatible testing. My results show that, Sc3 hydrophobins did not serve as satisfactory adhesion substrates for the Neuroblastoma cell line. However, the pheochromocytoma cells continued to grow on a regularly basis. Quantitation of the cells was not successful due to limited samples and time. Cell numbers were

relatively low or too low to count. Further biocompatible testing including a viability test should be conducted to ensure the affects of Sc3 hydrophobin-coated Parmax.

HOW ODORS OF GROUP-HOUSED PREGNANT FEMALES AFFECT THE OLFACTORY DEVELOPMENT OF ISOLATED PUPS

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Little is known about how social influences can affect mice prenatally. It has been found that pups born to pregnant females placed in late social situations during pregnancy have accelerated olfactory development in comparison to pups born to mothers who were isolated. Pups of social situations can distinguish scents of their home bedding from clean bedding on postpartum Day 3 or 4; however pups of isolated mothers do not distinguish scents of their home bedding until postpartum Day 5 or 6. Bedding of group-housed females added to bedding of isolated mothers also produces a similar acceleration. This study was designed to decipher if actual contact with the mice or their bedding creates the acceleration or if exposure to only the odor of group-housed mice can produce the same affect. It was found that the exposure of these airborne odors seems to have no affect on the pups of the isolated mother. Tactile contact or exposure to soiled bedding appears to be the source of acceleration.

THE INHIBITORY EFFECTS OF PB ON NMDA RECEPTORS, SYNAPSIN AND CA-MK II IN PRIMARY CULTURED NEURONAL CELLS

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The objective of present study is to examine dose-dependent and time-course effects of Pb on NMDAR (NR1C1, NR2A, and NR2B), synapsin and calcium/calmodulin kinase II (CaM KII) in primary cultured neuronal cells. Neuronal cells were isolated from the brain of the fetus of Sprague Dawley pregnant rats at 18-20th gestation and planted in 6 well plates (N = 4). Cells were exposed to Pb at 10^{-10} – 10^{-7} M for 24 h and then harvested. Later on, 10^{-7} M of Pb was incubated with cells for 30 min, 8 h, 14 h, 20 h, 36 h, and 48 h. Antigens of NMDAR, synapsin and CaM KII were first enriched with protein A agarose by immunoprecipitation, and later detected by western blotting with specific antibodies. Meanwhile, total RNA was extracted from harvested cells with Trizol. RT-PCR was employed to detect mRNA expressions of NMDAR with specific primers. The results showed that Pb significantly reduced mRNA expressions of these NMDAR subunits. Protein levels were slightly reduced, but reduction was significant at 10^{-8} and 10^{-7} M of Pb in comparison with actin control. From exposing for 20 h, Pb gradually reduced protein levels all NMDAR until 48 h. In addition, Pb at 10^{-8} and 10^{-7} M significantly decreased protein levels of synapsin and CaM KII. Our study suggests that Pb inhibits not only NMDAR subtypes but also synapsin and CaM KII directly. (Supported by NIH/NIGMS/MBRS-SCORE#GM55356.)

SPERM MOVEMENT IN MICROFLUIDIC DEVICES

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Spermatazoa have been known to exhibit chemotactic behavior in the presence of follicular and oviductal fluids, the oocyte microenvironment, and some hormones. Despite these findings, the components of the materials that are responsible for the chemotactic behavior of sperm are not known. Microfluidics, a relatively new science that examines the behavior of fluids at a microscopic level, can provide a steady state environment in which sperm movement and chemotaxis can be studied in real time. An important aspect in studying the chemotaxis of sperm using complex microfluidic devices, or chips, is to understand how sperm move in the apparatus. The main goal of this study is to observe the motion of spermatozoa so that we will be able to carry out a more efficient chemotaxis assay using microfluidic devices. The observations of sperm movement will be used to find a microfluidic device that has microchannels large enough to allow sperm to swim closer to their natural swim pattern, but small enough to produce a complex gradient that will allow accurate control of the concentration of possible chemoattractants.

USING RNA INTERFERENCE FOR UNDERSTANDING THE FUNCTION OF SMN PROTEIN

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Spinal Muscular Atrophy (SMA) is a common autosomal recessive disorder which causes the loss of motor neuron function in the spinal cord. One in 6,000 babies are born every year with SMA, and one in 40 people carry the mutation that causes it. Children born of parents that are both carriers have a 25% chance that they will develop SMA. SMA is usually divided into three different types. Type 1 is the most severe with the onset occurring in early childhood, and type 3 is the least severe, with onset in early adulthood. The most common cause of SMA is deletion of the SMN gene, which expresses the survival motor neuron (SMN) protein. A second nearly identical copy of the SMN gene called SMN2 expresses very low levels of active SMN protein and is unable to fully substitute for the missing SMN protein. The SMN protein is ubiquitously expressed and its function is essential in all organisms studied, including mouse, *Caenorhabditis elegans* and *Schizosaccharomyces pombe*. Motor neurons are particularly sensitive to SMN reduction compared with other cells. The function of SMN1 in motor neurons is still unknown. To understand the function of SMN we used a technique called RNA interference (RNAi), which leads to reduced levels of a specific protein. The RNA interference pathway is shown in Figure 1. One of the key role players in RNAi is small interfering or siRNA. There are several ways to generate siRNA. For our long term studies we used a tetracycline-inducible siRNA-expression vector with a luciferase reporter system to quickly check whether the selected siRNA was effective. Although the presence of siRNA decreased luciferase activity four fold, meaning our siRNA was working, we would need to try additional siRNAs to improve the silencing effect.

TOXICITY EVALUATION OF ACRYLAMIDE ON THE EARLY LIFE STAGES OF THE ZEBRAFISH EMBRYOS (*DANIO RERIO*)

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Abstract: Embryos of the Zebrafish (*Danio rerio*) were exposed to serial concentrations of acrylamide (0, 100, 300, and 500 mg/L) to investigate its sub-chronic effects on embryonic development. Eggs/embryos less than 24 hrs old were exposed under static non-renewal conditions until hatching. The toxic endpoints evaluated included: egg/embryo viability, hatchability, and morphological/developmental abnormalities. The acute toxicity test resulted in a 48 h-LC₅₀ of 585 mg/L for egg viability. Exposure of eggs to sub-chronic concentrations significantly reduced hatchability and larval survival, in a concentration dependent manner. At 500 mg/L, the highest test concentration, the survival of embryos was greatly reduced within 24hrs of exposure. The lower test concentration, 100 mg/L, produced a significant number of developmental effects to the Zebrafish, including dorsal tail flexure, severe pericardial edema, facial and cranial defects and increase heartrate (150 bpm). Premature hatching and developmental arrest was observed in all concentrations (except control). The severity of these abnormalities was concentration-dependent. It can be concluded from these results that acrylamide is teratogenic and also indicates the ecological significance of sublethal toxicity testing using the zebrafish embryos.

EFFECT OF pH ON INTERLEUKIN-4 ANTIGEN-ANTIBODY INTERACTIONS AS ASSESSED BY ENZYME-LINKED IMMUNOASSAYS

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Certain opioid peptides and their metabolic derivatives affect the production of interleukin-4 (IL-4) by immune cells. IL-4 drives the immune response against allergens and certain parasites. Usually the amount of IL-4 present in cell supernatants is very low and requires the use of undiluted samples in the enzyme-linked immunoassay (ELISA). For this reason, we sought to determine if: (1) increases in incubation time and ConA concentration alter the pH of the cell supernatants and (2) changes in the pH of the cell supernatants have a significant effect on the interaction between IL-4 and the ELISA capture antibody. ELISA calibration curves consisted of different concentrations of recombinant mouse IL-4 in serum-free medium from pH 5.0 to 7.5. Splenocytes were incubated for various periods in the presence of different amounts of ConA. At the end of the incubation period, cell supernatants were collected and their final pH and IL-4 concentration measured. Longer incubation times and higher ConA concentrations caused a progressive acidification of the cell supernatants. The slopes of the calibration curves (dependent variable-Y) were plotted against the pH of cell supernatants (independent variable-x), resulting in a bell-shaped function that reached a maximum at pH 6.2. The limit of detection for the assay was 1 pg/mL for 5.7 < pH < 7.2. Since IL-4 ELISA results are considerably affected by the pH of the cell supernatants in addition to the cytokine concentration itself, we conclude that accurate comparisons can be only made using samples and calibration curves of similar pH.

ALPHA7 NICOTINIC RECEPTORS: ROLE IN ETHANOL-INDUCED NEUROTOXICITY?

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Alpha7 nicotinic acetylcholine receptors (nAChRs) have been suggested to be involved in modulating neuronal viability because agents that act at alpha7 receptors are protective against a variety of neurotoxins, including ethanol. Preliminary data in primary neuronal cultures derived from $\alpha 7$ nAChR null mutant mice have suggested that the absence of $\alpha 7$ nAChRs increases susceptibility to ethanol-induced neurotoxicity without affecting baseline neuronal viability. Here we attempted to assess whether the results obtained in cell culture (in vitro) were predictive of what would be seen in whole animals (in vivo). Using a whole animal model of binge-drinking induced neurotoxicity, we proposed to test the hypothesis that subchronic treatment with high doses of ethanol would result in greater deficits in learning ability in alpha7 null mutant mice than in wild type mice. This hypothesis is based on the assumption that null mutant mice would show greater ethanol-induced neurotoxicity and that this would result in greater deficits in learning. Mice were to be treated for 4 days, 3 times daily. The starting dose was to be 8 g/kg with subsequent doses determined by scoring animals on level of intoxication. Animals were then to be withdrawn from ethanol for 3 days prior to testing for learning behavior in a T-maze and in a passive avoidance paradigm. Unexpectedly, most of the null mutant and heterozygous mice died following a single administration of ethanol rendering continuation of the study not feasible. These data, while unexpected, support the hypothesis that null mutation of the alpha7 nAChR gene results in a greater susceptibility to the toxic effects of ethanol. Whether this increased susceptibility is to neurotoxic or other toxic effects remains to be determined. Both in vitro and in vivo studies suggest that alpha7 nAChRs may be a useful site for drug development for agents to protect against ethanol-induced toxicity in alcohol overdose.

ASSESSING SUBNANOMOLAR CONCENTRATIONS OF ENDOGENOUS OPIOID PEPTIDES BY NON-RADIOACTIVE METHODS

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Methionine-enkephalin (ME) is an opioid pentapeptide (YGGFM) that affects the immune response. Mitogens such as Concanavalin A (ConA) stimulate the production of preproenkephalin. Very low concentrations of endogenous ME accumulate in cell supernatants. We have developed a non-radioactive procedure consisting of solid-phase extraction followed by enzyme-linked immunoassay (ELISA) to assess accurately ME concentrations in splenocyte-conditioned culture media. We set up experiments to ascertain the effect of concentrated, solid-phase extracted culture medium on ME ELISA and ME recovery after the solid-phase extraction step. Phenol red-free culture medium (AXL) was solid-phase. The solid residue was dissolved in phosphate saline buffer. The second experiment was performed by adding ME to AXL to a final concentration of 10^{-9} M. ME ELISA was linear between 10^{-9} and 10^{-6} M, had a limit of detection of 1×10^{-8} M and a coefficient of variation

6 % or less. The ELISA calibration curves for SP-AXL and AXL were parallel; however, their intercepts differed considerably. Therefore, SP-AXL was included as control (absorbance value = 100 %) in subsequent immunoassays. At 10^{-9} M, 65% of the added amount ME was recovered after solid-phase extraction and freeze-drying. The concentrated cell-conditioned medium contained 2×10^{-8} M of ME, a value that fell within the calibration curve linear range. In conclusion, a sensitive and specific methodology was developed to measure subnanomolar concentrations of endogenous ME in cell supernatants. This assay can be performed with no extensively purified samples and has the advantage of avoiding the use of radioactive materials.

CHARACTERIZATION OF ALCOHOL METABOLIZING ENZYMES IN JAPANESE MEDAKA

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Cardiovascular defects in developmental ethanol exposure have been identified in both human and animal models and used as a phenotypic feature of fetal alcohol syndrome (FAS). The molecular mechanism of these developmental abnormalities has not yet been fully characterized. We used the Japanese medaka developmental model to evaluate cardiovascular defects produced by acute ethanol exposure. Viable medaka eggs within 1 h of fertilization were exposed to ethanol (0-400 mM) in hatching solution for 48 h. cardiovascular development was observed from 1-7 dpf. The embryos exposed to low ethanol concentrations (0-100mM) exhibited active blood circulation at 2 dpf but active circulation was significantly delayed at higher ethanol concentrations (200-400mM). Moreover, embryos exposed to these higher concentrations (200-400mM) developed tube heart and blood clots in the Blood Island and in the circulatory vessels. We hypothesized that the cardiovascular abnormalities seen in developing Japanese medaka were due to one or more metabolites of ethanol metabolism. To examine this possibility, we have begun to characterize the genes for alcohol metabolizing enzymes in medaka. By applying PCR-based technologies, we previously cloned and characterized two alcohol dehydrogenase (ADH) enzyme cDNAs from the liver tissue of medaka. Additional work has yielded partial clones of two subtypes of aldehyde dehydrogenase cDNA (ALDH α and ALDH β) in adult medaka liver. ALDH α mRNA showed tissue specific expression, however ALDH β was ubiquitously expressed (brain, eye, GI, gill, heart, kidney, liver, muscle, skin, spleen and ovary). Supported in part by ETRP, Department of Pharmacology and ORSP of the University of Mississippi.

REGIO-SPECIFIC (ω TO ω -6) FATTY ACID (LAURIC, MYRISTIC, AND PALMITIC) HYDROXYLATION IN HUMAN POOLED LIVER AND RECOMBINANT MICROSOMES

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Most studies of lauric acid hydroxylation have focused on only two hydroxylation products, ω , and ω -1. Modifications of an HPLC method (Lemaire et al., 1992) to include GC-MS (Buhler et al., 1997) have allowed more sub-terminal hydroxy-

lation products including ω -2 to ω -6 to be quantified. Further modifications now allow the measurement of not only lauric acid hydroxylation but also the hydroxylation of myristic and palmitic acids (Holmes et al., 2004). We have used a modification of the method to allow measurement of not only of ω and ω -1 but also ω -2 to ω -6 sub-terminal hydroxylation products. Previously we have shown regio-specific lauric acid hydroxylation in human pooled liver and recombinant microsomes. Preliminary evidence indicated significant lauric acid sub-terminal hydroxylation, specifically ω -2, ω -5, and ω -6 by both human liver male and female pooled microsomes, with only female microsomes catalyzing ω -1 while products of ω -3, ω -5, and ω -6 were produced by human recombinant CYP4A11. Interestingly, CYP2B6 produced significant lauric acid sub-terminal hydroxylation at the ω -1, ω -2, and ω -3 positions with high ω -6 activity. Additionally the source of the recombinant enzyme and the source of the cytochrome P450 reductase influenced the lauric acid hydroxylation pattern by CYP2E1. The sub-terminal hydroxylation of myristic and palmitic acids has not previously been reported. There is potential for sub-terminal hydroxylation products to act as second messengers in cellular signal transduction or to interfere with steroid biotransformation. These hypotheses will be investigated in future research.

INHIBITION OF HUMAN CYTOCHROME CYP1 ENZYMES BY FLAVONOIDS OF ST. JOHN'S WORT

Amit Chaudhary* and Kristine L. Willett, University of Mississippi, University, MS 38677

As with many available herbal preparations, components of St. John's wort are not completely characterized with respect to their interaction with drug metabolizing enzymes. Four flavonoids present in St. John's wort and apigenin were studied for their ability to inhibit TCDD-induced EROD activity in 22Rv1 human prostate cancer cells. Quercetin (IC₅₀: 4.1 μ M), kaempferol (3.7 μ M), myricetin (3.0 μ M) and apigenin (3.1 μ M) caused significant inhibition of TCDD-induced EROD activity whereas amentoflavone did not cause inhibition. CYP1B1 is involved in metabolizing both polycyclic aromatic hydrocarbons and estradiol to potentially carcinogenic intermediates, and it is also over-expressed in human cancer cells. In order to identify flavonoids that specifically inhibited CYP1B1, eight flavonoids in St. John's wort and apigenin were screened for their selective inhibition of recombinant CYP1B1 versus CYP1A1. IC₅₀s for CYP1B1 inhibition ranged from 0.22 μ M for apigenin to 18.34 μ M for hyperoside. CYP1A1 IC₅₀s ranged from 0.91 μ M for hyperoside to 63.7 μ M for quercetin. Seven flavonoids, quercetin (34-fold), apigenin, myricetin, kaempferol, amentoflavone, quercetrin, and isoquercetin, were more selective for CYP1B1 EROD inhibition compared to CYP1A1. Rutin did not inhibit in either system whereas hyperoside significantly inhibited CYP1A1 compared to CYP1B1. Apigenin, quercetin, and amentoflavone were competitive inhibitors of CYP1B1 with K_is of 0.02, 0.08, and 0.51 μ M, respectively. By distinguishing relative roles of cytochrome P450s (specifically CYP1B1 vs. CYP1A1) in different human cancer cell lines, methodologies can be developed to provide better diagnostics and possibly new therapies against cancer formation.

THE *snxA1* AND *nimA5* MUTATIONS OF *ASPERGILLUS NIDULANS* INTERACT TO AFFECT MITOTIC SPINDLE STRUCTURE AND THE DNA SYNTHESIS CHECKPOINT
Ryan Day *, Brandon Fontenelle, Shruti Chandna, and Sarah Lea McGuire, Millsaps College, Jackson, MS 39210

The *snxA* gene interacts with NIMX^{cdc2} to affect mitosis, and its mutation causes abnormal nuclear morphology at 17 °C, while the *nimA* gene affects the nuclear import of NIMX^{cdc2} and when mutated blocks mitotic entry at 42 °C. To characterize the effects of the *snxA1* mutation on microtubule and nuclear structure, strains expressing a GFP-tubA (α -tubulin) gene were generated with either the *snxA1* or *nimA5* mutations alone or with a *snxA1/nimA5* double mutant. At 17 °C, *snxA1/GFP-tubA* cells had severe nuclear defects, thickened hyphae, abnormal spindle structures, and abnormal interphase microtubule arrays. Mitotic spindles were highly variable in length. Some spindles had no nuclei attached to them, while yet others were bifurcated or trifurcated and had fragmented, variably condensed nuclei along their lengths. Similar abnormal nuclei and spindle structures were observed when *snxA1/nimA5* strains were germinated at 32 °C and upshifted to 42 °C for 3 hours. Additionally, *snxA1* was shown to suppress a checkpoint defect observed in *nimA5* cells, as the *snxA1/nimA5* double mutants were able to grow in the presence of 20 mM hydroxyurea, where *nimA5* cells were sensitive at 10 mM hydroxyurea. Cloning and further characterization of the *snxA* gene will provide clues to the interactions of NIMX^{cdc2}, NIMA, SNXA, and the regulation of mitotic spindle formation. Supported by NIHGM55885-03 and the Mississippi Functional Genomics Network.

CELLULAR UPTAKE OF CELL PENETRATING PEPTIDES FUSED TO ELASTIN-LIKE POLYPEPTIDES: EFFICIENCY AND MECHANISM

Iqbal Massodi*, Gene Bidwell III, and Drazen Raucher, University of Mississippi Medical Center, Jackson, MS 39216

Translocation through the plasma membrane is a major limiting step for the cellular delivery of macromolecules. Several cell-penetrating peptides (CPP) have been demonstrated to allow efficient internalization of various molecular "cargo" to targets within the cytoplasm and nucleus of eukaryotic cells. It has been shown that their delivery efficiency and cellular uptake is dependent on cargo. However, the mechanism used by CPP for cell entry is largely unknown. We evaluated efficiency and mechanism of cellular uptake of penetratin, Tat (48–60) and the membrane translocating sequence from (MTS) fused to elastin-like polypeptides (CPP-ELP). Elastin-like polypeptides (ELPs) are biopolymers composed of the pentapeptide repeats Val-Pro-Gly-Xaa-Gly (MW 51kD). They have several attractive features making ELPs useful as polymeric carriers for the delivery of therapeutics. Therefore, improving efficiency by fusing ELPs to CPP and understanding the mechanism of their cellular internalization could contribute to development of new therapeutic approaches. Flow cytometry of fluorescein labeled CPP-ELPs showed ten fold enhancement in cellular association of Pen-ELP, but no significant increase in cellular association of Tat-ELP or MTS-ELP was seen in HeLa cells as compared to ELP without CPP. Our trypan blue quenching assay showed that 70% of CPP-ELPs associated with cells were initially only attached to the cell surface, but

they were internalized completely 24 hours later. That CPP-ELPs are initially only attached to the cell surface was confirmed with confocal fluorescence microscopy. Cells observed immediately after incubation with rhodamine conjugate of the CPP-ELPs showed preferential plasma membrane localization. The internalization of all CPP-ELPs was impaired dramatically at 4 °C, indicating that CPP-ELPs are internalized by the endocytotic pathway.

USING ABSORBANCE DIFFERENCE SPECTROSCOPY TO INVESTIGATE THE INTERACTIONS OF SELECTED INHIBITORS WITH THE BREAST CANCER MOLECULAR TARGET CYTOCHROME P450 AROMATASE

Jonathan Priester* and Stanley V. Smith, Murrah High School, Jackson, MS 39202 and University of Mississippi Medical Center, Jackson, MS 39216

Research into the initiation and progression of breast cancer has led to many breakthroughs in fighting this dreaded illness. The identification of several molecular targets has resulted from this research. One of the molecular targets is cytochrome P450 aromatase. Inhibition of cytochrome P450 aromatase activity results in decreased production of estrogens and is the basis of the efficacy of aromatase inhibitors towards breast cancer. Cytochrome P450 aromatase is a member of the cytochrome P450 superfamily of enzymes. These enzymes are involved in a number of important cellular processes such as xenobiotic metabolism and the synthesis and metabolism of endogenous compounds. A common feature of the cytochrome P450s is the presence of a heme moiety liganded to a cysteinyl-thiolate at the enzyme active site. This allows the cytochrome P450s to bind molecular oxygen and modulate its reactivity through a series of controlled electron transfers and typically results in the insertion of one atom of molecular oxygen into the substrate. Cytochrome P450 aromatase utilizes these features to convert androgens into estrogens via a complex three-step mechanism. The goal of our investigation was to characterize the binding of aromatase inhibitors to cytochrome P450 aromatase. We estimated the binding affinities by measuring the changes in the spin-state of the heme-iron moiety at the aromatase active site using absorbance difference spectroscopy. The results indicate that the second-generation steroidal inactivator formestane binds tightly to aromatase but not as tightly as a natural substrate (androstenedione). These results will be incorporated into a molecular model for aromatase which will be used to suggest new approaches for inhibitor design. Supported by American Cancer Society #IRG-98-275-04 and the Base Pair Program.

Divisional talks begin

10:00 CHARACTERIZATION OF THE STRUCTURAL AND FUNCTIONAL IDENTITY OF THE GROEL1 CHAPERONE IN *MYCOBACTERIUM SMEGMATIS*

Amrita Balachandran¹*, Anil Ojha², and Graham Hatfull², ¹Mississippi University for Women, Columbus, MS 39701 and ²University of Pittsburgh, Pittsburgh, PA 15260

The Mycobacteria have two GroEL chaperones, namely, GroEL1 and GroEL2. In *Mycobacterium smegmatis* specifically, it has previously been observed that although the GroEL1 and GroEL2 proteins show 60% homology in their

amino acid sequences, GroEL1 is not essential for the survival of the organism. GroEL2, on the other hand, is essential. Moreover, groEL1 knock-out mutants show a phenotypic defect in biofilm maturation. These observations suggest possible functional differences between GroEL1 and GroEL2. Our project was aimed toward identifying the amino acid residues of *M. smegmatis* GroEL1 that characterize its distinguishing identity and function in relation to GroEL2. The experimental design involved the construction of groEL1 and groEL2 mutants, and the testing of their ability and extent of biofilm formation in comparison to the wild type *M. smegmatis* mc2155 strain. The results show that a chimeric construct constituting a 174 bp C-terminal groEL1 fragment fused to a 1425 bp N-terminal groEL2 fragment does not complement the defective biofilm phenotype in groEL1 knock-out *M. smegmatis* strains. Ongoing stages of the experimental process could possibly confirm the identification of random mutations in groEL1 that impede efficient biofilm formation, and analyze biofilms formed by two additional chimeric constructs. Further understanding of the distinct amino acid identity and structure of *M. smegmatis* GroEL1 could perhaps further the possibility of targeting the pathogenicity of *M. tuberculosis*.

10:20 RNA 5' END LABELING BY FLUOROPHORE-AMP-INITIATED TRANSCRIPTION AND APPLICATIONS IN RNA STRUCTURE-FUNCTION INVESTIGATION

Na Li¹*, Faqing Huang¹, and C.J. Yu², ¹University of Southern Mississippi, Hattiesburg MS 39406 and ²AdeGenix, Inc., Monrovia, CA 91016

Specific labeling at the either 3' or 5' end of RNA is essential for a variety of applications in RNA structure-function investigation. Conventionally, 5' end labeling is usually achieved through PNK-catalyzed phosphorylation of RNA by [γ -P³²]-ATP. The procedure requires the use of a high-energy radioisotope and multi-steps of labeling and purification. Furthermore, it may be difficult to label some RNA molecules if they form 5'-recessed duplex structure. In addition to the hazardous nature of P³², the relatively short half-life of P³² means frequent replacement of "old" radioactive ATP with fresh one. We have developed a simple method for efficient 5' end labeling of RNA via a single-step transcription. We demonstrate here the utility of 5' cyanine dye-labeled RNA for mapping the reaction sites of newly isolated ribozymes. These ribozymes possess 5' duplex structures with 3' overhangs. To define the reaction sites of ribozymes, 5' cyanine dye-labeled RNAs were partially hydrolyzed by lead-induced phosphodiester bond cleavage and fractionated by denaturing PAGE. Fluorescence signals were directly detected by a regular phosphorimager (Bio-Rad). The RNA ladder patterns revealed well-defined reaction sites (the location of reactive nucleotides) within ribozymes. 5' Fluorophore-labeled RNA prepared by in vitro transcription may find broad applications in various fields of biochemistry, biophysics, molecular biology, and biomedicine.

10:40 EVALUATION OF CPG METHYLATION OF SOCS GENES AS BIOMARKERS FOR JAK-2-INHIBITOR SENSITIVITY IN HUMAN BREAST CANCER CELL LINES

Ashley Jenkins^{1*}, Roy J. Duhé², and John K. Smith², ¹Alcorn State University, Alcorn State, MS 39096 and ²University of Mississippi Medical Center, Jackson, MS 39216

The regulation of the prolactin/JAK/STAT/SOCS pathway is essential in many biological processes, such as mammary gland development. Our lab is working to develop drugs that target abnormally active forms of Janus Kinases (JAK). We are also trying to find molecular markers that can identify cancer patients who will benefit from these drugs. It was recently discovered that SOCS-1 and SOCS-3 (Suppressors Of Cytokine Signaling) are silenced in several cancers, but not in normal tissue. The SOCS silencing occurs due to the hypermethylation of "CpG islands" in the socs gene. This removes an important negative feedback mechanism that normally inactivates the JAKs. Methylation silencing of the socs gene was found in 20–60% of the tumors examined, which included patient-derived hepatocellular carcinomas, pancreatic ductal neoplasms, multiple myelomas, acute myeloid leukemia, hepatoblastomas, and human lung cancers. Because the regulation of the prolactin signaling pathway is so important in normal breast development, we suspect that the loss of control of this pathway via socs methylational silencing might lead to breast cancer. Methylation of CpG islands can be measured by methylation-specific PCR, which distinguishes between unmethylated and methylated DNA in a given region. Ultimately, the methylation status of socs-1, socs-2, and/or socs-3 may be used to identify circumstances in which JAK2 inhibitors can be used to treat patients with breast cancer.

11:00 USE OF SITE-DIRECTED MUTAGENESIS TO INVESTIGATE THE MECHANISM OF REDOX REGULATION OF JANUS KINASES

Naila Mamoon*, Kiranam Chatti, Sheeyong Lee, and Roy J. Duhé, University of Mississippi Medical Center, Jackson, MS 39216

Many cytokines, growth factors and hormones signal through the Janus protein tyrosine kinases (JAKs), dysregulation of which has been implicated in a number of cancers. The catalytic activity of JAKs is modulated by their redox states; activity is abolished by oxidation and restored upon reduction. Pretreatment of JAK2 with NEM, an agent that selectively alkylates thiols, also abolished the autokinase activity of JAK2, providing additional evidence that cysteine thiols are essential for the maintenance of activity. The reductive stimulation of JAK activity may underlie cytokine-independent proliferation of leukemic T-cells overexpressing thioredoxin (Trx), a physiological reductant. Trx restored autokinase activity of oxidatively inhibited JAK2 in vitro, while redox-inactive Trx did not. We have evaluated the possibility that specific cysteine residues within JAKs are critical for the redox sensitivity of the enzyme. Using site-directed mutagenesis, nine cysteine residues (675, 722, 748, 787, 866, 917, 961, 1094, and 1105), within JAK2 were individually and progressively mutated to serines and the effects of these mutations were tested in autophosphorylation and transphosphorylation assays. All nine of the cysteine to

serine point mutants retained redox reversibility and demonstrated some level of catalytic activity. When all nine cysteines were converted to serines, the enzyme lost its ability to autophosphorylate under in vitro assay conditions. Under cellular assay conditions, enzyme activity was markedly reduced but not completely obliterated. These results suggest that oxidation of specific cysteine thiols modulates the catalytic activity of JAKs, a feature that may be exploited in JAK-targeted cancer therapy.

FRIDAY AFTERNOON

Cedar Room

12: 00–3:00 PLANTING THE SEEDS OF A BIOSCIENCE INDUSTRY IN MISSISSIPPI

Revolutionary advancements in biological research have spawned new business opportunities. In most regions of the United States, collaborations between innovative scientists and technologists have resulted in entrepreneurial start-up companies manufacturing novel products in pharmaceutical, medical, agricultural, chemical, and environmental industry sectors. Bioscience and biotechnology industrial development is at an early stage in Mississippi, and the membership of the Mississippi Academy of Sciences should be active participants in this process. This symposium will bring together bioscience industry experts with a broad range of perspectives, from the scientific innovators who bring novel ideas to the business community to the venture capitalists who provide start-up funding for bioscience business proposals.

Dr. Roy J. Duhé, Associate Professor of Pharmacology and Toxicology at the UMMC and MAS Director (2003–2006): "Promises and pitfalls of biotechnology and bioscience industries in Mississippi";

Dr. Garth Powis, Director of Basic Research at the Arizona Cancer Center and co-founder of ProlX Pharmaceuticals: "Academic entrepreneurship";

Dr. Lyn Stabler, Vice President of Policy and Analysis at the Mississippi Technology Alliance: "Policy initiatives for bioscience development in Mississippi";

Dr. Larry Walker, Director of the National Center for Natural Products Research at the University of Mississippi: "Spin-off products from academic research in Mississippi";

Mr. Frank Montgomery, Managing Partner of Moss Forest Venture: "The investment community's perspective";

Dr. Greg Perkins, President, BioDerm Sciences, Inc.: "How to attract biopharmaceutical industry to Mississippi."

Divisional talks resume

3:00 ASSEMBLING REPORTER CONSTRUCTS TO INVESTIGATE INTERFERON-MEDIATED REGULATION OF THE ONCOGENIC HERPESVIRUS MAREK'S DISEASE VIRUS

Joy Wall^{1*}, Ross Whitwam¹, and Shane Burgess², ¹Mississippi University for Women, Columbus, MS 39701 and ²Mississippi State University, Starkville, MS 39762

Marek's Disease Virus (MDV) is an α -herpesvirus that causes lymphomas in chickens. MDV is an economic concern to the poultry industry and a model for human lymphomagenesis. Phosphoprotein 38 (pp38), a MDV gene product, is thought to be involved in the latent/lytic transition of MDV and may exploit interferon for use in its regulation. The pp38 promoter region has two regions which the TransFac database identified as Interferon Response Element (IRE) binding sites. We wish to investigate whether IREs regulate pp38 expression. Reporter constructs are being assembled containing PCR-amplified regions of the pp38 promoter in front of a green fluorescent protein (GFP) reporter gene. The amplicons from the pp38 promoter were chosen to yield no IREs, one IRE, or two IREs. All were successfully amplified. The plasmid pd2EGFP-N1 contains a GFP gene behind the cytomegalovirus promoter. This promoter was digested out of the plasmid and ligations are under way to insert the three pp38 amplicons in front of the GFP gene. Once reporter constructs with each amplicon, in both possible orientations have been successfully assembled they will be transformed into chicken embryo fibroblast (CEF) cultures. How GFP expression in the CEF cultures responds to varying recombinant interferon concentrations will be tested to offer insight into the role of IREs as pp38 regulatory elements.

3:20 DYNAMICS OF NUCLEOLAR PHOSPHOPROTEIN B23 AND ITS MUTANTS IN HeLa CELLS

Sandeep S. Negi* and Mark Olson, University of Mississippi Medical Center, Jackson, MS 39216

B23/NPM is an abundant multifunctional nucleolar phosphoprotein involved in ribosome biogenesis. Activities of protein B23 include nucleic acid binding, ribonuclease and molecular chaperone activity. It is phosphorylated during interphase by casein kinase 2 (CK2) (Ser125) and by cyclin dependant kinase 1 (cdk1) (Thr199, 219, 234, and 237) during mitosis. We studied the effect of these phosphorylations on the dynamics of B23 in the nucleolus. Fluorescence recovery after photobleaching (FRAP) studies showed that the mutant (Ser125 to Ala) recovered slower than the wild type, suggesting that phosphorylation reduces affinity for other nucleolar components. Further studies on the phosphorylation mimicking mutant (Ser125 to Glu) showed no difference in the mobility. This may indicate that B23 mostly remains phosphorylated during interphase. Indirect-immunofluorescence studies done with an antibody against phosphorylated Thr199 revealed that B23 is phosphorylated at this site at the start of the mitosis and is dephosphorylated during early anaphase. This site had little or no signal in interphase cells. We hypothesize that these cdk1 phosphorylations affect the nucleic acid binding activity of B23. A Thr to Glu mutant of the cdk1 sites was studied in the interphase cells. This mutant and other members of the nucleoplasmin family, which lack the C-terminal nucleic acid binding region, B23.2 and NPM3, showed a greater mobility/faster recovery than the B23.1, indicating the importance of this segment.

3:40 Divisional Business Meeting

CHEMISTRY AND CHEMICAL ENGINEERING

Chair: John Pojman, University of Southern
Mississippi

Vice-chair: Dionne Fortenberry, Mississippi
University for Women

THURSDAY MORNING

Assembly Hall

8:00 THE EFFECTS OF MONOMERIC FUNCTIONALITY AND COMPOSITION ON PROPERTIES OF THIOL-ENE FILMS

Tolecia Clark^{1*}, Charles E. Hoyle¹, Sergei Nazarenko¹, Brian Olsen¹, and Luke Kwisnek², ¹University of Southern Mississippi, Hattiesburg, MS 39406 and ²Pennsylvania State University, The Behrend College, Erie, PA 16563

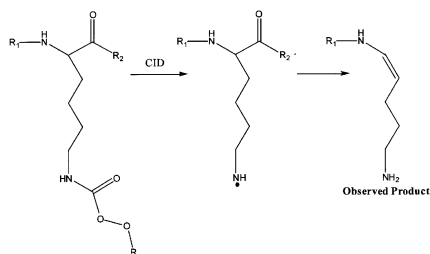
The purpose of this study is to understand the fundamental influence of the thiol and ene monomers on the polymerization kinetics, polymer crosslink formation, and physical properties of films when monomer functionality increases and thiol:ene composition varies. Multifunctional thiols ($f_{\text{thiol}} = 2, 3, 4, 6, \text{ and } 9$) and multifunctional allyl ethers ($f_{\text{ene}} = 2 \text{ and } 3$) are copolymerized by irradiation using a medium-pressure UV light source. Highly functional thiols ($f_{\text{thiol}} = 6 \text{ and } 9$) are synthesized by an amine-catalyzed thiol Michael addition reaction. Polymerization parameters are measured by photodifferential scanning calorimetry and real-time FTIR to obtain polymerization rates and percent conversions. Glass transition temperatures are measured by dynamic thermal mechanical analysis, and film densities are obtained by using an aqueous NaBr solution density test. Preliminary results show that polymerization rates, glass transition temperatures (T_g), and film densities increase when the functionalities of thiol and allyl ether monomers increase, although polymerization kinetics and film properties show greater changes when allyl ether functionality increases. Polymerization rates and film properties are optimal when films are composed of equal molar thiol:ene compositions (based upon functionality). Percent conversions are relatively high for copolymerizations of highly functional thiols with each ene having conversion of approximately 100%. High percent conversions indicate that a loose crosslinked network has been formed. This phenomenon can be attributed to localized events known as looping, which delay the gel effect and reduce effective crosslink density.

8:15 NOVEL GAS PHASE METHODS WITH POTENTIAL USE IN PROTEOMICS

Douglas S. Masterson^{1,2*}, Almary Chacon², Huiyong Yin², and Ned A. Porter², ¹University of Southern Mississippi, Hattiesburg, MS 39406 and ²Vanderbilt University, Nashville, TN 37235

This project aims to develop novel gas phase proteomics methodologies that rely on the site specific generation of free radicals in a mass spectrometer. Peptides are treated

with a peroxycarbonate reagent that selectively modifies lysine residues as peroxycarbamates. The resulting peroxycarbamates are introduced into a Q3 MS instrument where they undergo a CID process. The CID process produces nitrogen centered radicals at the modified lysine sites which then undergo hydrogen abstraction *via* a Hoffman-Löffler-Freytag reaction (HLF). The HLF reaction produces a carbon centered radical which is situated for β -elimination resulting in the cleavage of the peptide backbone. This reaction sequence is essentially the gas phase equivalent of a trypsin digestion. Under acidic pH conditions, the N-terminal nitrogen can be selectively modified as a peroxycarbamate. When the N-terminal nitrogen is modified and subjected to CID conditions in a MS the resulting MS spectra allow for the rapid determination of the N-terminal amino acid. Mechanistic studies show that this transformation is a free radical process and that it can be used to determine all 20 natural amino acids at the N-terminus. Future mechanistic and applications studies will also be discussed.



8:30 THE STRUCTURE AND NONLINEAR OPTICAL PROPERTIES OF THE HMT-CDA 1:1 ADDUCT: EXPERIMENTAL AND DFT APPROACH

Ramaiyer Venkatraman^{1*}, Paresh Chandra Ray¹, Frank R Fronczek², and Jagdish P. Singh³, ¹Jackson State University, Jackson, MS 39217; ²Louisiana State University, Baton Rouge, LA 70803; and ³Mississippi State University, Starkville, MS 39762.

Equimolar amounts of hexamethylenetetramine (HMT) and trans-1,2-cyclohexanedicarboxylic acid (CDA) formed a self-assembled unit through a hydrogen bonding network. Room temperature single crystal diffraction studies and FTIR spectroscopy of the system indicated adduct formation between HMT and CDA. Crystalline adduct sample exhibited appreciable macroscopic NLO properties. *Ab-initio* Density Functional Theoretical (DFT) calculations, using the 6-31G(d,p) basis set, have been performed to investigate the gas phase structure and IR frequencies. The dynamic NLO properties were calculated with the ZINDO/CV method including solvent effects. Theoretical parameters (geometry and vibrational frequencies) predicted by DFT method for the adduct are in good agreement with the experimental data.

8:45 GEOMETRY OF THE $A^2\Sigma, v = 0 \geq X^2\Pi, v' = 0$, ELECTRONICALLY EXCITED STATE OF OH RADICAL

Dorothy Wood^{1*}, S.P. McGlynn², and Paresh Chandra Ray¹,

¹Jackson State University, Jackson, MS 39217 and ²Louisiana State University, Baton Rouge, LA 70803

We present an experimental and quantum-mechanical analysis of the molecular geometry of the excited state of the OH radical emission, $A^2\Sigma, v = 0 \geq X^2\Pi, v' = 0$, 2800–3300 Å spectral region. The transition has been obtained using high-resolution plasma emission spectroscopy techniques¹. Time-dependent density functional theory (TD-DFT) and vibronic intensity distribution methods have been employed to calculate the geometry in the excited state. The latter method is a power series expression for the Franck-Condon (FC) integral in the harmonic approximation in terms of a parameter that approaches zero as the vibrational frequencies of the two combining electronic states approach equality². From this FC expression, we seek to verify the use of its truncated form to test the correspondence of bond lengths to the results obtained by TD-DFT and other techniques. Theoretical results will be compared with the experimental values wherever available (we currently have two spectra from our laboratory.) The results are evaluated in detail about the agreements and disagreements between theoretical and experimental findings. 1. Mills, R.; Ray, P.C.; Mayo, R.M., CW, H1 Laser Based on Stationary Inverted Lyman Population from Incandescently Heated Hydrogen Gas with Certain Group I Catalysis, IEEE Trans. of Plasma Science, (2003), 31, 236-247. 2. Wood, D. M.; Hochmann, P.; Klasinc, L.; McGlynn, S.P., Vibronic Intensities in Diatomic Molecules, International Journal Of Quantum Chemistry (2004), 99(4), 522-532.

9:00 THE INVESTIGATION OF FRONTAL POLYMERIZATION IN THIOL-ENE SYSTEMS

Alford Perryman, Jr.*¹, Birsan Virsali, and John A. Pojman, University of Southern Mississippi, Hattiesburg, MS 39406

Thiol-ene polymerization proceeds through a sequential radical propagation/chain transfer mechanism that leads to polymer and network formation much like a step-growth polymerization. Thiol-enes are advantageous over traditional acrylate systems in that they exhibit low oxygen inhibition during cure and have the ability to form thin and thick cures. The frontal polymerization of the thiol-ene allows conversion of the monomers into polymer via a localized reaction that propagates through a reaction zone. The overall purpose of this research project was to develop a new frontal polymerization system for potential use in in situ repair on the earth, in space, on the moon, and on Mars. In this study, the velocity and front temperature was determined as a function of the initiator concentration and thiol-ene ratio. This information is essential for determining the optimal chemical composition for actual applications and for developing an understanding of how frontal polymerization of thiol-enes differ from other frontal polymerization systems previously studied.

9:15 SHAPE VS. SIZE IN SIZE EXCLUSION CHROMATOGRAPHY

Gregg Anazia* and Susan Pedigo, University of Mississippi, University, MS 38677

Cadherin is a cell adhesion protein that is significant in tissue formation. Crystallographic studies indicate that the extracellular domains of cadherin are prolate ellipsoid in shape. The molecular weight of two cadherin constructs as determined

experimentally using size exclusion chromatography (SEC) was approximately twice that of the computed value. This is misleading given the tendency for cadherin to dimerize in vivo. Alternatively, the SEC column was calibrated according to the Stokes radius of the standard proteins. Using this revised standard curve, cadherin constructs appeared to have Stokes radii very similar to that determined computationally for these constructs using the program HYDROPRO. Thus, calibration of SEC columns according to the Stokes radius yields more reliable determination of the size of proteins.

9:30 QUANTIFICATION OF ALL TRANS RETINOIC ACID (ATRA) BY HPLC, SUBJECTED TO LIGHT AND HEAT TREATMENTS

Mudlagiri Goli^{1*}, Shanise Brown¹, and Doug Paulsen², ¹Mississippi Valley State University, Itta Bena, MS 38941 and ²Morehouse School of Medicine, Atlanta, GA 30310

All-trans Retinoic Acid is a derivative of vitamin A. It is the stable form and is used in the treatment of cancer and skin wrinkles. ATRA and its isomer are highly toxic to pregnant women or nursing mothers. They are known to cause birth defects. 13-cis retinoic acid, an isomer of ATRA used to treat acne, is known to be more toxic than ATRA. It is well known that ATRA and its isomers are light sensitive. Our purpose was to study the behavior of ATRA samples subjected to heat and light. ATRA was exposed to normal visible light and incubation (heat) for various periods of time (0-92 hours). The exposed samples were analyzed with an Agilent series 1100 HPLC using a diode array detector. ATRA samples subjected to light slowly isomerized to 13-cis retinoic acid. The extent of isomerization reached a maximum after 20 hr. ATRA degradation reached a maximum by 92 hours. Formation of other detectable isomers was negligible. The ATRA samples subjected to heat (37.5 °C) were remarkably stable for a long period (20 hours). No other isomers of ATRA were found in the heat-treated samples. The quantification of ATRA and isomer formation and destruction of the sample, if any, was well studied using the HPLC method.

9:45 ACCESSING LEAD IN DRINKING WATER FROM SOURCES IN THE DELTA

Deere Curtisine* and William C. Mahone, Mississippi Valley State University, Itta Bena, MS 38941

It has been noted and well-documented that lead presents one of the most serious environmental health risks to young children, fetuses, and pregnant women. Lead has been identified as a pollutant in several different aspects of the environment. This investigation accesses the lead content in drinking water sources in the delta. The approach was to develop test methods and quality control procedures for determining levels of lead in drinking water. The method used to test the samples of drinking water for lead was based on the Flame A.A. instrumentation techniques. We developed sample preparation procedures that allowed us to maximize our detection limits using pre-concentration techniques. In these findings, there was lead indicated in several drinking waters near and just above the action level (15 ppb). Preliminary data indicated Belzoni, Mississippi had a 10 ppb of lead, Isola, Mississippi had 25 ppb of lead, Louise, Mississippi had 25 ppb of lead, Silver City, Mississippi had 9 ppb of lead, and Mid-

night, Mississippi had 10 ppb of lead. The correlation coefficient was 0.999 for the instrument response curve. The sample responses was located within the lower limits of the least squares data range. This data suggest that a more thorough study with better instrumentation and more quality control procedures are required to definitively assess the exposure potential.

10:00 SYNTHESIS AND MESOMORPHIC BEHAVIOUR OF A HOMOLOGOUS SERIES OF N-(4-N-ALK-OXYSALICYLIDENE)-4'-N-ALKOXYANILINES AND THEIR COPPER(II) COMPLEXES

Francis Tuluri^{1*}, Nandiraju V.S. Rao², Manoj Kr. Paul², Romeo Singh², and V. Padmini², ¹Jackson State University, Jackson, MS 39217 and ²Assam University, Silchar - 788 011, Assam, India

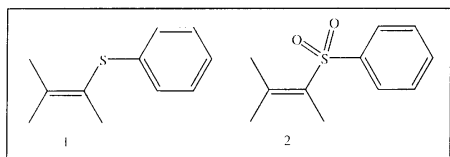
A series of metal (Cu) complexes with bidentate Schiff-bases viz. N-(4-n-alkyloxy salicylidene)-4'-n-alkoxyanilines obtained by the 1:1 condensation of 4-n-alkyloxy salicylaldehyde and 4-n-alkoxyanilines viz., 4-n-hexyloxyaniline, 4-n-octyloxyaniline, 4-n-decyloxyaniline 4-n-dodecyloxyaniline, 4-n-tetradecyloxyaniline and 4-n-hexadecyloxyaniline and have been prepared and characterized. The synthesis of the ligands N-(4-n-hexyloxysalicylidene)-4'-n-alkyloxyanilines as well as the complexes and characterization by thermal microscopy for mesomorphism are presented. The ligands are found to exhibit interesting smectic phases (mostly tilted phases) in addition to nematic phases and polymorphism, while the complexes showed orthogonal smectic A, smectic B, and smectic E phases. The mesomorphic range as well as the polymorphism decreases with increase in chain length. However the coordination with Copper (II) leads to thermally stable metallo-mesogens possessing larger mesomorphic range and a reduced number of mesomorphic phases.

10:15 Break

10:30 A COMPARISON OF SOLVENT EFFECTS ON THE REGIOSELECTIVITY OF SINGLET OXYGEN ENE REACTIONS OF 2-METHYL-3-PHENYLTHIO-2-BUTENE AND 2-METHYL-3-PHENYLSULFONYL-2-BUTENE

Natacha Touchette* and Kristina Stensaas, Millsaps College, Jackson, MS 39210

2-Methyl-3-phenylthio-2-butene (1) and 2-Methyl-3-phenylsulfonyl-2-butene (2) were photooxidized in deuterated benzene, deuterated methanol, and deuterated methanol/water mixtures. Proton nuclear magnetic resonance spectroscopy was used to monitor product distributions. The photooxidation of sulfide 1 resulted in competitive formation of ene product and sulfoxide product, depending on the choice of solvent. Only ene product was formed during the photooxidation of sulfone 2. The observed regiochemistries are a result of several factors including hydrogen bonding of the solvent with the proposed peroxide intermediates, the cis effect, the geminal effect, and formation of the thermodynamically favored conjugated product.



10:45 SOLUTION PROPERTIES OF SINGLE-WALLED CARBON NANOTUBES

Mark Hamon*, Gina A. Sorci, Miles A. Sugar, James P. McVaugh, and Daniel T. Walker, Millsaps College, Jackson, MS 39210

Single-walled carbon nanotubes (SWNTs) are unique molecules which possess outstanding physical properties. Chemical modification of the SWNTs has succeeded in producing soluble material in various organic solvents, thus allowing for a higher degree of process ability and study. Despite these advances, a complete understanding of the solvation of SWNTs has not been realized. By studying the soluble SWNTs in solution with static light scattering techniques we have achieved a greater understanding of how SWNTs interact with one another as well as their affinity for the solvent.

11:00 PREPARATION OF INITIATOR-CORE MICROCAPSULES AND THEIR USE IN FRONTAL POLYMERIZATION

Brian McFarland*, Sammy Popwell, and John A. Pojman, University of Southern Mississippi, Hattiesburg, MS 39406

Frontal polymerization is a mode of converting monomer into polymer via a localized exothermic reaction zone that propagates. Frontal polymerization systems often consist of a monomer in which a thermal free-radical initiator has been dissolved. These systems are sometimes not practical for real-world applications however, because the systems often suffer from a short pot life, reacting homogeneously before they can be used for their desired application. A possible remedy to this problem is examined by attempting to microencapsulate free-radical initiators and then use those microcapsules in frontal polymerization systems, keeping the monomer and initiator separate until the desired time. Several different methods of microencapsulation are tested, the most successful proving to be an interfacial polymerization of polyurea shells around an initiator droplet, consisting of either a hydroperoxide or a peroxyketal. The capsules are tested for core loading, dry powder stability, temperature stability and monomer storage stability. The capsules have an initial core loading of 75-80%, which remains stable upon dry storage. The capsules release their core at approximately 85 °C, ensuring that they will release in a frontal system, which can achieve temperatures of over 200 °C at the front. Frontal systems prove to run successfully when microencapsulated initiator is used in lieu of a dissolved initiator. There proves to be a substantial improvement in the pot life of frontal systems when the initiator is microencapsulated, both in elevated temperature environments and in systems in which a redox accelerator is added. The effect

of shell crosslinking is currently being studied.

11:15 BIOSENSOR BASED ON GOLD NANOPARTICLES INDUCED BY NON-CROSSLINKING DNA HYBRIDIZATION: A SPECTROSCOPIC INVESTIGATION WITH THEORETICAL IMPLEMENTATION

Pareesh Chandra Ray* and Hongtao Yu, Jackson State University, Jackson 39217

Taking advantage of recent developments in the field of metallic nanoparticle-based biosensor, we have investigated aggregation phenomena of DNA-functionalized gold nanoparticles prepared by linking sulfur functionalized oligomer DNA with gold nanoparticles through S-S linkage. A solution of 500 nM of HS-(CH₂)₆-5'-TAC GCC ACC AGC-3' was incubated with 1 nM of gold nanoparticle. At various NaCl concentrations, the aggregation behavior of the gold nanoparticle was observed by observing the solution colors and by monitoring the visible spectra. Modified gold nanoparticles aggregated when they were hybridized with target DNA. The solution become colorless when a complimentary DNA strand was added with the target DNA tethered to gold nanoparticles. Solution color remains the same when a complimentary DNA strand with a single base mismatch was added. This method can detect target DNA at a concentration of nanomolar and discriminate a single base pair mismatched DNA strand. To understand the role of metal-DNA interactions, we also studied the absorption ex-situ using Fourier Transform Infrared (FTIR) and Surface-Enhanced Raman Spectroscopic (SERS) techniques. A simple model describing the optical properties of a DNA-gold nanoparticle aggregate is established and the theoretical data are compared with experimental findings.

11:30 ELECTROGENERATED CHEMILUMINESCENCE AND ITS BIO-RELATED APPLICATIONS

Wujian Miao, University of Southern Mississippi, Hattiesburg, MS 39406

Electrogenerated Chemiluminescence (ECL) has been investigated since 1964 as a method of producing light at an electrode. In a sense, ECL represents a marriage between electrochemical and spectroscopic methods. ECL has some advantages over fluorescence methods, because it does not involve a light source and hence the attendant problem of scattered light and luminescent impurities. Moreover, the specificity of the ECL reaction decreases problems with side reactions and is characterized by good spatial and temporal resolution. The general principle of DNA probe assays and immunoassays based on ECL technique using ECL labels can be described as follows. Single stranded (ss) DNA or an antibody is first immobilized on the surface of the substrate (electrode), then the complementary ssDNA tagged with the ECL label (e.g., tris(2,2'-bipyridyl)ruthenium(II) or Ru(bpy)₃²⁺ hybridizes with the confined ssDNA, or the antigen combines with the immobilized antibody before it further couples with the antibody that is tagged with the ECL label. When a potential is applied to the electrode in contact with a coreactant solution or scanned over a certain potential range, an ECL signal is generated and detected with a photomultiplier or CCD camera. The most widely used ECL label and coreactant are Ru(bpy)₃²⁺ and tri-n-propylamine (TPA), respectively, since the combina-

tion of these two gives the highest ECL efficiency in all coreactant ECL systems. A brief review of the principles of ECL will be followed by a discussion of its applications to a variety of analyses (e.g., immunoassay, DNA probes).

11:45 Divisional Business Meeting

THURSDAY AFTERNOON

Assembly Hall

1:30 SYNTHESIS OF AMINO BENZO-CROWN COMPLEXES AND CARBOXYLIC ACID COMPOUNDS TO FORM HYDROGEN-BONDED CLAY MIMICS

Stefanie Cummings* and Alicia M. Beatty, Mississippi University for Women, Columbus, MS 39701 and Mississippi State University, Mississippi State, MS 39762

Hydrogen-bonded clay mimics, layered organic solids, have a wide variety of chemical applications, but predictably crystallizing these frameworks is difficult. The reaction of certain organic acids (for example, 3,5 pyrazoledicarboxylic acid) with amines, such as benzylamines and alkylamines, has led to hydrogen-bonded pillared clay mimics, and by varying the organic acid and amine used, a variety of predictable layered structures can be synthesized. The organic acid forms the layers of clay mimics, and the pillars are made from amines. Varying the amine compound used may allow us to generate clay mimics with a wide variety of practical applications. To that end, we wish to incorporate crown ether substituents between layers. The use of aminobenzo-crown ethers as pillars may allow for host-guest chemistry to occur. The synthesis of aminobenzo-18-crown-6 and aminobenzo-15-crown-5 will allow for the study of these compounds as possible pillars in clay mimics, and allow for the testing of their ability to trap ions and molecules between layers. New multicarboxylic acids for layer makers are also possible, so the synthesis of 1,10-phenanthroline-4,7-dicarboxylic acid and biphenyl-3,3',5,5'-tetracarboxylic acid will allow for the study of these compounds as possible components in clay mimics. Through the synthesis of these four compounds more research can be conducted on the synthesis of clay mimics, their reactivity, and applications.

1:45 THE USE OF LASER LINE DEFLECTION (WEINER'S METHOD) TO DETERMINE THE DIFFUSION COEFFICIENTS OF METHYL METHACRYLATE AND POLY(METHYL METHACRYLATE)

Josh Hanna* and Lydia L. Lewis, Millsaps College, Jackson, MS 39210

Isothermal Frontal Polymerization (IFP) is a self-sustaining, directional polymerization that occurs when a solution of monomer and thermal initiator come in contact with a polymer seed and create a viscous region where a higher polymerization rate, the gel effect, occurs. IFP can be used to produce gradient refractive index materials (GRINs) for use in the fiber-optic industry, and mathematical models of IFP have been constructed in hopes of improving GRIN fabrication. One drawback to these models is the lack of information in the

literature on the two diffusion processes that occur in IFP: liquid monomer diffusing into the polymer seed and the polymer seed diffusing into the liquid monomer. We use laser line deflection (or Weiner's method) to measure the diffusion coefficients of monomer into polymer of the methyl methacrylate/poly(methyl methacrylate) system over the temperature range of 40 to 60 °C and present the analysis technique for these coefficients.

2:00 THE SYNTHESIS OF A POLYMERIC INHIBITOR AND ITS USE WITH ISOTHERMAL POLYMER FRONTS

Evan Underwood* and Lydia L. Lewis, Millsaps College, Jackson, MS 39210

Isothermal frontal polymerization (IFP) is a directional polymerization that occurs where a solution of monomer and thermal initiator contacts a polymer seed creating a viscous region. This region exhibits a higher polymerization rate due to the Trommsdorff, or gel, effect. Monomer solution continues to diffuse into the forming polymer matrix, and the reaction proceeds directionally until the homogeneous polymerization of the monomer above the front halts the movement of the polymerizing front. To prolong the homogeneous polymerization of the monomer solution, a polymeric inhibitor (of sufficient size to prevent diffusion into the forming polymer matrix) was synthesized using 4-amino-2,2',6,6'-tetramethyl-1-piperidinyloxy. The polymeric inhibitor has been characterized through IR spectroscopy, and quantification of substitution was determined by electron pair resonance. Isothermal fronts were run with and without this polymeric inhibitor confirming that the polymeric inhibitor has been successful in prolonging the lifetimes and distances of isothermal fronts.

2:15 ANALYZING ISOTHERMAL FRONTAL POLYMERIZATION IN THIN LAYERS BY LASER LINE DEFLECTION

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

The purpose of this study is to investigate the ability to use laser line deflection to observe the progression of isothermal frontal polymerization within a thin layer. Laser line deflection takes advantage of density gradients occurring in fronts, which cause a deviance in the beam emitted from the laser. Typically, laser line deflection has been used to examine samples with a width of 1 cm. Samples in this study are constrained to a width of 1 mm. The monomer polymer systems examined in this study include methylmethacrylate, dodecyl acrylate, and 1,6 hexanediol diacrylate.

2:30 METATHESIS IN AQUEOUS MEDIA: SYNTHETIC STRATEGIES TO NEW CATALYSTS

Hans J. Schanz, University of Southern Mississippi, Hattiesburg, MS 39406

Conducting organic transformations in water displays many benefits over classical synthesis in organic solvents. Water is non-toxic, environmentally benign and vastly abundant. Apart from the economic and ecological advantages, aqueous media as solvents are also attractive due to their high heat capacities and their low miscibility with organic solvents which forms the basis of methodologies for catalyst recycling.

Over the past four decades metathesis has evolved to become a highly valuable and versatile tool in organic and polymer synthesis. In particular during the last ten years, Ru-based Grubbs-type metathesis catalysts have significantly expanded the application spectrum due to their substrate tolerance and inertness towards air and moisture. Several water-soluble catalysts have been synthesized and successfully employed in aqueous ROMP and ROM reactions. These catalysts are coordinated by water-soluble phosphine ligands providing less active and thermally less stable "first generation" Grubbs-type catalysts. In our research, we target the synthesis of water-soluble N-heterocyclic carbene (NHC) ligands for the application in aqueous metathesis reactions. Substitution of one phosphine versus one NHC-ligand provides "second generation" Grubbs-type catalysts which should display significantly improved catalytic performances. We are currently developing various synthetic procedures which could provide NHC ligand derivatives for the application in aqueous metathesis.

4:00 Divisional Poster Session

EXPERIMENTAL AND COMPUTATIONAL STUDIES OF PERFLUOROCYCLOALKANES $c\text{-C}_n\text{F}_{2n}$, $N=3-5$) AND THEIR STABLE NEGATIVE ANIONS

Adel Elsohly^{1*}, Gregory S. Tschumper¹, Richard A. Cromcombe², Jih Tzong Wang², and Francon Williams², ¹University of Mississippi, University, MS 38677 and ²University of Tennessee, Knoxville, TN 37996

Perfluorocycloalkanes ($c\text{-C}_n\text{F}_{2n}$, $n = 3-5$) are common compounds used in the manufacture of integrated circuits. Thus, the electronic ground states of their anions are of practical importance. In order to definitively determine the electronic states of the anionic species of these cyclic structures, quantum chemical calculations (B3LYP and MP2) were performed in conjunction with experimental ESR spectroscopy. It was determined that the perfluorocyclopropane anion adopts a D_{3h} geometry and a $^2A_2''$ ground electronic state. The perfluorocyclobutane adopts a D_{4h} geometry and a $^2A_{2u}$ ground electronic state. Finally, the perfluorocyclopentane anion adopts a C_s structure and a $^2A'$ electronic state. The highest level calculations were found to be within 1% of the $a(^{19}\text{F})$ experimentally determined values.

COMPUTING THE INTRINSIC CONFORMATIONAL PREFERENCES OF SUBSTITUTED CYCLOHEXANES AND TETRAHYDROPYRANS: SOME SURPRISES AND NEW INSIGHTS

Abby Weldon* and Gregory S. Tschumper, University of Mississippi, University, MS 38677

Cyclohexane and tetrahydropyran rings containing simple, electronegative substituents such as CH_3 , F, OH, OCH_3 provide a paradigm for the anomeric effect. A series of ab initio and density functional (DFT) theory computations have been carried out with basis sets ranging in size from the modest 6-31G(d) split valence basis to the massive cc-pV5Z correlation consistent basis in order to determine the conformational preference (axial versus equatorial) of these substituted 6-membered rings. In most cases, qualitative agreement exists between each of the theoretical methods and experiment. However, substantial discrepancies are observed for cyclo-

hexanes with simple electronegative substituents such as OH and OCH_3 . For example, MP2 calculations with split valence basis sets as large as 6-311G(2df,2pd) suggest that axial methoxycyclohexane is electronically more stable than the equatorial conformer by nearly 0.6 kcal/mol. On the other hand, RHF and B3LYP computations with the same basis sets indicate that the equatorial orientation is favored by 0.2 - 0.4 kcal/mol. The relative energies of these cyclohexane conformers computed with high-level ab initio methods such as MP2 and CCSD(T) are surprisingly sensitive to the quality of the atomic orbital basis set. Only by progressing to extremely large basis sets does a consistent trend begin to emerge. In addition, corrections for the zero-point vibrational energy and entropy are substantial and can even reverse the electronic conformational preferences of these species.

NMR OF A HIGH SALT PROTEIN

John Young* and Bulent Binbuga, Mississippi State University, Mississippi State, MS 39762

Dihydrofolate reductase (DHFR) catalyzes the reduction of dihydrofolate to tetrahydrofolate using coenzyme nicotinamide adenine dinucleotide phosphate (NAPD) as a proton donor. *Haloferox volcanii* DHFR (hvDHFR) is an Achaean group microorganism that flourishes in a salty environment (3.5M) which is necessary for both stability and activity. We have produced and purified the hvDHFR (^2H , ^{13}C , ^{15}N labeled) to probe its structural characteristics by NMR. The result of this study will be used to investigate the protein's flexibility, through NMR dynamics, at varying salt concentrations. As salt concentrations are lowered the protein shows a reduction in activity without lose in structure or binding affinity. We have hypothesized that this reduction in activity may be due to reduced flexibility. Here we present the sequential backbone assignments of hvDHFR accomplished through triple-resonance NMR experiments.

SECOND VIRIAL COEFFICIENT CORRELATED WITH THE HAMPTON CRYSTALLIZATION SCREEN

Jessica Reily* and William Wilson, Mississippi State University, Mississippi State, MS 39762

The Hampton Crystallization Screen Lite (HCSL) is a complete kit of 50 reagents designed to provide a rapid screening method for the crystallization of biological macromolecules such as proteins, peptides, and nucleic acids. The primary screen variables are salts, pH, and crystallizing agents. The second virial coefficient (B) is a dilute solution thermodynamic parameter that has been shown to be an accurate predictor of crystallization conditions for proteins. Favorable crystallization conditions correspond to B values in the range of -1 to -8 mol/mL/g², called the crystallization slot. We have used laser light scattering to measure B for the protein lysozyme in the HCSL and found that 26 of the 50 conditions fell within the slot. Five conditions were chosen to perform crystallization trials: one with very positive B, one with slightly positive B, one with B near zero, one with slightly negative B, and one with very negative B. The hanging drop method was used to determine if crystals would form under these five conditions. Results of the crystallization trials were found to correlate with and be accurately predicted by the measured B values.

THE EFFECT OF NATURAL SUNLIGHT ON CIPROFLOXACIN EYE DROP

Jiben Roy^{1*}, Diaa M. Shakleya², Patrick S. Callery², Dilip K. Sarker³, Anwar H. Miah³, and Subodh C. Das³, ¹Mississippi University for Women, Columbus, MS 39701; ²West Virginia University, Morgantown, WV 26506; and ³Square Pharmaceuticals Ltd, Pabna, Bangladesh

Ciprofloxacin 0.3% preparation is available on the market for topical ophthalmic use. The marketed eye drop samples, as well as reference ciprofloxacin in water solution was found to degrade to an ethylenediamine analog of ciprofloxacin when exposed to natural sunlight. The degradation product was identified by comparison to a reference standard as well as by LC - MS, MS/MS and MS & MS/MS after deuterium exchange. A model compound, phenylpiperazine also was found to decompose in a similar fashion but after a long duration of sunlight exposure compared to ciprofloxacin. When tested against *Bacillus pumillus*, the sunlight induced eye drop showed slightly less antimicrobial activity compared to original eye drop. However, ciprofloxacin eye drop containers were stored in cartons, there was no photolytic degradation.

HPLC METHOD FOR QUANTIFICATION OF 13-cis RETINOIC ACID (13-cis RA) SUBJECTED TO LIGHT AND HEAT TREATMENTS

Mudlagiri Goli¹, Ramona Burris¹, and Doug Paulsen², ¹Mississippi Valley State University, Itta Bena, MS 38941 and ²Morehouse School of Medicine, Atlanta, GA 30310

13-cis RA is a derivative of vitamin A. It is one of the forms used to treat cancer and skin wrinkles. 13-cis RA and all-trans retinoic acid (ATRA) isomers are highly toxic to pregnant women or nursing mothers. They are known to cause birth defects. 13-cis RA is an isomer of ATRA and is more toxic than ATRA. Vitamin A derivatives are known to be light sensitive. Our purpose was to study the behavior of this compound when subjected to heat and light. 13-cis RA was exposed to normal visible light and incubation (heat) for various periods of time (0-92 hours). The exposed samples were analyzed by using Agilent series 1100 HPLC equipped with a diode array detector. 13-cis RA samples subjected to light slowly isomerized to ATRA. The extent of isomerization reached a maximum by approximately 20 hr. Degradation reached a maximum around 92 hours. Formation of other isomers was negligible. The 13-cis RA samples subjected to heat (37.5 °C) were remarkably stable for a long period (20 hours). No other isomers of 13-cis RA were found in the heat-treated samples. The quantification of 13-cis RA and ATRA formation and destruction of the sample, if any, were well studied using the HPLC method.

NOVEL MULTIDENTATE NHC LIGANDS FOR THE USE IN ASYMMETRIC METATHESIS

Erika Shaffer* and Hans J. Schanz, Loyola University New Orleans, New Orleans, LA 70118 and University of Southern Mississippi, Hattiesburg, MS 39406

Over the last three years, several chiral ruthenium-based metathesis catalysts have been synthesized. These bear chiral NHC ligands and have been employed successfully in catalyzing ARCM (Asymmetric Ring Closing Metathesis) and

AROM (Asymmetric Ring Opening Metathesis) reactions providing enantioselection beyond 90 % ee for various substrates. Particularly interesting are catalyst with back-bonding hydroxy moieties which promote metathesis in air and non-dried solvents. In our research, we target the design of an array of novel, chiral NHC ligands with back-bonding hydroxy moieties in generally applicable synthetic sequences of few steps. Ru-based metathesis catalysts of the new ligands are expected to display high enantioselection in ARCM and AROM reactions, as well as being fairly inert towards molecular oxygen and moisture. Due to the straightforward synthesis, we now can explore the possibility of ligand tuning adjusting steric and electronic parameters to obtain maximum catalytic performance. Starting from enantiomerically resolved trans-1,2-cyclohexanediamine, we initially targeted tridentate, C2-symmetric NHC-ligand precursors with two backbonding hydroxy groups which are available via reductive amination and subsequent ring closing reaction with triethyl-orthoformate. The synthesis of dissymmetric, bidentate ligand precursors was attempted in a sequential derivatization of the diamine. The optimization of the second step of the reaction sequence, a Pd-mediated arylation reaction or reductive amination remains under current investigation. Both precursors can be readily used for catalyst preparation in a one-pot ligand exchange reaction with first generation Grubbs' catalyst derivatives.

SURFACE MODIFICATION BEHAVIOR OF AMPHIPATHIC FUNGAL PROTEINS ISOLATED FROM EDIBLE FUNGAL SOURCES

Cynthia McWright^{1*}, Clara Short², Ashley Grant³, Sonya D. Benson³, and Sarah E. Morgan³, ¹Hancock High School, Hancock, MS 49930; ²Hattiesburg High School, Hattiesburg, MS 39401; and ³University of Southern Mississippi, Hattiesburg, MS 39406

Amphipathic fungal proteins called hydrophobins were isolated from three edible fungal sources: ABH1 from *Agaricus bisporus*, LEH1 from *Lentinans edodes*, and POH1 from *Pleurotus ostreatus*. Contact angle analysis was used to evaluate the surface modification behavior of hydrophobins ABH1, LEH1, and POH1 applied to surfaces of varying hydrophobicity. The surface modification behavior of each hydrophobin protein was monitored as a function of protein concentration and deposition method. Protein solutions ranging in concentration from 5 to 50 ig/mL were prepared and applied to substrates using two deposition methods. The deposition methods evaluated included drop deposition and adsorption methods. The drop deposition method applied a fixed volume of hydrophobin solution directly onto substrates. The adsorption method maintained a substrate in a fixed volume of hydrophobin solution for controlled periods of time. The ability of each hydrophobin to modify surfaces was affected by substrate hydrophobicity, protein concentration, and deposition method. Acknowledgements: Major support for these studies from NSF IUCRC and NSF MRSEC is gratefully acknowledged.

EXPLORING IMPACT OF SURFACTANT INTERACTIONS ON SURVIVAL OF BACTERIAL SPECIES USING FLUORESCENT NUCLEIC ACID STAINING SYSTEM

Ayesha R. Alam*, Alicyn M. Rhoades, Mohamed O. Elasri, and Douglas A. Wicks, University of Southern Mississippi, Hattiesburg, MS 39406

Spoilage of latex emulsions and harmful components of common in-can preservatives used to deter such spoilage are a serious threat. Because of their unique kill method, peptide-based antimicrobials are expected to be less susceptible to antimicrobial resistance, serving as favorable biocides and preserving latex stability. Thorough understanding of microbes and emulsion components are of primary concern toward these developments. Fluorescence is a powerful tool currently employed in concurrent detection, identification and enumeration of microbes in emulsion systems, providing a means for rapid evaluation of spoilage activity. As part of essential groundwork, this study focuses on impact of surfactant interactions on survival of model bacteria *Pseudomonas aeruginosa* and *Escherichia coli* using a fluorescent nucleic acid staining system. Stain compatibility with surfactant solutions, and detection of bacterial growth and survival was confirmed. Explored systems include different formulations and concentrations of hydroxyethyl cellulose, ionic and nonionic surfactants, including ethoxylated nonylphenols (nonionic, phosphated and sulfonated forms), ammonium acetate and modified bacterial nutrient medium. Over a series of experiments, specific ratios of live and dead bacteria, prepared by suspension in phosphate buffered saline and ethanol respectively, were used to inoculate the aforementioned combinations of surfactants/emulsion components. Absorbance and fluorescence peaks were measured, and trends observed.

NANOTRIBIOLOGICAL STUDIES OF POLYMER SURFACES VIA ATOMIC FORCE MICROSCOPY

Rahul Misra*, Paul J. Jones, and Sarah E. Morgan, University of Southern Mississippi, Hattiesburg, MS 39406

Smooth surfaces of rigid rod polymers were generated by spin coating and drawdown techniques to study changes in surface topography after coating with the fungal protein Sc3 hydrophobin. The Sc3 hydrophobin was placed on the polymer surface by both dip coating and spin casting. Friction studies were performed on a polystyrene film to determine the frictional coefficient directly from atomic force microscopy. Studies of interactions of biological molecules with polymer surfaces are of interest for potential use in biomedical and personal care applications, i.e., improvement in lubricity, hydrophilicity, and/or biocompatibility. Acknowledgment is made to the donors of the American Chemical Society Petroleum Research Fund for partial support of this research.

HYDROPHILIC CAMPTOTHECIN ANTI-CANCER DRUGS

Randy Wadkins¹*, David Bearss², Govindarajan Manikumar³, Mansukhlal C. Wani³, Monroe E. Wall³, and Daniel D. Von Hoff², ¹University of Mississippi, University, MS 38677; ²University of Arizona Cancer Center, Tucson, AZ 85724; and ³Research Triangle Institute, Research Triangle Park, NC 27709

Camptothecin analogs that form more stable ternary complexes with DNA and topoisomerase I (termed cleavable

complexes) show greater activity in their ability to inhibit tumor cell line growth in pre-clinical studies. Based on our earlier work, we hypothesized that analogs bearing hydrogen bonding moieties at the 7- through 10-position of camptothecin would result in more stable cleavable complexes. Consequently, we synthesized analogs with 7-mono-, 7-di-, and 7-trihydroxymethylaminomethyl groups. These analogs showed increasing cleavable complex stability as the number of hydroxyl groups was increased. The 7-trihydroxymethylaminomethyl analog of 10,11-methylenedioxycamptothecin (THMAM-MD) showed remarkable ternary complex stability with a half-life of 116 minutes. This is an order of magnitude more stable than any previously-examined analog. Our in vitro analysis demonstrated that these analogs were all potent topoisomerase I poisons, and could inhibit tumor cell growth in culture. We studied the effects of THMAM-MD in vivo in SCID mice bearing HT-29 colon cancer and MiaPaCa-2 pancreatic cancer tumors. The THMAM-MD analog showed excellent, persisting activity in inhibiting tumor growth with both lines. Taken together, our results suggest that camptothecins with hydrophilic, hydrogen bonding groups at the 7-position hold the promise of excellent clinical activity.

THE INVESTIGATION OF MORPHOLOGY DEVELOPMENT IN H-PDLC FILMS

Askim F. Senyurt*, Garfield Warren, Charles E. Hoyle, and Joe B. Whitehead, Jr., University of Southern Mississippi, Hattiesburg, MS 39406

Due to numerous important functional properties, liquid crystal (LC) polymer blends have been studied for a wide variety of applications, the most popular being displays and shutters. The electro-optical properties of LC polymer composites depend on both the LC phase and the polymer phase. The size and the shape of the LC domains determine the properties and suitability for system applications. Holographic Polymer Dispersed Liquid Crystal (H-PDLC) films with different thiol-ene functional monomers were made and investigated to understand the relationship between morphology and electro-optic properties. Thiol-ene systems based upon enes that vary in hardness were chosen for photopolymerization to produce polymer matrices for preparation of optical devices. The matrices formed were found to have several inherent advantages including: high monomer conversion, low shrinkage, resistance to oxygen inhibition during polymerization, and phase separation properties of small molecule LCs with homogenous droplet sizes.

CHARACTERIZATION OF 5-SULFOSALICYLIC ACID USING ANALYTICAL INSTRUMENTATION

Denaya Butler* and Murrell Godfrey, University of Mississippi, University, MS 38677

The purpose of this experiment was to use analytical instrumentation and methods to characterize a given drug. The results from these characterizations can later be used as standards in different drug testing methods and/or to provide a basis for future research studies. In characterizing and analyzing different compounds and drugs, there are different forms of analytical methods and instrumentation that could be used. Several different types of analytical processes and instrumentation were used to determine the analytical and organic proper-

ties of the given drug in aqueous solution. Ultraviolet visible spectrophotometry was used to determine the wavelength maximum, concentration, and molar absorptivity of the compound. In order to determine the purity of the given compound, gas chromatography was performed. After determining these properties, nuclear magnetic resonance spectrometry was used to reveal the structure of the drug. The compound to be characterized in this research experiment was sulfosalicylic acid. This compound has three other names by which it is known. These names are 2-hydroxy-5-sulfobenzoic acid, 5-sulfosalicylate, and 5-sulfosalicylic acid. Its molecular formula is $C_7H_6O_6SH_2O$ with a formula weight of 254.22 grams. Sulfosalicylic acid is an aromatic sulfur-oxygen compound. It is a white, odorless powder that is very soluble in water and has a melting point of 120 °C. Sulfosalicylic acid is a protein precipitant that is commonly used in blood and urine analysis. It is most frequently used in a process known as the sulfosalicylic acid method or proteinuria. This method breaks down the components of a substance to determine its protein concentration. This particular test and others like it are used in forensic examinations during criminal investigations. The results from these characterizations could be used later as standards in different drug testing methods or to provide a basis for further research studies. Such future studies could include examining the effects of added substituents to sulfosalicylic acid.

EXCIPIENT SELECTIONS FOR PEPTIDE STABILITY STUDIES

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Purpose: The objective of this current study is to select appropriate excipients for the peptide stability studies in amorphous solid. **Methods and Results:** Eleven excipients were tested in this study by examining the solubility, color, cake shape and ability for reconstitution in the designed experimental condition. Each excipient was made to 5% (w/v) in CAPS buffer. Samples were then lyophilized. The lyophilized samples were then stored in the stability chamber at 50 °C with relative humidity of 30%, 75%, or 95%. The physical properties were evaluated for a period of two weeks, and polyethylene glycol, polyethylene oxide, sucrose, dextran 500, hypromellose, hydroxyethyl cellulose and hydroxypropyl cellulose are good candidates for serving as the excipient for peptide stability studies. Among those, polyethylene glycol, polyethylene oxide, and sucrose were formulated with peptide VYPNGA. These excipients were made with 5% (w/v) and dissolved in CAPS buffer. The VYPNGA peptide was added to each excipient solution at a concentration of 100mg/ml. After lyophilization, they were placed in the stability chamber at 50 °C with RH of (sucrose 30%, PEG 75%, and PEO 95%). At time 0 and other predetermined time intervals the samples were analyzed with HPLC. **Conclusion:** The sucrose will recrystallize in 7 days. PEG, PEO, hypromellose, dextran 500, hydroxyethyl cellulose, and hydroxypropyl cellulose are potential good candidates for peptide stability studies. VYPNGA peptide have complex chemical reactions when formulated with PEO and PEG, and the peptide mass balance was achieved in PEO and sucrose.

RESONANCE ENERGY TRANSFER STUDIES OF SUB-

UNIT EXCHANGE KINETICS AND EQUILIBRIUM DIMERIZATION IN THE LAMBDA CRO REPRESSOR

Haifeng Jia* and Michael C. Mossing, University of Mississippi, University, MS 38677

The Cro repressor helps to regulate the master switch that controls the development of bacteriophage lambda, a longstanding paradigm for the control of gene expression. Dimers of Cro are required to recognize operator DNA and repress transcription. Dimerization of Cro is weak relative to DNA binding, and slow relative to other processes required for its production and function. At concentrations typical for DNA binding, most free Cro subunits exist as isolated monomers. Folding and assembly of Cro dimers from unfolded states have been shown to be limited by slow proline isomerization (Satumba and Mossing, *Biochemistry* 2002, 41,14216-24). Here we demonstrate that exchange of subunits between Cro dimers is also slow under native states. Exchange of subunits between dimers can be monitored by Fluorescence Resonance Energy Transfer (FRET). Several single-cysteine variants were used to study dimerization equilibria and subunit exchange kinetics. Unique cysteine residues were covalently modified either with the donor fluorophore iodoacetamidoadans (IAEDANS) or the acceptor 5- iodoacetamido-fluorescein (IAF). The labeled subunits with IAEDANS as donor and IAF as acceptor allow measurement of dimer dissociation and subunit association. Subunit exchange experiments initiated by mixing pre-equilibrated donor and acceptor samples resulted in slow kinetics that were independent of protein concentration but highly dependent on temperature. A simple kinetic model for subunit exchange predicts that the observed rates for this mixing protocol will always be identical to the dimer dissociation rate. Titration of a trace amount of highly fluorescent acceptor subunits by excess donor subunits allow straightforward determination of the fraction of acceptor subunits in dimers by FRET, and thus the dimer dissociation equilibrium constant (Kd). Thus, the association rate constant could be calculated, which then was confirmed by the DNA binding experiments.

INVESTIGATING THE IMPACT OF BIOCIDES BEHAVIOR IN THE PRESENCE OF SURFACTANT AND POLYMER MOLECULES

Adam Hathorne*, Alicyn M. Rhoades, and Douglas A. Wicks, University of Southern Mississippi, Hattiesburg, MS 39406

The problem of latex degradation by microbial action is of vital importance, and the development of new and more effective methods of antimicrobial treatment is an important area of current research. The focus of this project is to determine the minimum inhibitory concentration (MIC) values of two biocides provided by ISP Nuosept[®] 95 and Nuosept[®] 495, versus *Pseudomonas aeruginosa* when in the presence of surfactant molecules and also within a latex environment. The environment of a biocide molecule impacts resulting efficacy, and ultimately these studies lay the groundwork for the development of new environmentally compatible biocides. These surfactant solutions contain both ionic and nonionic end groups. Based on commercial applications, the expected MIC values are 483 mg/L for Nuosept[®] 95 and 966 mg/L for Nuosept[®] 495. Using standard culture plating techniques the MIC of Nuosept[®] 95 in the surfactant solutions has been

determined to be between 97 mg/L and 579 mg/L and for Nuosept[®] 495 to be between 576 mg/L and 966 mg/L. It is hypothesized that the decrease from the theoretical values is due to the presence of the negatively charged end groups of the surfactants. Nuosept biocide behavior as determined in surfactant solutions is compared to the behavior of gentamicin in surfactant solutions, as well as the behavior observed for the same biocides in a latex environment. Gentamicin is reported as having a MIC of 0.25 mg/L in water but was measured as 1050 mg/L in the presence of surfactant molecules.

INTERCALATION OF SMALL MOLECULES INTO HYDROGEN-BONDED SOLIDS

Bentley Curry* and Alicia M. Beatty, Millsaps College, Jackson, MS 39210 and Mississippi State University, Mississippi State, MS 39762

Utilizing organic compounds such as 3,5-PDCA, 3,5-PzDCA and amines such as octylamine and diaminododecane, we are able to create layered solids. The layers of these crystals are hydrogen-bonded as well as ionic, but only hydrophobic components are found between the layers, making them ideal, we believe, for intercalation to occur. Taking advantage of the relatively weak interactions between layers of these hydrogen-bonded crystals, guest molecules can squeeze into the lattice of the crystalline structures. Our study includes intercalation experiments using solvents of varying boiling points (volatility) as well as different sizes in order to fully explore the abilities of these crystalline structures to intercalate. The materials have been studied using DSC, TGA, and powder X-ray diffraction to determine the presence of any guest molecules. We will report on several techniques and methods that we have used for intercalation, and data collected to support our hypothesis.

CALCIUM-DEPENDENT STABILITY OF E-CADHERIN DOMAIN 1 AND 2

Susan Pedigo*, Alka Prasad, and J. Matthew Rutherford, University of Mississippi, University, MS 38677

Epithelial cadherin is important in establishing and maintaining cell to cell interactions in epithelial cells thereby playing an important role during morphogenesis. The epithelial cadherin molecules have three main regions- the N-terminal extracellular region, the transmembrane region that spans the cell membrane once, and the C-terminal cytoplasmic region that communicates with the cytoskeletal actin filaments through catenins. Crystallographic studies done by Shapiro showed that N-terminal domains have two types of interactions which we designate as cis- and trans- interactions, both of which are mediated by domain 1 (Shapiro et al., 1995, Nature 374:327-370 CAD1). We report studies of the calcium dependent stability of extracellular Domains 1 & 2 of epithelial cadherin as a two domain construct (ECAD12). The molar extinction coefficient was determined using the Edelhoch method and found to be independent of the calcium. CD spectra of the ECAD12 indicated a typical beta-sheet conformation in all solution conditions. There was a significant calcium-dependent decrease in the signal 235 nm (tryptophan). Thermal and denaturant-induced unfolding was monitored by CD. DSC experiments were performed in the presence of either 10 μ M EGTA or 5 mM Ca^{2+} . General observations were made from these experiments. The apo-state fitted well to a 3-state model.

Both transitions were less stable than the unfolding of the isolated Domain 2, indicating that the domains were destabilized in the two domain construct. Calcium stabilized ECAD12 as witnessed by an increase in T_m (40 °C in Apo to 66 °C in 10 mM Ca^{2+}) and delHm (a 3 fold increase from Apo to 10 mM Ca^{2+}), and an increase in $[D]_{1/2}$ for both Urea and GdnHCl. With calcium added, the unfolding transitions were highly cooperative. DSC transitions shifted from ~ 40 to 65 °C and narrowed upon adding calcium.

TREE SEARCH NEIGHBORHOODS FOR THE PROTEIN FOLDING PROBLEM IN HP LATTICE MODEL

Haitao Li¹*, Cesar Rego¹, and Fred Glover², ¹University of Mississippi, University, MS 38677 and ²University of Colorado, Boulder, CO 80309

We examine a prominent and widely-studied model of the protein folding problem, and provide two new methods for the neighborhood search in metaheuristic algorithms. Given a sequence of amino acids, the protein folding problem (PFP) consists of predicting the native tertiary structure (i.e., conformation) of the corresponding protein. One of the most widely studied biophysical models of protein folding is the hydrophobic-hydrophilic (HP) model. In this study we consider the popular two-dimensional (2D) version of the HP model where chains of amino acids are configured as self-avoiding paths on a regular square lattice in which vertices are labeled by the amino acids. An optimal conformation maximizes the number of pairs of hydrophobics that are adjacent on the lattice and not consecutive in the sequence. In this research we propose two neighborhood search methods based on a tree search framework for the problem under investigation. A fundamental feature of the proposed search methods is the use of neighborhoods capable of exploring the solution space in a dynamic and adaptive fashion. In one algorithm this is accomplished through a tree search neighborhood built upon a filter-and-fan (F & F) approach. In another a specialized ejection chain method (EC) is designed to generate compound moves. Computational results obtained on a standard set of benchmark problems indicate that the F & F algorithm can be advantageously compared to the state-of-the-art algorithms and that the EC algorithm clearly outperforms all of them, affording a new advance for practitioners who seek to handle applications in this area.

USE OF SURFACTANTS IN MODIFYING THE SURFACE CHARACTERISTICS OF NATURAL FIBERS FOR USE IN POLYMERIC COMPOSITES

Kapil Inamdar*, Ellen Lackey, and John O'Haver, University of Mississippi, University, MS 38677

Natural fibers are hydrophilic which creates problems when they are used as reinforcements in polymeric composites. The polymeric matrix material has difficulty in penetrating and coating these natural fibers to form a good solid product due to the presence of hydroxyl (-OH) groups on the fiber surfaces. This study aims at treating hemp/jute fiber surfaces with different surfactant solutions in an attempt to achieve a hydrophilic-hydrophobic surface character transition of the hemp/jute fibers. We hope to understand the basic surface characteristics of the hemp/jute fibers and use the knowledge gained from the initial experiments as the building blocks for

further product development and optimization. The fibers will be treated with surfactant solutions at different concentrations (to make the fiber surface hydrophobic), providing data for an adsorption isotherm. The understanding of the various isotherm regimes will be used to choose the different surfactant concentrations that should be used in further studies (for best results). A KSV Sigma 70 tensiometer will be used to do powder wettability studies on the hemp/jute fibers. Theoretically a liquid capable of wetting a solid should yield a contact angle between 0 and 90 degrees with the former indicating complete wetting. The aim being to make the fibers hydrophobic, the contact angles of water and the resin with the fibers should increase and decrease, respectively, indicating effective use of the surfactant.

MICHAEL ADDITION IN THIOL-ENE SYSTEM POLYMERIZATION

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

Thiol-ene polymerization by means of Michael addition is possible with amines as catalyst, from primary to tertiary. Other catalysts involving nitrogen atoms are possible to use too. We established that any primary amine can catalyze the bulk polymerization of the system, with the exemption of the aromatic amines. Also most of the secondary amines are able to catalyze the reaction with the same exemption for the aromatic ones. No tertiary amine is able to catalyze the Michael addition in the Thiol-ene system but 4-(aminomethyl) pyridine. Also we have tested carbamate systems. Carbamates behave in different manner depending of the cations on them. We have showed that the ammonium carbamate is the most active one when it reacts together with 18-crown-6 ether. It promotes a fast polymerization and the formation of a foam as a product.

SYNTHESIS OF NON-SYMMETRICALLY SUBSTITUTED PERYLENETETRACARBOXYLIC BISIMIDES WITH PEG SWALLOWTAILS

Ramakrishna Samudrala* and Daniell Lewis Mattern, University of Mississippi, Oxford, MS 38677

Non-symmetrically substituted perylenetetracarboxylic bisimides, which may serve as molecular rectifiers of electricity, were synthesized with pyrenemethyl, pyrenebutyl or phenylethyl groups connected to one imide nitrogen and the 10-(2,5,8,12,15,18-hexaoxanonadecyl) group, serving as polyethylene-glycol (PEG) swallowtail, connected to the other imide nitrogen. The 2,5,8,12,15,18-hexaoxa-10-nonadecanamine (swallow tail) was prepared by protecting serinol's nitrogen with benzyl protecting groups and then attaching 2-methoxyethoxyethyltosylates to the alcoholic oxygens, followed by deprotection of the benzyl groups. These non-symmetric bisimides were soluble in organic solvents like CHCl_3 , but insoluble in water.

PHOTOMUTAGENECITY OF POLYCHLORINATED BIPHENYLS, A CLASS OF ENVIRONMENTAL POLLUTANTS

Esabel Neto*, Elgenaid Hamadain, and Hongtao Yu, Jackson State University, Jackson, MS 39217

Chemical agents represent a largest source of environmental mutagens. Human are constantly exposed to a variety of

natural and synthetic chemicals. Among these toxic chemicals is a class of compounds called polychlorobiphenyls (PCBs). These compounds are produced from industrial sources and have been a major concern of the public as they are classified as priority pollutants by the US Environmental Protection Agency (US EPA). These compounds contain the biphenyl rings with multiple substitutions of chlorine atoms. Human contact with these compounds occurs via inhalation, ingestion and absorption through the skin. Since these compounds absorb light, exposure to light should contribute to both the environmental fate and the toxicity of PCBs. Fourteen PCBs were selected randomly in this study, from lower to higher chlorine substituted and they are tested with conventional Ames test for photomutagenicity with modifications. *Salmonella typhimurium* histidine auxotrophic bacteria strain TA 102 were exposed to light irradiation in the presence of PCBs with concentrations of 0, 5, 10, 25 μM , respectively. After incubation, the number of revertant bacteria colonies, which signifies mutation events, was counted. The results shows that 2,6-dichloro-, 3,4,5-trichloro-, 2,3,5,6-tetrachloro-, and 2,2',3,4',2,2',3,4,5-pentachlorobiphenyl, 2,2',4,4',5',6'-heptachlorobiphenyl are photomutagenic, producing at least twice the reverted colonies at the light control. On the other hand, 4,4'-dichloro-, 3,3',4,4',5-pentachloro-, 3,3,4,4',5,5'-hexachloro-, 2,2',3,4,5,6,6'-heptachloro-, 2,2',3,3',4,5,6,6'-octachlorobiphenyl are not photomutagenic. A structure-photomutagenicity, relationship is being established.

NITRIC OXIDE SENSOR USING MYOGLOBIN IMMOBILIZED IN SOL-GEL AND NAFION MATRICES

Sarah Mohamed*, Anandhi Ray, Hiroyasu Tachikawa, and Elgenaid Hamadain, Jackson State University, Jackson, MS 39217

Electrochemical reduction of NO was observed at glassy carbon electrode modified with myoglobin film and covered with Nafion and in sol-gel encapsulated myoglobin. Detection was carried out by cyclic voltammetry under aerobic and anaerobic conditions. Determination of NO at a reduction potential (-0.75 V vs. Ag/AgCl), shows no interference from such species as nitrate, nitrite, ascorbic acid, carbon dioxide and dopamine. Immobilization of Mb by physically trapping the molecules in individual pores of the sol-gel matrix permits the molecules to be isolated, stabilized and used as NO sensor. Electrochemical experiments were carried out using a cypress systems model CS-1190 computer-controlled potentiostat system. The electrochemical cell used consists of a (3 mm) GC disk electrode covered with either Mb and Nafion or sol-gel as working electrode, a platinum wire as auxiliary electrode and an Ag/AgCl as a reference electrode. In sol-gel modified electrode, the solution was prepared by hydrolyzing 1 ml of tetramethylorthosilicate (TMOS) with 30 μl of .04 M of hydrochloric acid and 225 μl of distilled water. Equal amount of this sol was mixed with 1 mM myoglobin solution. Upon addition of protein solution, the gelation occurred within few minutes. The peak corresponding to metmyoglobin reduction appears at around -0.25 V in the Nafion and sol-gel matrices. Upon addition of NO saturated solution new peak appears around -0.75 V. Various amounts of NO saturated solution was added and corresponding changes in the amplitude of the reduction peak was observed. Results show that myoglobin in

nafion and sol-gel matrices can be used as NO sensors.

FRIDAY MORNING

Assembly Hall

8:00 MISCIBLE FLUIDS IN MICROGRAVITY (MFMG) — AN INVESTIGATION ON THE INTERNATIONAL SPACE STATION

John A. Pojman¹*, Nick Bessonov², and Vitaly Volpert²,
¹University of Southern Mississippi, Hattiesburg, MS 39406
and ²Université Lyon I, F-69622 Villeurbanne Cedex, France

A zero-upmass investigation was performed on the International Space Station, called Miscible Fluids in Microgravity (MFMG). The goals of the experiment were to determine if miscible fluids, honey and water, could exhibit transient interfacial phenomena. Specifically, we tested if a stream of honey into water could exhibit the Rayleigh-Tomotika instability and if a blob of water in honey would spontaneously become spherical. No dramatic phenomena were observed. We used a 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 performed simulations of drops and streams of miscible fluids and showed that it is possible for transient phenomena to occur that are similar to that observed with immiscible fluids. Specifically, we show that an aspherical drop can spontaneously become spherical and that a stream of a fluid can exhibit a Rayleigh instability. We also simulated a miscible drop migrating in a temperature gradient. By comparing simulations to the MFMG results, we are to set an upper limit on the value of the Korteweg stress parameter, at least for honey and water.

8:15 EXPRESSION OF HUMAN PEPTIDE HORMONES IN INSECT CELLS

Amanda Parker* and Robert C. Bateman, Jr., University of Southern Mississippi, Hattiesburg, MS 39406

Many peptides and peptide hormones are synthesized as larger precursors that require the action of enzymes in the secretory pathway to become fully active. The sequence of these processing enzymes is highly conserved from humans down to insects. In order to study peptide hormone processing a model insect system will be developed. The human gonadotropin-releasing hormone (GnRH) will be expressed in the S2 cell line derived from *Drosophila melanogaster*. Subsequent production of GnRH will show the ability of the processing enzymes in the insect secretory pathway to properly process human peptides. Establishment of the *Drosophila* system for the production of peptide hormones will aid in the identification of which enzymes are necessary for hormone maturation in humans. Also, the system could provide a means of secreting large amounts of human hormones for biotechnology and drug development. Similarities between insect and human peptide processing enzyme function will suggest an evolutionary relationship among peptide biosynthetic pathways.

8:30 ARE MOLECULES AT A SOLID/SOLUTION INTERFACE AFFECTED BY GRAVITY?

Newton Fawcett¹*, Richard D. Craven¹, Ping Zhang², and Jeffrey A. Evans¹, ¹University of Southern Mississippi, Hattiesburg, MS 39406 and ²Reichold, Inc., Durham, NC 27703

Molecules in homogeneous solution do not spontaneously settle because their thermal kinetic energy (kT) energy is 10^6 - 10^7 times greater than their potential energy due to gravity. However solvated molecules adsorbed or bonded to a solid surface in contact with a solution are inhomogeneous with respect to the bulk solution. Furthermore, there is a large decrease in entropy associated with immobilization on a surface. Will, therefore, molecules at a solid/solution interface be affected by the Earth's gravitational field? This question is addressed experimentally using a quartz crystal microbalance, a device that is itself immune to gravity. Evidence is presented showing that DNA macromolecules, solvated in aqueous buffer at room temperature, collapse toward an up facing surface and away from a down facing surface. It is also experimentally shown that, to hybridize, DNA must move away from an upfacing surface.

8:45 POLYMER-DISPERSED AQUEOUS MATERIALS

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

The focus is to prepare hydrophobic polymeric materials in which an aqueous phase is distributed throughout the polymer matrix as droplets. Depending on the composition of the aqueous phase, the resulting material could respond to various external stimuli, such as magnetic fields, electric fields, or volatile compounds. The thin films consist of water droplets dispersed among a continuous polymer phase, and the films are prepared via reverse microemulsion polymerization of a surfactant, water, and acrylate mixture. The surfactant, Aerosol-OT is employed to encapsulate the nanometer-sized aqueous molecules within a surfactant monolayer. Photopolymerization of the microemulsion solution produces an opaque polymer, therefore the initially nanometer-sized droplets aggregate to sizes large enough to scatter visible light. Opaque films contained at 100% relative humidity will retain the opaque quality, while films exposed to lower humidity levels become transparent. The macroscopic humidity response is a quasi-reversible phenomenon that is assumed to result from water droplets shrinking in size or evaporating from the films. To determine the exact cause of the quasi-reversible hydration, we are using Thermal Gravimetric Analysis (TGA) and Attenuated Total Reflection Infrared Spectroscopy (ATR-IR). Comparison and analysis of data from both techniques suggest water does evaporate from the films, and completely dehydrated (i.e., transparent) films cannot be re-hydrated by sealing them in a saturated environment. Additionally, ATR-IR and Small angle Light Scattering (SALS) together indicate that the water droplet distribution is not uniform throughout the films. This hypothesis will be further investigated with phase contrast and Scanning Electron Microscopy (SEM).

9:00 CHEMICAL PROFILING AND ANTIMICROBIAL ANALYSIS OF A TRADITIONAL HERBAL MEDICINE CONTAINING GARLIC AND BLACK CUMIN

Jiben Roy^{1*}, Daa M. Shakleya², Patrick S. Callery², and Jhon G. Thomas², ¹Mississippi University for Women, Columbus, MS 39701 and ²West Virginia University, Morgantown, WV 26506

A combination of crushed garlic and black cumin seeds has been used as a traditional remedy for urinary tract infections. In-vitro antimicrobial testing suggested that the mixture of two spices in the ratio of 1:1 has antimicrobial effects on both *Staphylococcus aureus* and *E. coli* species. Analyses of the extract of garlic and black cumin by GC-MS as well as LC-MS & MS/MS confirmed that the main components of garlic were allicin, γ -glutamyl-S-allylcysteine and allicin transformed products such as diallyldisulfide and vinylthiins. Components of black cumin were thymoquinone, p-cymene, p-tert-butylcatechol, and pinene. Isolated samples of allicin by preparative HPLC from garlic extract and reference samples of diallyldisulfide and thymoquinone were tested individually and in combination for their antimicrobial activities against *S. aureus* and *E. coli*. All of these compounds showed modest antimicrobial effects individually (except diallyldisulfide against *E. coli*) and in combination.

9:15 ORGANIC SYNTHESIS AND CHROMATOGRAPHIC SEPARATION OF [4+2] CYCLOADDITION REACTION PRODUCTS FROM METALLIC NITRIDE FULLERENE (MNF) NANOMATERIALS

Steven Stevenson^{1*}, Helen Yu¹, Ryan Stephen¹, Shanna Lavergne¹, Ivory Dean¹, Jonathan Dupont², and Christy Dyess², ¹University of Southern Mississippi, Hattiesburg, MS 39406 and ²Mississippi School for Math and Science, Columbus, MS 39701

The recently discovered metallic nitride fullerene (MNF) nanomaterials have generated interest within the scientific community due in part to their unique structural and electronic properties. A striking feature is the presence of an internal metallic nitride nanocluster which is encapsulated within the carbon cage housing (e.g., C80). Emerging applications include their use in medicine (e.g., MRI contrast agents). However, development of MNF-based pharmaceuticals depends on the ability to functionalize the MNF carbon cage. Unfortunately, a paucity of MNF reactivity data hampers research application development. With little research in the organic synthesis and derivatization of the MNF carbon cage surface, the objective of this research is the investigation of MNF cage reactivity. The selected reaction type is a [4+2]cycloaddition to the cage, functionalized via o-quinodimethane intermediates. Results indicate the presence of mono- and bis-adducts for these MNF nanomaterials. Generation of the reactive o-quinodimethane diene and subsequent cycloaddition is performed under refluxing 1,2,4-Trichlorobenzene. The reaction products are chromatographically separated and isolated. Purified MNF adducts have been characterized by NMR and mass spectrometry. In conclusion, cycloaddition reactions with MNFs are feasible and result in novel, functionalized nanomaterials. Mono-adduct formation is favored versus

bis-adducts.

9:30 MOLECULAR DYNAMICS STUDIES OF THE BT TOXIN CYT1A IN SOLUTION

Xiaochuan Li^{1*}, Jun Xie², Dexuan Xie², and Peter Butko¹, ¹University of Southern Mississippi, Hattiesburg, MS 39406 and ²University of Wisconsin, Milwaukee, WI 53201

A protein's structure determines its function. Ideally, knowledge of structure along with the dynamics and energetics of atomic motions, provides a good insight into the behavior of a protein. By using CHARMM, a molecular dynamics software, we performed a computer simulation of the protein Cyt1A from *Bacillus thuringiensis* var. *israelensis*, which is a mosquito-specific toxin. Considering the lack of experimental data on the interaction between Cyt1A and the cell membrane, computer simulation appears to be an ideal tool to study this interaction. Dynamics of Cyt1A and mutated Cyt1A (Lys225 to Ala) in water with periodic boundary condition were run in CHARMM. The minimization revealed that the major contribution to the total energy is the electrostatics. The simulation results identified the most flexible regions of the protein, which might be involved in its binding to the membrane. Since electrostatic interactions play an important role in the toxin's function, we employed the Adaptive Poisson-Boltzmann equation Solver (APBS) to map the electrostatic interaction between the protein and the solvent. The APBS uses the finite element or finite difference methods to solve the related nonlinear second order partial differential equations. Our results are in accord with the few available pieces of experimental data and will serve as a basis for the future simulation of the toxin in the presence of the lipid membrane.

9:45 THE CHARACTERIZATION OF DENDRITIC POLYOL/CLAY NANOCOMPOSITES

Jillian Danner^{1*}, Sergei Nazarenko², and Sarah E. Morgan², ¹Mississippi University for Women, Columbus, MS 39701 and ²University of Southern Mississippi, Hattiesburg, MS 39406

In an effort to eventually determine the intercalation spaces of dendritic polyols, two known procedures were tested to determine the optimal method of testing as well as to determine the effect of thermal history and polydispersity of polyol/clay nanocomposites. A third, more optimal, method was created and tested and all methods were compared to determine the effect of the glass transition on the reaction. A nanocomposite of various synthetic and natural clays and second, third, and fourth generation dendritic polyols were synthesized via intercalation and exfoliation. The reactions were then re-prepared so the surface topology of the nanocomposite films could be examined via Atomic Force Microscopy.

10:00 MECHANICAL AND INTERFACIAL BEHAVIOR OF AMPHIPATHIC NATURAL AND SYNTHETIC POLYMERS

Sonya D. Benson^{*}, Gordon C. Cannon, Charles L. McCormick, and Sarah E. Morgan, University of Southern Mississippi, Hattiesburg, MS 39406

The mechanical and interfacial behavior of amphipathic natural and synthetic polymers is reported. The natural amphipathic polymers called hydrophobins have been isolated from the wood-rotting fungus *Schizophyllum commune* and

from three edible fungal sources: *Agaricus bisporus*, *Lentinans edodes*, and *Pleurotus ostreatus*. The amphipathic synthetic polymers evaluated are nonionic surfactants composed of triblock copolymers of polypropylene oxide and polyethylene oxide. Natural and synthetic solutions of varying concentrations were applied to substrates of varying hydrophobicity using the adsorption technique. Changes in substrate morphology were monitored using tapping mode atomic force microscopy. Adhesion characteristics of unmodified and modified substrates were evaluated using advanced atomic force microscopy techniques. The ability of both natural and synthetic polymers to modify the polarity of substrates was evaluated using contact angle analysis. Owens-Wendtttheory was used to determine the polar and dispersive components present on both unmodified and modified substrates. Natural hydrophobins are significantly better surface modification agents than the synthetic triblock copolymer studied. Hydrophobins significantly increased the polarity of hydrophobic substrates at much lower concentrations than the synthetic polymers without significant alteration of substrate morphology. Acknowledgements: Major support for these studies from the National Science Foundation Materials Research Science Engineering Center (DMR 0213883) is gratefully acknowledged.

10:15 Break

10:30 CONDUCTIVITY DEPENDENCE OF PEG CONTENT IN AN ANHYDROUS PROTON CONDUCTING SOL-GEL ELECTROLYTE

Braja D. Ghosh* and Jason Ritchie, University of Mississippi, University, MS 38677

Proton conducting polymer electrolytes have important applications in electrochemical devices such as fuel cells and electrochromic displays. We have prepared anhydrous proton conducting electrolytes composed of mixtures of our "MePEG polymer," a sol-gel based MePEGn polymer, and a MePEGnSO₃H acid. Our goal is to gain a fundamental understanding of the mechanism of anhydrous proton conductivity in our MePEG polymer. We have shown that H⁺ transport is dependant on the volume fraction of polyethylene glycol (PEG) present and that the Grothaus mechanism of H⁺ transport dominates at low acid concentrations. Here the molar equivalent conductivity of the MePEGnSO₃H acid is linearly correlated with the inverse of volume fraction of PEG (V_f,PEG). This indicates that volume fraction of PEG is a strong factor controlling the conductivity in these solutions of acid and polymer. In addition, the dependence on the concentration of PEG supports the Grothaus mechanism of conductivity. Moreover, the lack of a dependence of equivalent conductivity on the size of the MePEGnSO₃H acid indicates no contribution from the vehicle mechanism of H⁺ conductivity.

10:45 DIFFUSE REFLECTANCE INFRARED FOURIER TRANSFORM SPECTROMETRY (DRIFTS) ON MINERAL ADDITIONS TO JSC MARS 1 SIMULANT SOIL

Nicholas A. Phillips¹*, Charles Smithhart¹, and Richard Ulrich², ¹Delta State University, Cleveland, MS 38733 and ² University of Arkansas, Fayetteville, AR 72701

Many substances such as hydrates, sulfates, carbon-

ates, and oxides have been discovered to be on Mars either on the surface or in the atmosphere. These minerals indicate that Mars may once have had liquid water on its surface. This experiment is designed to take DRIFTS readings on Mars simulant soil with mineral additions, and it is also designed to determine if DRIFTS is a useful method of identifying elements on the surface of Mars. Minerals were added to the soil in different percentages, and then DRIFTS was used to determine where the functional groups of the mineral additions appeared in the infrared spectra. The minerals added in this experiment included calcite, magnesium sulfate, hematite, and olivine. All of these minerals produced observable peaks in the infrared spectra due to the particular functional group of the mineral, and spectra were collected for all of the mineral additions to the simulant soil. These spectra indicate that DRIFTS would be a useful method of identifying elements on the surface of Mars.

11:00 ELECTRONIC EXCITATION OF TiO IN DIFFUSION FLAME

Chandra M. Pathak, Alcorn State University, Alcorn State, MS 39096

Electronic excitation of molecular species such as C₂, formed in the flame produced by burning butane in air, has been fairly well known. The study of such flames have yielded spectroscopic data of considerable interest and importance involving both the ground state and the upper electronic states of the molecules formed in the flames. The present study was undertaken in the expectation that under appropriate conditions of excitation in a diffusion flame, a diatomic or a tri-atomic species can be formed in an excited state and an electronic transition to a lower state may give rise to a new electronic band system in the molecule formed in the flame. Diffusion flames have in the past given rise to a number of new electronic band systems of several species as a consequence of the highly exothermic elementary reactions occurring in such systems which produce overpopulations of certain excited states, yielding emission that would be unobservable under thermal excitation. Four new electronic band systems were observed in the emission spectrum of a low pressure diffusion flame of TiCl₄ plus oxygen burning in potassium vapor. The new systems, all of which lie in the ultraviolet region, are attributed to TiO. Two of them have also been observed in emission from a TiBr₄O₂-K flame. One system appears to involve transition to the ground, X³Δ_g, state. The lower state of the other three systems seems to be the low-lying singlet state of TiO. The new bands permit two new excited states to be located with some certainty: a triplet state at 32,000 cm⁻¹ and a ¹Σ state at 30,970 cm⁻¹.

11:15 THE ACCURATE CALCULATION OF RO-VIBRATIONAL EIGENENERGIES OF HYDROGEN CYANIDE

Joseph Bentley* and Jennifer L. Curry, Delta State University, Cleveland, MS 38733

A methodology for accurately calculating the quantal ro-vibrational energies of light-heavy-heavy (LHH) triatomic molecules is presented. Calculated ro-vibrational energies of the ground electronic state of HCN are given for J < 3. The discrete variable representation (DVR) [J. C. Light and T. Carrington, Jr., *Adv. Chem. Phys.* 114:263 (2000)] is used as a

basis set for radial coordinates. An angular basis set is used which diagonalizes the rotational ($J > 0$) part of the total kinetic energy. It is shown how this basis is contracted through a series of diagonalizations of smaller Hamiltonian matrices. The final basis set is a direct product of these contracted angular functions and the primitive radial DVRs. Diagonalization of the full Hamiltonian in this final basis set gives the ro-vibrational energies of HCN. These are compared with an earlier calculation.

11:30 IRREVERSIBLE PHOTOOXIDATION USING N-SUBSTITUTED HETEROAROMATIC SYSTEMS

Wolfgang Kramer, Millsaps College, Jackson, MS 39210

Photoinduced homolytic N-O bond cleavage in N-alkoxyheterocycles has been shown to be an efficient pathway to oxygen-centered radicals and/or aromatic radical cations. The reaction pathway should depend upon the stability of the oxy-radical product. The use of N-phenoxy compounds should lead to the formation of a stable phenoxy radical, that would increase the overall efficiency of the fragmentation reaction. Synthesis of N-phenoxyheterocycles involves the reaction of the aromatic N-oxide with a diazonium salt. The synthesis and photochemistry of ArN⁺-OAr compounds, and their use as irreversible photooxidants is discussed.

11:45 POLYHEDRAL OLIGOMERIC SILSESQUIOXANE (POSS) CAGES WITH ATOMIC ALKALI, NOBLE GAS, TRANSITION METAL AND HALOGEN IMPURITIES

Delwar Hossain¹*, Charles U. Pittman, Jr.¹, Svein Saebo¹, and Frank Hagelberg², ¹Mississippi State University, Mississippi State, MS 39762 and ²Jackson State University, Jackson, MS 39217

Octahydridosilsesquioxane, (HSiO_{3/2})₈, or the Polyhedral Oligomeric Silsesquioxane (POSS) T₈ cage system and its derivatives have attracted considerable interest. The POSS monomer T₈ cage consists of silicon atoms occupying the vertices of a cube and oxygen atoms bridging each pair of silicon atoms. In the parent octahydridosilsesquioxane, a single hydrogen atom is attached to each silicon atom. In general, POSS derivatives exhibit the composition (RSiO_{3/2})_{2n}, where R denotes an organic ligand. POSS derivatives incorporated into organic polymers, dendrimers, and zeolites have attracted substantial attention due to their applications in material science and catalysis. One interesting feature of these cages is the encapsulation of atoms and ions. Several studies, including our own, have focused on this property. Most experimental and theoretical studies reported in the literature have focused on the pure or the metal-substituted parent POSS cage with or without encapsulated species. We will present a comparative study on endohedral complexes [X@ (HSiO_{3/2})₈], [X@ (HSiO_{3/2})₁₀], and [X(HSiO_{3/2})₁₂] of T₈, T₁₀, and T₁₂ cages respectively. Investigations have been carried out on T₈, T₁₀, T₁₂ cages which encapsulate the atomic or ionic species: Li⁺, Na⁺, K⁺, F⁻, Cl⁻, Br⁻, He, Ne, Ar, and first row transition metal atoms or ions. B3LYP/6-31G**, B3LYP/6-311G**, B3LYP/6-311++G** levels of theory were employed. Geometric, energetic and electronic properties were investigated. Endohedral noble gas atoms cause the cages to expand. The extent of the expansion depends the size of the encapsulated atom. Endohedral alkali ions and

transition metal atom/ions in contrast, exhibit both attractive and repulsive interactions with the cage atoms.

FRIDAY AFTERNOON

Assembly Hall

1:00 AN INVESTIGATION ON MICROENCAPSULATION OF CARBON TETRABROMIDE

Max Bonner*, John A. Pojman, and Brian McFarland, University of Southern Mississippi, Hattiesburg, MS 39406

The goal of the study was to encapsulate carbon tetrabromide via interfacial polymerization or complex coacervation. The study of interfacial polymerization lead to poor experimental data due to the interaction of carbon tetrabromide with a non-miscible monomer. However, the encapsulation method of complex coacervation of gelatin and gum arabic introduced two miscible polyelectrolytes that formed a liquid-liquid phase. As the pH was altered and crosslinking occurred a dense coacervate shell encapsulated the core material. The carbon tetrabromide capsules were then analyzed using atomic transfer radical polymerization of tri (ethylene glycol) dimethacrylate in an oxygen-free environment.

1:15 DETERMINATION OF CRITICAL CONDITIONS FOR THE EXISTENCE OF FRONTAL POLYMERIZATION WITH MULTIFUNCTIONAL ACRYLATES

Burcu Binici*, Nesrin Olten Kocaeli, and John A. Pojman, University of Southern Mississippi, Hattiesburg, MS 39406

Frontal polymerization is a mode of polymerization in which a localized reaction zone propagates from the coupling of thermal transport and the Arrhenius-dependence of the reaction rate of an extensive polymerization. Because frontal polymerization is similar to combustion, it is very sensitive to heat loss. We studied the effects of reactor diameter, reactor medium and filler amount and type on the existence of frontal polymerization for multifunctional acrylates with a peroxide initiator.

1:30 ANALYSIS OF BIFIDOBACTERIUM USING CAPILLARY ELECTROPHORESIS

Timothy Ward*, Aprile McGilvray, Courtney Vowell, Jason Eastlack, David Smith, and Robert Nevins, Millsaps College, Jackson, MS 39210

Identifying and quantitating bacteria and other microorganisms is a difficult problem that is becoming increasingly important. The traditional method for characterizing microorganisms by isolation of pure cultures is slow and tedious. At the present time, there are no reliable and easy to perform techniques for separating and identifying intact microorganisms. Recently, a number of groups have explored the possibility of applying the technique of capillary electrophoresis in order to separate intact bacteria. The application of this technique is advantageous, because it allows the bacteria to remain intact while being analyzed quickly and efficiently with broad applicability. In general, microorganisms tend to be amphoteric, containing multiple charges thus ideally suiting them for analysis by electrophoresis. In this study we have

constructed calibration curves correlating colony forming units (CFU) to the absorption profiles of bacteria by UV detection using capillary electrophoresis. Good correlations between peak area and bacterial concentrations were obtained. In addition, we will present examples of bacterial separations via capillary electrophoresis and discuss the relevant characteristics that must be carefully controlled before a practical and useful separation can be achieved.

1:45 SYNTHESIS AND CHARACTERIZATION OF POLY(ETHYLENE GLYCOL) BASED DISCRETE HYDROGELS

Stacy Trey* and Douglas A. Wicks, University of Southern Mississippi, Hattiesburg, MS 39406

In this research we investigate how structural variations in discrete hydrogels, both chemical and mechanical, will affect water absorption and retention. We first synthesized poly(ethylene glycol) based hydrogels crosslinked with a polyhexamethylene diisocyanate crosslinker as films with varying PEG number average molecular weights ranging from 400 g/mol to 7,000 g/mol. A dispersion of PEG based acrylate functionalized hydrogel was also polymerized, composed of tolylene diisocyanate (TDI 2,4), PEG of $M_n = 6000$ g/mol, hydroxyethylmethacrylate (2-HEMA), and PEG monomethacrylate of $M_n = 2000$ g/mol. The absorption properties were evaluated by absorption studies and thermal gravimetric analysis (TGA). The films were characterized by solid state ^{13}C Nuclear Magnetic Resonance. The absorption kinetics were found by placing dehydrated hydrogels in a saline buffer solution containing the fluorescent probe 5-(and-6)-((N-(5-aminopentyl)amino)carbonyl)tetramethylrhodamine and tracking the intensity and shift in the absorption peak. The network structure as a function of chain motion was studied by observing the spin-lattice relaxation times of dehydrated and hydrated materials, and also as a function of temperature. It is clear from this research that morphological properties play an important role in determining the characteristics of PEG based hydrogel films.

2:00 CONCENTRATED ACID PRETREATMENT FOR THE CONVERSION OF LIGNOCELLULOSIC MATERIALS TO SUGAR

William Miller* and Roger D. Hester, University of Southern Mississippi, Hattiesburg, MS 39406

The first stage of a two-step concentrated sulfuric acid process that converts softwood sawdust to sugars has been explored. The research focuses on the ability of an in-house custom fabricated co-rotating twin-screw reactor (TSR) to effectively breakdown and solubilize crystalline cellulose into low molecular weight carbohydrates. This is achieved through intense mechanical shearing action of the lignocellulosic solids during exposure to sulfuric acid at elevated temperatures in the TSR. After the TSR system was placed into operation, an initial two level, three factor screening design of experiments (DOE) was performed to determine the importance of screw speed (70 rpm versus 110 rpm), reactor temperature (30 versus 50 °C) and sawdust feed rate (2 versus 3 g/min). This screening DOE showed that screw speed was relatively insignificant in comparison to sawdust feed rate and reactor temperature. Based on the DOE screening results, a four-level, two-factor experimen-

tal model building DOE was undertaken. In this design two independent variables, sawdust feed rate and TSR temperature, were varied from 2 to 5 g/min and 40 to 70 °C. Solid sawdust conversion to liquid, screw torque and TSR exit pressure were measured or recorded to yield percent conversion of solids, material energy requirements and processed material viscosity. Thereafter, model quadratic equations were fitted to the experimental data and the resulting statistical significance of these equations was evaluated.

2:15 SYNTHESIS OF A NEW IONIC LIQUID MONOMER

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

Ionic liquids can be defined as salts with a melting temperature below the boiling point of water, most ionic liquids are liquids at room temperature; they have properties like non-volatility and high polarity. Some of them have been used as solvents in chemical reactions, e.g., in ring-opening polymerization of ethylene carbonate, condensation polymerizations leading to polyamides and polyimides, atom-transfer or conventional radical homopolymerizations of some acrylates and styrene. Trioctylmethylammonium acrylate ($\text{C}_{28}\text{H}_{57}\text{NO}_2$) was synthesized from Aliquat 336 and acrylic acid. In order to produce this compound an appropriate amount of Aliquat 336 was combined with an aqueous solution of acrylic acid in a separatory funnel and agitated vigorously; the product was above the aqueous phase, it was washed with water to remove residual reagents and centrifuged to break the emulsion formed in the washing. The reaction was followed with a pH-tester, this is due to HCl production; in this way, pH can give an idea of the conversion degree. The ammonium acrylate was used in a simple polymerization reaction using luperox 231 as initiator. Polymerization was initiated by heating the solution with a soldering iron. The polymer obtained is a viscous liquid. If copolymerized with a multifunctional acrylate, an opaque and brittle material is produced.

2:30 MEASUREMENT OF THE EFFECTIVE INTERFACIAL TENSION IN A MISCIBLE SYSTEM (1-BUTANOL-WATER) BY SPINNING DROP TENSIO-METRY

Jola Marszalek*, Renato Lamberto, and John A. Pojman, University of Southern Mississippi, Hattiesburg, MS 39406

The system of 1-butanol in water was studied by spin drop tensiometry. The experiments on the water/1-butanol system have permitted us to observe an unambiguous example of interfacial tension in a miscible system. Slow solubilization permitted the observation of alcohol droplet. By applying the Vonnegut and modified Vonnegut methods we were able to determine the Effective Interfacial Tension (EIT). The EIT was estimated for different temperatures and at different rotation speeds. In the Vonnegut zone of the droplet shape the EIT remained constant. However, the modified Vonnegut method resulted in rather incoherent EIT values. A constant value for the EIT can be explained considering that the drop shrinks because the 1-butanol flows out into the water matrix while no significant amount of water flows in. In this case, droplet composition remains constant.

2:45 DYNAMIC INTERFACIAL TENSION BEHAVIOR OF NONAQUEOUS PHASE LIQUIDS IN AQUEOUS AMPHIPHILIC BLOCKCOPOLYMER SOLUTIONS

Nicola Muratore*, Jola Marszalek, Rosie Parker, and John A. Pojman, University of Southern Mississippi, Hattiesburg, MS 39406

Hydrophobic contaminants like as petroleum-based products frequently enter to the subsurface forming a separated organic phase in the groundwater or nonaqueous phase liquid (NAPL) domains. Under normal condition, this phase is retained within soil pores by the capillary forces and represents a long-term source of aquifer contamination. Remediation technologies based on the use of surfactants by reducing the capillary forces between the organic and aqueous phases are the most promising technique for removal of NAPL from the subsurface. This approach (mobilization) is based on the ability of surfactants to mobilize or displace entrapped NAPL by lowering the interfacial tension. Such thermodynamic property is playing a fundamental role on the removal of NAPL by mobilization. Most of the studies have dealt this aspect under equilibrium condition whereas little attention has been directed to the measurement of interfacial tension under nonequilibrium conditions, i.e., in condition of the contaminants removal. Dynamic interfacial tension studies of organic contaminants in amphiphilic block copolymer solutions were done by using spinning drop technique.

3:00 THE MULTICENTERED INTEGRATED QUANTUM MECHANICAL TECHNIQUE FOR AB INITIO STUDIES OF EXTENDED π STACKING INTERACTIONS

Brian W. Hopkins* and Gregory S. Tschumper, University of Mississippi, University, MS 38677

An improved, more general method for performing multicentered integrated QM/QM calculations is presented. The new approach allows the multicentered approximation to be extended to overlapping model systems, thereby removing a significant limitation of the original approach. The applicability of multicentered (MC) QM/QM computations to π stacking interactions is demonstrated. The trimers of cyanogen and diacetylene are studied. Each trimer is studied at six geometries, for a total of 12 unique structures. The accuracy of the MC QM/QM approach is excellent. In all cases, MC QM/QM calculations reproduce CCSD(T) binding energies within 0.05 kcal/mol. In addition, the method has been applied to several configurations of the benzene trimer. The results for these small systems suggest that the relatively new MC QM/QM method may be a powerful tool in the study of extended π systems such as nucleic acids.

3:15 Break

3:30 DETERMINATION OF ANION MOBILITY IN A H^+ CONDUCTING ELECTROLYTE

Kyle F. Lott* and Jason Ritchie*, University of Mississippi, University, MS 38677

Proton conducting polymer electrolytes have important electrochemical applications in devices such as fuel cells and electrochromic displays. We have prepared polymer

electrolytes from a mixture of our "MePEG polymer," (MePEGnO(CH₂)₃SiO₃)_n, and a PEG-based acid, MePEGnSO₃H. These electrolytes display substantial anhydrous H^+ conductivities. Our hypothesis is that ionic mobilities in these systems depend on the volume fraction of PEG (Vf,PEG). Our goal is to understand the mechanism of ion transport in these PEG-based materials. In order to separate the contributions of anions and cations to the overall conductivity, we have prepared mixtures of our MePEG polymer and a redox hybrid polyether melt [Co(bipy)₃₊₂](MePEGnSO₃) (n=3,7,12,17). In this mixture, we are able to separately measure the anion and cations' contributions to the overall ionic conductivity by electrochemically measuring the diffusion coefficient of the Co_{2+/3+}(bipy)₃, and then measuring the ionic conductivity of the mixture. The Nernst-Einstein equation is then applied to solve for the diffusion coefficient of the MePEGnSO₃ anion. We will present a dependence of the physical diffusion coefficient of the MePEGnSO₃ anions on the Vf,PEG of the mixture, and will discuss the transference number of H^+ cations in these polymer electrolytes.

3:45 A SYSTEMATIC ASSESMENT OF DENSITY FUNCTIONALS FOR THE STUDY OF HYDROGEN BONDING IN PEPTIDES USING INTEGRATED QUANTUM MECHANICAL METHODS

Julie Anderson* and Gregory S. Tschumper, University of Mississippi, University, MS 38677

Twenty-four (24) density functional methods have been systematically studied to assess which functional(s), if any, can outperform HF as the low-level method in integrated QM/QM calculations. In other words, this work addresses the question "How do MP2/DFT integrated techniques compare to MP2/HF when computing hydrogen bond strengths?". A careful comparison of dissociation energies (De) and substituent (S-) values for hydrogen bonding between water and the central polar side-chain of Gly-X-Gly tripeptides reveals some surprising results. While all 24 density functionals reproduce MP2 dissociation energies more reliably than the HF method, no MP2/DFT scheme offers substantial improvement over the MP2/HF approach. Further, even the worst MP2/DFT combinations outperform the best density functional methods.

4:00 FRONTAL POLYMERIZATION OF A THIOL-ACRYLATE SYSTEM WITH A PEROXIDE INITIATOR COMBINED WITH AMMONIUM CARBAMATE AND A MICROENCAPSULATED CROWN ETHER

Dawn Anderson*, Birsan Varisli, and John A. Pojman, University of Southern Mississippi, Hattiesburg, MS 39406

Thiols can copolymerize with acrylates via free-radical chain growth mechanism and a free-radical-step-growth mechanism. It is also possible to polymerize thiols and acrylates using an amine-catalyzed Michael addition reaction. We studied a system in which an ammonium carbamate becomes activated as a catalyst when a crown ether is released from microcapsules. We tested how this additional mechanism affects the frontal polymerization of 1,6 hexandiol diacrylate and a trithiol.

4:15 PREPARATION AND ANALYSIS OF INITIATOR-CORE POLYUREA MICROCAPSULES USING PENTAMINES AND DIAMINES AS SHELL COMPONENTS

Sammy Popwell*, Brian McFarland, and John A. Pojman, University of Southern Mississippi Hattiesburg, MS 39406

Frontal polymerization involves the conversion of monomer to polymer via a localized reaction zone, which propagates through an unreacted solution of monomer and initiator. The stability of free-radical initiators in frontal polymerization systems is investigated through microencapsulation of the initiator. A significant increase in the pot life of the frontal system has been observed. The capsules produced in this study contain a cumene hydroperoxide-core surrounded by a polyurea shell, and the capsule shell is formed via interfacial polymerization between an isocyanate and an amine. Amine functionality can be used to control the degree of crosslinking and subsequently the stability of the polymer shell. Our study now focuses on the effect of a varying amine functionality on capsule stability, using amines such as ethylene diamine and tetraethylene pentamine. Preliminary experiments suggest that the isocyanate to primary amine ratio affects the stability of the polyurea shell. At the optimum isocyanate to primary amine ratios, for both systems, there is a significant decrease in the pot life of capsules in monomer solution compared to capsules prepared with tetramine. However, there was still an increase in pot life of these systems compared to systems containing unencapsulated initiator.

ECOLOGY AND EVOLUTIONARY BIOLOGY

Chair: Clifford Ochs, University of Mississippi
Vice-chair: David Beckett, University of Southern Mississippi

FRIDAY MORNING

Classroom A

8:30 Divisional Poster Session

THE ROLE OF POLLINATORS IN AN *ASCLEPIAS* HYBRID ZONE IN SHENANDOAH NATIONAL PARK, VA
Mark Fishbein¹*, Joseph Vick², and Anna Stephenson³, ¹Mississippi State University, Mississippi State, MS 39762; ²Shorter College, Rome, GA 30165; and ³Whitman College, Walla Walla, WA 99362

Hybridization makes gene flow possible between species, resulting in speciation, increased genetic diversity, or merging of parental populations, among other effects. To hybridize, compatible parental species must overcome reproductive isolation through cross-pollination. With the formation of F1 hybrids and subsequent formation of backcrosses, interspecific gene flow is possible. However, the outcome of hybrid formation depends on the response of pollinators to the phenotypes of hybrids relative to parental species. We studied

the visitation rates and effectiveness of pollinators in a milkweed hybrid zone in Shenandoah National Park, in the Blue Ridge Mountains of Virginia. *Asclepias exaltata* (poke milkweed) and *A. syriaca* (common milkweed) are well-differentiated species that hybridize at this site. Hybrid plants display a range of intermediate morphological characters. Analyses of isozyme data show that both F1s and various backcrosses are present. We found that the two parental species differed in the most common floral visitors (bumblebees on *A. exaltata* and silver-spotted skippers on *A. syriaca* and that *A. syriaca* received significantly more visits. Hybrids received visits commonly from bumblebees and skippers, but had overall rates comparable to *A. exaltata*. Overall, floral visitors were more effective at pollinating *A. syriaca* and hybrids than *A. exaltata*. *A. syriaca* was best. *A. syriaca* was best pollinated by honeybees and hybrids were best pollinated by bumblebees. Silver-spotted skippers were the only pollinators that were effective on both parents as well as hybrids, which suggests that they play an important role in the hybridization of these species.

THE PHYTOPLANKTON COMMUNITY IN STREAMS OF CAMP McCAIN, GRENADA COUNTY

Carmen L. Hernández*, Nestor R. Anzola, and George F. Pessoney, University of Southern Mississippi, Hattiesburg, MS 39406

Information on the abundance and diversity of phytoplankton in headwater creeks is sparse. Previous work with algae has concentrated in the periphytic community as the primary producers of streams. Eight collection sites located on 4 creeks in Grenada County, North Mississippi, were sampled each spring and autumn between 1999 and 2003. These creeks originate in and drain from Camp McCain, a National Guard training facility that covers 13,000 acres. Algal densities and richness were compared with water quality parameters including seventeen chemical and physical properties of the creeks. Camp McCain creeks were characterized by having low phytoplankton abundance and high genera richness. Algal concentrations were under 300 org/l. Phytoplankton genera richness was influenced by water temperature and flow. Seventy-seven algal genera belonging to five divisions were recorded. The Chlorophyta and the Chrysophyta accounted for 86% of the genera richness. The diatoms *Navicula*, *Nitzschia*, *Synedra*, *Eunotia*, *Pinnularia* and the green algae *Closterium*, *Mougeotia*, and *Ankistrodesmus* were recurrent members of the algal community.

REPTILES AND AMPHIBIANS OF THE MISSISSIPPI BARRIER ISLANDS AND COASTAL MAINLAND

Thomas Mohrman* and Carl Qualls, University of Southern Mississippi, Hattiesburg, MS 39406

The Mississippi Gulf Islands consist of five barrier islands that stretch along the Gulf Coast. These islands vary in size, habitat diversity, distance from the mainland, and time since separation from the mainland, all of which have likely influenced the plant and animal communities found on each island today. Dynamic conditions, especially tropical storms and hurricanes, impact these islands on a frequent basis, causing major changes to island structure, vegetation communities, and presumably vertebrate communities as well. Being subject to a wide variety of disturbance events the Gulf Islands

offer a unique opportunity to examine the movement and distribution of faunal communities through a dynamic island system. Starting in the spring of 2004 researchers from the herpetology laboratory at the University of Southern Mississippi began an inventory of the reptiles and amphibians of the Gulf Islands National Seashore. After one field season of sampling, preliminary examination of the herpetofaunal species richness of these islands and coastal mainland are possible. The species assemblages on each of the islands, and nearby coastal mainland, will be compared and contrasted in island biogeographic terms, examining how colonization, local extinction, and recolonization may have shaped the island herpetofaunas we see today.

CONSERVATION AND ECOLOGY OF THE BLACK PINE SNAKE (*PITUOPHIS MELANOLEUCUS LODINGI*) IN MISSISSIPPI

Danna Smith* and Carl Qualls, University of Southern Mississippi, Hattiesburg, MS 39406

The black pine snake (*Pituophis melanoleucus lodingi*) is a colubrid snake that is historically endemic to longleaf pine forests, ranging from southwestern Alabama to extreme eastern Louisiana. This taxon has piqued recent conservation concern due to geographic isolation as well as the ongoing fragmentation of remaining longleaf pine habitat. From March 2004 through July 2004, data on the distribution and habitat associations of the black pine snake in southern Mississippi was collected. Habitat characteristics such as soil type, dominant canopy tree species, canopy cover of trees, amount of shrubs in the understory, amount of herbaceous understory, estimated recency of fire, slope, and exposure aspect were quantified and recorded. Nine new records for this elusive taxon were collected, of which four were roadkill. With several black pine snake populations identified through the 2004 field season, prospective research for 2005 includes more exhaustive surveys of targeted areas coupled with radio telemetry of captured snakes. For each captured snake, habitat data will continue to be collected, and temperature sensitive radio transmitters will be used in an attempt to correlate black pine snake behavior and location with ambient temperature. Small mammal traps will also be employed in order to elucidate prey dynamics of areas with substantial black pine snake populations. Since our current knowledge of black pine snake ecology is limited, data gained from this study will greatly aid efforts to protect and restore this snake in Mississippi.

EFFECTS OF CHEMICAL AND NUTRIENT MANIPULATION ON ALKALINITY AND ALGAL PRODUCTION: AN ECOLOGICAL APPROACH TO LAKE MANAGEMENT

Kevin H. Wyatt*, George F. Pessoney, Nestor R. Anzola, Carmen L. Hernández, Richard E. Burris, and Jeremy Overstreet, University of Southern Mississippi, Hattiesburg, MS 39406

Management officials recommend adding agricultural limestone to lakes with alkalinities < 20 parts per million as a precursor to fertilizing; suggesting that sediments in low alkaline waters will adsorb nutrients, making them unavailable to the phytoplankton. To test these recommendations, experimental containers were treated with various concentrations of phosphorus (K_2HPO_4) and/or agricultural limestone ($CaCO_3$)

and suspended in a low alkaline lake (Lamar County, MS) during April and May 2004. Physical and chemical parameters were measured and algal samples were collected weekly throughout a five-week period. Algal primary production was quantified as dry weight. Our results support liming recommendations; liming substantially increased alkalinity and algal growth in experimental containers, while phosphorus without lime did not. Control containers had similar physical and chemical conditions as the pond. A combination of lime and phosphorus produced more algal growth than high concentrations of either individual ingredient.

Oral Presentations

10:00 THE EFFECTS OF HYPORHEIC WATER INFLUX ON RIVER PERIPHYTON COMMUNITY STRUCTURE: PRELIMINARY FINDINGS FROM THE STUDY OF A LARGE ALLUVIAL RIVER

Kevin H. Wyatt¹*, George F. Pessoney¹, and F. Richard Hauer²; ¹University of Southern Mississippi, Hattiesburg, MS 39406 and ²University of Montana, Flathead Lake Biological Station, Polson, MT 59860

In their undisturbed state, alluvial river systems of the northern Rocky Mountains often follow an alternating pattern of confined and unconfined valley segments as they move down the stream gradient. Stream reaches within unconfined valley segments have an additional alternating pattern of downwelling and upwelling vertical exchange of water and materials between the hyporheic zone and surface stream. Waters in the hyporheic zone often cycle nutrients that limit primary production in the main channel. As hyporheic waters enter the surface stream, nutrients are delivered to the stream benthos. Previous studies have shown that areas of hyporheic upwelling have more algal biomass than areas of downwelling; however, less is known about the taxonomic differences in algal assemblages between contrasting areas of vertical hydrologic exchange. Metal piezometers were inserted into the sediments and epilithic algal samples were collected from the main channel of a large alluvial river in northwestern Montana during June, July, and August 2004 to test the null hypotheses that there are no differences in epilithic algal biomass and community composition between sites of hyporheic upwelling, surface water downwelling, and no hyporheic-surface water connectivity. Periphyton biomass was quantified as chlorophyll *a* $\mu g/cm^2$ of rock substrate using the spectrophotometer method. Algae were identified to the genus level and quantified as algal units/ cm^2 of rock substrate. Preliminary data analyses of this study indicate that differences in benthic algal biomass and community composition may occur between sites of contrasting vertical water movement.

10:15 TEMPORAL AND SPATIAL VARIATION IN PHYTOPLANKTON COMMUNITY BIOMASS, PRODUCTION AND COMPOSITION WITH PHYSIOCHEMICAL CONDITIONS IN SARDIS RESERVOIR

Engela Sthapit* and Clifford A. Ochs, University of Mississippi, University, MS 38677

Reservoirs, as transitional systems between lakes and rivers, are known to exhibit spatial and temporal variation in

physiological characteristics with changing nutrient conditions. We evaluated spatial and seasonal variations in phytoplankton composition, biomass, distribution and production along the longitudinal axis of the Sardis reservoir and major tributary embayments. Sardis Reservoir is a flood control reservoir built in 1940 and lies in the Little Tallahatchie River Watershed of Yazoo River Basin. The phytoplankton community composition and biomass were measured with high performance liquid chromatography and inverted microscopic counts. Nutrient analysis for total dissolved nitrogen (TDN) and total dissolved phosphorous (TDP) were done with continuous flow auto analyzer. Productivity was measured with C14 incubation method. The up-lake station had the highest production. It changed from 69.59 mg/m³/hr in spring to very low values of 2.62 mg/m³/hr in mid-summer and again increased to 99.6 mg/m³/hr in fall. Similar trend in TDN and TDP were observed with spring high values and summer low values. TDN was highest at Clear creek tributary embayment, which changed from 80 ppm in spring to 22 ppm in summer. TDP was below detection limit in summer. The low summer and high fall values coincide with the summer stratification and fall overturn. TN: TP ratios indicate phosphorous as the limiting nutrient.

10:30 THE IMPORTANCE OF PHYSICAL AND CHEMICAL VARIABLES ON THE SEASONAL DYNAMIC OF PHYTOPLANKTON IN STREAMS AT CAMP SHELBY TRAINING SITE

Nestor R. Anzola*, Carmen L. Hernández, and George F. Pessoney, University of Southern Mississippi, Hattiesburg, MS 39406

Little is known about the phytoplankton of headwater streams. Although primary production is minimal in such streams, the algal contribution represents the inocula for the potamoplankton in high-order streams. Water monitoring in Camp Shelby, the largest National Guard and Reserve training facility in the continental USA, has been conducted seasonally, beginning in 1998 at designed sites in 28 streams. Such monitoring includes the identification of genera of phytoplankton. The information is used to study the impact of training, fertilization, and construction on water quality and algal numbers and diversity. A total of 147 algal genera within six divisions were identified. Chlorophyta and Chrysophyta were the dominant taxa in the phytoplankton of Shelby Creeks. Rain events influenced water quality parameters in the streams. Total solids, conductivity, turbidity, and fecal coliform bacteria increased after local precipitation. Nutrients such as nitrogen, phosphorus, and potassium remained below the standards according to water quality criteria for streams and aquatic life in Mississippi. Seasonal variations in the phytoplankton density were related to changes in water temperature, phosphate concentrations, and storm events. Algal diversity and variation in the system were driven by water temperature and flow. Creeks in the north area had similar physical conditions and phytoplankton genera compositions to those creeks in the south, but higher phytoplankton density. The difference between the streams in the north and the south is believed to be the results of variation in phosphorus availability in both regions.

10:45 A STUDY OF SOIL BIOGEOCHEMICAL AND PHYSICAL PROPERTIES OF DISTURBED FORESTS AND ASSOCIATED WETLANDS

Bikash Rajkarnikar* and Marjorie M. Holland, University of Mississippi, University, MS 38677

This research focuses on quantifying the resilience of disturbed forested wetland habitats by studying the physical and biogeochemical properties of soil. The need for knowledge about ecosystem resilience following disturbance is becoming more critical for curbing the loss of natural resources. Using soil parameters as environmental indicators may lead to a better understanding of managing these resources. The aim of the study is to estimate resilience data from the study site and incorporate it with similar pre-existing studies to provide a wider perspective on soil processes occurring throughout the watershed. Soil samples were taken from three disturbed sites of different ages (6 months, 7 years and 18 years) and one undisturbed site (94 years) from Northern Webster County, Mississippi. Six sampling points -three uphill and three streamside- were sampled in each of the sites. Soil samples were tested for Total Organic Matter (TOC), Total Carbon (TC), Total Nitrogen (TN), Total Phosphorous (TP), pH, Compaction, and Moisture Content. Early results show that moisture content in the 7 yr site is significantly lower than other sites, and 6 month streamside samples had significantly higher moisture content than uphill samples. Also, soil compaction was found to decrease with increasing age of the sites, with the 6 month site showing the highest compaction. Future plans include analysis of TOC, TN, TP and pH values, and creation of a Soil Perturbation Index, which will incorporate these parameters to estimate the regeneration period and the resilience of the disturbed areas with respect to the undisturbed standard.

11:00 THE ECOLOGY OF RESURRECTION FERN

Robert Hamilton, Mississippi College, Clinton, MS 39058

Pleopeltis polypodioides is an epiphytic leptosporangiate fern that occurs throughout the southeastern United States. *P. polypodioides* is the only temperate member of the otherwise tropical genus *Pleopeltis*. The pattern of rhizomatous growth indicates a branching pattern that is anisotomous, but intermediary between a lateral branching and an apically branching plant. Such a pattern of growth may be a response to intraspecific competition. Frond emergence patterns indicate that the environment has a high degree of certainty. Preliminary studies of genetic variation indicate that *P. polypodioides* reproduces sexually.

11:15 ANALYSIS OF FUNGAL PRODUCTS OF AZO DYESTUFF

Xueheng Zhao¹*, Ian Hardin², and Huey-Min Hwang¹, ¹Jackson State University, Jackson, MS 39217 and ²University of Georgia, Athens, GA 30602

Microbial treatment of environmental pollutants including dyes with white rot fungi has received wide attention as a potential alternative for conventional methods in wastewater treatment. The degradation products from dyes and mechanism underlying fungal degradation of dyes is desirable to be understood. Fungal degradation of Acid Orange 7 (C.I. 15510), and Disperse Orange 3 (C.I. 11005), was conducted in

this study and degradation products were determined with capillary electrophoresis coupled with mass spectrometry (CE-MS), gas chromatography-mass spectrometry (GC-MS), and high performance liquid chromatography (HPLC). Biodegradation products of Acid Orange 7 and Disperse Orange 3, by white rot fungus, *Pleurotus ostreatus*, were identified as 4-hydroxybenzenesulfonic acid, benzenesulfonic acid, 1,2-naphthoquinone, 4-nitrophenol, nitrobenzene, 4-nitroanisole, and 4-nitroaniline. Formation of these products in fungal degradation are briefly discussed.

11:30 Divisional Business Meeting

FRIDAY AFTERNOON

Classroom A

1:30 CORRELATION OF POPULATION DENSITY OF *ARCTOSA SANCTAEROSAE* TO HUMAN IMPACT ON NATIVE BEACHES ALONG THE NORTHERN RIM OF THE GULF OF MEXICO

Robert Hataway¹*, Ron L. Jenkins², W. Mike Howell², and Kristen Ramsey², ¹University of Mississippi, University, MS 38677 and ²Samford University, Birmingham, AL 35229

Arctosa sanctaerosae Gertsch & Wallace 1935 occurs only on the white beaches of the northern Gulf of Mexico. McNatt et al. (2000) described the specific habitat preference of this spider as native secondary dunes and, they suspected sensitivity to commercial encroachment. The objective of this study was to assess the ecological status of *A. sanctaerosae* and to evaluate the impact of commercial expansion on the spider. *Arctosa sanctaerosae* populations were estimated in 21 locations of varying commercial impact along the Northern Gulf Coast in the summer of 2003. Mean population densities of *A. sanctaerosae* on native beaches were significantly greater ($p < .002$) than on beaches with extensive commercial development. There was also a significant difference ($p < 0.01$) between population densities on the native beaches and those only moderately impacted. In October 2004, a second visit was made to these sites after Hurricane Ivan made landfall in this animal's habitat. This preliminary survey showed that the spiders were displaced and often absent in the affected areas.

1:45 HYBRIDIZATION EFFECTS IN *GAMBUSIA AFFINIS* AND *GAMBUSIA HOLBROOKI*

Sheba Winters* and Jennifer Regan, University of Southern Mississippi, Hattiesburg, MS 39406

The effect of natural hybridization is a controversial issue that dates back to the Linnaean species concept and system classification. Natural hybridization takes place in a natural setting among populations of related species that are distinguishable on the basis of one or more heritable characters. Under this condition, overlap occurs spatially and temporarily. Due to the overlap, species can hybridize to form viable, at least partially fertile, or sterile offspring. Library research was conducted to review studies on hybridization effects in *Gambusia affinis* and *Gambusia holbrooki*. The research indicated that further investigation is needed to clarify distinction between *Gambusia affinis* and *Gambusia holbrooki*, as they are

currently considered different species.

2:00 ANALYSIS OF CONSTRAINTS IN EVOLUTION OF ECOLOGICAL SPECIALIZATION

Arnas Palaima, University of Mississippi, University, MS 38677

Often assumed, rarely tested the 'jack-of-all-trades is a master of none' proverb/assumption states that adaptation to one regime necessarily entails a fitness loss elsewhere along an environmental gradient leading to a genetic fitness trade-off between generality and specialization. Current methods testing this assumption are mainly restricted to unicellular organisms or provide inconclusive results. Here, a new approach is proposed to test experimentally the hypothetical fitness trade-off between a generalist and a specialist which is based on properties of the tolerance curve and which can be applied to both unicellular and multicellular organisms. The proposed approach is based on three independent analytical methods: (1) to examine the genetic correlation between height and breadth of the tolerance curve. If the assumption about the genetic fitness trade-off is correct, a negative correlation is predicted between height and breadth of the tolerance curve; (2) to estimate the area under the tolerance curve and compare it among genotypes. If the assumption about the trade-off is correct, no significant variation of the area under the tolerance curve is predicted among genotypes; (3) to calculate the genetic correlations of fitness across different environmental conditions. If the assumption about the trade-off is correct, negative genetic correlations are predicted between fitness at optimal and extreme conditions. In addition, the first two analytical methods complement each other and, when used together, provide a better understanding of the nature of possible genetic fitness trade-off between generality and specialization.

2:15 PHYLOGENETIC RELATIONSHIPS OF THE GENUS *AMSONIA* (APOCYNACEAE) IN NORTH AMERICA BASED ON rpoB-TRNC AND rpl16 SEQUENCE DATA

Chris Doffitt* and Mark Fishbein, Mississippi State University, Mississippi State, MS 39762

Amsonia is one of the few genera in the Apocynaceae with a primarily holoarctic distribution. The approximately 20 species are found in four geographic regions: southeastern and southwestern North America, the Mediterranean, and Japan. This distribution represents a disjunction pattern observed in many other taxonomic groups. The groups of species found in southeastern and southwestern North America appear to be complexes of closely related species, several of which are rare or of conservation concern. This work examines the relationships of the species within southeastern and southwestern North America and the relationship between the two regions utilizing cpDNA sequences derived from the rpoB-trnC spacer and the rpl16 intron. Initial results indicate some taxa currently recognized in the southeast are conspecific with the wide-ranging species *Amsonia tabernaemontana*. Preliminary results also provide evidence that two morphologically similar species, *Amsonia ciliata* and *Amsonia hubrichtii*, are not closely related, and that *Amsonia tabernaemontana* is not monophyletic.

2:30 CORRELATED EVOLUTION OF PLANT DEFENSE SYNDROMES IN *ASCLEPIAS*

Mark Fishbein* and Anurag Agrawal, Mississippi State University, Mississippi State, MS 39762 and Cornell University Ithaca, NY 14850

Plant defense traits may covary across species due to shared evolutionary history, adaptive convergence, and genetic or selective constraints. We examined macroevolution of defense traits in 24 species of milkweeds (*Asclepias*). Employing phylogenetically independent contrasts, we found few correlations between seven traits, notably positive correlations between trichome density and latex production, and a negative correlation between these traits and specific leaf area. Four phenotypic clusters of species differed in expression of mechanical defenses, chemical defenses, and nutritional quality. A dendrogram of defense trait similarity was not congruent with a molecular phylogeny, suggesting convergence on "defense syndromes." We examined the performance of monarch butterfly caterpillars on the same species in the field; monarch growth did not differ across trait clusters, although multiple regression revealed that leaf trichomes and toughness reduced growth. The discovery of convergent plant defense syndromes can be used as a starting point to ask questions about how abiotic environments, herbivore communities, and biogeography are associated with plant defense strategies.

2:45 WHAT DO WE KNOW (OR NOT KNOW) ABOUT THE PLANTS OF MISSISSIPPI?

Lucile McCook, University of Mississippi, University, MS 38677

Although Mississippi has a rich flora, it is poorly known compared to that of most other states in the nation. Collaborative databases assembled from many herbaria, coupled with innovative computer programming, allow researchers to analyze the distribution of Mississippi plants in entirely new ways. The same technology can be used to illuminate gaps and deficiencies in our understanding of the flora.

GEOLOGY AND GEOGRAPHY

Chair: Stan Galicki, Millsaps College

Vice-chair: Barbara Yassin, MDEQ - Office of Geology

THURSDAY MORNING

Classroom C

8:30 THE MISSISSIPPI FLOOD MAP MODERNIZATION INITIATIVE: THE PROGRAM BACKGROUND AND OVERVIEW

Jack Moody* and Stephen D. Champlin, Mississippi Office of Geology, Jackson, MS 39289

From 1990 to 1999, the United States had 460 major disasters declared, costing \$25.4 billion; that is nearly twice the

previous decade's number of declarations costing only \$3.9 billion and is higher than any previous decade. In the 90's flooding was a significant contributor; it was the most frequently declared disaster type and cost the Federal Emergency Management Agency (FEMA) \$7.3 billion. With the rising number of events and the increasing cost, FEMA has been ordered to modernize its flood maps. Congress has funded this effort and FEMA has turned to the states to manage their own map development. Here in Mississippi the management is a joint effort between the Department of Environmental Quality (MDEQ), the Mississippi Emergency Management Agency (MEMA), and our engineering contractor team, Mississippi Geographic Information (MGI). The new maps will be digital flood insurance rate maps (DFIRMs). They will be in a geographic information system (GIS) format available on the web. By using aerial imagery for the base map, the location of individual structures with respect to the flood plain boundary can be easily determined. This will make the new maps more informative than the previous paper format. The ultimate vision is to have "no adverse impact" in predictably flood prone areas. This probably can't happen in existing developed areas but it can occur in those areas that will be developed in the future.

8:45 THE MISSISSIPPI FLOOD MAP MODERNIZATION INITIATIVE: THE TECHNICAL, GIS AND ENGINEERING ASPECTS OF THE PROGRAM

Stephen D. Champlin* and Jack Moody, Mississippi Office of Geology, Jackson, MS 39289

On January 28th, 2003, the State of Mississippi joined the Federal Emergency Management Agency (FEMA) in a partnership which has as its goal the modernization of all the existing flood maps for the currently mapped communities in the state and to create new county wide digital flood insurance rate maps (DFIRMs) for the entire state. Following FEMA's developed guidelines, standards and flood mapping procedures, and using an integrated software program adopted by FEMA called Watershed Information SystEm (WISE), the state and its contractor began the mapping program in early 2004. As of November 1, 2004, mapping was under way in ten Mississippi counties. The DFIRM process consists of seven steps. The WISE software is used in most of these steps. Existing flood studies, flood data, GIS data, topography, aerial photography, survey data and community information is input into WISE. The needed reports and maps, such as an up to date base map, can then be generated. WISE allows extensive automation and development of hydrologic and hydraulic models and analyses, with as much engineering review or modification as deemed necessary. The resulting digital flood maps and FIS Reports created from this process will be an improvement over the old "paper" flood maps and will be easier to use, allow wider access and speedier updating of flood maps in the future.

9:00 OSCAR M. LIEBER IN MISSISSIPPI AND BEYOND

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

Oscar Montgomery Lieber (1830-1862) had a short but notable career in geology in the southern United States. He began his professional career at the Mississippi Geological Survey from mid-1851 to January 1852, under State Geologist

John Millington and as assistant professor of geology at the University of Mississippi. He later worked for the Geological Survey of Alabama 1854-1855 under Michael Tuomey, and served as the State Geologist of South Carolina from 1856 to 1860. In South Carolina he reported primarily on the ore deposits in the Piedmont. Mississippi geologists may best remember Lieber as the author of an 1854 article in *Mining Magazine* that included the first sketch map of the geology of Mississippi. Lieber published this article to claim credit for identifying Millstone Grit and Carboniferous limestone in northeastern Mississippi, which indicated the likelihood of coal being present. Lieber's main claim to fame may be his book *The Assayer's Guide*, first published in 1852 after mineral discoveries in California brought wide attention to mining. This was shortly after his employment at the Mississippi Geological Survey. Apparently *The Assayer's Guide* filled a need, as it was reprinted in Philadelphia in 1877, 1891, and 1907. Lieber's early connection to Mississippi was preserved, as even in the 1907 (revised and enlarged) edition of *The Assayer's Guide*, he is identified on the title page as "Late Geologist to the State of Mississippi."

9:15 NEWLY PUBLISHED "ECOREGIONS OF MISSISSIPPI" MAP REFLECTS THE ENVIRONMENTAL INFLUENCE OF BEDROCK GEOLOGY

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

The new "Ecoregions of Mississippi" map at "Level IV," published by the U.S. Environmental Protection Agency, reflects the influence of bedrock geology on surface environments. At "Level III," only four ecoregions are recognized in Mississippi; these are the Southeastern Plains (65), Mississippi Alluvial Plain (73), Mississippi Valley Loess Plains (74), and Southern Coastal Plain (75). While these ecoregions are equivalent to geologic/physiographic provinces, many more such provinces appear at "Level IV." Within the "Level III" Southeastern Plains Ecoregion, the "Level IV" map of Mississippi contains ten regions, the following of which correspond to bedrock geologic units: (1) the Blackland Prairie (65a) on Cretaceous chalk of the Selma Group, (2) the Flatwoods/Blackland Prairie Margins (65b) on the Porters Creek Clay and upper Selma Group, (3) the Buhrstone/Lime Hills (65q) on the Tallahatta Formation, and (4) the Jackson Prairie (65r) on the Jackson Group. Other additions at "Level IV" include five ecoregions within the Mississippi Alluvial Plain, three ecoregions within the Mississippi Valley Loess Plains, and three ecoregions within the Southern Coastal Plain.

9:30 THE WILCOX STRATIGRAPHIC SECTION (PALEOCENE) EXPOSED IN THE HIGHWALL OF THE RED HILLS LIGNITE MINE, CHOCTAW COUNTY, MISSISSIPPI

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

The 6,500-foot-long cut face along the northern highwall of the Red Hills Lignite Mine in Choctaw County, Mississippi, exposes lignite seams D through J at the time of the mine's deepest cut of its 30-year lifetime (60 years if extended). According to mine environmental specialist Benson Chow, the cut is 322 feet below the original 594-foot ground

elevation (above msl) at its deepest point, a point where it quarried through core hole CH-3646-CC. As measured from this core hole, the tops (above msl) of lignite seams below the original surface level are as follows: J seam at -70 feet (+524 feet msl), I at -105 feet (+489 feet msl), H at -179 feet (+415 feet msl), G at -200 feet (+394 feet msl), F at -219 feet (+375 feet msl), E (distinguished by the greenish color of its underburden) at -256 feet (+338 feet msl), D at -295 feet (+299 feet msl), and C at -318 feet (+276 feet msl). The present upper highwall contains the channel sands of the lower Tuscaloosa Formation, which are capped by the J seam, and which locally cut out the I and H2 seams but not the basal Tuscaloosa H seam. The underlying shaly Grampian Hills Member of the Nanafalia Formation contains seams G-C.

9:45 PRECIOUS OPAL: MISSISSIPPI'S FIRST GEM-STONE

James E. Starnes, Mississippi Office of Geology, Jackson, MS 39289

Mississippi has been endowed with extremely rich fossil deposits dispersed throughout much of the exposed geological section. Many of Mississippi's unique geological treasures adorn local personal collections and professional collections in museums as far away as Japan. Though the interest by collectors and scientists is mainly in excellently preserved fossil specimens, many coarse-grained, aggregate-bearing deposits such as the Citronelle and Pre-loess gravels are regularly combed for semi-precious stones such as agate, carnelian, jasper, clear quartz, and fossil palm. Until recently, no precious stones have been reported from Mississippi. Historically, small-scale mining of gem-quality opal has been done in the basal Fleming Formation (Catahoula equivalent in Mississippi) of Vernon Parish, Louisiana, near the Texas border. The vibrantly colored opal cements coarse-grained sands into hard sandstones and quartzites which were fashioned into gemstones and once sold to Tiffany's of New York. Much of the Louisiana Opal on the market today can be credited to recent prospecting by Ben F. Stevens, whose mine is closed at present. Recent geological mapping of the Catahoula Formation in Claiborne County by the Mississippi Office of Geology led to the discovery of another precious opal deposit much like the Louisiana locality. The material was first tested, in October of 2004, for gem quality by Janie Hand of the Mississippi Gem and Mineral Society. The exquisitely crafted stones show brilliant flashes of fire, ranging in color from green to red.

10:00 INVESTIGATION OF THE INFLUENCE OF THE WHITE RIVER FAULT ZONE ON FLUVIAL SYSTEMS IN NORTHWEST MISSISSIPPI

Allison Innman* and Terry Panhorst, University of Mississippi, University, MS 38677

The White River Fault Zone (WRFZ), which has been proposed to extend from northeast Arkansas into northwest Mississippi, has several fluvial anomalies attributed to it, such as terrace positions, parallel drainage patterns, Mississippi River sinuosity variations, and abnormal projected channel and valley profiles. The location of the WRFZ, however, is problematic in northwest Mississippi. Stream gradients were used to investigate the potential influence of the WRFZ in northwest Mississippi on fluvial systems and hence better delineate its

location. Longitudinal profiles were created for four streams (Coldwater River, Tallahatchie River, Long Creek and Yocona River) using both 7.5- and 15-minute quadrangles. Changes in gradient (either steepening or flattening) that corresponded with the position of the projected WRFZ boundaries were noted along all four streams. Field investigations of Long Creek in Panola County showed that the anomalous gradient there was the result of cropping out of a resistant layer. No definitive changes in gradient can be attributed solely to the WRFZ. This channel profile method is sensitive enough to delineate changes in stream gradient due to lithology, but changes in gradient due to seismic activity along the WRFZ, if present, are too subtle to be detected using the current methodology.

10:15 Break

10:30 IMPLICATIONS OF A QUATERNARY SOIL CHRONOSEQUENCE TO LANDSCAPE DEVELOPMENT IN SOUTHEASTERN MISSISSIPPI

Amy L. Seiter* and David F. Ufnar, University of Southern Mississippi, Hattiesburg, MS 39406

The landscape in southeastern Mississippi is characterized by a chronosequence of soil development in progressively older surfaces occupying distinct topographic positions. The morphological properties of the soils and Optically Stimulated Luminescence (OSL) dating techniques are being used to resolve the geomorphic history. The landscape is characterized by three geomorphic domains: uplands (elevations of 200-350'), stream-cut terraces (160-200'), and recent alluvium (< 160'). The parent material consists of the silty-clay Miocene Hattiesburg Formation overlain by the fluvial sands and gravels of the Plio-Pleistocene Citronelle Formation (typically seen in the upland areas). The valleys are filled with alluvial sands, gravels, and lesser amounts of silts and clays reworked from the Hattiesburg and Citronelle Formations. A prominent terrace is cut into the alluvium, and has been mapped as a Quaternary deposit. OSL dating techniques have constrained the terrace soils to ages between 18,000 and 25,000 years before present. Qualitatively, soils developing in the uplands are the oldest in the chronosequence: lower horizons are reddened and have prominent illuviated clay cutans, with a leached E horizon. Soils developing in the terraces have minor clay cutans and are not as hardened or reddened as the upland soils. The recent floodplain soils lack horizonation, illuvial accumulations, and soil structure. A better understanding of the regional soil development in this coastal plain may help elucidate some of the recent geological and climatic history. Furthermore, this study is improving our understanding of the regional distribution and relationships between the Hattiesburg and Citronelle Formations and the Quaternary alluvium.

10:45 COMPARISON OF HISTORIC EARTHQUAKE FELT AREA-MAGNITUDE RELATIONSHIPS WITH THE CURRENT WEB-BASED FELT AREA DATA COLLECTION SYSTEM

Terry Panhorst, University of Mississippi, University, MS 38677

Felt areas of earthquakes are determined by collecting responses of individuals after the seismic event. For earthquakes prior to seismic instrumentation, reports of felt area

along with the intensity of shaking is often used to help estimate the seismic magnitude. Sources of public perceptions used to make these area determinations included newspaper reports and mail surveys. Numeric models relating felt areas to seismic magnitude in the central United States have been derived since the mid-1970s. In 1999, the U.S. Geological Survey began collecting general population felt reports via the Internet, using their system *Did You Feel It?* Since April 2000 some 34 earthquakes with magnitudes of at least 2.9 have occurred in the central United States. At least 20 felt reports were filed using this system for each of these events; in four cases several thousand felt reports were made. With such a large group of respondents, potentially more accurate felt areas can now be determined as compared to earlier methods. Estimation of the felt area for each of the 34 seismic events was made using map prints of the *Did You Feel It?* data. Comparison of this compilation with the original (1970s) felt area studies indicates no statistically-significant difference between these two data sets. The empirically-derived numeric models for felt area and magnitude relationships are supported by this enhanced recent data set.

11:00 GIS AND REMOTELY SENSED PRECIPITATION DATA FOR WATERSHED MODELS

Louis Wasson* and Jeff Ballweber, Mississippi State University, Mississippi State, MS 39762

The Upper Pearl Watershed located in central Mississippi covers over 2000 square miles in 15 counties. The environment of the Upper Pearl Watershed is rapidly changing due to residential and commercial development in the Jackson metropolitan area, the state capital, and further upstream near Philadelphia, MS. These changes may present water quality challenges to both the Pearl River and the Gulf of Mexico coastal waters. Heavy precipitation events in Upper Pearl can significantly impact coastal fisheries and essentially close near shore oyster reefs for several days until the transported pollutants from the Pearl River dilute to safe levels. Modeling the relationship between meteorology and climatology and water quality could provide valuable management insights to upstream managers on downstream, coastal impacts. Developing such a model faces some daunting challenges. Surface weather stations are the typical source for meteorological data but the distribution of these stations results in large spatial gaps in data coverage. It can rain in one part of the watershed but never be recorded and placing a weather station every few kilometers would be unrealistic. This paper examines the validity of using remotely sensed meteorological observations using NASA's Tropical Rainfall Measurement Mission (TRMM) satellite, NOAA's Multi-Precipitation Estimate (MPE) and GOES satellite Hydro Estimator (HE). Arc Hydro, ESRI's new water resources data model, will systematically bring in the different data formats for use in the Army Corps of Engineers HEC simulation models.

THURSDAY AFTERNOON

Classroom C

- 1:30 SURVEYING THE GIS COMMUNITY TO FACILITATE COMMUNICATION AND COORDINATION
Barbara Yassin, Mississippi Office of Geology, Jackson, MS 39289

People working with Geographic Information System (GIS) data are always in search of GIS contacts and to learn what data they have. GIS specialists know their field is growing with new people and no one wants to spend two months developing data that has already been created. Federal Emergency Management Agency (FEMA) recognizes this with creating the new county Digital Flood Insurance Rate Maps (DFIRM), so they gave the new Geospatial Resources Division in the Office of Geology a grant to collect GIS contacts and data information around the state. We included in the survey a few extra questions to benefit Geology's efforts in coordination. A contacts database was populated and a phone survey was developed and reviewed. Then municipalities, counties, and planning districts were contacted and their GIS staff were surveyed about the data layers they managed. They were also asked about planned future activities. A database was made of the responses and used to make maps in a GIS. These maps are an easy-to-read form to show who is doing what around the state. They can be posted on the coordination website along with contact information. With this information available, the DFIRM process will be more efficient, and entities can contact one another to share data, collaborate on work projects, and coordinate imagery collections to save money.

- 1:45 EVALUATION OF AN ENGINEERED STORM-WATER REMEDIATION SYSTEM, MISSISSIPPI MUSEUM OF NATURAL SCIENCE, JACKSON, MISSISSIPPI

Stan Galicki* and Crystal Wilson, Millsaps College, Jackson, MS 39210

The Mississippi Museum of Natural Science features an engineered, multi-component, stormwater remediation system designed to minimize or eliminate suspended matter and hydrocarbons in runoff from its public parking lot. The system is composed of baffled drainage channels, a Vortechnic hydrodynamic separator, and a series of settlement ponds. Automatic and manual sampling techniques were used to sample influent into, and effluent from, the Vortechnic Unit. Water samples were analyzed gravimetrically for hexane extractable material. Automatic sampling of runoff from storm events over a five month period failed to indicate the presence of detectable hydrocarbons (> 2.0 ppm) in either the influent or effluent flow. When no hydrocarbons were detected following additional tests using the automated sampler and 100 ml of contaminant (50/50 mix of used motor oil and diesel fuel) introduced to the pavement prior to storm events, the timing of the sampling by the automated sampler was suspect. Final tests were done using manually controlled sampling and controlled contamination (250 ml) during storm events. The majority of the hydrocarbons were contained by the Vortechnic Unit with

effluent contamination generally limited to light oil sheen; one sample containing 2.6 ppm hydrocarbons was collected. The limited release of oil through the system during slug tests suggests that under normal conditions the system may efficiently remove hydrocarbons from the parking lot runoff.

- 2:00 CLAY MICROFABRIC SIGNATURES DRIVING ORGANIC MATTER PRESERVATION IN MARINE SEDIMENT

Kenneth J. Curry*, Richard H. Bennett, Ann Curry, Maritza Abril, and Patricia M. Biesiot, University of Southern Mississippi, Hattiesburg, MS 39406

Specific clay particle arrangements in marine muds (i.e., face-to-face domains, micropores in aggregates, etc.) may trap organic matter and isolate (sequester) it from the larger scale biogeochemical system preventing the physical entry of microorganisms or their enzymes into the pores and spaces of the aggregates, and thereby enhancing organic matter preservation. Our focus is on polysaccharide preservation driven by microfabric signatures formed as clay passes through the guts of deposit-feeding polychaete worms. The signatures formed at the surface of fecal pellets due to the shear forces on the fecal material during gut passage are expected to enhance organic carbon preservation. The close-stepped face-to-face domains (parallel spacing of clay platelets) may trap organic matter and prevent its subsequent degradation by microorganisms and their enzymes by the physical limitations of the pore sizes. We have successfully visualized, with a transmission electron microscope, polysaccharides from polychaete fecal pellets at the nanometer level of organization using a periodic acid-thiocarbohydrazide-silver proteinate technique. Continuing with a successful visualization technique, we are now proceeding with a series of experiments involving enzymatic digestion of sectioned material from laboratory-controlled clay sources with and without organic material and from polychaete fecal pellets to assess polysaccharide preservation in various microfabric signatures.

- 2:15 INFLUENCE OF COASTAL PROCESSES ON HIGH FECAL COLIFORM COUNTS IN THE MISSISSIPPI SOUND

David F. Ufnar¹*, Jennifer Ufnar¹, Dawn Rebarchik², and R.D. Ellender¹, ¹University of Southern Mississippi, Hattiesburg, MS 39406 and ²University of Southern Mississippi, Gulf Coast Research Laboratory, Ocean Springs, MS 39564

Microbial source tracking efforts have historically focused on input of fecal bacteria from sources such as storm drains, sewers, and runoff from rain events. Fecal coliform levels in the Mississippi Sound estuary have been analyzed and compared to physical factors in an attempt to characterize possible non-point sources of pollution in the estuary. Results from this study show that a main factor in elevated levels of fecal coliform is a change in wind direction. Many times related to storm events, these changes in wind direction cause drastic spikes in fecal coliform counts, pointing to the sediment as a possible source of fecal coliform bacteria observed in the water column.

- 2:30 Divisional Business Meeting

4:00 Divisional Poster Session

EVALUATING THE PERFORMANCE OF A RECENTLY NOURISHED ESTUARINE BEACH: THE MISSISSIPPI SOUND, HANCOCK COUNTY, MISSISSIPPI

Joseph Harwood^{1*}, Keil Schmid², and David F. Ufnar¹, ¹University of Southern Mississippi, Hattiesburg, MS 39406 and ²Hart Crowser Environmental, Cherry Hill, NJ 08002

We are studying the performance of a freshly nourished (completed June, 2004), 1.6 km long, artificial estuarine beach in Hancock County, Mississippi. The beach profiles were stable during the first three months; however with the passage of hurricane Ivan (9/15/04) and tropical storm Matthew (10/10/04), significant changes in the beach/nearshore profiles have occurred. Multiple longshore bars have developed in the nearshore zone during the post-storm adjustment period. The morphological changes that occur in these nearshore bars will be closely monitored to help denote erosional hotspots in the coming months. Erosional "hotspots" on the Mississippi Sound coast are areas where the shoreline is retreating at rates of 2-4 m/yr. The morphodynamics of nearshore bars in Mississippi Sound may indicate zones that are highly susceptible to erosion. Temporal and spatial data are being used to analyze the relationships between the nearshore bar morphologies, wave and tidal current processes, shoreline retreat, and the distribution of sediment in the nearshore zone of the Hancock County beach. Shoreline GPS surveys and shore-perpendicular profiles coupled with historical data and aerial photographs are being used to map changes in the shoreline position, beach-nearshore profile, and the position/orientation of the nearshore bars. Mississippi Sound is a low wave-energy, microtidal, estuarine coastal system dominated by mud-sized sediment. Sedimentation along the Mississippi Sound coast mainly occurs during storms, and the most energetic wave conditions occur with the passage of tropical storms or winter cold fronts (20 to 30 per year).

GIS GEODATABASE DATA MODEL DEVELOPMENT FOR ROAD MANAGEMENT: THE ARMY CORPS OF ENGINEERS TENNESSEE-TOMBIGBEE WATERWAY (MOBILE DISTRICT)

Rita Jackson, Mississippi State University, Mississippi State, MS 39762

The Army Corps of Engineers Tennessee Tombigbee Waterway located in the Mobile District, is responsible for 234 miles of the Tombigbee River. On both sides of the river, roads are used to manage the river and the activities associated with the river. The Corps has approximately 53 miles of paved roads and 130 miles of unpaved roads. These roads have various functions. Roads are used as access roads into the waterways ten locks and dams, as well as access into roads into campground and day camp use facilities. Managing the maintenance of these roads can prove to be difficult without an appropriate system set in place to record and update road maintenance projects. Accordingly, the Corps is developing a geographic information system (GIS) geodatabase to assist in these activities. A GIS geodatabase stores spatial as well as attribute data. The key component in the geodatabase is its ability to efficiently relate spatial data and attribute data in a management system. The geodatabase will also be used as an inventory

and maintenance tool to help the Corps more efficiently plan and prioritize their long term maintenance needs and manage day-to-day roads management. A data model of the Corps GIS geodatabase was built using Microsoft Visio 2002, a diagramming program used to illustrate simple or complex information. A data model clearly shows how the geodatabase is constructed and how each component in the geodatabase is related. A diagram of the geodatabase of the Corps roads network would enable Corps personnel to quickly distinguish how each component of the road network interrelates, making it a valuable decision making tool.

HEALTH SCIENCES

Chair: D. Michelle Tucci, University of Mississippi Medical Center

Vice-chair: Audrey Tsao, University of Mississippi Medical Center

THURSDAY MORNING

Auditorium

Clinical Diagnostics I
8:30 GENETIC MARKERS FOR EVALUATION OF SIC PATIENTS AT RISK OF SEPTIC COMPLICATIONS

James Hamilton*, Lee Y. Tee, Lynn J. Calcote, Marjelyn Brock, Christine Toves, Ginger Hogg, Roger Blake, Robert Schmieg, Gregory Timberlake, and D. Olga McDaniel, University of MS Medical Center, Jackson, MS 39216

Background: Severe trauma injury often leads to the development of sepsis and organ failure. A challenge for appropriate treatment of sepsis is identification of the patients who are at increased risk for sepsis. Clinical findings support the fact that despite comparable risk factors, post trauma sepsis and organ failure develops in some patients but not others. Hypothesis: In clinical settings, interindividual genetic differences associated with host immune response appear to be a major contributing factor to the development of trauma induced infection and subsequent organ failure in surgical patients. Methods: All blunt and penetrating trauma, with injury severity scores of >15 were included in this study. Thirty eight patients (17 African American and 21 Caucasian patients) were studied. Peripheral blood mononuclear cells (PBMCs) were used for genotype analysis. Genotypes for cytokines including IL-6, TNF- α , IL-10, IL-18, IFN- γ and Toll-like receptor genes, such as TLR-2 and TLR-4 were determined. Results: A majority of patients have developed sepsis. In terms of cytokine genotypes, the high producer genotype of IL-6 was found in 90.5% of patients who developed sepsis ($p < 0.05$). No correlation was observed among Toll-like receptor mutations and the development of sepsis. In conclusion, a high number of patients that met the criteria for the study (ISS > 15) developed sepsis. While the IL-6 high producer genotype shows a statistically

significant correlation to sepsis, other factors including Toll-like receptors are important in the development of sepsis. A larger sample size is needed to determine the significance of the Toll-like receptors in sepsis.

8:45 MHC CLASS II-RESTRICTED PROCESSING AND PRESENTATION OF A CYTOPLASMIC ANTIGEN

Jeremy Lott^{1,2*}, Joseph A. Cameron², and Janice S. Blum¹,
¹Indiana University School of Medicine, Indianapolis, IN 46202 and ²Jackson State University, Jackson, MS 39217

The Major Histocompatibility Complex (MHC) encodes genes necessary for host defense. These genes code for many molecules involved in protecting the body from foreign pathogens and antigens. MHC class II proteins typically present peptides derived from extracellular antigens, which have been internalized by antigen presenting cells (APC). Upon uptake into an APC, these antigens are processed within endosomes and lysosomes by acidic proteases called cathepsins. Studies by our lab and others have shown that cytoplasmic antigens normally presented by MHC class I, may also be presented by class II. In this study, the processing and presentation of SMA, a mutant form of the IG Kappa light chain variable domain was monitored. Studies have shown that endogenous SMA gives rise to peptides such as kappa II (residues 145–159), which are then presented by the class II proteins to T-cells. Here, investigations determined that cytoplasmic SMA is presented via an endogenous pathway for display in the context of class II. Thus, release of SMA of its antigenic peptides were not detected with SMA transfected APC. Current studies also suggest a role for specific proteases in processing SMA for class II presentation. Investigations are ongoing in terms of defining specific steps in cytoplasmic antigen presentation as this pathway has relevance to viral, tumor and auto-immunity. Supported in part by: NIH R25 GM067592-02

9:00 MODULATION OF PHASE 1 AND BRCA PROTEIN EXPRESSION IN RESPONSE TO TREATMENT WITH ALCOHOL AND *VERNONIA AMYGDALINA* EXTRACT

Alden Hopkins^{1,2*}, Jacqueline Samuel¹, Joseph A. Cameron¹, and Carolyn B. Howard¹, ¹Jackson State University, Jackson, MS 39762 and ²Hinds Community College, Jackson, MS 39217

Useful anti-cancer agents affect Phase 2 metabolic enzymes without affecting Phase 1 enzymes. Phase 1 enzymes are relevant in cancer studies in that they are involved in chemical reactions, whereas phase 2 enzymes are involved in clearance. Previous studies revealed that treatment of MCF-7 breast cancer cells with low concentration of ethanol alone induced cell growth, whereas very high concentrations of ethanol were inhibitory. Studies have shown that *Vernonia amygdalina* (*V.A.*) extract induces Phase 2 enzymes, without affecting Phase 1 enzymes, providing evidence supporting the chemotherapeutic potential of *V.A.* We hypothesize that treatment with a combination of *V.A.* extract and ethanol will change responses which take place following treatment with ethanol alone. Twenty-four female mice were exposed to ethanol in the drinking water for sixteen weeks. Eight were continued for four additional weeks of ethanol exposure, eight others received *V.A.* plus ethanol for the four additional weeks,

and the other eight, which served as the control group received drinking water alone. Liver and mammary tissues samples were removed from animals following treatment and immuno-histochemistry was performed. Results indicated *V.A.* treatment affected ethanol-induced responses by leading to a decrease in apparent mammary tumors. Studies are being conducted to further characterize these responses. This work is supported in part by GM50117.

9:15 PROTECTION AGAINST PNEUMOCOCCUS BY PspA

Quincy Moore* and Larry S. McDaniel, University of Mississippi Medical Center, Jackson, MS 39216

Pneumococcal infections are prevalent in children under the age of 5 and the elderly (> 65 years of age). Prevention of diseases that result from pneumococcal infection is of great medical importance. Our work focuses on the use of the pneumococcal surface protein A (PspA) as a vaccine candidate. The DNA fragment encoding the alpha-helical domain of PspA/EF5668 was cloned into an eukaryotic expression vector designated pJB100EF. We examined the effect of priming with pJB100EF and boosting with purified recombinant protein. We also tested the hypothesis that the genetic background of the pneumococcus affects the ability of anti-PspA antibodies to protect in a systemic model. We used a genetically modified variant of WU2 that expresses PspA from EF5668, WU2, and EF5668 as challenge strains. Anti-PspA levels were enhanced when mice were primed with DNA and boosted with protein. Western blot analysis demonstrates that the immune serum was cross-reactive with PspA from several different pneumococcal isolates representing different PspA clades. Survival of immunized mice following pneumococcal challenge demonstrated the ability of prime-boost immunizations with the alpha-helical domain of PspA to elicit protective immunity.

9:30 Break

Environmental Influences on Health I

9:45 HARMFUL HEALTH EFFECTS OF HIGH DOSE IONIZING RADIATION

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

The most common forms of ionizing radiation are alpha and beta particles and photons of gamma and x-rays. Effect depends on the type, dose, and the dose rate of the incident radiation and the composition of the human tissue. The mechanism which causes health effect is the direct ionization of the atoms and molecules of the cells, while indirect effects are mainly produced by highly reactive free radicals H_2O^+ , H^+ , and HO^- created by the radiation when it interacts with water molecules. This often leads to damage to the membrane, nucleus, chromosomes, or mitochondria of the cell that either inhibits cell division, results in cell death, or produces a malignant cell. A dose of only 300 J of x-ray or γ -ray radiation is fatal for the average human, even though this radiation raises the temperature of the body by only 0.001 °C. Some of the people who died at Chernobyl received a high dose, 100–250 rem, in a short period. External sources of ionizing radiation include cosmic rays from the sun and other stars, α -particles or γ -rays emitted from rocks and soil. Internal sources include

nuclides that enter the body when we breathe (^{14}C , ^{85}Kr , ^{220}Rn , and ^{222}Rn) and through the food chain (^3H , ^{14}C , ^{90}Sr , ^{131}I , and ^{137}Cs). The cells of bone marrow, the reproductive organs, the epithelium of the intestine, and the skin suffer the most damage from radiation.

10:00 THE DEVELOPMENTAL EFFECTS OF BENZO-(A)PYRENE ON *FUNDULUS HETEROCLITUS* EMBRYOS

Joseph Wahome^{1*}, Kimberley Jefferson², and Kristine L. Willett², ¹Mississippi Valley State University, Itta Bena, MS 38941 and ²University of Mississippi, University, MS 38677

This experiment was done to study growth and developmental effects of the carcinogenic polycyclic aromatic hydrocarbon benzo(a)pyrene on *Fundulus heteroclitus* embryos. The Medaka Embryo Larval Assay was adapted for use of studying the chemical effects on the saltwater teleost, *Fundulus heteroclitus*. Hatching and sterilization processes were adjusted. The affects of 1 and 10 ppb concentrations of BaP in ethanol and DMSO carrier solvents were studied along with ethanol and DMSO controls. Ethanol had adverse affects from DMSO treatments and proved to be the worse solvent. Ethanol treatments were statistically different when comparing stage developments to the other treatments. A basic morphological scoring system was used to score the embryos with craniofacial, cardiovascular, skeletal, organ, body part, pigmentation, movement disorders, and stage delay. BMS scores for 1 and 10 ppb BaP in DMSO treatments were higher than the controlled groups meaning BaP dosed fish were affected by the chemical. Also percent survival of embryos in 1 and 10 ppb BaP in DMSO treatments were lower when compare to controls. When observing abnormal swimming behavior the 1 and 10 ppb treatments, the BaP dosed fish displayed a higher percentage of abnormal swimming behavior. Ethanol was an unacceptable carrier solvent for benzo(a)pyrene. Benzo(a)pyrene does cause effects on growth and development.

10:15 HOUSEHOLD ELECTROMAGNETIC FIELDS EFFECTS ON HUMAN HEALTH

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

Exposure levels of electric and magnetic fields (EMFs) around the home are in the range of 0.01–0.25 μT , near powerlines 0.5–1.0 μT , and under the power lines, 6.0–10.0 μT . The frequency and energy of radiation produced by time-varying electric and magnetic fields are very low (< 300 Hz) to damage a cell or DNA, and therefore in principle are not capable of initiating cancers. The only known interaction between the EMFs and the human body is the induction of an electric current which is proportional to the magnetic field. Laboratory studies on animals and cell cultures have shown that weak magnetic fields can have effects on several biological processes. For example, they may alter hormone and enzyme levels and the rate of movement of some chemicals through living tissue. By themselves, these changes do not appear to constitute a health hazard. Most studies have produced inconclusive results or no increased cancer incidence in laboratory animals following exposures to EMFs. The radio waves and microwaves used for communications, such as radio, television, cell phones, radar, telephone, etc, are of much higher frequency and energy, but the intensity used in these applications are low

and therefore safe for the general public. The evidence for a link between EMFs and adult central nervous system cancers, male breast cancer, and leukemia is also very weak. More research to produce more reliable information is needed before any conclusions can be drawn.

10:30 ASSESSMENT OF MICROBIOLOGICAL WATER QUALITY OF PEARL RIVER AND THE GBNERR IN MISSISSIPPI

Zakiya Coleman^{1,3*}, Stephen S. Kishinhi¹, Ibrahim O. Farah¹, Paulinus Chigbu¹, Paul B. Tchounwou¹, and Mark Woodrey², ¹Jackson State University, Jackson, MS 39217; ²Grand Bay National Estuarine Research Reserve, Moss Point, MS 39562; and ³Hinds Community College, Raymond, MS 39211

The Grand Bay NERR and the Pearl River Basin are important water bodies in the state of Mississippi for recreation as well as being sources for providing aquatic food for the population. Health considerations with regards to these two water bodies and the diversity of their ecological systems are attracting research in the area of water quality. The purpose of this study was to evaluate levels and temporal variations of heterotrophic and indicator microorganisms in these bodies. We have established 15 sampling stations on the GBNERR and ten stations for the Pearl River. Samples were analyzed by membrane filtration and incubation on selective media, within 8 hours of collection, for total coliforms (ENDO), fecal streptococci (ENTERO), fecal coliform (FC/*E. coli*) and total heterotrophic (HPC) counts. Summary of the Pearl River data showed averages of 1578 for ENDO, 127 for ENTERO, 150 for FC/*E. coli*, and 67,335 for HPC. Corresponding results for the GBNERR were 381, 74, 118, and 27,297 respectively. Data presented here showed variability in ranges and averages within sampling stations and within sampling duration. It also indicates the presence of significant numbers of coliforms, fecal coliforms, and fecal streptococci at both water bodies. The Pearl River data also showed higher numbers for all groups as compared to the GBNERR. This is an alarming call for further research and intervention. Supported in part by NIGMS R25 GM50117.

10:45 Break

Outcomes Research

11:00 EFFECTS OF STANDARD POPULATION IN COMPUTING DISPARITY IN HEALTH STATUS OF RACIAL MINORITY IN MISSISSIPPI

Abu Khan* and Fazlay S. Faruque, Jackson State University, Jackson, MS 39217 and University of Mississippi Medical Center, Jackson, MS 39216

This study uses total mortality as an indicator of health status, and compares it between whites and non-whites of 82 counties of Mississippi. When the rates are age-adjusted, the minority non-white population experiences significantly higher mortality rate than the white population, suggesting that a disparity in minority health status exists in Mississippi. The need and rationale of converting mortality observed in a population to that of a standard population (age-adjustment), is well established. The 1940 standard population was in use for quite some time. The distribution of this standard was such that

the proportion in lower age groups was more than that in higher age groups. It is recently suggested that with the increase in life expectancy, the average population has increased in age (i.e., proportion of people in higher age groups has increased), and thus, a new standard that reflects this change is required. As a result, the 2000 standard population came in use. When the age distribution of non-white and white population of each of the 82 counties of Mississippi were compared to the standards of 1940 and 2000, it was found that the distribution of non-white population resembles more to the 1940 standard suggesting that the non-white population has not substantially changed in its age distribution. If the 2000 standard is used, the computed mortality rates of non-whites are underestimated. The reflected disparity in health status markedly differs as well. This suggests that the 1940 standard population may be more reflective of the non-white population and the 2000 standard population may fit better to the white population.

11:15 FACTORS INFLUENCING EXERCISE AND BMI IN UNDERGRADUATES

Rhiannon Neff^{1*}, Carol Jones², and Reid Jones², ¹Southern Arkansas University, Magnolia, AR 71753 and ²Delta State University, Cleveland, MS 38733

Recent reports from the Centers for Disease Control have cited an alarming increase in obesity among young Americans. Lack of exercise was considered a key determinant influencing obesity, as defined by elevations in body mass index (BMI). The present research examined the role of exercise patterns and personality characteristics on BMI among undergraduates. Eighty-five students at a regional state university in the Southeast volunteered to complete surveys involving demographics, exercise patterns, and Wallston's Multidimensional Health Locus of Control (HLOC). An 'internal' HLOC indicated that the person expected that their health was most likely influenced by their own personal behavior. An 'external' HLOC indicated that the person expected that their health was most likely influenced by external factors, beyond their control. Results showed that students with an internal HLOC were significantly ($p < .05$) more likely to exercise, and that this effect was far stronger ($p < .01$) among female students. Further, upperclassmen were significantly ($p < .05$) less likely to believe that external factors influenced their health than were Freshmen.

11:30 HEALTH INSURANCE CHARACTERISTICS OF COLLEGE STUDENTS

Jessica C. Olive, University of Southern Mississippi, Hattiesburg, MS 39406

Lack of health insurance is a persistent problem in the United States. Due to escalating costs, many people can afford health insurance only if it is offered as a benefit of employment. Even then, employers are cutting back on benefits to employees and their dependants and are requiring more cost-sharing for those benefits. The consequences of having no insurance include reduced use of preventive health services, less access to a regular source of care, inappropriate use of emergency services, and a higher probability of not receiving needed medications and treatment. The purpose of this study was to characterize the insurance status and needs of full-time undergraduate and graduate students at the University of

Southern Mississippi. An online survey was developed and pre-tested using a focus group. Incentives were provided to encourage participation. A total of 79 people responded to the invitation to participate in the survey. The data was analyzed using SPSS. The majority of students that participated in the survey was found to have health insurance and had a regular place to go for medical care.

11:45 THE USE OF ORAL HISTORY METHODOLOGY FOR EDUCATIONAL AND PROFESSIONAL DEVELOPMENT

Cynthia K. Scott* and Ruth M. Burgess, University of Mississippi Medical Center, Jackson, MS 39216

This study explores the educational and professional benefits of student participation in oral history research. Subjects include five Master of Physical Therapy students who participated in a project to document the development of physical therapy in Mississippi. Using an oral history format, accounts from Mississippi pioneers in physical therapy were documented. Contributions from two deceased pioneers were documented via proxy. Four months after completion, the subjects were asked to reflect on the value of this project to their educational and professional development. This was done via an open ended questionnaire of nine questions developed by the researchers and validated by faculty members with research and educational backgrounds. Responses were anonymous and participation was not grade related. Results: Qualitative analysis revealed 3 themes resonating with subjects: (1) importance of professionalism; (2) effective teamwork; and (3) importance of understanding professional history. Subjects reported a new appreciation of those who "paved a road" allowing us to practice as we do today. This was an excellent method to actively teach professionalism, teamwork, and respect for the profession of physical therapy. Gaining insight into these issues may strengthen long term professional development. Professionalism, teamwork and an appreciation of professional contributions are essential qualities which allow physical therapists to function as part of a team. Participation in this project strengthened these qualities for these students.

THURSDAY AFTERNOON

Auditorium

Mini-Symposium Drug Delivery

1:30 OPENING INTRODUCTION TO DRUG DELIVERY DEVICES

Hamed Benghuzzi, University of Mississippi Medical Center, Jackson, MS 39216

Keynote: Historical perspective of the discovery of ceramic delivery systems and major applications in the biomedical field.

1:45 INVITED GUEST SPEAKER, OSMOTIC PUMP DRUG DELIVERY

Ateegh Al-Arabi, JCCC, Overland Park, KS

Novel Applications for Osmotic Pump Delivery Systems.

2:00 EVALUATION OF THE MALE REPRODUCTIVE ORGANS AFTER TREATMENT WITH CONTINUOUS SUSTAINED DELIVERY OF STATIN FOR FRACTURE HEALING

Felix I. Adah^{1*}, Hamed Benghuzzi¹, Michelle Tucci¹, George Russell¹, Audrey Tsao¹, and Barry England², ¹University of Mississippi Medical Center, Jackson, MS 39216 and ²University of Michigan Medical School, Ann Arbor, MI 48104

The 3-hydroxy-3-methylglutaryl coenzyme A (HMG-CoA) reductase inhibitors (statins) are widely used for the treatment of hyperlipidemia, and recent *in vitro* and animal data suggest that statins promote bone formation and increase bone strength. We examined the relationship between sustained continuous delivery of statin and fracture healing rates in adult male animals with either femoral defect or segmental fractures. Because statin affects the production of cholesterol we also evaluated the influence statin, on adrenal and testicular steroidogenesis and the morphology of the reproductive tract tissues in animals receiving statin for periods of 4, 8 and 12 weeks post surgery. Simvastatin significantly increased fracture healing and reduced total cholesterol without influence on the plasma HDL-cholesterol levels. Basal plasma LH, FSH and testosterone levels were not affected by active treatment with simvastatin. Reproductive tissue morphology was unchanged by local sustained release of statin. In conclusion, long-term simvastatin treatment, at doses effective in improving lipid profile, did not influence testicular reproductive and endocrine function, but was able to effectively heal simple and complicated fracture types. *Graduate student in Clinical Health Sciences

2:15 ANDROGENIC MODULATION OF ANGIOGENESIS IN THE TISSUE IMPLANT RESPONSE

Kenneth R. Butler and Hamed Benghuzzi, University of Mississippi Medical Center, Jackson, MS 39216

Several previous studies on the effect of steroid hormones on the tissue-implant response have recently appeared in the scientific literature. The objective of this project was to demonstrate that androgens affect angiogenesis in the fibrous tissue surrounding TCP implants. It is hypothesized that the number and size of blood vessels formed within the fibrous tissue surrounding TCP implants loaded with androstenedione (A), dihydrotestosterone (D), and testosterone (T) is greatly affected by the androgens. Sixteen animals in four experimental groups (n = 4/group) were implanted with one TCP implant each. Group I animals were implanted with the sham TCP ceramic (Control). Group II animals received the T-TCP ceramic. Group III animals were implanted with the D-TCP bioceramic. Group IV animals received the A-TCP bioceramic. At 90 days post-implantation, the animals were euthanized and the fibrous tissue surrounding the implants were evaluated microscopically following staining with routine hematoxylin and eosin (H&E), modified Papanicolaou, and PAS. Using digital analysis software, data were collected and evaluated comparing hormonal effects on number and size of blood vessels within the fibrous tissue collected from all four groups. The presence of androgens greatly affected the angiogenic response within the fibrous tissue. Both testosterone and androstenedione appear to suppress or limit angiogenesis. The results of this study demonstrate that some steroid hormones have a strongly varying affect on angiogenesis within the

fibrous tissue surrounding TCP implants.

2:30 COMPARISON OF CONVENTIONAL AND SUSTAINED DELIVERY OF L-DOPA ON SH-SY5Y NEUROBLASTOMA CELLS

Tina Martin*, Hamed Benghuzzi, and Michelle Tucci, University of Mississippi Medical Center, Jackson, MS 39216

L-dihydroxyphenylalanine-(L-DOPA) has been used for the treatment of Parkinson's disease for decades. Recently it has been shown that L-DOPA, at concentrations of 0.25×10^{-4} M or larger, can be toxic for human neuroblastoma cells. Toxicity has been associated with the productions of high levels of quinones. The reactive oxygen or nitrogen species generated in the enzymatic oxidation or auto-oxidation of an excess amount of dopamine or L-DOPA induce neuronal damage and/or apoptotic or non-apoptotic cell death. The objective of this study was to investigate if the delivery method could reduce the toxicity associated with higher levels of L-DOPA. SH-SY5Y neuroblastoma cells were challenged with a bolus administration of 5, 50, 100, or 500 μ M of L-DOPA or a sustained delivery of L-DOPA to release the desired concentrations by the end of one incubation period. The cells were incubated for periods of 24, 48, or 72 hours, and at the end of each phase cell number, cell morphology, and cellular glutathione levels were determined. Conventional administration of L-DOPA showed reductions in cell number at 72 hours in cells treated with 50 and 500 μ M L-DOPA. A similar trend was observed using drug delivery administration of L-DOPA. Glutathione levels were reduced in the treatment groups after 24 hours and showed recovery by 48 hours. Morphologic evaluation revealed that the lower dose groups appeared similar to control in both conventional and drug delivery whereas cellular distortion was observed at higher doses regardless of delivery method. Conclusion: Lower dose L-DOPA was demonstrated to be less cytotoxic in SH-SY5Y neuroblastoma cells. *Graduate Student in Clinical Health Sciences

2:45 THE EFFECTS OF CORTISOL CONCENTRATION ON THE RC/4B PITUITARY CELL LINE

Lisa Haynie*, Hamed Benghuzzi, University of Mississippi Medical Center, Jackson, MS 39216

Pituitary adenomas are benign tumors that arise exclusively within the anterior pituitary. Treatment for any pituitary hormone-secreting adenoma has three main goals: (1) remove/shrink tumor mass, (2) remove/inactivate any hypersecreting pituitary tissue, and (3) provide hormone replacement. Surgery generally accomplishes the first two goals. The replacement hormone therapy regime is the most cumbersome and often leaves the patient at serious risk for peaks and valleys in hormone levels. Without the hypothalamic-pituitary-adrenal axis (HPA) the patient's ability to produce an anti-stress effect may be altered. Glucocorticoids (GCs) are regulated by HPA and mediate diverse physiological effects. GC level is elevated after infectious/inflammatory stress and exerts a suppressive effect on the immune function. The objective of the study was to evaluate RC/4B/C pituitary cells after 24, 72, and 96-hour incubation periods with low, medium and high doses of cortisol. Cell viability, number, morphology, and metabolism were evaluated. The results of the study showed a significant decrease in cell number as early as 24 hours in the treated

groups. Increases in cellular damage were evident at 72 and 96 hours in all treated groups. Cellular protein levels were unremarkable for the duration. Reduced cell numbers in the treated groups along with evidence of cellular membrane oxidation suggests the possibility that GC may reduce or suppress neuroendocrine regulation by causing cellular apoptosis. The results show a need for further studies on the cell line to establish the mechanism by which GC suppress the immune system in times of infectious/inflammatory stress.

4:00 Divisional Poster Session

THE EFFECTS OF CORTISOL ON THE VIABILITY AND PROLIFERATION OF CERVICAL TUMOR CELL LINES, SW 756 AND HELA, AND NORMAL CERVICAL CELLS, Ect 1/E6E7, IN CULTURE

Melissa Daniel* and Hamed Benghuzzi, University of Mississippi Medical Center, Jackson, MS 39216

Cervical cancer remains a health issue worldwide, and the role of steroid hormones on cervical cancer cells is not clearly defined. This study investigated the effects of the physiological and supraphysiological levels of cortisol, on the viability and proliferation of two cervical tumor cell lines, SW 756 and HeLa, and cervical cells, Ect 1/E6E7 cells, that were HPV transformed. In this study, all cell lines were treated cortisol and examined biochemically and morphologically at 24, 48, and 72 hours. Results from this study indicated the following: the MTS Assay for cell counts revealed supraphysiological doses of cortisol (0.05 μ M) produced a statistically significant decrease in cell proliferation in all cell lines for the duration of the study ($p < 0.05$). Assays for cellular damage revealed the following: MDA and LDH levels were increased at all time periods following the addition of supraphysiological levels of cortisol for SW 756, HeLa and Ect1/E6E7 cells. Protein levels were unremarkable. Morphological changes were seen in all cell lines given supraphysiological doses of cortisol. Cytoplasmic changes included slight increases in vacuolization, fragmentation, and intracytoplasmic debris. Nuclear changes included a slight increase in bizarre and aberrant nuclear shapes. This investigation provides significant information regarding the interrelationship between the stress hormone, cortisol and the viability and proliferation on cervical tumor cells and normal cells transformed with HPV.

ELECTRICAL STIMULATION AT THE ACUPUNCTURE POINTS FAILS TO IMPROVE DELAYED ONSET MUSCLE SORENESS

Min Huang*, Mark D. Weber, William R. Woodall, Cynthia K. Scott, Felix I. Adah, and Neva F. Greenwald, University of Mississippi Medical Center, Jackson, MS 39216

The purpose of the present study was to determine whether electrical stimulation at acupuncture points can decrease muscle pain and increase muscle strength at different time periods after delayed onset muscle soreness (DOMS) induced by exercise. Subjects consisted of 19 untrained female volunteers that had no known medical conditions. A single blind experimental design was used during this experiment. Each subject was randomly placed into either a treatment or control group. DOMS was produced in subjects by having them perform eccentric flexion of the elbow using free weights.

Elbow range of motion, muscle strength of biceps and pain were measured daily for 3 days. All subjects were connected to electrical stimulation machines by electrodes placed at eight pre-determined places based on acupuncture points and pathways. The experimental group received stimulation over the sensory threshold. The control group received no stimulation. The main effect within subjects over time was found to be significant for passive extension ($p < 0.01$), strength ($p < 0.001$), and pain ($p < 0.001$). There was no significant difference between the treatment group and control group for passive extension ($p > 0.05$), strength ($p > 0.05$), and pain ($p > 0.05$). The results of this study showed an increase in subjective pain and a decrease in strength of biceps and range of motion of the elbow over the time, but failed to show any beneficial treatment effect of electrical stimulation at the acupuncture points on DOMS.

INCORPORATION OF LIPID PANELS, WEIGHT MANAGEMENT PROGRAMS, AND DIETARY CHANGES IN THE TREATMENT OF OBESE PEDIATRIC PATIENTS

Felisa Wilson* and Hamed Benghuzzi, University of Mississippi Medical Center, Jackson, MS 39216

Critical measures are being explored to combine laboratory data, clinical guidelines, weight management programs, and nutritional counseling to establish more effective treatment plans for obese pediatric patients. Clinical practice alone is not enough to remedy the rapidly increasing number of obese children and adolescents. The efficacy of incorporation of laboratory data, weight management program, and dietary changes was implemented in approximately 25 patients 6 to 13 years of age who were obese with average weight 20% greater than standard guidelines. Treatment included use of lipid panel, nutrition counseling and therapeutic exercises guided by licensed physical therapist for 8 weeks increments. Prior to program admissions, lipid panels were drawn to establish risk for coronary heart disease. These levels were monitored to ensure the patient was at minimal risk for heart attack prior to initiating any type of exercise regime. After a median follow-up of 2 months, changes in weight and laboratory profiles were seen. Combining laboratory expertise, exercise, and diet the pediatric population can initiate resolution strategies in the fight against obesity in the pediatric population. Thus, from a medical viewpoint, clinical evidence indicates that a significant reduction and modification of risk factors can be obtained by incorporation of lipid panel monitoring, exercise, and healthy dietary changes in daily lifestyle. Furthermore, healthier children result in healthier adults and decreased healthcare cost.

ACUPRESSURE FAILS TO IMPROVE DELAYED ONSET MUSCLE SORENESS

Min Huang*, Mark D. Weber, William R. Woodall, Cynthia K. Scott, Felix I. Adah, and Neva F. Greenwald, University of Mississippi Medical Center, Jackson, MS 39216

The purpose of this study was to determine if acupressure treatment at the acupuncture points can decrease muscle pain and increase muscle strength faster after DOMS was induced by exercise. Twenty subjects with no complicating medical history volunteered for this study. The control and treatment group consisted of 3 males and 7 females. Delayed onset muscle soreness was induced through eccentric exercise

of the subject's non-dominant biceps. Range of motion, pain, and strength were measured each day. Subjects were randomly placed into either a treatment or control group. Subjects in the treatment group received acupuncture treatment and subjects in the control group received no treatment. A repeated ANOVA test showed a significant difference for strength between days 0 and 1 ($p < 0.01$), 1 and 2 ($p < 0.01$) and 3 and 4 ($p < 0.05$). Pain was significant between days 0 and 1 ($p < 0.05$), 1 and 2 ($p < 0.01$), and 3 and 4 ($p < 0.05$). There was no significant difference between the treatment group and control group for passive extension ($p > 0.05$), strength ($p > 0.05$), and pain ($p > 0.05$). Conclusion: The protocol used to induce DOMS was effective, but acupuncture treatment did not significantly improve DOMS as compared to the placebo treatment. A larger patient population is needed to determine if acupuncture is truly effective in treating DOMS.

DEG/ENaC PROTEINS ARE REQUIRED FOR MYOGENIC CONSTRICTION IN MOUSE INTERLOBAR ARTERIES
Nikki Jernigan* and Heather Drummond, University of Mississippi Medical Center, Jackson, MS 39216

Autoregulation is the local adjustment of vascular resistance to maintain blood flow and is important in protecting the kidney against injury. A component of autoregulation, the myogenic response, is the inherent ability of vascular smooth muscle (VSM) to contract in response to increases in intraluminal pressure. Although mechanosensitive ion channels are thought to initiate VSM stretch-induced contraction, the molecular identity of these channels is unknown. Recent reports suggest Degenerin/Epithelial Na^+ Channels (DEG/ENaC) are required for normal mechanosensation in sensory neurons, however, the role of DEG/ENaC proteins in myogenic constriction has not been established. We hypothesized that DEG/ENaC proteins are mechanosensors in VSM and required for myogenic vasoconstriction. To determine if ENaC transcripts and proteins are expressed in cultured mouse renal VSM cells, we used reverse transcriptase PCR, immunoblotting, and immunolocalization. We detected expression of α , β , and γ ENaC transcripts and proteins. Further, we examined myogenic constriction and agonist-induced constriction and dilation in isolated mouse renal interlobar arteries in the presence or absence of the specific DEG/ENaC inhibitors, amiloride and benzamil. The DEG/ENaC inhibitors blocked myogenic constriction in a concentration dependent manner, without interfering with agonist-induced reactivity. Our findings suggest DEG/ENaC subunits are 1) expressed in renal vessel VMC and 2) required for myogenic vasoconstriction. DEG/ENaC proteins may be components of mechanosensitive ion channels required for myogenic vasoconstriction. This work was supported by the NIH and NHLBI.

PHARMACOLOGICAL BLOCKADE OF CORTICOTROPIN RELEASING FACTOR DOES NOT ALTER DEPENDENCE ON BUTORPHANOL

George Howell III, Melissa Parker*, and Robin Rockhold, University of Mississippi Medical Center, Jackson, MS 39216

We hypothesized that corticotropin releasing factor (CRF) facilitates both behavioral signs and neuronal activation which occur upon withdrawal from physical dependence on butorphanol or morphine. Dependence was induced in male

Sprague-Dawley rats by administration, via osmotic minipump, of either morphine or butorphanol (28 nmol/ $\mu\text{l/hr}$; i.c.v.) for 72 hours. At the end of 72 hours, animals were treated with saline (5 μl i.c.v.) or the CRF antagonist, alpha-helical CRF (αhCRF ; 10 $\mu\text{g}/5 \mu\text{l}$ i.c.v.), 15-20 minutes prior to naloxone (48 nmol/5 μl i.c.v.) precipitated withdrawal. Behavioral signs of withdrawal were counted for 30 minutes and scored. Pretreatment with αhCRF significantly decreased the occurrence of teeth-chattering in butorphanol-dependent animals, however, it did not significantly decrease the overall withdrawal scores in butorphanol- or morphine-dependent animals. Immunohistochemical analysis revealed a significant increase of Fos immunopositive cells, an indication of neuronal activation, in the paraventricular nucleus of the hypothalamus (PVN), central nucleus of the amygdala (CeA), periaqueductal grey (PAG), and supraoptic nucleus (SON) of saline-pretreated, morphine-dependent animals compared to saline-pretreated, butorphanol-dependent animals. Our data indicate chronic administration of butorphanol, as opposed to morphine, elicits a physical dependence in which one or more behavioral signs of withdrawal are facilitated by CRF. Paradoxically, morphine withdrawal elicits a greater degree of neuronal activation in most of the measured brain nuclei than butorphanol withdrawal.

EFFECT OF ADJOINING LINKER SEGMENTS UPON THE STABILITY OF DOMAIN 2 OF EPITHELIAL CADHERIN
Alka Prasad*, Corey Nichols, Tex Song, Gregg Anazia, Nicole Housley, and Susan Pedigo, University of Mississippi, University, MS 38677

Epithelial cadherin is a cell adhesion protein that is essential in calcium-dependent cell-cell recognition and adhesion. It contains 5 to 7 modular domains in its extracellular region that have a 7-strand β -sheet immunoglobulin-type fold. These domains, particularly Domain 1, are responsible for the protein-protein interactions that lead to adhesion between cells in tissues. Recently stability studies of Domain 2 were undertaken with the motivation that it is a representative modular domain for this family of proteins. Because the definition of a domain boundary is somewhat arbitrary, we have undertaken studies to examine the effect of the adjoining linker regions that connect Domain 2 to the adjacent domains in the physiological context of the molecule. These short 7 amino acid segments are highly conserved and offer 3 to 4 oxygens that are known to chelate the calcium ions that bind at the interface between the domains (Nagar et al. (1995) *Nature* 380: 360-4). We performed temperature induced denaturation studies monitored by circular dichroism. Each of these linker regions destabilize Domain 2 by 4 to 5 $^{\circ}\text{C}$ in the apo state such that the construct with both linkers attached is destabilized by 8 $^{\circ}\text{C}$. This represents a decrease in stability of 1.7 kcal/mol for the construct with both linkers over just Domain 2 alone. In addition, all constructs with linkers are stabilized to approximately 6 kcal/mol by the addition of 5 mM calcium to solution. Calcium stabilization of constructs with Linker 1 was confirmed through limited proteolysis. Contrary to similar studies on other modular proteins these studies show that the adjoining sequences actually destabilize the modular domain.

EVALUATION OF MRC-5 AND MG-63 CELL GROWTH RATES USING THE ALAMAR BLUE ASSAY

Joyce Belcher¹, Alexis Hand¹, Laura Franklin², Michelle Tucci², Hamed Benghuzzi², and Joseph A. Cameron¹, ¹Jackson State University, Jackson, MS 39217 and ²University of Mississippi Medical Center, Jackson, MS 39216

The process of cell counting is a valuable tool that enables researchers to study cellular proliferation and optimize cell culture conditions. Traditionally, the hemocytometer has been a widely used to manually count cells; however, there is an increased chance of human error in performing this technique. An alternative method of counting cells is the Alamar Blue Assay (ABA). The specific aim of this experiment was to examine the growth rates of normal lung fibroblast (MRC-5), and an osteosarcoma cell line (MG63), utilizing the ABA. Use of the ABA presents numerous advantages over established proliferation measurements, but we also observed several drawbacks to the routine use of the ABA. First, we showed a decrease in variability in the spectrophotometric data with minimal differences within the group, but the ABA was not sensitive enough to detect differences between the groups. Our data showed the reduction rate of Alamar Blue varies according to the cell line. Cells with higher metabolic rates (MG63 cancer cells) reduce the dye much quicker than primary non-transformed cell lines leading to a over estimation of cell number. We also found that the cells growing within the 96 well plates interfere with absorbance values reducing the accuracy of the total cell numbers. Varying the method of cellular treatment and analysis with the plate reader may help to improve the sensitivity of the ABA. Supported in part by NIH GM50117.

*Graduate Student

EVALUATION OF INSULIN-LIKE GROWTH FACTOR-1 AND PARATHYROID HORMONE ON GROWTH CHARACTERISTICS OF MG-63 CELLS

Laura Franklin*, Michelle Tucci, Hamed Benghuzzi, George Russell, Ashraf Ragab, and Audrey Tsao, University of Mississippi Medical Center, Jackson, MS 39216

Insulin-like Growth Factor-1 and Parathyroid Hormone are hormones secreted in the body that have roles in bone formation. The purpose of this experiment was to examine MG-63 cells after treatment with PTH and IGF-1 in low (1 µg), medium (5 µg), and high (50 µg) dosage levels and to make comparisons between the two hormones. MG-63 cells were plated onto a 24 well tissue culture plate at a density of 1×10^5 cells per well. The experiment was designed to evaluate cell counts, MDA, protein levels, calcium levels, alkaline phosphatase levels, and cellular morphology after 24, 48, and 72 hours post incubation with IGF-1 and PTH. Both hormones stimulated cellular division as evidenced by morphology and cell numbers. There was an inverse relationship between dose and cell number with the lower dose of IGF-1 and PTH causing the most increase. In both hormones, the highest dose level showed the largest MDA level increase. However, in the protein levels, few changes in protein levels were found with IGF-1, but PTH showed an increase of protein levels over the time periods. Morphological evaluation showed prominent nucleoli and cellular division throughout both treatments, however, the cells with IGF-1 became extremely elongated and the cells with PTH became rather plump. The information

gathered suggests that IGF-1 and PTH have an anabolic effect on MG-63 and the effect is dose dependent with both treatments with the lower dose being more effective.

CALCIUM BINDING TO E-CADHERIN TWO DOMAIN CONSTRUCT

Susan Pedigo* and Huaying Zhao, University of Mississippi, University, MS 38677

Cadherins are a family of calcium binding cell-adhesion molecules. Cadherin is a transmembrane protein that has 3-7 independently folded beta-barrel extracellular domains. Cadherins mediate calcium-dependent cell-cell adhesion through the most N-terminal extracellular domains. Calcium ions bind at the interface of the extracellular domains changing the relative disposition of the domains. Our work focuses on the first two-extracellular domains of epithelial cadherin (ECAD12). The crystal structure of ECAD12 (Nagar et al. (1996) Science 380: 360-4) showed 3 calciums binding at the interface between the domains and requiring residues from both domains as well as the short linker peptide that joins them. We use tryptophan-fluorescence and circular dichroism to monitor the local and global conformational change as a function of calcium concentration. Time-dependent proteolytic susceptibility studies of ECAD12 were performed at various levels of calcium using chymotrypsin. Titration endpoints were not well-defined in the fluorescence data, but the midpoint was estimated and compared to results from CD experiments. In our CD work, the spectrum of ECAD12 was monitored from 210 nm to 240 nm at 20 calcium concentrations. Titration curves were analyzed in two groups 212 nm to 222 nm and 230 nm to 236 nm and individually according to two models (Equal/independent, and Unequal/cooperative). There was no difference between the two groups indicating that tryptophan signal at 235 nm monitors 2° structure. This is consistent with fluorescence experiments. Proteolytic susceptibility studies revealed that in the absence of calcium the protein (ECAD12) was digested gradually through multiple cleavage events, however, one of the fragments was very stable even after 2 hours of digestion. In the presence of calcium, ECAD12 was totally protected by calcium.

EXPRESSION ANALYSIS OF TUMOR PANELS: DIFFERENT ARRAYS AND METHODS

Margot Kaelbling*, Christoph Klett, Warren May, and Charles Streckfus, University of Mississippi Medical Center, Jackson, MS 39216

Our aims were to (1) assess if microarray analysis of tumors detects altered gene expression and (2) evaluate different microarrays, RNA isolation kits, and labeling methods. We used tumors containing mutations in PTEN/MMAC1/TEP1 which leads to down-regulation of many proteins and to cell cycle arrest and/or apoptosis. We analyzed three primary cancers and one uterine tumor along with uninvolved tissue from the same patients; all but the uterine tumor contained mutations in PTEN. Total RNA was isolated from tumor and uninvolved tissue using one of three kits, reverse-transcribed into cDNA, and labeled with fluorescent dyes (either Cyanine 3 and Cyanine 5 or Alexa 594 and Alexa 488). The labeled tissues of each panel were hybridized to a microarray. Panels labeled with Cyanine dyes were hybridized to Human Onco-

gene and Tumor Suppressor Gene Microarrays that contained at least 281 known human cancer-related genes of average 2,200-bp cDNA length spotted twice including PTEN. Panels labeled with Alexa dyes were hybridized to Human SS-H19k7 microarrays containing 19,008 human ESTs (Expressed Sequence Tags) of 100-150-bp, supposedly spotted once but actually spotted two-four times; no PTEN sequences were found. Expression ratios were calculated for each slide and statistically analyzed using SPSS software. Most genes with altered expression were underexpressed. RNA isolation methods were equally satisfactory. Expression from duplicate gene sequences provided confidence in uniform hybridization across a slide. The longer fluorescence of Alexa versus Cyanine dyes was of no advantage, but our labeling method for Alexa dyes required more RNA than labeling with Cyanine. For PTEN expression analysis, EST microarrays are not useful. Research and specimen collection were supported by MFGN and CHTN.

A NOVEL TECHNIQUE FOR THE QUANTITATIVE IMMUNO-STAINING

Melanie C. Pollan*, Michelle Tucci, and Hamed Benghuzzi, University of Mississippi Medical Center, Jackson, MS 39216

The use of histochemical immuno-staining has been widely used to identify the presence of certain proteins in animal tissue. The results gained from this type of examination are purely qualitative, and are based on the ability to visualize a stain tagged to a second antibody under a microscope. Problems that arise when using this method include: expense of reagent, visualization of minute quantities of protein, reaction time, and difficulty reporting results. We describe a new method that employs both the specificity of the traditional double antibody immuno-stain along with the sensitivity of a Western blot. In this procedure the tissue slide is flooded with the primary antibody synthesized in rabbit. After an overnight incubation, anti-rabbit IgG with conjugated peroxidase (second antibody) is added to the slide. To this point the procedure is identical to a traditional immuno-stain, except that the concentration of antibody used is reduced due to sensitivity of the detection agent, a chemiluminescent substrate. The chemiluminescent properties of the substrate allow the tagged proteins to develop on X-ray film in a relatively short period of time (about 30 minutes). The exposed x-ray film can also be analyzed using a densitometer to extrapolate the protein concentration using a standard curve. This technique offers several advantages over the traditional staining methods including the use of less reagent, easily visualized results without a microscope, decreased turn-around time, and the ability to quantitate the results using a densitometer and standard curve. *Graduate Student in Allied Health

RESEARCHING AMIFOSTINE (ETHYOL) AND ITS USES IN COMBINATION WITH RADIATION THERAPY

Brian Comer^{1,2*} and Raymond Wynn³, ¹Mississippi Gulf Coast Community College, Gautier, MS 39533; ²National Aeronautics and Space Administration, Stennis Space Center, MS 39522; and ³Singing River Hospital Oncology Center, Pascagoula, MS 39563

The purpose of this project was to conduct a literature review of Amifostine. Amifostine is a cytoprotective agent

manufactured by MedImmune, Inc. It is used to reduce levels of renal toxicity in patients receiving cisplatin. Amifostine is also used to reduce the occurrence of moderate to severe xerostomia in patients that are receiving radiation therapy. This presentation will provide information on the pharmacology and clinical uses of Amifostine.

FRIDAY MORNING

Auditorium

Clinical Diagnostics II

8:00 TYLESYNERGY®: BENEFITS IN CANCER DIAGNOSIS

Stacey Overstreet^{1,2*} and Raymond Wynn³, ¹Mississippi Gulf Coast Community College, Gautier, MS 39533, ²National Aeronautics and Space Administration, Stennis Space Center, MS 39522; and ³Singing River Hospital Oncology Center, Pascagoula, Mississippi 39563

Telesynergy® is a new technology from which both doctors and patients can benefit. A patient can be diagnosed faster when the doctor needs a second opinion with the use of this system. Telesynergy® has the ability to place conference calls, send x-rays, and send microscope views to doctors many miles away. The focus of this project was to discover the benefits of the use of Telesynergy® in the patient diagnosis.

8:15 PURIFYING POSsmLE PRIMAQUINE-BINDING PROTEINS FROM PNEUMOCYSTIS CARINII USING AFFINITY CHROMATOGRAPHY

Pamela L. Ruffin^{1,2*}, William I. Sullivan, Jr.², and Sherry F. Queener², ¹Jackson State University, Jackson, MS 39213 and ²Indiana University School of Medicine, Indianapolis, IN 46202

Primaquine, an approved treatment for malaria, is effective against the opportunistic fungal pathogen *Pneumocystis carinii*. *P. carinii* is one of the major opportunistic infections of AIDS patients. The goal of the study is to determine the mechanism of action of primaquine against *P. carinii*. Our hypothesis is that *P. carinii* contains primaquine binding proteins. To begin we isolated proteins from *P. carinii*-infected rat lungs that were retained by primaquine-linked Sepharose. A column of primaquine-linked Sepharose was loaded with extract containing the soluble proteins of *P. carinii*; bound proteins were eluted with primaquine. Sodium dodecyl sulfate-polyacrylamide gel electrophoresis of the eluted fractions shows a single protein band in a late eluting fraction. This band has been submitted for protein sequencing by mass spectrometry. Our results indicate that the primaquine-linked resin retained proteins from the *P. carinii* infected rat lung extract. Identification of the retained protein is being performed to determine if it is from *P. carinii*. Future studies include using extract from uninfected rat lung as control to compare with *P. carinii* infected lungs to ensure eluted proteins are from the pathogen. We also evaluated *P. carinii* antisera using a dot blot as a potential tool for use in future affinity chromatography experiments. Supported in part by NIH R25 GM067592.

8:30 INHIBITION OF IFN- γ SIGNALING IN MACROPHAGES BY POXVIRUS PHOSPHATASE VH1

Andre W. Hite, Jr.^{1,2*}, Alicia A. Cecil¹, Joseph A. Cameron², and Michael J. Klemsz¹, ¹Indiana University School of Medicine, Indianapolis, IN 46202 and ²Jackson State University, Jackson, MS 39217

Poxviruses including Variola (small pox), and Vaccinia, which is used to vaccinate against small pox have developed numerous methods for evading an immune response. One way is the ability of the viral VH1 phosphatase to alter signaling cascades in infected cells. Our studies focused on showing if either the Vaccinia or Variola VH1 protein dephosphorylates STAT1 during activation of macrophages with Interferon-gamma. In order to answer this question we transfected the STAT1 responsive Tap-1 luciferase reporter plasmid (pLTP) into the murine macrophage line P388D1. We optimized DNA concentrations by titrating pLTP and determined that maximal light units were obtained using 1.0 μ g of pLTP. Our results show that a ratio of 3:1 of Fugene transfection reagent to pLTP yielded maximal light units. To determine if the Vaccinia VH1 protein affected Tap-1 promoter activity, pLTP was co-transfected with the VH1-PJ6 or PJ6 alone followed by stimulated with IFN- γ . These results show that Vaccinia VH1 protein reduced pLTP expression compared to the empty vector following the addition of IFN- γ for 4 hours. We also determined that the transfection reagent Fugene reagent had an effect on IFN- γ induction of the pLTP plasmid. Our results suggest that VH1 may be blocking the IFN- γ response, and the Fugene may alter how IFN- γ activates cells. Supported in part by: NIH R25 GM067592-02.

8:45 Break

Environmental Influences on Health II

9:00 BENEFICIAL HEALTH EFFECTS OF LOW-LEVEL IONIZING RADIATION

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

We receive approximately 0.20 - 0.30 rem per year from natural radiation sources, depending on where we live. Several places are known in Iran, India (Kerala), Brazil (Araxa, Tapira), Sudan, China (Han) and Europe, where natural background radiation gives an annual dose of more than 5 rem and up to 79 rem/yr (at Ramsar in Iran). There is no evidence of any increase in cancer among people living in areas where natural, background radiation is several times higher than average. Also, the mortality rate due to cancer was significantly less than similar areas with a low background radiation level. The survivors in Nagasaki from the atomic bombs in Japan, who received 1 to 19 rem of radiation, had lower cases of cancer and are living longer than the non-irradiated population. It has been reported that the mortality caused by cancer at nuclear power plants in Canada and U.K. were lower than the national average. UNSCEAR Report on Chernobyl concludes that no increases in cancer incidence or mortality have been observed that could be attributed to ionizing radiation. Below an individual dose of 5 rem in one year or a lifetime dose of 10 rem risks of health effects are either too small to be observed or are non-existent. Low to moderate doses of radiation are not harmful and evidence has proven that radiation at these levels

can actually be beneficial to one's health.

9:15 NITRIC OXIDE INHIBITORS POTENTIATE DOMOIC ACID INDUCED HIPPOCAMPAL DAMAGE *IN VIVO*

Manju Pande^{1*}, A. Harps¹, M. Lopez², D. D'Souza², J. Wei², T. Jones², and M. Sundaram², ¹Mississippi Valley State University, Itta Bena, MS 38941 and ²University of Mississippi Medical Center, Jackson, MS 39216

Domoic Acid (DA), a potent excitotoxin produces hippocampal damage and functional lesions as seen in temporal lobe epilepsy. Previous studies have suggested that nitric oxide (NO) may possess anticonvulsant properties and have a protective role against excitotoxic injury in epileptogenesis. The present investigation was done to further understand the role of NO in DA induced hippocampal degeneration, and if a single subconvulsive exposure to DA causes progressive damage to the hippocampus. Based on the data obtained from our earlier studies, the ICR mice were treated with subconvulsive dose of DA in the presence and absence of NOS inhibitors L-NAME and 7NI. After treatment, the animals were observed for 30-45 min for the stereotypic neurological effects in the form of scratching. Animals in various groups were sacrificed after 30 and 60 days of treatment. The brains were removed and processed for histological and immunohistochemical analysis. Some brains were stored at -80 degree C for biochemical analysis. The initial observation of animals showed that nitric oxide inhibitors potentiated DA induced stereotypic seizures indicating that NO may possess anticonvulsant properties. Tissues from the 60-day treatment groups were processed first. The CA1/2 region of hippocampus immunostained for glial fibrillary acidic protein (GFAP) showed reactive glial cells with large cell bodies and long processes in DA treated animals as compared to the controls. These changes were more pronounced in groups treated with NO inhibitors. The double immunostaining showed loss of calbindin D28k positive neurons in CA1/2 regions in L-NAME and 7NI treated animals. The data from 30-day treatment groups is currently being analyzed.

9:30 NONIONIZING ELECTROMAGNETIC RADIATION AND HEALTH EFFECTS

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

Nonionizing electromagnetic radiation photons have smaller frequency, and therefore, smaller energy than the photons of ionizing radiations (< 12.4 electron volts), which is insufficient to ionize atoms and molecules in human tissue. But they can excite the atoms and the molecules and break chemical bonds in the tissues, and can be hazardous to health if their intensity is large. These include with increasing frequency: radio waves, microwaves, infrared (heat), and visible light. The intensity as well as the frequency of the radiation, and exposure time are crucial to the health effects. Biological systems are sensitive to heat, which may come from a microwave oven, cooking range, sun, radio waves, or intense visible monochromatic light (laser beam). An increase of about 6 °C in body temperature as a result of radiation absorption would be fatal. Any part of the body that cannot dissipate heat efficiently or is heat sensitive may be damaged by microwave radiation. A 70-kg human requires 1.5×10^6 J of nonionizing radiation to kill.

For a visible light of frequency 5×10^{14} Hz, absorption of about seven moles of photons will be needed to kill an average human. The radiowaves used by analog and digital cellular phones have much lower frequency and the intensity level is very low to produce harmful biological effects even with long term exposure. National and international scientific opinion is that there is no substantiated evidence that using a mobile phone causes harmful health effects.

9:45 SYNTHESIS AND CHARACTERIZATION OF COMPLEXES OF VANADIUM ACETYLACETONATE WITH DI-2-PYRIDYLKETONE THIOSEMICARBAZONE

Miriam Thaggard^{1,2*}, Ramaiyer Venkatraman¹, Terrell Bradford^{1,2}, and Joseph A. Cameron¹, ¹Jackson State University, Jackson, MS 39217 and ²Hinds Community College, Raymond, MS 39211

Vanadium complexes have been considered for use as insulin-mimetics. It has been shown that vanadium(V) and vanadium(IV) can stimulate glucose uptake/oxidation and glycogen synthesis. Vanadium complexes with organic ligands have proved to be less toxic with improved solubility and lipophilicity. As an organic ligand, thiosemicarbazones were found to exhibit antilukemic properties. Extensive research has been carried out on aliphatic, aromatic, heterocyclic and other types of thiosemicarbazones and their metal complexes due to their therapeutic value. In view of the extensive biomedical significance of these compounds, we have synthesized and characterized three new vanadium complexes of di-2-pyridylketone thiosemicarbazone and vanadyl acetylacetonate. These complexes were characterized using thermal, spectral, and molar conductivity methods. The molar conductivity studies indicate that the complexes exist in the nonionic form. Solubility studies indicate the nonpolar nature of the complexes. Further structural characterizations were carried out using infrared, UV-Visible and proton NMR techniques. These studies, combined with information available from previous X-ray studies in our laboratory, provided the structural characterization of these complexes. The results indicate that the trifunctional thione form of the ligand is chelated to the vanadium center through the pyridine nitrogen, imine nitrogen and thione sulfur atoms. The bidentate acetylacetonate ligand occupies the fifth and sixth metal coordination. Supported in part by NIH-NIGMS Bridges Grant GM50117.

10:00 Break

10:15 Divisional Poster Session

CYP 1A2 ENZYME ACTIVITY IN THE LIVERS OF RATS EXPOSED TO LEAD

Christopher Bennett*, Roger Holloway, Shang-Zhi Xu, and Bettaiya Rajanna, Alcorn State University, Alcorn State, MS 39096

The liver detoxifies xenobiotics. Liver enzymes such as, P450s play a significant role in detoxification. CYP 1A2 is abundant (15%) in the liver compared to other CYPs. Toxins are found in higher concentrations in the liver. This leads to liver damage, including decreased activities of essential enzymes. Lead (Pb) is an environmental contaminant and upon

exposure is found in huge quantities in the liver. The objective of this study is to determine the effect of Pb on the CYP 1A2 enzyme in the rat liver. Wistar, male rats were treated with 0.1 M lead acetate in water for 45 days. Control groups received distilled water. All animals were provided with rat chow food ad libitum. Animals were sacrificed at intervals of 1, 5, 10, 15, 21, and 45 days. The livers were perfused with ice-cold saline through the gate vein until they became yellowish. The livers were then removed, and microsomes were fractionated as per procedures established in our laboratory. Enzyme activity was determined by measuring the fluorescent intensity of the livers. 7-ethoxy-3H-phenoxazin-3-one was the substrate used. NADPH started the reaction and it was stopped by adding acetonitrile. The tissue Pb levels were determined. There was a gradual decrease in fluorescent intensity of exposed compared to normal rats and the response was time dependent. The tissue Pb levels were higher in Pb exposed rats confirming a higher Pb accumulation. The results also suggest that Pb decreases CYP 1A2 enzyme activity in liver over time. (Supported by NIH/NIGMS/MBRS-SCORE#GM 55356).

CARDIOVASCULAR HEALTH PROMOTION IN SCHOOLS: MODIFIABLE RISK FACTORS IN RURAL MISSISSIPPI FIFTH GRADE STUDENTS

Raven Worthy^{1*}, Deborah S. King², and T. Kristopher Harrell², ¹Murrah High School, Jackson, MS 39202 and ²University of Mississippi Medical Center, Jackson, MS 39216

Hypertension and obesity are more prevalent in the Southeast than in any other region in the United States. These health disparities exist even among children, with rural Mississippi children at increased risk. This study evaluated body weight, height, and blood pressures among children from Forest and Morton, Mississippi. The body mass index (BMI) and height percentiles were calculated for each student and blood pressure was classified as acceptable, borderline, or high. Of the 205 fifth grade students, 57% were male and 43% female. Average systolic blood pressure (SBP) for Morton was 108 mmHg compared to 102 mmHg for Forest. Average diastolic blood pressure (DBP) for Morton was 65 mmHg while that for Forest was 75 mmHg. Both SBP and DBP were > to the 85th percentile in approximately 15% of both groups. Forest's average height percentile was 62% while Morton's was 58%. Forest's BMI average was 70% and Morton's 75%, with over 50% of children in both groups either at risk for overweight or overweight (> 85th percentile). Morton children had both higher SBP and BMI percentile averages. Forest had the higher DBP and height percentile averages. Rates of cardiovascular risk factors in rural Mississippi school children are well above reported national averages, mirroring the increased rates in Mississippi adults. Early intervention in this age group is crucial to reversing these risk factors and preventing progression to cardiovascular disease. Future studies are needed regarding successful interventions in this age group, as well as family and societal approaches for prevention.

THE INHIBITORY EFFECTS OF D-CARNITINE AND QUERCETIN ON *TRYPANOSOMA LEWISI* INFECTION IN RATS

Catherine Karlak*, Rebecca Rose, and Frank Lowell, Belhaven College, Jackson, MS 39202

Trypanosomes are a leading cause of death in third world countries, and most current drug therapies are impractical due to their toxicity and cost. Nutritional therapies are often more practical and recent research has explored such methods of controlling trypanosomal infections. Manganaro et al. (2003) suggested that D-carnitine, an amino acid derivative, is successful in controlling *Trypanosoma lewisi* infections in rats. Based on this study, the inhibitory effects of D-carnitine and Quercetin, a flavonoid, were investigated. A combined therapy of both drugs was considered for a possible synergistic effect. Sprague-Dawley rats were given I.P. injections of the drugs in dosages based on weight, beginning on day 3 of infection and ending on day 18. The level of trypanosomes in the rats' blood was measured through counts performed regularly according to standard procedures. The means of these counts demonstrate that rats given D-carnitine had significantly lower levels of parasitemia, in agreement with previous research. Quercetin and the combined therapy did not appear to significantly inhibit the trypanosomes. Further study is needed to develop the potential of such combined drug therapies as treatment for *Trypanosoma* infections.

THE EFFECTS OF ESTROGEN AND TESTOSTERONE ON MG-63 CELLULAR METABOLISM.

Ameze Adah¹*, Hamed Benghuzzi², Michelle Tucci², and Felix I. Adah², ¹University of Mississippi, University, MS 38677 and ²University of Mississippi Medical Center, Jackson, MS 39216

Estrogen (E) and testosterone (T) have complex effects on the skeleton, including regulation of modeling and maintenance of bone mass. Osteoblasts are key regulators of skeletal matrix synthesis and degradation. However, whether osteoblasts mediate E and T effects remain unclear. MG63 osteoblast-like cells were cultured in 24-well culture plates and treated with high, medium and low E or T at 24, 48, and 72 hours. At the end of each time point, cellular numbers, protein, damage (MDA), and glutathione levels were evaluated. The cell counts of the MG63 E-treated were increased at 48 and 72 hours in the medium dose and elevated at 72 hours in the high dose. The cell counts for T- treated cells showed a significant increase ($p < 0.05$) in the medium and high levels at 24 and 48 hours. Cellular damage was not evident in either treatment group as ascertained using MDA. The protein levels of the E and T-treated cells were similar to control for the duration of the study. The glutathione levels of the E-was reduced at 48 hours at the median concentration ($p < 0.05$). No significant difference in the glutathione levels for the cells treated with T were observed for the duration of the study. The results showed no significant difference between the two hormones (E and T), but both hormones undoubtedly increased cellular proliferation. The results revealed that E increased cell proliferation in a dose and time-dependent manner and testosterone in a dose-dependent manner. Both of their proliferative abilities suggest that estrogen and testosterone may contribute to bone loss prevention. * Undergraduate Student

THE PROTECTIVE EFFECTS OF UV BLOCKING AGENTS ON CELLULAR MORPHOLOGY AND CELLULAR FUNCTION OF FIBROBLAST CELLS EXPOSED TO UV LIGHT. Montica Wilson¹*, Lolitta Crawley¹, Laura Franklin², Hamed Benghuzzi², Michelle Tucci² and Joseph A. Cameron¹, ¹Jackson

State University, Jackson, MS 39217 and ²University of Mississippi Medical Center, Jackson, MS 39216

The goal of this study was to determine the degree of cellular protection offered by sunscreens of different SPF ratings in an attempt to prevent squamous damage as a result of UV free radical induced generation. The specific aim was to evaluate the morphological responses of MRC-5 fibroblast cells exposed to UV-radiation in the presence of absence of sunscreen. The criteria for the morphological evaluation was as follows; cell and nucleus shapes, size, N/C ratio, nucleus pleomorphism, hydropic swelling, as well as other features or characteristics of membrane and cytoplasmic alterations. The experimental design was divided as follows: Twenty-four tubes per time period (24, 48 and 72 hours) were divided into four groups. Group 1 consisted of control unexposed cells, group 2 consisted of cells exposed to UV light, group 3 cell culture tubes were pre-treated with SPF 8 sunscreen prior to UV exposure, and cell tubes in group 4 were pre-treated with SPF30 sunscreen prior to UV exposure. Cell numbers were determined and the morphological evaluation was assessed using Image Pro Digital Analysis technique. Data obtained demonstrated that, forty-five minutes of radiation exposure caused traumatic stress to the cells, swelling, cellular debris and fragmentation. However, treatment with both SPF 8 and SPF 30 pre-exposure provided protection for the cells. The SPF 30 treatment resulted in less cellular aggregation, more abundant eosinophilic cytoplasm and an overall healthy appearance. Supported in part by NIH GM50117. *Undergraduate Student

THE EFFECTS OF H₂O₂ ON FIBROBLAST GROWTH PROPERTIES FOLLOWING PRE-TREATMENT WITH ANTI-OXIDANTS

Mindy M. Bertucci*, Angela M. Phillips, Hamed Benghuzzi, Michelle Tucci, and Zelma Cason, University of Mississippi Medical Center, Jackson, MS 39216

Cellular proliferation is a critical component of wound healing, and oxidative stress can lead to significant reduction in cellular proliferation. The goal of this study was to investigate the effects of antioxidants on MRC-5 fibroblast cells alone or in the presence of a potent oxidant, H₂O₂ for 24, 48 and 72 hours. Cells were evaluated using cytological criteria, protein concentrations, and cellular damage markers. The experimental design was divided into two phases. First, doses of vitamins E and C were evaluated to determine effective nontoxic dosages. Results from phase I showed moderate toxicity of vitamin C, which was due to the acidic nature of the vitamin and buffering capacity of the media. In the second phase, vitamin E low/high doses were added to the MRC-5 cells for thirty minutes prior to the addition of 180 mM H₂O₂ and the cells were evaluated at 24, 48 and 72 hours for changes in the aforementioned criteria. The results showed low and high doses of vitamin E were ineffective in protecting the cells from H₂O₂ damage. Decreases in cellular number, cellular protein concentrations and increases in cellular damage were evident at all time points in cells treated with H₂O₂. Changes in cellular morphology included fewer cells, multiple nucleoli, bare nuclei, and web like cytoplasm. Overall, the results suggest oxidants play a strong role in reducing cellular proliferation which would result in decreased wound healing. *Undergraduate student, Allied Health

GROWTH AND CELL VIABILITY OF ESTRADIOL AND IP-6 TREATED HEP-2 LARYNGEAL CARCINOMA CELLS
Mary Dorsey*, Hamed Benghuzzi, Michelle Tucci, and Zelma Cason, University of Mississippi Medical Center, Jackson, MS 39216

Inositol 6-phosphate (IP6) has demonstrated novel anti-cancer activity using several different tumor models. IP6, a phytoestrogen, has estrogen receptor (ER) binding capabilities that are not known to cause cellular proliferation in hormone sensitive cells. It is hypothesized that IP6 can induce competitive inhibition with estrogen for estrogenic binding sites on cancer cells resulting in decreased proliferation. In this experiment, Hep-2 cells were treated with estradiol and IP6 in a dose dependant manner for 24, 48, and 72 hours. They were analyzed for changes in number, protein concentrations, damage, and morphology. There was an increase in cell proliferation in Estradiol treated Hep-2 cells. Cells treated with IP6 showed no change in cell proliferation in the 24 or 48 hour groups, but there was a decrease in number with the 72 hour group, particularly the 1mM dose. Both the estradiol and IP6 treatments caused no membrane oxidation and the level of protein synthesis stayed consistent. The morphology showed small round to cuboidal, single cells with scant, dense, basophilic cytoplasm and hyperchromatic nuclei with smooth borders. Some cells showed anucleation and cellular degeneration. Although IP6 is a phytoestrogen, the results show that affinity for estrogen binding sites on Hep-2 cells is greatly decreased. However, over time given increased concentrations, IP6 can cause a decrease in the cellular proliferation of Hep-2 cells without initiating cellular apoptosis.

EFFECTS OF REPEATED ETHANOL ADMINISTRATION ON EXTRACELLULAR SEROTONIN CONCENTRATIONS IN THE HIPPOCAMPUS OF P AND WISTAR RATS

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Previous research has demonstrated that extracellular levels of serotonin (5-HT) in the hippocampus (hipp) increases in alcohol preferring (P) rats when exposed to ethanol (EtOH). Serotonergic innervation of the hipp appears to play a key role in the rate of tolerance development to the high dose effects of ethanol (hypothermia and motor incoordination). Wistar and P rats will be assigned to two groups. The ethanol group will receive 1 g/kg ethanol for 5 consecutive days while the saline control group will receive an equivalent volume of saline. On the sixth day, in vivo quantitative microdialysis using the no net flux procedure will be run. The no net flux procedure involves perfusing different concentrations of 5-HT levels into the hipp. We hypothesized that P rats will have lower 5-HT levels than Wistar rats in the hipp and that repeated ethanol will result in a larger increase in basal extracellular 5-HT levels in P rats compared to Wistar rats. In doing the experiment, we found that repeated ethanol administration resulted in a trend toward an increase in basal 5-HT levels in the vHipp. of Wistar rats; and significantly higher basal 5-HT levels in ethanol treated Wistar rats compared to ethanol treated P rats. Repeated

ethanol administration resulted in a significant increase in 5-HT clearance within the vHipp. of P rats. The purpose of this study is to determine the effect of repeated ethanol administration on basal 5-HT levels in the hipp. Support Contributed By: AA 07611, HL 07802 and MH 16926.

EVALUATION OF THE CYTOTOXIC EFFECTS OF TANTALUM AND K₂Cr₂O₇ USING A FIBROBLAST CELL LINE

Angela M. Phillips*, Mindy M. Bertucci, Hamed Benghuzzi, Michelle Tucci, and Zelma Cason, University of Mississippi Medical Center, Jackson, MS 39216

Particulate wear debris is associated with aseptic loosening of the implant leading to implant failure. Inorganic metal compounds such as chromium and tantalum can be associated with implant debris triggering changes in cellular viability at the implant interface. The goal of this study was to determine the cytotoxic effects of chromium and tantalum (Ta) when co-incubated with fibroblast cells. A soluble hexavalent chromium salt (K₂Cr₂O₇) was used at concentrations of 0.0001 M, 0.001 M, and 0.01 M, and insoluble Ta at concentrations of 0.005, 0.01, and 0.02 g/mL were incubated in the presence of MRC-5 fibroblast cells. At the end of 24, 48 and 72 hours cells were evaluated for number, protein, damage, and morphology and compared to non-treated cells. The results showed cell number was influenced positively in cells treated with the higher doses of metal salts. Levels of cellular protein and damage were unaffected by the metal salts. Cellular morphological evaluations of K₂Cr₂O₇ treated cells showed increased N/C ratios, multiple nucleoli, irregularity of nuclear membranes, mitotic figures, and wispy cytoplasm. Morphological evaluations of tantalum treated cells showed wispy and web-like cytoplasm compared to the control. Overall, the results indicate that cellularity was moderately elevated without alterations in cellular protein or damage. These results suggest that the concentration of metals tested were not cytotoxic to the fibroblast cells, one of two cell types at the tissue-implant interface. *Undergraduate student, Allied Health

INFLUENCE OF GLUCOSE, FRUCTOSE, VANADIUM AND THEIR COMBINATIONS ON METABOLIC TOXICITY AND SURVIVAL OF JURKAT CELLS

Jarret Smith^{1,2}*, Clement Yedjou¹, Ibrahim O. Farah¹, Ramaiyer Venkatraman¹, and Joseph A. Cameron¹, ¹Jackson State University, Jackson, MS 39217 and ²Hinds Community College, Raymond, MS 39211

Studies showed that tumor growth and abnormal cell survival was associated with a number of metabolic abnormalities. Glucose metabolism is known to be deranged (an impaired oral glucose tolerance test), lipoprotein-lipase activity is depressed (hypertriglyceridemia after an exogenous lipid load) and protein metabolism showed abnormality as revealed by changes in plasma amino acid profile and evidenced by an increased plasma free tryptophan levels in patients with breast, lung, colon, stomach, and other cancers from various origins. The role of carbohydrate metabolism and Vanadium salts (as mimickers of insulin in glucose transport) were not clearly established in the literature, therefore, the purpose of this study was to evaluate metabolic toxicity to Jurkat cells exposed (48h) to glucose, fructose, vanadium salt (Vanadium (IV)-di-2-

pyridyl-ethyl thiosemicarbazone) and their combinations, and to measure toxicity indices and survival trends using the MTT assay. Results showed that, both sugars and vanadium alone or in combination affected cell survival negatively and that LC50's ranged from 2133.96–3867.56 ug/ml. Death of these cells could be attributed to either an increase in pro-oxidant activity leading to the production of reactive oxygen species (ROS) or due to increased internal pH as a result of glycolytic metabolism. Future studies will focus on the mechanisms of death in response to manipulation of cellular metabolism in cancer aiming at prevention/control. Supported in part by NIGMS R25 GM50117.

THE EFFECTS OF ISOLATED ANTIOXIDANTS FROM BLACK SEED ON THE CELLULAR METABOLISM OF A549 CELLS.

Nourelhoda Farah*, Hamed Benghuzzi, Michelle Tucci, and Zelma Cason, University of Mississippi Medical Center, Jackson, MS 39216

Reactive oxygen species cause cytotoxic effects in biological systems. The body requires the uptake of exogenous compounds with antioxidant potential. Black seed is a plant that contains at least one active lipid soluble antioxidant, thymoquinone. Fractionation of the seed components yielded antioxidant compounds in both the water soluble and lipid soluble fractions. The OBJECTIVE of the study was to determine the safety of the fractionated compounds and compare their potency with pure thymoquinone and vitamin E on A549 cells in culture for 24, 48, and 72 hours. RESULTS: Black seed extracts and pure thymoquinone showed markedly reduced levels of MDA for the duration of the study. The vitamin E dosage used led to greater toxicity and cellular damage rather than cell protection. Cellular proteins levels after 24 hours showed cells in BS + ETOH extract group had the highest metabolic activity. However, at 72 hours, the activity was shifted and showed the least amount of protein synthesis. As for vitamin E, the results were consistent throughout all three phases showing slow metabolic activity. Cell number was decreased after 24 hours in thymoquinone treated cells, and remained reduced for the duration of the study. The BS+H₂O fraction showed a similar trend to thymoquinone, where as the BS+ETOH fraction showed a negative shift in cell number at 48 hours when compared with the control. CONCLUSION: The study concludes that of the two BS extracts, the BS+H₂O extract had the greatest effect on the cell viability and function.

THE EFFECTS OF PALMITIC ACID CONCENTRATIONS ON A549 CELLULAR INCORPORATION AND CELLULAR FUNCTION

Shadonna Jefferson*, Hamed Benghuzzi, Michelle Tucci, and Zelma Cason, University of Mississippi Medical Center, Jackson, MS 39216

Neonates exhibit a high risk of developing acute and/or chronic lung disorder, often associated with surfactant deficiency. Alveolar type II cells (A549) synthesize dipalmitoyl phosphatidylcholine as the main surfactant phospholipid. The objective of our study was to administer various concentrations of palmitic acid (PA) to A549 cells and determine the level of cellular viability, cellular damage, cellular morphology, and degree of surfactant production at 24, 48 and 72 hours of

incubation. The results of our study show that incorporation of ³H-palmitic was approximately 96% after 24 hours. Our results also demonstrated concentrations of 0.01 M and 0.1 M PA caused marked reductions in cell number as early as 24 hours. The reduction in cellular numbers appeared to be dose dependent. Markers of membrane cellular damage also were elevated in all treatment groups after 24 hours and remained elevated for the duration of the study. Cellular morphology evaluations revealed cells treated with PA initially appeared in clusters, with hyperchromatic nuclei compared with control. No differences in nuclear/cytoplasmic ratios between control and treated cells were observed. After 72 hours the PA treated cells showed evidence of scant cytoplasm and hyperchromasia when compared to control. Overall, the results indicate that incorporation of palmitic acid ranging in concentrations from 0.001 M to 0.1 M caused increases in cellular damage and cellular death. This is most likely due to changing the distribution of the phosphatidyl moieties on the cellular membrane. *Allied Health Student

THE EFFECTS OF GENISTEIN CONCENTRATION ON Hep-2 CELLULAR FUNCTION

Natalie Beard*, Hamed Benghuzzi, Michelle Tucci, and Zelma Cason, University of Mississippi Medical Center, Jackson, MS 39216

Genistein (GEN) is a phytoestrogen that has shown potential as a chemotherapeutic agent, which acts by inhibiting protein-tyrosine kinase and topoisomerase II enzymes. These particular enzymes are crucial for cellular proliferation. The goal of this study was to administer 0.5, 0.05 or 0.005 mg/mL to Hep-2 cells and evaluate cellular number, protein, damage and morphology at 24, 48, and 72 hours. Cell numbers were significantly reduced in low and medium concentrations after 24 hrs, and cell number appeared to rebound at 48 and 72 hrs in an inverse fashion. This data suggests GEN was metabolized by the cells, which left cells virtually without treatment after 24 hrs in both low and medium concentrations. Data also suggests continuous administration of the drug at therapeutic levels would serve as a better chemotherapeutic agent. Cellular damage was not evidenced in the experiment suggesting that the drug did not target the cellular membrane. Morphological changes such as anucleation were seen at 24 hrs in all dose treatments suggesting that GEN targets the cell nucleus. Interestingly, cellular function was able to recover in the lower doses of GEN treatment suggesting cellular metabolism of the drug. Also, this information suggests GEN targeted enzymatic activity as opposed to causing alterations within the cellular membrane leading to leakage of cellular contents and ultimately cellular death since the membrane did not show evidence of lipid peroxidation. *Undergraduate, Allied Health

FRIDAY AFTERNOON

Auditorium

Mini-Symposium Advances in Clinical Health Sciences

1:00 ADVANCES IN CLINICAL CHEMISTRY

La'Toya Ross Richards* and Hamed Benghuzzi, University of Mississippi Medical Center, Jackson, MS 39216

Over the years, the healthcare industry has made both rapid and numerous advances. These advances have resulted in better approaches to aid in the diagnostic work-up of patients as well as patient response to treatment. Clinical Chemistry serves as the major branch between basic and applied research, between the research scientist and the patient. The division of Clinical Chemistry provides an extensive array of highly sophisticated tests, which utilize current and advanced technology with unending intellectual changes. These changes have led to a better understanding of disease pathogenesis and more decisive roles in the diagnosis and interpretation of laboratory tests. Some examples of assays involved in Clinical Chemistry testing are assays for therapeutic drug monitoring, assays detecting various hormone levels such as thyroid and parathyroid hormone levels, triple-panel testing for neural tube defects, tests for cystic fibrosis diagnosis, and a vast majority of others. These tests are performed on instruments employing various technologies. Examples of some of these technologies include enzyme linked immunosorbent assays (ELISA), fluorescence polarization immunoassays (FPIA), microparticle enzyme immunoassays (MEIA), and chemiluminescence immunoassays. Regardless of the technological principles involved, all methods tend to serve as beneficial agents in the molecular pathogenesis of disease and patient management and improvement. Overall, advances in Clinical Chemistry have ultimately resulted in startling improvements in the field of laboratory medicine.

1:15 ADVANCES IN CLINICAL HEMATOLOGY

Felicia Magee Tardy*, Michelle Tucci, and Hamed Benghuzzi, University of Mississippi Medical Center, Jackson, MS 39216

The role of the clinical laboratory in patient care has become increasingly more important over the last few decades. The increase in the number of laboratory tests ordered, in addition to the variety of laboratory tests being offered, has resulted in a demand for new and improved technology. Advances in hematology include the development of "all-inclusive" hematology analyzers that are capable of performing complete blood counts (CBCs) and reticulocyte counts, making peripheral blood smears, and staining the smears all within the same system. Other analyzers can perform body fluid analyses in a matter of seconds compared to manual methods, which take significantly longer. Advances in technology allow the clinical laboratory to provide accurate test results more quickly, thus shortening test turnaround times. Technological improvements also increase employee productivity and reduce the number of medical errors.

1:30 ADVANCES IN BLOOD BANKING

Pamala Fair Jones* and Hamed Benghuzzi, University of Mississippi Medical Center, Jackson, MS 39216

The healthcare industry is growing vastly. The diversification of the field is extraordinary, the field of Laboratory Medicine is just one of the many outlets of the health care industry. Laboratory Medicine includes an array of departments, including blood bank. Human blood is required to save lives of people suffering from accidents and disease. Many years ago blood donation was limited to a few laboratory tests and a few preliminary screenings. Today the technology has expanded allowing for more adequate testing and donor screening. Some of the test that are performed today allow safe blood products to be transfused to patients. A few of these test include Hep B which was introduced in 1971, followed by Hep C, HTLV I and II which were introduced 20 years later. The first blood test for HIV was implemented in 1985, only a year after it was identified as a cause of AIDS. HIV-1 and-2 antibodies screening was implemented in 1992, and West Nile Virus in 2002. As time progress the new technology and available test have created a safer blood industry. Technology and research has extended the storage time of blood, in 1979 it was 35 days and 5 years later the shelf life of blood was extended to 42 days. Transfusion Medicine aspects of the industry has advanced tremendously, the time it takes to process blood has decreased significantly due to advanced testing and improved technology. Many years ago Blood Banking was mostly done by manual procedures, today it has become automated. Thanks to these advances, blood donation has become a safer practice.

1:45 MEDICAL LABORATORY ERRORS: HOW MANY HAVE YOU MISSED?

Stacy Vance*, Michelle Tucci, and Hamed Benghuzzi, University of Mississippi Medical Center, Jackson, MS 39216

Objective: To examine the type and frequency of laboratory errors and how errors can be prevented in the clinical laboratory. Design: Bibliographic review of the current literature through electronic search in Medline data-base from 1940 to 2004, with selection of the most relevant articles. A Medline search using terms medical laboratory errors (739), laboratory errors (3008), laboratory types (118), type of laboratory errors (215), delta check systems and laboratory (11), and proficiency testing (662) were performed. Results: The search revealed large differences in study designs and quality on this topic, as well as a lack of available data and the lack of a shared definition of "laboratory error" (also referred to as "blunder", "mistake", "problem", or "defect"). Despite these limitations, there was considerable concordance on the distribution of errors throughout the laboratory working process: most occurred in the pre- or postanalytical phases, whereas a minority occurred in the analytical portion. The reported frequency of errors was related to how they were identified: when a careful process analysis was performed, substantially more errors were discovered than when studies relied on complaints or report of near accidents. Conclusions: The large heterogeneity of literature on laboratory errors together with the prevalence of evidence that most errors occur in the preanalytical phase suggest the implementation of a more rigorous methodology for error detection and classification and the adoption of proper technologies for error reduction. Clinical

audits should be used as a tool to detect errors caused by organizational problems outside the laboratory.

2:10 Divisional Business Meeting and Awards

HISTORY AND PHILOSOPHY OF SCIENCE

Chair: Robert Hamilton, Mississippi College
Vice-chair: Bud Donahue, Northwest Community College

FRIDAY MORNING

Classroom C

8:00 FUNCTION IN BIOLOGY — WHAT DOES IT MEAN?

Robert Waltzer, Belhaven College, Jackson, MS 39202

The concept of function is foundational within any discussion of biology and other sciences. Function is considered the normal or characteristic action of a structure. For example, the heart pumps blood. But it also makes a thump-thump sound. We acknowledge that it does both, but we consider its main function to pump and view sound production as accidental. But what do we mean by accidental? Not planned? According to evolution nothing is planned. So even though both sound and pumping are a result of accident, one is a function of the heart and the other isn't. How can this be? In this presentation I will overview a number of views on function, consider their strengths and weaknesses, and consider the role of naturalism in understanding function. Accounts of function may be placed in 3 categories: (1) function as an explanation of why a structure is present (2) function as a causal contribution to a complex process (3) and function as a historical concept. In account 1, the heart is there because it pumps the blood. In account 2, the heart functions as a pump because it delivers blood through vessels to other vital systems. In account 3, the heart pumps because it did a similar action in ancestors of the organism in which it is found. Antiteleological naturalism limits discussion of function and a loosening of restrictions may lead to fruitful solutions.

8:30 SCIENCE IS SENSE, NON-SCIENCE IS NON-SENSE NOT

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

Science truly makes sense since its results are verifiable everywhere. Does it therefore transpire that non-scientific knowledge is nonsense? I think not. Though we are mesmerized by the material world science has helped us create, the non-scientific world—both visible and invisible—remains fascinating to scientists and non-scientists alike. The visible world is full of phenomena we can't explain. For example, why do all the living things have the urge to procreate—probably the

purpose of life itself? As scientists, we are deservedly proud of our achievements during the last three hundred years. But we must not be blind to our limitations, especially those of our senses that enable us to observe and experiment with nature. We are discovering that in comparison to our senses the mind is more powerful than the credit we have been giving it. Could it be that we are so focused on science having immediate utility, especially in a free-market economic system, that we are not letting our minds roam freely, beyond the scientific domain? While science finds the material world fascinating, non-science prefers the complexities of the immaterial one. Science helps us build and furnish a house, it is the non-science that renders the house a home. Science is powerful enough in explaining the material world, but fails miserably even in imagining anything beyond.

9:00 SCIENCE'S CONSCIENCE: THE METAEPISTIMOLOGICAL IMPLICATIONS OF PYRRHONIAN SKEPTICISM

Michael Dodge, University of Southern Mississippi, Hattiesburg, MS 39406

All forms of skepticism make knowledge their primary concern; for this alone, they should never be flippantly rejected. This presentation will focus on metaepistemological tools that enable philosophers to analyze epistemological claims, specifically the 'modes' developed by Pyrrhonian skeptics, in the attempt to avoid scientific dogmatism—overconfidence in the certainty of scientific propositions. Science is filled with propositions; for example: Matter on Earth is accelerated towards the globe's center at -9.8 m/s^2 . In some cases, the belief that x is certain can be justified; however, this is not the same as claiming x 's certainty, thus it may be concluded that justified belief, even justified true belief, is not a sufficient condition for the metaepistemological claim that we have knowledge of epistemically interesting propositions (such as the future can/cannot be known; other minds can/cannot be known). This is pertinent, since lapsing into dogmatism can put up a shield of protectionism over any given scientific discourse, making it more difficult to investigate seemingly outlandish claims that could, upon further investigation, open up new roads to scientific knowledge. I will show Pyrrhonian methods cause us to balk at proclaiming knowledge as certain, but instead will argue that we might have knowledge, which I equate with 'scientific knowledge'. I conclude that Pyrrhonian skepticism is a tool to enhance scientific knowledge, and that skepticism as a philosophy should be carefully considered by scientists and philosophers alike as Science's conscience.

9:30 Break

9:45 DARWIN'S THEORY OF SEXUAL SELECTION: A HISTORY

John D. Davis, Mississippi Museum of Natural Science, Jackson, MS 39202

Darwin recognized that Natural Selection could not account for differences in the ornamentation and behavior of the sexes in many animals. In 1871 he proposed his theory of Sexual Selection operating at two levels (1) same sex competition and (2) mate choice. The abolitionist Darwin proposed that sexual selection could account for the origin of human "races"

from a common ancestor and used this concept to oppose pro-slavery ‘polygenists’ who claimed that human ‘races’ were separate species. Sexual Selection was the first ‘scientific’ defense of the equality of humankind and ascribed human variation to female choice! A.R. Wallace broke with Darwin over Sexual Selection. The Peckham’s (1889) study of female choice in jumping spiders was the only 19th century work supporting Sexual Selection. In 1930 the mathematical geneticist Ronald Fisher proposed a model for the origins of mate choice and its consequences as ‘runaway selection.’ Little research was done in this area until R. Trivers (1972) concept of parental investment; the time, or energy expended to aid the survival and reproduction of one offspring at the expense of other requirements. Parker (1979) showed that mating systems may lead to antagonistic coevolution with adaptations in one sex being detrimental to the other (Sexual Conflict Theory). An immense experimental literature (2,400,000 references in Google alone) now exists on the role of Sexual Selection in genetics, evolution and social systems.

10:15 A REVIEW OF THE NEW SYSTEMATICS

Robert Hamilton, Mississippi College, Clinton, MS 39058

The ongoing discussion of species has begged the introduction of the basic species concept in biology. Ernst Mayr’s species concept as described in the new systematics developed in the mid 20th century seems to have been forgotten. The new systematics requires the description of the range of variation present among the populations of species. The typological species concepts that pre-date the new systematics were supplanted by the new systematics at the time. It appears, however, that many philosophers have forgotten the new systematics when presenting arguments as to the meaning and use of species concepts in general. The basic definition of a species as a group of potentially interbreeding individuals still stands as a viable concept in an evolutionary sense, and as such still stands as a central concept in biological theory.

10:45 Break

11:00 THE BIOLOGICAL SPECIES UNDERSTOOD AS A RELATIONSHIP OF PARTS TO A WHOLE

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

Philosophical accounts of biological species cast them either as concrete individuals explained in terms of parts to a whole or as concepts explained in terms of members to a set. The current most popular philosophical argument for biological species taxa, i.e., groups of organisms with a formal binomial name, cast the species as an individual explained in terms of concrete parts of a concrete whole. We argue here that understanding species taxa as parts to a whole is misleading. The popularity of this approach may lie in the notion that concrete things, because they are more tangible than conceptual things, offer more compelling accounts of similarity. The species-as-an-individual thesis is a part to whole argument by analogy. Cells are to organisms as organisms are to species. We argue that the analogy is flawed and leads to various confusions. Consider this example. Parts of wholes are also properties of the whole when taken in the context of possession by the whole. Hence a tree has leaves (possession) and a leaf is a part

of a tree. Leaves can be specific, individual properties of a particular tree or they can be generic properties of trees in general. Note that (some) individual properties are concrete parts, while generic properties are always abstractions. But a species cannot have individual properties, so the species as an individual is characterized by generic (abstract) properties. If the properties are all abstractions, the species cannot be a concrete individual; it must be conceptual.

11:30 THE BIOLOGICAL SPECIES UNDERSTOOD AS A RELATIONSHIP OF MEMBERS TO A SET

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

We argued in the accompanying presentation that the popular account of species taxa found in terms of parts to a whole as embodied in the notion of the species as an individual is misleading. Here we argue that a more compelling account is found by explaining species conceptually in terms of members to a set. We start by arguing that a compelling account of similarity among organisms considered members of a species flows from W.V. Quine’s argument for natural kinds. The world the way it is contains certain patterns that are more likely to obtain than others. We recognize these similar patterns as natural kinds. Richard Boyd suggested that species are that type of natural kind he called a homeostatic property cluster kind (HPCK). By this he meant that certain groups of properties tend to occur together and hold together. Here homeostasis is a metaphor. The homeostatic property cluster kind does not require any particular property for admission to the group. Membership is based on having a large number of the properties recognized as the core of the cluster. Boyd’s concept only applies to living members of extant species. This is the horizontal dimension of species. We refine Boyd’s concept by considering the vertical dimension of species as embodied in ancestral lineage. The HPCK seen in both horizontal and vertical dimensions represents a compelling account of biological species taxa.

FRIDAY AFTERNOON

Classroom C

1:30 LINGUISTIC AND ONTOLOGICAL CONFUSIONS IN THE SPECIES-AS-INDIVIDUALS HYPOTHESIS

Paula Smithka, University of Southern Mississippi, Hattiesburg, MS 39406

In the recent debates concerning the ontological nature of species taxa, the species-as-individuals (SAI) hypothesis has gained much popularity. Michael Ghiselin and David Hull have argued that because species taxa are like individual organisms, they are historical entities, i.e., they have a beginning and an end, a birth and a death. Hence, species taxa must be individuals and not natural kinds or classes, as Michael Ruse and Martin Mahner and Mario Bunge maintain. More recently, Keith A. Coleman and E. O. Wiley have defended the SAI hypothesis, based on the way biologists actually *talk about* species. Coleman and Wiley suggest that when biologists use the term ‘species’, they use it as a singular term. For example,

when biologists say, “Species are the units of evolution,” the term ‘species’ here is not a general term; it is *really* a singular term. Furthermore, they suggest that binomial terms are indispensable in biological theories and biologists’ general discourse. Therefore, species taxa are denoted by binomials. Hence, SAI is true. Even though Coleman and Wiley are correct in their observations concerning biological talk about species taxa, and in their claim that binomial terms cannot be replaced by descriptive or predicative phrases, their “objectual account” of species taxa falls prey to a simple category mistake. Simply because biologists, (or anyone else for that matter), happen to employ grammatical subject terms to denote (or refer to) an object, does not imply they necessarily denote *an object*. Merely because we employ language in ways that *suggest* we are referring to “things,” does not guarantee that we are actually referring to concrete, real, individual things.

2:00 JAMES BLUNDELL: FATHER OF HUMAN TO HUMAN TRANSFUSION

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

The documented history of blood transfusion dates to the 1600s beginning with the transfusion of blood from one dog to another by Richard Lower. These early experiments were expanded by Jean Denys in France with the transfusion of blood from sheep or calves to humans. When his fourth patient died of the treatment, Denys was charged with murder and malpractice by the victim’s wife. Although Denys was later exonerated, the scientific and medical societies of England, France and Italy outlawed transfusion. Although transfusions were discussed in medical literature in the mid-1700s, the procedure was not revived until 1818 by the British physiologist and physician James Blundell (1790-1878). Blundell is credited with publishing the first articles describing the benefits and mechanics of performing human to human transfusion. Between 1825 and 1830 Blundell performed a series of transfusions in an attempt to save women with severe postpartum hemorrhages. Blundell addressed problems of transfusion such as clotting and described in his publications mechanical devices he developed. The success rate of these transfusions was not high due to the lack of knowledge concerning ABO blood groups and the severity of blood loss before therapy was instituted. Other physicians have been cited as performing human to human transfusions earlier than 1818, but their attempts were not documented or published. Therefore, James Blundell is regarded as the father of blood transfusion.

2:30 Divisional Business Meeting

2:45 THE BIOLOGICAL “INDIVIDUAL”: PHILOSOPHICAL RUMINATIONS ON AN ENDURING QUANDARY

Malachi Martin* and Michael Dodge, University of Southern Mississippi, Hattiesburg, MS 39406

How are biological organisms individuated? The commonsense or concrete notion of individuality suggests that the biological “individual” is a singular, discrete, spatiotemporally bounded entity. Metazoan organisms are easy to individuate on this basis, but a variety of biological entities challenge the concrete notion of individuality; for example,

some fungi and colonial organisms which lack obvious boundaries. Linguistic confusions compound the problem (for example, by equating “individuals” with “particulars”), and discussions of Darwinian “individuals” as units of selection lead us into quite disparate philosophical territory. Casting what might be termed “conceptual individuals” as legitimate, concrete individuals leads to further confusions (enter the species-as-individuals thesis). Some biologists and philosophers of biology have attempted to embellish a useful notion of concrete individuality for myriad kinds of organisms. In his book “Biological Individuality,” Jack Wilson (1999) advances multiple types of individuation, and in an article of the same title, De Sousa (1997) proceeds from the concept of a “minimal individual” as a “potentially competitive space-occupier.” However, such approaches exemplify the difficulties inherent in any approach to individuation which nets all species and is biologically useful without pluralizing notions of individuality or furnishing overly simplistic requisites. It is our contention that useful criteria for individuation should remain constant in all essentials while possessing sufficient plasticity to account for all taxa.

3:15 THE HAND ON THE WEDGE: ANTI-MATERIALISM, INTELLIGENT DESIGN, AND THE PROSPECTS OF CULTURE

Malachi Martin, University of Southern Mississippi, Hattiesburg, MS 39407

The Intelligent Design (ID) movement is perhaps the most sophisticated offshoot of creationism. Organizations like the Discovery Institute have recently won modest victories in states such as Ohio, where high school biology curricula have been modified to reflect so-called objectivity in teaching evolution. The emphasis is on science, not the Bible, and ID precludes religious connotations in favor of “teaching the controversy.” How have these efforts influenced the ongoing controversy and how do they differ with respect to classic creationist approaches? Understanding the philosophical arguments of the ID movement, its aims and goals, is crucial for scientists who may be confronted with the issue. Contemporary ID seeks to drive a wedge into scientific materialism, contending that materialism delimits science and is corrosive to our culture and values. ID also seeks to compel the scientific community to cede ground to the possibility of supernatural explanations and argues that school curricula should be reorganized to reflect actual controversies over evolution. If the goal is to drive a wedge into materialism by discrediting evolution, then the “thin end” of the wedge is, as the Discovery Institute has proclaimed, the supposed scientific evidence in favor of ID. It then becomes apparent that the hand steadying the wedge is a holdover from creationism: Moral and existential qualms over evolution, its negative impact on culture and society, and broader philosophical misgivings over methodological materialism.

MARINE AND ATMOSPHERIC SCIENCES

Chair: Charlotte A. Brunner, University of Southern Mississippi

Vice-chair: Paulinus Chigbu, Jackson State University

THURSDAY MORNING

Oak Room A

8:00 THE INFLUENCE OF CLIMATE VARIABILITY AND ANTHROPOGENIC FACTORS ON BIOTA AND BIOGEOCHEMICAL PROCESSES IN COASTAL WATERS

Charlotte A. Brunner and Paulinus Chigbu, University of Southern Mississippi, Stennis Space Center, MS 39529 and Jackson State University, Jackson, MS 39217

The symposium theme is intended to cover a range of topics such as, but not limited to, coastal hypoxia and eutrophication, microbial fecal pollution and enteric pathogens in coastal waters, harmful algal blooms, impact of invasive species on coastal environments, human and climate impacts on nursery habitats of fish (e.g., as explored through otolith microchemistry or other tools), problems in coastal erosion, impacts of ENSO events, modeling of processes affected in part by human activities, etc.

9:00 FULFILLING THE ROLE OF A CIVIC SCIENTIST: A CASE STUDY OF THE "EVALUATING THE ENVIRONMENTAL QUALITY FOR THE BAY OF ST. LOUIS" (EEQ) PROJECT

Pradnya Sawant* and Donald G. Redalje, University of Southern Mississippi, Stennis Space Center, MS 39529

Determining the human and climate change impacts on the coastal waters is essential to improve our understanding of these ecosystems. There are, however, three major aspects that such studies must include. First, a comprehensive and interdisciplinary approach is necessary. Secondly, it is important to communicate the scientific findings to the decision makers. Finally, it is imperative to share the results with all the stakeholders. EEQ in the bay of St. Louis is one such effort. We have monitored this ecosystem periodically and looked at the relationship between the environmental quality of this estuary and the factors influencing it. The primary concerns are anthropogenic impacts superimposed with the effects of the variability in climate. Based on the results, we have proposed to develop an evaluation system for the bay that may be used as an effective management tool. All of the environmental data will be shared with the community using the Geographic Information Systems (GIS) mapping techniques. Through this project we have addressed the three major components necessary to translate the science into the information required by the policy makers and rightfully demanded by the society. It is our attempt of responding to the changing duties of the scientific community and moving on from being just scientists to becoming civic scientists.

9:15 FOSSIL INDICATORS OF LOW OXYGEN HOT SPOTS IN THE MISSISSIPPI BIGHT

Charlotte A. Brunner¹*, Jennifer Beall², and Yoko Furukawa³, ¹University of Southern Mississippi, Stennis Space Center, MS 39529; ²Louisiana Department of Natural Resources, Baton Rouge, LA 70802; and ³Naval Research Laboratory, Stennis Space Center, MS 39529

Foraminifer proxies of oxygenation suggest low oxygen conditions in several hot spots in the Mississippi Bight. Several foraminifer proxies of water column oxygenation were tabulated from core-top data collected in 1951 and 1956 and compared to core tops collected in 1999-2000 during the Northern Gulf of Mexico Littoral Initiative (NGLI). Additionally, the oxygenation history of a site near the Balize delta was evaluated over the past one hundred years based on samples from a gravity core dated by 210Pb. The results from the 1950s core-top collections suggest recurrent low oxygen conditions on the shelf at hot-spot locales seaward of the Mississippi-Alabama barrier islands and the eastern distributaries of the Balize delta. Specifically, the ratio of *Ammonia* to *Elphidium* exceeds 80% seaward of Horn Island Pass, Ship Island Pass, and Mobile Bay in the Mississippi-Alabama barrier island region, and seaward of Pass à Loutre and the southernmost outlet from Breton Sound in the Balize delta area. Consistent with these results are reports of sporadic, low-to-hypoxic oxygen concentrations in bottom waters at several of these sites associated with seasonally-high, average surface chlorophyll-a and seasonal strengthening of a freshwater cap. Results from core tops collected in 1999-2000 indicate that the low-oxygen hot spot is increasing in size seaward of Pass à Loutre. Results from the gravity core 45 km east of Pass à Loutre indicate no clear change in conditions over the past century, placing a limit on the maximum extent of apparent low oxygen conditions.

9:30 THE USE OF HEART RATE IN *CALLINECTES SAPIDUS* RATHBUN AS AN INDICATOR OF ECOSYSTEM HEALTH: A GLOBAL HEART BEAT PROGRAM INITIATIVE

Matt Reudelhuber¹*, Harriet Perry², and Judith Williams¹, ¹University of Southern Mississippi, Long Beach, MS 39560 and ²University of Southern Mississippi, Gulf Coast Research Laboratory, Ocean Springs, MS 39564

The health of the oceans is inextricably tied to our own. Industrial processes, residential development, and commercial/recreational activities introduce contaminants that impact coastal waters and riverine systems. Traditionally, the biological effects of pollutants have been addressed using acute lethal toxicity tests that provide information on the concentration of a particular chemical that will kill a certain proportion of the population. Bio-monitoring is a tool that may prove useful in the identification of the impact of sub-lethal toxicity from pollutants. Project Global Heartbeat is an international environmental program that uses new, non-invasive scientific technology to assess how well marine organisms adapt to stress in their environment. This program uses a computer-aided physiological monitoring system (CAPMON) to measure the heartbeats of crustaceans and molluscs. Because heart rate in these organisms has been linked to environmental stress, it provides a measure of the health of individual ecosystems and can serve as an early warning system for ecological degradation.

tion. The present study compared heart rate of blue crabs from degraded waters with crabs from more pristine areas. The methodology, modified from previous and on-going bio-monitoring studies, recorded heart rate of crabs in natural settings, upon return to the laboratory and before and after addition of a stressor.

9:45 PROJECT GLOBAL HEARTBEAT: ESTABLISHING BASELINE DATA FOR DETERMINING EFFECTS OF ENVIRONMENTAL CONDITIONS ON HEART RATE IN THE BLUE CRAB *CALLINECTES SAPIDUS*

Christina Vorhoff^{1,2*}, Oliver Kuttner^{1,2}, Harriet Perry³, and Matt Reudelhuber^{3,4}, ¹Mississippi Gulf Coast Community College, Gautier, MS 39533; ²National Aeronautics and Space Administration, Stennis Space Center, MS 39522; ³University of Southern Mississippi, Gulf Coast Research Laboratory, Ocean Springs, MS 39564; ⁴University of Southern Mississippi, Long Beach Campus, MS 39560

Project Global Heartbeat is an international environmental program that uses non-invasive scientific technology to assess ecosystem health. A computer-aided physiological monitoring system (CAPMON) is used to measure heartbeats of crustaceans because heart rate in these organisms has been linked to environmental stress. To examine the effect of environmental stress on heart rate, baseline data must first be collected to determine individual crab variability. Intermolt, male, blue crabs of similar size were collected by drop net from the Gulf Coast Research Laboratory pier and heart rate determined using the CAPMON unit. Heart rates were measured at the time of capture, immediately after transportation to GCRL, and after acclimation to laboratory conditions for 24 hours. Temperature, salinity, and dissolved oxygen were measured in the field at the time of capture and a water sample taken to determine pH, ammonia, nitrate, nitrite, and total phosphate. Current data will become part of a larger data set to provide information on variability of heart rate of individual blue crabs. Once variability has been addressed, data from crabs collected from degraded waters can be compared with data from crabs from more pristine areas and the usefulness of this technique evaluated.

10:00 DETERMINATION OF DISSOLVED GALLIUM IN PROFILES FROM THE ATLANTIC AND PACIFIC OCEANS

Gautam Raj Bairamadgi* and Alan Shiller, University of Southern Mississippi, Stennis Space Center, MS 39529

The seawater gallium (Ga) distribution is of interest due to the aeolian source of this element. Its chemical similarity to aluminum can be used to test assumptions about the use of Al as a deep-water mass tracer. We have determined dissolved Ga in oceanic profiles using Mg-induced co-precipitation (MagIC) and isotope dilution ICP-MS. The method involves adding clean ammonium hydroxide to the acidified seawater sample to precipitate magnesium hydroxide, which, in turn, scavenges the trace elements of interest from solution. The Mg precipitate needs to be rinsed several times to eliminate barium, an interferent. With a 7 ml sample, a detection limit in the low picomolar range is possible and other elements such as lead and cadmium can be determined simultaneously. Results to date are

similar to other published seawater Ga data; for instance, surface Atlantic concentrations are in the 30-50 pM range. Further analyses should shed light on possible anthropogenic inputs as well as dust inputs to the western North Pacific Ocean.

10:15 Break

10:30 DETERMINATION OF TRACE METALS IN FISH OTOLITHS BY ICP-MS

Zikri Arslan, Jackson State University, Jackson, MS 39217

Otoliths are calcium carbonate biominerals in the inner ear of vertebrate fish. These biominerals provide balance and hearing to fish. Trace elements from resident waters incorporate into the crystal lattice of the otoliths throughout the life of fish. The levels of these elements in otoliths reflect the chemical composition of the resident waters and are therefore useful indicators of fish's past history and natal origin. Two particular challenges, however, hamper the accuracy of the information from otoliths by solution ICP-MS; very low concentrations of trace metals and interferences from calcium matrix that results from the dissolution of otolith calcium carbonate. Several sample introduction techniques have been developed for on-line and off-line removal of calcium from otolith digests. In on-line method, a mini-column of an iminodiacetate chelating resin is used to separate trace elements from calcium. Trace elements retained on the column are flushed to ICP-MS instrument with dilute acid. In off-line method, calcium is precipitated with hydrofluoric acid. An ETV device is used for introduction of samples to the instrument. Methods are validated by analysis of a fish otolith reference material and then applied to analysis of otoliths of fish from different estuaries. Not only are both methods capable of measuring small differences in otolith elemental concentrations, but also they are complementary to gather more information from otoliths as they enable the determination of several different elements.

10:45 ASSAY DEVELOPMENT AND MEASUREMENT OF IMMUNOGLOBULIN G (IGG) LEVELS IN THE SPECTACLED EIDER (*SOMATERIU FISCHERI*)

Jill M. Frank*, Bobby L. Middlebrooks, and Rhonda A. Patterson, University of Southern Mississippi, Hattiesburg, MS 39406

Populations of eiders in Alaska have been in a state of decline since the 1970s. Given the importance of the immune system to survival and health and the fact that perturbations in the immune system may provide indications of stress within a population, examination of the eider immune system may shed some light on the plight that these birds are facing. Immunoglobulin G (IgG) was isolated from the yolks of fourteen spectacled eider eggs (infertile or from abandoned nests), which were provided by the Alaska SeaLife Center (Seward, AK). Egg yolk extraction was chosen not only because it is a noninvasive method but also because large amounts of antibody are stored in the yolk. In SDS-PAGE, Grabar Williams, and Western blot assays commercially available anti-chicken IgG has been shown to have binding affinity for the immunoglobulin isolated from the eider egg yolk. Subsequently, the IgG in

the extracted yolk samples was further purified using an affinity column coupled with purchased anti-chicken IgG. A sandwich ELISA was developed to measure spectacled eider serum IgG concentrations. One hundred and forty serum samples were assayed and IgG levels were determined. Significant differences were found between captive and wild birds ($p < 0.01$) and also between males and females of the wild population ($p < 0.01$). No significant difference was found between males and females of the captive population.

11:00 KUDOA SP. FROM BRAIN OF GULF KILLIFISH (*FUNDULUS GRANDIS*) IN THE NORTHERN GULF OF MEXICO

Joshua O. Cook*, Stephen A. Bullard, Robin M. Overstreet, and Reginald B. Blaylock, University of Southern Mississippi, Gulf Coast Research Laboratory, Ocean Springs, MS 39566

A myxozoan has not been reported from the brain of species in the genus *Fundulus*. Reports of myxozoan infections in the brains of other teleosts suggest that plasmodia may exert pressure on adjacent brain tissue, speculatively affecting host behavior. Most species of *Kudoa* infect skeletal muscle, but a few infect the gills, brain, gall bladder, ovary, and heart. *Kudoa* contains four species that reportedly infect the brain of teleosts: *K. cerebralis* from connective tissue in the brain, *K. tetraspora* from optic lobes, and *K. paralichthys* and *Kudoa* sp. from the brain. A recent survey of the parasites of *Fundulus grandis* in the northern Gulf of Mexico from Mississippi Sound and adjacent waters revealed the presence of a fifth species of *Kudoa* in the brain. The infection was present at only one of the four collection sites surveyed, and it occurred in one of the sixty fish collected at that site. *Kudoa* has not been reported previously as infecting the brain of a cyprinid. Funded in part by the Tidelands Trust Fund through the Mississippi Department of Marine Resources (03-042).

11:15 THE CENTRAL GULF OF MEXICO OCEAN OBSERVING SYSTEM (CenGOOS)

Stephan Howden¹*, Don Roman², Steven Lohrenz², and David Dodd², ¹University of Southern Mississippi, Hattiesburg, MS 39406 and ²University of Southern Mississippi, Stennis Space Center, MS 39529

The national integrated coastal ocean observing system is envisioned to have multiple operational nodes on all U.S. coasts. In the Gulf of Mexico, start-up systems are operational along the Texas and Florida coasts. However, a "gap" in coastal ocean observations exists currently in the central Gulf of Mexico region. Marine science researchers at USM have identified a need for a coastal observing system in this dynamic region of the Gulf of Mexico, a region where the Mississippi River has a major influence on oceanographic processes. To fill this gap, USM researchers have developed and are deploying a single data platform in the central Gulf of Mexico in coastal waters south of Mississippi. USM is a signatory of the Gulf of Mexico Coastal Ocean Observing System (GCOOS) governance and participates in requisite GCOOS planning and data sharing. The Central Gulf of Mexico Ocean Observing System (CenGOOS) will close a key "gap" in the integrated ocean observing system in the Gulf and it will support vital research and observations that will help predict environmental change, manage ocean resources, protect

life and property, and provide decision makers with reliable scientific information. An ocean observing systems in the central Gulf of Mexico is important to enable the observation and prediction of such processes as hypoxia, harmful algal blooms and other important changes in this vital coastal region that produces an abundance of seafood, a significant fraction of the country's energy needs, and is of prime importance to the shipping industry.

11:30 Divisional Poster Session

A COMPARATIVE STUDY OF METAL CONTAMINATION IN THREE MISSISSIPPI GULF COAST AREA BAYOUS

Joyce Williams¹*, Paulinus Chigbu¹, Paul B. Tchounwou¹, Ibrahim O. Farah¹, David Ruple², and Mark Woodrey², ¹Jackson State University, Jackson, MS 39217 and ²Grand Bay National Estuarine Research Reserve, Moss Point, MS 39562

The concentrations of selected metals in water and sediments in Bayou Heron and Bayou Cumbest located within the Grand Bay National Estuarine Research Reserve (GBNERR), a relatively pristine area, and Bayou Cassotte located outside the GBNERR in a more industrialized area were examined. Samples were collected in October and December 2003 from 4 sites along each bayou, and were analyzed for lead, cadmium, chromium, nickel, manganese, molybdenum and copper using a graphite furnace atomic absorption spectrophotometer. Lead (average: 3.19 mg/kg) and nickel (average: 2.67 mg/kg) had the highest concentrations in the sediment whereas cadmium (average: 0.06 mg/kg) had the lowest concentration. Similarly, lead (average: ~275 µg/L) and nickel (average: 125 µg/L) concentrations in water were higher than the concentrations of other metals examined (average: < 8.5 µg/L). Lead (4.17 mg/kg) and cadmium (0.07 mg/kg) levels were higher in sediments from Bayou Cassotte than in sediments from Bayou Cumbest (2.30 mg/kg Pb; 0.05 mg/kg Cd) and Bayou Heron (3.08 mg/kg Pb; 0.04 mg/kg Cd). This may be due to the proximity of Bayou Cassotte to industries in the Mississippi Gulf Coast. Studies are on-going to characterize seasonal variations in metal levels and water quality in the bayous.

THURSDAY AFTERNOON

Oak Room A

1:30 STATISTICAL AND CHANGE-DETECTION ANALYSES USING THE SIDESCAN-SONAR DATA FROM SOUTHWEST REGION OF THE MISSISSIPPI SOUND.

Vidyavathy Renganathan* and Jerald Caruthers, University of Southern Mississippi, Hattiesburg, MS 39406 and University of Southern Mississippi, Stennis Space Center, MS 39529

Sediment classification is important for mine detection, data compression and environmental management studies. The main purpose of this study is to conduct statistical analyses of side-scan sonar data and to develop a change-detection algorithm to identify any changes in the sediment types on the seafloor. The data for this study was collected using modified

side-scan sonar (SSS). The change-detection algorithms that is dealt with, in this study, is based upon mean, standard deviation and chi-square test statistics. The approach is to create PDF of the entire data and compare it with the PDFs of smaller domains. The main focus of this task is to determine which one of the sub-PDF best represents the finite segment under consideration. This was done using Chi-square test. The sub-PDF with the least chi-square goodness-of-fit value is chosen to represent the domain under consideration.

1:45 AN EPIZOOTIC OF *NEOBENEDENIA MELLENI* (MONOGENEA: CAPSALIDAE) ON THE EXTERNAL BODY SURFACES OF RED SNAPPER (*LUTJANUS CAMPECHANUS*) IN RECIRCULATING AQUACULTURE

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

Neobenedenia melleni is a serious pathogen of aquacultured and aquarium-held fishes because it has a direct life cycle and exhibits minimal site- and host- specificity, infecting the eyes, fins, gill cavity, nasal cavity, and skin of over 100 teleost species. Details about the pathological alterations to host tissue associated with debilitating infections of *N. melleni* are lacking, but a recent epizootic on 200 captive red snapper represented an opportunity to document the relationship. Grossly, the heavily-infected fish had ragged fins, missing scales, clouded eyes, and skin appearing as a steadily-undulating, glistening surface. Histologically, the epidermis was severely altered. Some scales were covered by a thinned epidermis comprised of scant goblet and malpighian cells. However, in other regions, cell-to-cell junctions were separated, scales were dislodged, and the epidermis was absent or separated from the dermis. The cornea was hyperplastic. Two strains of the bacterium *Chryseobacterium indologenes* were isolated from the skin, and trophonts of the dinoflagellate *Amyloodinium ocellatum* were attached to the gill epithelium; any of those could contribute to the health of fish. The epidermis of the snapper is an osmotic barrier. When breached, osmotic imbalance may result or the volume of lymph circulating in the dermis may be altered, negatively affecting the circulating blood volume as well as debilitating the infected fish or making it vulnerable to secondary infections. Supported by NOAA/NMFS Marine Stock Enhancement Program Award No. NA06FL0501.

2:00 SKIN LESIONS ASSOCIATED WITH *DENDROMONOCOTYLE OCTODISCUS* (MONOGENEA: MONOCOTYLIDAE) ON BLUNTNOSE STINGRAYS (*DASYATIS SAY*) AND YELLOW STINGRAYS (*UROBATIS JAMAICENSIS*) IN THE GULF OF MEXICO

Hannah Fouasnon* and Stephen A. Bullard, University of Southern Mississippi, Gulf Coast Research Laboratory, Ocean Springs, MS 39564

Monogeneans are serious pathogens of sharks and stingrays in public aquaria; however, we know little about their relationships with wild hosts. Skin lesions associated with the ectoparasite *Dendromonocotyle octodiscus* on the dorsum of bluntnose stingrays, *Dasyatis say*, from off Horn Island, MS,

and yellow stingrays, *Urobatis jamaicensis*, from off Long Key, FL, were studied using standard histological techniques. Adult Atlantic stingrays, *Dasyatis sabina*, as well as embryos of *D. say* and *U. jamaicensis* were uninfected and used as negative controls. This monogenean apparently exhibits a high degree of site and host specificity, infecting the dorsum of *D. say* and *U. jamaicensis* only. The lesion associated with infection by *D. octodiscus* was relatively superficial. Grossly, lesions were irregularly-shaped dark gray skin patches typically located on the anterodorsal surface of the disk adjacent to and between the eyes. Light microscopy revealed that the haptor of adult *D. octodiscus* attached to a smooth-surfaced, continuous epithelium that was only slightly thickened, if at all, and that the dermis in all samples was intact and usually indistinguishable from the control tissue. Although infrequently clustered beneath the basement membrane of lesioned skin, granulocytes with brightly eosinophilic intracytoplasmic granules, resembling eosinophils, resided in the dermis and epidermis of all skin samples.

2:15 AQUACULTURE OF THE BLUE CRAB, *CALLINECTES SAPIDUS* RATHBUN

Dyan Gibson*, Harriet Perry, Christine Trigg, Verlee Breland, Casey Nicholson, John Ogle, and Faye Mallette, University of Southern Mississippi, Gulf Coast Research Laboratory, Ocean Springs, MS 39564

Aquaculture of the blue crab *Callinectes sapidus* Rathbun can provide a source of crabs to enhance natural stocks and be a source of peeler crabs for the soft crab industry. Impediments to the development of culture techniques for this species have included their lengthy larval development and cannibalistic nature. This study investigated the feasibility of rearing blue crabs from eggs under laboratory conditions. Late-stage ovigerous crabs were collected from waters in the Mississippi Sound and were held individually in glass aquaria until they spawned. Active, newly-hatched zoeae were collected en masse, counted, and transferred into cylindrical fiberglass tanks (1.2m x 1.2 m) containing 1000 L of synthetic seawater of 30 ppt salinity at 25°C. Zoeae were stocked at a rate of 100 larvae per liter. Test systems were both filtered and unfiltered. Temperature, salinity, dissolved oxygen, ammonia, and nitrite levels were monitored. Larvae were counted, fed daily, and moltstages were determined. Early zoeal stages were fed rotifers, *Brachionus plicatilis*, and later zoeal stages were fed *Artemia salina* nauplii. Tests were repeated. Blue crabs were successfully raised through the seven zoeal stages to the megalopal stage in both systems. Length of time from zoea I to megalopa varied from 20 to 31 days. Highest percent survival was 15% compared to 30% and higher for similar studies from the Chesapeake Bay area.

2:30 CAN FRACTURES IN SOFT SEDIMENTS HOST SIGNIFICANT QUANTITIES OF GAS HYDRATES?

Carol Lutken¹*, Tom McGee¹, Rudy Rogers², Jennifer Dearman², F.L. Lynch², Charlotte A. Brunner³, Jenny Kuykendall³, and Bob Woolsey¹, ¹University of Mississippi, University, MS 38677; ²Mississippi State University, Mississippi State, MS 39762; and ³University of Southern Mississippi, Stennis Space Center, MS 39529

Current interest concerning what types of geologic features contain significant accumulations of gas hydrate arises from the expectation that someday commercial quantities of natural gas will be produced from hydrates. Various geologic structures within the hydrate stability zone have been imaged, seismically, but there is little consensus concerning serious candidates for exploratory drilling. Some investigators favor targeting sandy sediments where porosity and permeability are greater than in silts and clays. Others expect fractures within fine-grained sediments may host greater volumes of hydrates. The latter scenario seems to fit better with conditions in the hydrate stability zone in the northern Gulf of Mexico and with laboratory results. Hydrates have been created in the laboratory by adding natural gas, sea water and naturally occurring microbial surfactants to artificial sediments comprised of smectite, kaolinite and sand under appropriate conditions of pressure and temperature. Findings show that biosurfactants greatly enhance hydrate formation and that hydrates form preferentially on smectite (a known component of soft sediments in the Gulf) rather than kaolinite or sand. Given sufficient natural gas, all that remains to complete the formation of hydrates is a mechanism of producing a dense population of fractures open to gas and water circulation. This presentation postulates that the mechanism is polygonal faulting and provides supporting evidence.

2:45 Divisional Business Meeting

FRIDAY MORNING

Oak Room A

9:00 PRELIMINARY ASSESSMENT OF SWIMMING PERFORMANCE AND RECOVERY OF JUVENILE RED SNAPPER, *LUTJANUS CAMPECHANUS*, FROM THE NORTHERN GULF OF MEXICO.

Bryan A. Cage* and Glenn R. Parsons, University of Mississippi, Oxford, MS 38677

The assessment of swimming performance and recovery from forced exercise was conducted at 18 °C and 25 °C to describe the relationship between fish size, temperature, and swimming velocity (intensity). The goals were to define active, burst, and critical swimming speeds of juvenile snapper, profile recovery from several levels of forced exercise, compare recovery lengths between rested/non-rested, post-exercise fish (exposed to 0 or 10 cm/sec current following swimming bout fatigue), and determine the effect of temperature on each of these components. All experiments were conducted in a 1kl Brett style swim tunnel located at the University of Mississippi. Lactate, hematocrit, glucose, and cortisol were measured to determine recovery time. Burst speeds (highest swimming velocity lasting < 20 seconds) were in excess of 2m/sec at 18 °C and 25 °C for all but the smallest fish tested. Critical swimming speeds were significantly lower during winter months, but showed little variation between day and night swimming. Preliminary indications suggest that recovery time from exhaustive exercise in juvenile snapper is directly proportional to exercise intensity (swimming speed) and

temperature, and that post exercise activity may shorten the recovery period.

9:15 SUBSTRATE PREFERENCE OF THE SNAPPING SHRIMP, *ALPHEUS HETEROCHAELIS*, FROM THE CHINCOTEAGUE ISLAND AREA

Raymond Pluhar* and Bruce L. Haase, University of Southern Mississippi, Stennis Space Center, MS 39529 and East Stroudsburg University, East Stroudsburg, PA 18301

Substrate preference of the snapping shrimp, *Alpheus heterochaelis*, from Chincoteague, VA was determined through laboratory experimentation. Pairs of shrimp were placed in an experimental tank with six types of substrates (mud, sand, crushed shell, fine gravel, coarse gravel, and pebbles) and a clear area as the control. The shrimp chose the coarse gravel substrate nearly 80% of the time and was followed by the muddy substrate with a mere 11%. The results were significant for the coarse gravel ($P < 0.05$), but not for the muddy substrate ($P > 0.05$).

9:30 RECORDS OF THE GIANT NORTH PACIFIC SQUID *MOROTEUTHIS ROBUSTA* (FAMILY ONYCHOTEUTHIDAE)

Will V. Bet-Sayad* and Glenn R. Parsons, University of Mississippi, University, MS 38677

The giant North Pacific Squid *Moroteuthis robusta* (Family Onychoteuthidae) is an elusive species in its natural habitat and in the literature (fewer than 10 publications). Much of our knowledge of this species comes from specimens that have washed ashore, in physical states that yielded more questions than answers. We report on two specimens of the giant North Pacific squid captured in the Bering Sea. The first was an incidental capture by commercial pollock fishermen while trawling during the day at 210 m depth on 27 June 2002 at 54°28.44' W 165°39.59'. The squid was male and weighed 41.73 kg. Its total length, measured from the top of the mantle to the tip of the longest tentacles, was 3.72 m. The second specimen was captured at 54°30.41' W 165°32.55'. The squid was also an incidental capture by commercial Pollock fisherman while trawling at night at 288 m depth. The squid was female and weighed 33.57 kg. The total length measured 3.2 m. These captures were significant because 1. the species is rare, 2. the proximity of capture of the specimens (within 20 km of each other) may suggest that the area of capture is biologically significant (migratory, mating, or feeding grounds), 3. these were the largest known specimens wherein reliable catch data (location, depth, and time) were available, and 4. being freshly deceased, biological data such as tentacle length, eye diameter and sex was recorded, information rarely available from washed ashore specimens.

9:45 ANTIBACTERIAL ACTIVITY OF LYASE-DEPOLYMERIZED PRODUCTS OF ALGINATE

Xiaoke Hu^{1*}, Xiaolu Jiang², Jun Gong², Huey-Min Hwang¹, Yan Liu², and Huashi Guan², ¹Jackson State University, Jackson, MS 39217 and ²Ocean University of China, Qingdao, 266003, P.R. China

A series of mannuronic acid (M-block) and guluronic acid (G-block) fractions (M1-5 and G1-5) with different molecular weights were obtained by lyase depolymerization of

alginate and evaluated for in vitro antibacterial activity against 19 bacterial strains. The antibacterial data revealed that both types of fractions generally showed activity against certain tested bacteria, whereas M-block fractions showed broader spectra and more potent inhibition than G-block ones. Among these fractions, M3 (molecular weight 4.235 kDa) exhibited the broadest spectrum of inhibition and high inhibitory activity against *Escherichia coli* (minimal inhibitory concentrations, MIC = 0.312 ig mL⁻¹), *Salmonella paratyphi* B (MIC = 0.225 ig mL⁻¹), *Staphylococcus aureus* (MIC = 0.016 ig mL⁻¹) and *Bacillus subtilis* (MIC = 0.325 ig mL⁻¹). This research and the presentation trip are supported by (1) the Shandong Province Key Project of China #003110112 and (2) U.S. Department of the Army #W911NF-04-1-0327.

10:00 Break

10:15 TOWARD MODELING OF THE CIRCULATION OF THE INDONESIAN SEAS

Kieran O'Driscoll* and Vladimir Kamenkovich, University of Southern Mississippi, Gulf Coast Research Laboratory, Ocean Springs, MS 39564

The Indonesian Seas play a crucial role in the global ocean circulation. The circulations in these seas provide the major link between the Pacific and Indian Ocean. The three dimensional circulation of the Indonesian Seas is studied using a primitive equation sigma-coordinate numerical ocean model, the Princeton Ocean Model. A smoothed bottom topography has been used that retains important topographical features affecting the Indonesian Seas circulation (e.g., sills). Four open ports are configured in the model to simulate the impact of the Mindanao Current, New Guinea Coastal Current and North Equatorial Counter Current on the Indonesian circulation. The fourth port is introduced in the Indian Ocean part of the model to support the specified transport of the Indonesian Through-flow. The most difficult part of this study is the formulation of the open boundary conditions. For the barotropic motion we specify the velocity distribution across the ports. For the baroclinic motion some simplified versions of the basic equations are used at the entrance of the ports with nudging to the climatological characteristics. The parameters of nudging for inflow and outflow ports are substantially different. The results of a series of numerical experiments are discussed to reveal the physical mechanisms that control the splitting of the currents within the area and the role of the bottom form stress in the overall momentum balance.

10:30 EFFECT OF SALINITY ON POPULATION GROWTH OF THE MARINE ROTIFER, *COLURELLA* SP.

Vasile Suchar* and Paulinus Chigbu, Jackson State University, Jackson, MS 39217

Few marine rotifer species (*Encentrum linnhei*, *Synchaeta cecilia*, *S. cecilia valentina*, and *S. littoralis*) have been successfully cultured beside *Brachionus plicatilis* and *B. rotundiformis*. A *Colurella* species isolated from the Mississippi Gulf Coast area was cultured with artificial seawater using six different algae species (*Nannochloropsis oculata*, *Chaetoceros gracilis*, *Tetraselmis chuii*, *Isochrysis galbana*, *Rhodomonas salina*, and *Prorocentrum micans*). An experi-

ment was conducted to determine the effects of six salinity levels (10, 15, 20, 25, 30, and 35 ppt) on *Colurella* population growth rate. Rotifers were fed *Nannochloropsis oculata* at a density of 100,000 cells/ml for 15 days. Salinity influenced rotifer production ($p < 0.001$). Rotifer numbers (Mean \pm SD) at the end of the experiment were similar at lower salinity levels (Fisher's PLSD, $p > 0.730$): 15 ppt (25,980 \pm 7071), 10 ppt (22,840 \pm 2640), and 20 ppt (19,780 \pm 1029), but were comparatively higher (Fisher's PLSD, $p < 0.02$) than at 25 ppt (4,240 \pm 1783), 30 ppt (1,300 \pm 264), and 35 ppt (100 \pm 101). Population growth rates (r) of *Colurella* sp. ranged from ~ 0.4 day⁻¹ at 15 ppt to ~ 0.0 day⁻¹ at 35 ppt. The population growth rate of *Colurella* sp. at 30 ppt (~ 0.2 day⁻¹) is similar to the growth rate observed in previous experiments conducted at similar salinity, food type and levels.

10:45 MEASURING BUBBLE VOLUME USING AN ELECTROMAGNETIC DETECTOR

Kevin M. Martin* and Vernon Asper, University of Southern Mississippi, Stennis Space Center, MS 39529

This study looks at a new technique to quantify the bubbling volumes using an inductive conductivity cell. The principle behind this device is that a bubble passing through the inductive cell will displace seawater, changing the conductivity of the volume detected by the sensor. The changes in conductivity can be empirically related to bubble volume. The prototype device, based on a Brancker analogue conductivity cell, uses a Tattletale Model 8 data logger to digitize and record the analogue signal. Under laboratory conditions of 1 atm, 20 °C and $S = 35$, preliminary results confirm the expected drop in conductivity resulting from a bubble displacing the volume of seawater detected by the sensor. These conductivity changes appear to be proportional to the bubble volume and our ongoing efforts will focus on calibrating the system using a variety of bubble sizes.

11:00 DETERMINATION OF V, MN, AND CO IN SEAWATER USING MAGIC WISRD AND HR-ICP-MS

Alan Shiller* and Patrick Heidingsfelder, University of Southern Mississippi, Stennis Space Center, MS 39529

Magnesium-induced co-precipitation (MagIC) has been used for the determination of a number of elements in seawater. The principle of the method is straight forward: a small amount of clean ammonium hydroxide is added to the sample to precipitate magnesium hydroxide which, in turn, scavenges the elements of interest from solution. For ICP-MS analysis of dissolved metals in seawater, others have used an isotope dilution version of this method. We have extended this method for the determination of mono-isotopic Mn and Co as well as V (for which a suitable enriched isotope spike is not available) in seawater. Enriched isotopic spikes of Cr and Fe are added to the sample, the precipitation performed and the elements quantified "with internal standard ratio determination" (WISRD). Absolute calibration of Mn, Co, and V is performed by analysis of a known standard. Medium resolution HR-ICP-MS analysis is required to resolve spectral interferences from remaining sea salt. Typically, 5 mL of seawater is used and detection limits in the picomolar range are achievable. In other words, with this method we can determine these elements at their natural levels in uncontaminated seawater. Use of

enriched Cr and Fe as internal standards allows quantification of those elements at the same time. We have further extended the method to most of the first row transition elements by addition of enriched Cu, Ni, and Zn.

MATHEMATICS, COMPUTER SCIENCE AND STATISTICS

Chair: Andrew Harrell, CEWES-GM

THURSDAY MORNING

Magnolia A

8:45 Divisional Poster Session

THE SATELLITE LIST AND K-LEVEL SATELLITE TREE: NEW DATA STRUCTURES USEFUL FOR FINDING HAMILTONIAN CYCLES

Colin Osterman* and Cesar Rego, University of Mississippi, University, MS 38677

We propose new data structures—the Satellite List and k-Level Satellite Tree—for representing paths and cycles with a discussion of properties in the framework of general graph operations. We show that the k-Level Satellite Tree is far more efficient than its predecessors.

Oral presentations begin

9:20 GENERATING MOLECULAR GRAPHS FOR PRE- DICTIVE CHEMISTRY

Laura Sheppardson, University of Mississippi, University, MS 38677

Graph theoretical methods have long been used to enumerate the isomers of organic compounds. There are few practical tools, however, for generating a listing of all isomers with a specific chemical formula. This talk will discuss a current project to develop such a generator. The graphs produced may be considered potential reaction products, and used to guide searches for novel chemical reactions. We first examine the difficulties of exhaustive, non-redundant graph generation, and then discuss several methods which have been successfully applied to overcome these difficulties. Most generators developed to date have imposed specific limitations on graph properties (e.g., planarity, regularity) to control the number of graphs considered. We address the general case, and describe an algebraic method which can be employed to avoid redundancies.

10:00 Break

10:20 A NEW RAMP ALGORITHM FOR THE CAPACI- TATED MINIMUM SPANNING TREE PROBLEM

Frank Mathew^{1*}, Cesar Rego¹, and Fred Glover², ¹University of Mississippi, University, MS 38677 and ²University of Colorado, Boulder, CO 80309

The capacitated minimum spanning tree (CMST) problem is fundamental to the design of communication networks, and has been widely studied for its importance in practical applications. Nevertheless, the best methods to date still have difficulty finding solutions of highest quality. We show how a variant of the Relaxation Adaptive Memory Programming (RAMP) method succeeds in solving the CMST effectively. The RAMP approach is a relatively new meta-heuristic procedure that takes advantage of primal and dual relationships and adaptive memory programming derived from tabu search. In this research we implemented a version of the RAMP approach that uses surrogate constraint relaxations and adaptive memory to create and project dual solutions onto the primal feasible space. Computational results on a classical set of benchmark instances indicate that even a simple version of the RAMP approach advantageously compares with current state-of-the-art algorithms for the CMST problem. We also sketch how more advanced RAMP strategies can be employed to achieve further enhancements.

10:40 A SIMPLE RAMP ALGORITHM FOR THE SET COVERING PROBLEM

Jose H. Ablanado* and Cesar Rego, University of Mississippi, University, MS 38677

The Set Covering Problem (SCP) is a classical combinatorial problem used to model a wide range of applications such as airline and railway crew scheduling, political districting, and truck routing, just to cite a few. The problem is NP-Hard and therefore heuristic algorithms are required to solve large scale instances such those commonly arising in real world applications. We present a new algorithm for the SCP based on a relatively simple RAMP approach that combines surrogate constraints relaxation with tabu search. Computational results carried out on a standard set of benchmark problems indicate that the proposed algorithm is competitive with the best and suggest the use of more advanced RAMP strategies to achieve better performance.

THURSDAY AFTERNOON

Magnolia A

1:40 PATTERN RECOGNITION SOFTWARE TOOL DEVELOPED FOR THE CLASSIFICATION OF REMOTE SENSING SPECTRAL REFLECTANCE DATA

Abdullah Faruque^{1*}, Raj Bahadur², and Gregory A. Carter³, ¹Southern Polytechnic State University, Marietta, GA 30060; ²Mississippi Valley State University, Itta Bena, MS 38941; ³Gulf Coast Research Laboratory, Ocean Springs, MS 39566

This paper describes the development and implementation of LIP (Leaf Identification Program), a pattern recognition software tool intended to classify remote sensing spectral reflectance data of stressed soybean leaves by using neural network and other statistical pattern recognition techniques. The development of this software tool takes advantage of the high performance computational and visualization routines of the MATLAB programming environment. LIP provides an integrated environment for various data analysis, data visualiza-

tion and pattern recognition techniques to analyze remote sensing spectral reflectance data. Data analysis component of LIP includes: principal component analysis, fisher and variance weight calculations and feature selection. Data visualization tool permits visual assessment of the spectral reflectance data patterns and their relationships. Several classification methods have been implemented in LIP using both neural network and statistical pattern recognition techniques. Neural network methods include the back propagation neural network (BPN) and radial basis function (RBF) neural network. Statistical pattern recognition component of LIP includes linear discriminant analysis (LDA), quadratic discriminant analysis (QDA), regularized discriminant analysis (RDA), soft independent modeling of class analogy (SIMCA) and discriminant analysis with shrunken covariance (DASCO). 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. LIP software tool has been used successfully to classify the different classes of stressed leaves from their spectral signature.

2:00 A MATRIX EIGENVALUE APPROACH TO TEAM RANKINGS

Kendrick Savage* and James Reed, University of Mississippi, University, MS 38677

A fundamental problem in ranking sports teams is the incomplete nature of most competitions where some teams play each other and some do not. It is challenging to compare teams that do not play each other. An example of this phenomenon is the controversy surrounding the selection of the 2003 NCAA Division 1 Football Champion. Both Louisiana State University and the University of Southern California were named champions by different polls. A reason for the uncertainty as to which of these teams should be higher ranked is the fact that they did not play each other. In fact most of the NCAA Division 1 teams do not play each other as there were 117 such teams in 2003 but each team played roughly 12 games. Hence each team only plays roughly 10% of all the other Division 1 teams. This situation is analogous to the problem of ranking web pages where some pages are linked to each other but the vast majority of web pages are not. The internet search engine Google assigns a rank to each web page called the pages "pagerank". The method Google uses is to model the importance of a particular page relative to the importance of pages that are linked to this particular page. The ranking vector of all web pages is an eigenvector of a matrix. Motivated by the success of the Google pagerank ranking scheme, we apply a similar ranking scheme based on eigenvectors to the 2003 NCAA Division 1 Football Season. We will find the Division 1 School with the largest ranking in the real positive eigenvector of largest modulus. The results of this research will have applications to practical personnel assignment problems. The incomplete information available is the common difficulty of each of these problems: ranking web pages, ranking sports teams, matching job applicants to positions.

2:20 Divisional Business Meeting

FRIDAY MORNING

Magnolia A

Special Subsession on Supercomputing and Concurrent Poster Session

8:00 ADDRESSING INSTALLATION AND CONFIGURATION ISSUES IN A COMPUTATIONAL RESEARCH GRID AT THE MISSISSIPPI CENTER FOR SUPERCOMPUTING RESEARCH

Tyler A. Simon*, Jason Hale, and Taner Pirim, University of Mississippi, University, MS 38677

The nature of GRID computing enables one to harness the resources of remote, heterogeneous computers over potentially wide geographic areas to accomplish computationally intensive tasks. Our testing environment is composed of a RedHat Linux cluster, a SuSE Linux symmetric multiprocessor and an Onyx 10000 Supercomputer running Irix 6.5. Our GRID is constructed using a layered services architecture that uses the Globus Toolkit for Application management, and the Java programming language for application development, and OpenSSL as our persistent inter-node security protocol. To test the system we run MPI jobs that traditionally run on clusters and symmetric multiprocessors. The benefits of this project aim at enabling the researchers of the state of Mississippi with high performance, real time collaboration, as well as letting them take advantage of the emerging technologies that support a GRID computing environment.

8:10 A CUSTOM MULTIHOMED NETWORK TOPOLOGY FOR CLUSTER LOAD BALANCING

Tyler A. Simon, University of Mississippi, University, MS 38677

The current network topology of the Beowulf Linux cluster at the Mississippi Center for Supercomputing Research is composed of a single high bandwidth interconnection ring that facilitates both inter-node communication and disk access. As our production environment has demonstrated, a single thread connecting hundreds of machines can become saturated as processor demands and file I/O increase, leading to reduced overall system performance. We address this single point of contention by distributing interprocess communication and file access over separate network interfaces, and therefore through separate switches. Positive results from these tests involve a reduction in total execution time for a particularly common job requiring consistent disk access and interprocess communication. The goal of this work is to be able to increase cluster performance using a custom low cost load balancing mechanism, that may be applied to a common design problem in ring topologies to increase overall cluster performance.

8:25 AN EXPANDED DYNAMIC LOAD BALANCING TECHNIQUE FOR OVERCOMING CLUSTER NODE FAILURES USING MPI

Jason Hale* and Jie Tang, University of Mississippi, Oxford, MS 38677

The goal of shared memory parallel computers and distributed memory compute clusters is to increase the perfor-

mance of computations over what is possible on single-CPU systems. MPI is a widely used message passing interface for parallelizing computations on distributed memory architectures, such as Beowulf clusters. One of the strategies in optimizing parallel performance is keeping as many available processors/nodes as possible productive at all times. In problems where the work is not clearly divisible by the number of processors available, many processors may sit idle after completing their subtasks, while one or few processors solve the remainder of the problem. In heterogeneous computer clusters, processors of differing speeds may be allocated to the problem, further complicating the task of equally distributing load to maximize performance. Furthermore, if one node of a cluster fails, it can often be rebooted, repaired, or replaced without affecting the rest of the cluster, but parallel computations that were using that node often fail to complete satisfactorily, yet may linger hopelessly in a defunct state, tying up scarce resources and delaying other jobs. Once the doomed job is finally detected and deleted, the user may have to resubmit the job, and wait hours or days before the resubmitted job accumulates enough resources privileges to try to run again. Well-known techniques allow the programmer to anticipate work inequities and write programs that attempt to carve up and dynamically distribute remaining work among available processors. We propose an expanded load balancing technique to allow the original program to save valuable time by surviving the failure of a node, and explore the technique on the Mimosa Intel cluster at the Mississippi Center for Supercomputing Research (MCSR).

8:45 THE PERFORMANCE ANALYSIS OF HIGH PERFORMANCE LINPACK BENCHMARKS ON ALTIX 3700 AND BEOWULF LINUX CLUSTER

Taner Pirim, University of Mississippi, University, MS 38677

The Mississippi Center for Supercomputing Research, MCSR, has recently increased the capacity of its resources by adding a new supercomputer to its High Performance Computing, HPC, lineup, which is acquired in July 2004 and put into production in August 2004. Named "redwood," the new SGI Model 3700 Altix high performance compute server with 64 Itanium2 processors, 64 Gigabytes memory, and 2.336 Terabytes fiber channel disk system serves as a capability resource for researchers who have particularly high performance codes and calculations that cannot be run efficiently on other MCSR supercomputers or clusters. This study presents the high performance linpack benchmark, HPL, analyses of the new SGI Altix 3700 as well as the Mimosa Beowulf Linux Cluster with various configurations such as idle, non-idle situations and different network speeds. It also compares the results obtained from both systems. Furthermore, we outline the importance of running such tests as a method for obtaining reliable processing capability for multi-node supercomputing applications. Thorough analyses of the benchmark results have helped the center to distinguish the performance differences between two systems, numerically. The analysis also has proven to be an integral and necessary step toward system optimization and increased overall performance for the researchers in the state of Mississippi.

9:05 MISSISSIPPI CENTER FOR SUPERCOMPUTING

RESEARCH (MCSR) USER ADVISORY GROUP MEETING, POSTER SESSION, AND SPECIAL SUBSESSION ON SUPERCOMPUTING

David G. Roach, University of Mississippi, University, MS 38677

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, 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, showcasing research projects that utilize MCSR facilities and services, will follow the Advisory Group Meeting. A Special HPC Subsession of the Mathematics, Computer Science and Statistics Division, sponsored by the MCSR, will also be held to serve as a forum on supercomputing in which faculty and graduate student researchers will have the opportunity to describe their research projects that involve HPC, Internet2, Grid Computing, Visualization, Network Security, Computer Systems Administration, 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 and participate.

9:20 Break

Regular Session Resumes

9:40 EVALUATING COMPUTATIONAL CHEMISTRY APPLICATIONS ON PARALLEL COMPUTING PLATFORM

Haibo Wang, University of Mississippi, University, MS 38677

Many computational chemistry applications have studied by means of different types of parallel computing methods. This presentation will report on a way of evaluating different parallel approaches for these applications. A set of benchmark problem is created by user community for this study. The hardware and software limitations on the parallel implementation for the methods that solve these applications will also be discussed. And, a strategy for resource management to be used while solving the applications will also be included.

10:00 TOWARD AB INITIO THEORETICAL PREDICTIONS OF CHEMICAL REACTIONS

Gregory S. Tschumper* and Brian W. Hopkins, University of Mississippi, University, MS 38677

Although computational chemistry has evolved into a reliable laboratory tool, the theoretical "prediction" of a chemical reaction generally requires a priori knowledge of the potential energy hypersurface (PES). In other words, not only

must the reactan(s) be specified but also the product(s) and possibly the transition state(s) and intermediate(s). In this way, the predictive ability of computational chemistry is to a large extent limited by the creativity of chemists. Standard methods are, for example, incapable of finding unspecified or unknown reaction paths. Methods have been developed to address this shortcoming (e.g., isopotential searching and molecular dynamics). Presented here is a different approach to the prediction of chemical reactions and reaction mechanisms that is grounded in graph theory. By combining simple principles from graph theory and chemistry, it is possible to generate every feasible atomic connectivity pattern on a PES by merely specifying the reactant(s). These atomic patterns can be conveniently stored as matrices and converted into 3D molecular structures that can subsequently be used to guide existing methods. This graph theoretical technique allows chemists to systematically and efficiently explore a PES without a priori knowledge of its topology.

10:20 CHARACTERIZING URBAN VEHICLE TEST COURSES BY THEIR POWER SPECTRA

Andrew W. Harrell, Engineering Research and Development Center (ERDC), Vicksburg, MS 39180

This paper will discuss various ways to use wavelet detrending parameters to learn and identify patterns in power spectra. ERDC vehicle ride courses with urban obstacles were analyzed in terms of different time averaged, or windowed, Fourier transform formulas in order to characterize the spectra of their elevation profiles. Simulation results of the High Mobility Multi-purpose Wheeled Vehicle (HMMV) on two different test courses, both with nearly the same root mean square (RMS) variation, have been found to generate different power spectra response characteristics in test vehicles. The Vehdyn mathematical model that was used for parallel simulations, models a test vehicle's response as being primarily due to the RMS of the test course. In these simulations the spacing of the bumps was found to generate different power spectral characteristics in different test courses with the same RMS. Thus, improving the theoretical understanding of how to characterize the power spectra of the courses should give us new and better ways to improve and validate our modeling. For instance, we expect to see this in terms of developing a better understanding of the effects of the surface geometry in urban terrain with sharp discontinuities such as potholes and obstacles on military vehicles.

10:40 EFFECTIVE INFORMATION EXTRACTION USING NATURAL LANGUAGE PROCESSING TECHNIQUES

Susan Lukose*, Frank Mathew, Sumali Conlon, and Pamela Lawhead, University of Mississippi, University, MS 38677

Information available in electronic form has grown exponentially with the growth of the Internet. Most of this information is in the form of text and is spread over a wide range of documents. If this information can be structured into a tabular form and stored in a database, it can be used for efficient decision making by systems like Real Time Expert Systems, Decision Support Systems, or intelligent agents. But manually going through all these documents to extract information is not practical. Therefore there is a need for automatic

information extraction. Our approach to this problem is to build a partially domain independent information extraction system using natural language processing techniques and resources such as the lexical database WordNet and Collocation Information to perform semantic and syntactic text analysis. System development consisted of two phases. In the training phase, a knowledge base was built, which was later used in the test phase to extract information. This extracted information is structured and hence can be stored in a database easily. The unstructured input data that we use are the international corporate reports which appear in the Wall Street Journal. The performance of the system was evaluated using precision and recall of the output and the results obtained were satisfactory with the precision at 85% and recall at 87%.

11:00 Awards

PHYSICS AND ENGINEERING

Chair: Robert S. Fritzius, Shade Tree Physics

Vice-chair: Alexander B. Yakovlev, University of Mississippi

THURSDAY MORNING

Magnolia B

Antenna Research

8:00 ADAPTIVE NULLING IN A PHASED ARRAY ANTENNA WITH A GENETIC ALGORITHM

Andy Harrison, Radiance Technologies, Inc., Huntsville, AL 35805

The objective of this work was to show an approach to adaptive nulling in systems that incorporate a phased array antenna. This approach for adaptive nulling is based on the genetic algorithm. When operating a system in the presence of one or more strong interfering sources, sidelobe levels may not be low enough to ensure adequate reception of the desired signal. A method for overcoming this problem is adaptive nulling. In this method, the amplitude and phase coefficients of each element in the phased array are adjusted in such a fashion as to place a null in the antenna pattern in the direction of the interfering sources. Since the genetic algorithm is a global search method, a solution is found that places very deep nulls in the desired directions, while maintaining the characteristics of the antenna main beam. The sidelobe structure of the antenna pattern is distorted and other optimization parameters may be added to the genetic algorithm as needed.

8:15 PROBLEMS IN DESIGNING BEAM FORMING NETWORKS FOR HIGH FREQUENCY APPLICATIONS

Manish Hiranandani* and Ahmed A. Kishk, University of Mississippi, University, MS 38677

Recently, Beam Forming Networks (BFN) have been

attracting more attention as their applications evolve from military to commercial purposes. Today, the most common beam forming networks are the Butler Matrices and Rotman lens. In this project, we analyze the performance of these BFNs operating in the X-band (8-12 GHz). The Butler Matrix and Rotman lens are $N \times N$ passive microwave networks, consisting of 'N' input and 'N' output ports, used to feed an array of 'N' antennas. The above $N \times N$ networks generates a set of 'N' orthogonal beams, which could scan the whole visible region. Broad banding techniques are introduced in the conventional circuits to obtain appreciable wide band performance. Problems encountered in designing such networks at high frequencies are addressed. The designs are simulated using a full wave commercial code based on the method of moments. The networks are then fabricated and tested using a Hewlett-Packard 10C Network Analyzer to obtain the S-parameters. Good agreement between the computed and measured results is obtained.

8:30 WIDEBAND TWO-DIMENSIONAL ARRAYS OF MICROSTRIP-PROXIMITY FED RECTANGULAR SLOT ANTENNAS WITH LOW SIDELobe LEVEL

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

In applications where loss, dispersion, size, weight, cost, performance, ease of installation, and aerodynamic profile are constraints, printed slot antennas offer viable alternatives to other types of traditionally used antennas. Moreover, in some applications like wireless communications and radar systems, very wide bandwidth and high gain are among the main design objectives. This paper presents the design of two-dimensional arrays based on microstrip-proximity fed rectangular slot antennas for marine RADAR applications. Two designs are conducted, one consists of 16x4-element array, and the other consists of a 32x4-element array. A wideband corporate (parallel) feed network is designed to feed the proposed arrays, rather than the narrowband feed network used with the traditional patch array for this type of application. The designed feed network for the 16x4-element array provides uniform power distribution, while the feed network of the 32x4 array uses Dolph-Tschebyscheff coefficients to reduce the levels of the sidelobes. The measured return loss and radiation patterns are presented for the proposed array designs.

8:45 ANALYSIS OF RADIATION APERTURE ANTENNA USING THE REGION-BY-REGION FDTD METHOD

Yizhe Zhang*, Ahmed A. Kishk, Alexander B. Yakovlev, and Allen W. Glisson, University of Mississippi, University, MS 38677

In the finite difference time domain method (FDTD) method a non-rectangular computational domain is usually approximated by a rectangular domain to terminate the region by an absorbing boundary. Internal problems can be modeled efficiently using the region-by-region approach in order to discretize only the non-conducting parts of the problem in order to reduce memory requirements and CPU time. Here, the same technique is used to analyze open structure such as aperture and horn antennas. In this work, the region-by-region approach is applied for modeling rectangular horn antennas. The far field

radiation patterns are computed based on the Fourier transformed aperture distribution.

9:00 ANALYSIS AND DESIGN OF PRINTED VIVALDI ANTENNA FOR WIDEBAND APPLICATIONS

Walker Hunsicker*, Atef Z. Elsherbeni, and Charles E. Smith, University of Mississippi, University, MS 38677

The dual use of printed circuit boards in communications devices for circuit mounts and antenna substrates has generated a whole new category of antenna. Printed and slot antennas take advantage of the highly refined and inexpensive dielectric boards by conforming metallization patterns to produce desired radiation patterns and gains. One such design which exhibits wideband characteristics is the Vivaldi antenna. The exponential taper of this class of antenna is the dominant feature of the geometry. The design of the Vivaldi antenna is documented but with few details on how to mathematically construct it. Most of the available designs exhibit very complicated feeding structures to properly excite the antenna. This paper investigates simple feeding configurations for the printed Vivaldi antenna with an emphasis on wideband performance. The structure proposed is simulated with a finite difference time domain code to extract the input parameters and far field patterns. A prototype of a successful design is built and a comparison between measured and simulated results is performed to confirm the validity of the design.

9:15 Break

Transmission Lines/Waveguides

9:30 ANALYSIS OF PRINTED TRANSMISSION LINES

Asem Al-Zoubi* and Ahmed A. Kishk, University of Mississippi, University, MS 38677

Coplanar waveguides (CPWs) are finding extensive applications in microwave integrated circuits. Many structures have been analyzed using the conformal mapping method, the CPW with lower ground planes, asymmetric CPW (ACPW) with conductor backing, and conductor-backing ACPW with one lateral ground plane. Here, closed form expressions for the effective relative permittivity and the characteristic impedance of the asymmetric CPW with finite-extent ground and finite ground-backing are studied using the conformal mapping method (CMM). Closed form expressions for the effective relative permittivity and the characteristic impedance are derived. Various structures can be analyzed from the original structure. Also, the asymmetric CPW line with finite-extent ground and finite ground-backing is analyzed using the finite difference method (FDM). The formulation of the problem is based on the solution of Laplace's equation subject to appropriate boundary conditions, and the use of Taylor's series expansion to approximate the first and second order derivatives in Laplace's equation. Numerical results from the two methods are compared. The effect of various parameters such as: slots asymmetry, finite ground, substrate dielectric material, strip width, slots width, and substrate thickness of asymmetric CPW with finite-extent ground and finite ground-backing and microstrip line with finite ground planes are studied using the expressions obtained.

9:45 DIPOLE AND SLOT PERIODIC STRUCTURES FOR THE REALIZATION OF HARD AND SOFT SURFACES

Manish Hiranandani*, Alexander B. Yakovlev, and Ahmed A. Kishk, University of Mississippi, University, MS 38677

Hard and soft surfaces have been recently introduced as GO and STOP surfaces, respectively, with respect to the direction of propagation along the surface. Ideally, they could be viewed as periodic alternating perfect electric conductor (PEC) and perfect magnetic conductor (PMC) strips with period length approaching zero. In recent years, different methods of realizing artificial hard and soft surfaces have been developed. One of them is based on the use of dielectric-filled corrugated surfaces. Another common method is to introduce PEC strips on a dielectric slab of with the proper thickness, which is close to a quarter wavelength. A new method has been developed to create artificial hard and soft surfaces by mounting dipoles and slots in a periodic form on a conductor-backed dielectric slab [Maci S. and Kildal, P. S., Int. Symp. Electromagnetic Theory, Pisa, Italy, May 2004]. The new structure removed the restrictions on the dielectric slab thickness. Therefore, soft and hard surfaces can now be realized using thin substrates. These structures act as hard and soft surfaces for TE and TM polarizations, depending on the direction of the incident plane wave. In the present paper, the results obtained in the above paper are verified and the analysis of these structures is further extended in order to create new designs of multiband and polarization independent hard and soft surfaces. A full wave commercial software based on the method of moments is used for the analysis of the periodic structures. Such structures are technologically simple and can be implemented using etching techniques.

10:00 DYADIC GREEN'S FUNCTION ANALYSIS OF AN IDEAL HARD SURFACE RECTANGULAR WAVEGUIDE

Wei Huang*, Alexander B. Yakovlev, Ahmed A. Kishk, Allen W. Glisson, and Islam A. Eshrah, University of Mississippi, University, MS 38677

A rectangular waveguide with an ideal hard surface is studied, which is modeled by alternating the longitudinal perfect electric conductor (PEC) and perfect magnetic conductor (PMC) strips with vanishing widths. Compared to PEC and PMC rectangular waveguides, which can support only TM and TE modes, the most important feature of this "ideal hard surface rectangular waveguide" is that it allows a propagation of the TEM mode with a zero-cutoff frequency, which can provide new applications for this type of guided-wave structure. The purpose of the this paper is to develop an electric dyadic Green's function for the modal analysis of an ideal hard surface rectangular waveguide excited by an arbitrarily-oriented electric current source. A procedure for deriving the Green's function in terms of solenoidal and irrotational parts is presented, wherein the solenoidal part of the Green's function is obtained in the eigenmode expansion form as a superposition of three terms associated with TM, TE, and TEM modes of the ideal hard surface waveguide. A term corresponding to the TEM mode is obtained analytically as the solution of a vector Helmholtz equation in the zero-cutoff limit subject to the boundary conditions of electric field on the ideal hard surface.

Numerical results of the field distribution are demonstrated for the TEM mode and a few representative TM and TE modes propagating in a rectangular waveguide with ideal hard surface boundary conditions due to an arbitrarily-oriented electric dipole source.

10:15 PARAMETRIC STUDY OF THE DRA-WAVEGUIDE-BASED SPATIAL POWER COMBINING SYSTEM USING FDTD

Yizhe Zhang*, Ahmed A. Kishk, Alexander B. Yakovlev, and Allen W. Glisson, University of Mississippi, University, MS 38677

A generalized scattering matrix (GSM) approach that utilizes the finite-difference time-domain (FDTD) method is used to analyze waveguide-based coaxial probe-fed dielectric resonator antenna (DRA) arrays for use in spatial power combining system. First, a rectangular waveguide with hard walls (dielectric loading along narrow sides of the waveguide) is analyzed to achieve a uniform field distribution in the waveguide cross-section. This is crucial for the waveguide-based DRA array in order to provide a uniform (with respect to magnitude and phase) excitation of antenna elements. Next, a single DRA is studied for operation in the waveguide environment. This includes a parametric analysis of DRA geometrical and material parameters and coaxial probe feed position and dimensions. The analysis is further extended to the case of the DRA array in order to minimize mutual coupling between antenna elements and provide a uniform coupling of the power to individual DRAs. The numerical results obtained using our FDTD code that is based on the region-by-region approach are compared with those obtained using commercial three dimensional (3-D) software and exhibit very good agreement.

10:30 MODELING PERIODIC STRUCTURES USING FINITE-DIFFERENCE TIME-DOMAIN METHOD

Guiping Zheng*, Ahmed A. Kishk, Allen W. Glisson, and Alexander B. Yakovlev, University of Mississippi, University, MS 38677

In this work, numerical analysis of periodic structures based on the finite difference time domain (FDTD) method is presented. In many electromagnetic applications, structures have properties of periodicity in one or two dimensions, such as for frequency selective surfaces (FSS), photonic bandgap (PBG) structures, and infinite antenna arrays. The FSS structures have been widely used to construct a high impedance ground plane. By using a high impedance ground plane, the performance of antennas can be greatly improved. Low profile, low sidelobe levels, and high efficiency for antennas can be achieved in this way. The FDTD technique has been successfully used to obtain the numerical solution without resorting to the complex frequency domain analysis required in the Method of Moments (MoM). To implement the FDTD method in these periodic structures, Maxwell's equations are transformed and modified so that the complex periodic structures can be simply modeled by one unit cell with proper periodic boundary conditions. Several validation cases including FSS and antenna arrays are presented.

THURSDAY AFTERNOON

Magnolia B

Graphical Processing Simulations and Analyses

1:30 A GRAPHICAL USER INTERFACE (GUI) FOR PLANE WAVE SCATTERING FROM CHIRAL SPHERES

Veysel Demir^{1*}, Atef Z. Elsherbeni¹, Denchai Worasawate², and Ercument Arvas³, ¹University of Mississippi, University, MS 38677; ²Kasetsart University, Bangkok, Thailand; and ³Syracuse University, Syracuse, NY 13244

Various numerical techniques have been developed which model the electromagnetic field propagation in various novel complex media. The validity of these techniques is usually verified by comparison to the exact solutions of canonical problems. Recently, the chiral medium has gained focus in research, and electromagnetic wave propagation in chiral media has been modeled by various numerical techniques in various studies. In most of these studies, the validity of the developed techniques is verified by comparing the numerical results to the results of one-dimensional and two-dimensional problems that have known exact solutions. For the techniques solving three-dimensional problems, plane wave scattering from a chiral sphere is the benchmark. In this contribution, a software package is developed and presented to calculate plane wave scattering from a chiral sphere. The package involves a user-friendly GUI, which enables the user to enter the scattering parameters and observe the results, in near real time, and save the calculated data and displayed figures. Due to the nature of the chiral constitutive relations, the developed program can be used to calculate scattering from a dielectric or a perfectly conducting sphere as well.

1:45 USE OF GRAPHIC PROCESSING UNITS FOR GENERAL SCIENTIFIC COMPUTATIONS

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

Over the past few years, developments in the field of graphic processing units (GPU's) for video cards have vastly outpaced their general central processing unit (CPU) counterparts. As specifically applied to vector mathematic operations, the newest generation GPUs can generally outperform current CPU architecture by a wide margin. With the addition of large onboard memory units with significantly higher memory bandwidth than found in the main system, graphic cards can be utilized as a highly efficient vector mathematic co-processor. Implementing functions in high-level languages that utilize the vector processing power of the video cards, an appreciable increase in the effective speed for vector and matrix computations that are widespread in scientific computing currently can be achieved. By formulating proper procedures to realize general vector computations on GPUs it will be possible to maximize the processing power available to an extent greater than possible without the addition of the video card. This talk will review the state of the art in GPU for scientific programming with emphasis on numerical techniques for electromag-

netics and antenna applications.

2:00 MUR'S ABSORBING BOUNDARY CONDITION FOR THE SPLIT-FIELD METHOD

Guiping Zheng*, Ahmed A. Kishk, Allen W. Glisson, and Alexander B. Yakovlev, University of Mississippi, University, MS 38677

In this work, a second order Mur's absorbing boundary condition for the split-field method in the finite-difference time-domain (FDTD) method is presented. In many electromagnetic applications, one needs to model an "open" region or a structure that is situated in free space, such as a scattering or a radiation system that is radiating into unbounded space. Unfortunately, due to the limitations of the computational resources, the field computational domain in FDTD must be limited in size and suitable absorbing boundary conditions (ABC) on the outer perimeter of the domain must be applied to simulate its extension to an infinite domain. Before the Perfectly Matched Layer (PML) ABC was introduced, Mur's second order ABC and its extension played an important role in the FDTD technique. Compared to the PML ABC, Mur's second order ABC is much simpler and more convenient. In many applications, when the PML ABC is not easy and convenient to construct, Mur's second order ABC is a good alternative approach. When modeling periodic structures in the FDTD method, Maxwell's equations are transformed, modified, and discretized by using split fields. In order to properly absorb the outgoing waves, the Mur's procedure used to truncate the FDTD computational domain must also be transformed and modified. In this work, several validation cases including frequency selective surface (FSS) are presented.

2:15 FINITE-DIFFERENCE TIME-DOMAIN SIMULATION OF THE HUMAN HEAD

Veysel Demir* and Atef Z. Elsherbeni, University of Mississippi, University, MS 38677

Development of tools for numerical analysis of electromagnetic scattering and absorption in the human body has been the focus of many researches because these tools can be used for various purposes such as the evaluation of the specific absorption rates (SAR) for determination of the safe use of electromagnetic devices, diagnosis of tumors, etc. In this contribution, a finite-difference frequency-domain (FDFD) procedure is developed in order to simulate electromagnetic wave and human head interactions. The advantages of the FDFD method is its accuracy and stability. In order to integrate the human head model into the simulations, the head has to be discretized to fit in the FDFD computational domain. A human head model is obtained from magnetic resonance imaging (MRI) data. Some of the artifacts from these data are cleaned and then an anatomic head model, which includes the three dimensional distribution of various tissues, is constructed. Every biological tissue is assigned specific permittivity, permeability and conductivity values. The electromagnetic simulation is performed using the head model data and these electrical parameters. After the simulation, electromagnetic field distributions in the head can be viewed in any cross-sectional plane cut for medical diagnosis.

2:30 ITERATIVE MULTI-REGION TECHNIQUE FOR LARGE ELECTROMAGNETIC SCATTERING PROBLEMS

Mohamed Al Sharkawy*, Veysel Demir, and Atef Z. Elsherbeni, University of Mississippi, University, MS 38677

One of the techniques for solving large electromagnetic problems is to divide the computational domain into smaller sub-domains and solve each sub-domain separately. Then the sub-domain solutions are to be combined following a procedure that incorporates the interactions between these sub-domains to obtain a solution for the complete domain. In this work, we present a new technique based on the finite difference frequency domain (FDFD) method and an iterative procedure between the sub-domains to calculate the scattering from multiple two dimensional objects. The problem is decomposed into separated sub-domains, in each sub-domain, the scattered electromagnetic near fields are calculated due to the incidence of a time-harmonic wave, using the FDFD method. Then fictitious electric and magnetic currents on imaginary surfaces surrounding the objects in these sub-domains are calculated, using the equivalence principle. Radiated fields by these currents are then considered as incident fields on the opposing sub-domains. The same procedure of calculating the sub-domain field components, the fictitious currents and the radiated fields on the opposing domains is repeated iteratively until a convergence criterion is achieved. This technique effectively reduces the size of the required memory, especially for practical and three-dimensional problems. Furthermore, the central processor unit time reduction can be achieved if the separation between the sub-domains is large and/or coarser grids are used in some of the sub-domains.

2:45 NEURAL NETWORKS APPROACH FOR SOLVING INVERSE ELECTROMAGNETIC SCATTERING BY A PARTIALLY BURIED DIELECTRIC SPHERE IN A GROUND PLANE

Chye Hwa Loo* and Michael M. Hamid, University of Mississippi, University, MS 38677 and University of South Alabama, Mobile, AL 36688

An analytic solution of the problem of electromagnetic scattering by a dielectric spherical scatterer resting on, or partially buried in, an infinite perfectly conducting ground plane is formulated using the method of images. The scattered field coefficients are solved exactly so that the scattered field can be calculated as a function of the sphere radius and permittivity as well as the burial distance for any specified angle of incidence. The solution of this problem is relevant to analyze the scattering by complex three-dimensional bodies, plastic mines, icebergs, rough surfaces, etc., in which the flat background can be modeled by the ground plane while the complex body can be simulated by a sphere or a system of spheres partially truncated and resting on the ground plane. In order to solve the inverse scattering problem, we employ a radial basis function network to take the scattered field complex coefficients for the TE and TM polarization case as the network inputs to predict the three outputs of the electrical radius, burial distance, and relative permittivity of the sphere. The trained network is able to retrieve the three aforementioned parameters from new data that is different from the learning data. The neural network approach is simple, straightforward

and time saving, compared with analytical and numerical techniques.

4:00 Divisional Poster Session

INVESTIGATION OF THE THRU-REFLECT-LINE CALIBRATION TECHNIQUE FOR PACKAGED TRANSISTORS AND INTEGRATED CIRCUITS

Dalia Elsherbeni*, W. Elliott Hutchcraft, Charles E. Smith, and Darko Kajfez, University of Mississippi, University, MS 38677

The widespread use of vector network analyzers (VNAs) to characterize high frequency networks over wide frequency requires very precise calibration. Traditional, full, two-port calibration methods typically use three impedance standards and one transmission standard to calibrate VNAs. The standards normally used in this method are a short, open, load, and thru (the SOLT calibration). SOLT calibration standards can be difficult—if not impossible—to build in many non-coaxial measurement applications (such as in-fixture, wafer and waveguide measurements) which limits application for some frequency ranges and/or geometrical line configurations. In this paper, a newer calibration technique, called the thru-reflect-line (TRL) for two-port calibration that uses at least three standards to define the calibrated reference plane, is studied for use in testing packaged transistors and ICs having microstrip interface connections. Microstrip TRL standards for the thru, reflection, and line are designed, fabricated and tested primarily for X-band applications (8.2–12.4 GHz). TRL is the most accurate and widely used calibration method, but the frequency range coverage is limited to approximately an 8:1 ratio. The measured parameters of the thru, reflect, and line standards in a TRL calibration kit perform the same function as a SOLT calibration. The Reflect standard can either be an Open or a Short, and the accuracy requirements for the Reflect standards is lower than SOLT standards. The line section of a TRL calibration should be about 1/4 wavelength, or 90° at the center of the frequency range of interest (the exact length is not critical as long as it is known). Design and fabrication techniques for the TRL standards are presented along with accuracy verification tests of the standards and measurements for packaged microwave networks in the frequency ranges of interest.

DEVELOPMENT OF A WINDOWS BASED AUTOMATED SYSTEM FOR ANTENNA CHARACTERIZATION

Lisa Jordan*, Aik Min Choong, W. Elliott Hutchcraft, and Charles E. Smith, University of Mississippi, University, MS 38677

Because of their widespread use, vector network analyzers (VNA) have become the backbone of microwave and RF measurements. They can be used for the determination of an antenna pattern by rotating a test antenna and looking at the transmission from the test antenna to a known receiving antenna. However, the calibration of the network analyzer in addition to controlling the rotation of the antenna under test can be difficult and quite time consuming. To assist the user in the process, and allow the rapid characterization of an antenna, a Windows-based program with a graphical user interface was developed. This program uses a computer to control both the stepper motor which rotates the antenna and a network analyzer

that makes the measurements. With computer control, the setup and calibration of the system can be performed automatically without any user intervention. In addition, the pattern data can be transferred from the VNA to the computer. This will allow the easy manipulation and visualization of the data in MATLAB. Details of the interfacing between the computer, the stepper motor, and network analyzer will be shown and the development of the GUI will be presented.

FRIDAY MORNING

Magnolia B

Physical Measurements and Analyses

8:00 ULTRASONIC DISTANCE MEASURING DEVICE
Kori McDaniel¹*, Henk De Weerd², and James Conraw¹,
¹University of North Carolina, Charlotte, NC 28223 and
²University of Mississippi Medical Center, Jackson, MS 39216

A distance measuring device was designed using the AVR Butterfly Atmega169V and the SRF08 Ultra sonic range finder sonar. Measuring devices have been mainly developed using laser detection. Therefore, we have developed a rather simple ultrasonic device, which has broader application. This device was set up to measure distances between zero cm to 11 meters. The device was programmed using C code to administer the functions to a micro controller. The process consisted of establishing a TWI line bus (I2C bus). The TWI line consists of the SDA and SCL, located in USI port E, pin 4 and pin 5 respectively. These two pins were connected to 1.8k resistors, tied to the +5 VDC source and the SRF08. Once the communications between the two devices were established, the device was tested for measurements. During implementation the LCD displayed a count of 5 seconds delay to allow the Atmega169V to reset the I2C bus. During the delay the SRF08 was triggered by the toggle switch to deliver the +5VDC source to the power connection. The program was set to transmit the returning data from the SRF08's echo to the I2C bus for display on the LCD. Out of 50 measurements taken, only 2% error was observed. After debugging of the C code, subsequent readings presented satisfactory accuracy. With some modification this program will have the capability of automation and multiple measurements from different objects. The main program and all of its source files are available for modification.

8:15 TRANSIENT HEAT-TRANSFER ANALYSIS OF
SSME TEST-STAND DIFFUSER

Sam M. Aceil, Alcorn State University, Alcorn State, MS 39096

The high altitude simulation test diffuser is a large cylindrical structure where combusted rocket fuel passes through with supersonic speed up to 4 to 5 Mach number. The temperature at the wall of the diffuser could be as high as 1800 R. These conditions require special design for the wall of the diffuser. Analysis indicates that the dominant modes of heat transfer are conduction and convection. Considering the highly transient nature of test conditions, the lumped capacitance method was utilized to obtain reasonable first approximations for diffuser temperature variations. The result is a first order

non-homogeneous differential equation with the following solution $T(t) = b/a + (T_0 - b/a) e^{-at}$ where "T" and "t" represent temperature and time, and a, b and T_0 are constants involving physical properties and initial conditions. The result of this investigation indicates that the average wall temperature varies from the nozzle entrance to the diffuser exit. The maximum temperature rise occurs between 30–50 seconds after the start of the test and it changes from 710 to 940 R. This investigation was part of a summer assignment at NASA Stennis Space Center.

8:30 MECHANICAL TESTING AND STATISTICAL
CHARACTERIZATION OF HAND LAY-UP
GLASS REINFORCED POLYMERIC (GRP) COM-
POSITES

Reid J. Averill, University of Mississippi, University, MS 38677

The objective of this study is to determine mechanical properties of hand lay-up glass reinforced polymeric composites as specified in relevant standards. These mechanical properties will then be statistically characterized. The mechanical properties that are desired include ultimate tensile strength and tensile modulus, ultimate flexural strength and flexural modulus, ultimate compressive strength and compressive modulus, and shear strength. Specimen samples shall be fabricated according to all relevant standards. The ultimate tensile strength and tensile modulus shall be determined using a MTS servo-hydraulic test machine following ASTM D 3039 standard. The ultimate flexural strength and flexural modulus shall be determined using a 3-point flexural test according to the ASTM D790 standard. The ultimate compressive strength and compressive modulus shall be determined using the ASTM D 695 fixture according to the SRM 1R-94 (modified ASTM D 695 standard). The shear strength shall be determined using the Iosipescu shear test according to the ASTM D 732 standard. Test results are being used for the design of a new application for polymer composites.

8:45 Break

Special Invited Speaker

9:00 RAINWATER ASTRONOMICAL OBSERVATORY
SYMPOSIUM

James G. Hill, Director, Rainwater Observatory and Planetarium, NASA/JPL Solar System Ambassador, French Camp, MS 39745

"Visit to a Ringed Planet: Science Results from the Cassini Mission to Saturn"

The program will begin with an introduction to the new research telescope facility to be housed at Rainwater Observatory. A major part of the session will be devoted to discoveries of the Cassini spacecraft and Huygens probe. Time permitting, highlights will be provided regarding "NASA's Origins Program: Searching for Plants and Other Stars."

FRIDAY AFTERNOON

Magnolia B

Physics of Things that Can Hurt You

1:00 USE OF EMULSIONS FOR CAPTURING AIRBORNE PARTICULATE RADIOACTIVE CONTAMINANT FROM A DIRTY BOMB

Kaumudi Atapattu¹*, Garey Fox¹, and Victor Medina², ¹University of Mississippi, University, MS 38677 and ²Army Corps of Engineers, Vicksburg, MS 39180

A dirty bomb or a Radioactive Dispersal Device (RDD) combines conventional explosives such as dynamite with radioactive material, which when detonated spreads fine particulates of radioactive material. The main objective of a dirty bomb is to throw an area into a state of fear and panic, disrupting the daily life of millions of people. The fine particulate matter eventually settles on surfaces. The current method of dealing with a dirty bomb requires the removal of all contaminated surfaces: a very costly endeavor. An alternate strategy that has been proposed is the use of emulsions for stabilizing the released contaminant. The emulsions would be sprayed as a thin film on the surfaces in the contaminated area. Previous research has evaluated emulsions for capturing and immobilizing radioactive contamination already deposited on surfaces. A research question not yet investigated is whether such emulsions can immobilize radioactive particulate matter being deposited from the atmosphere. The goal of this experiment was to test the use of the emulsions in capturing and retaining particulate matter deposited from the atmosphere. Emulsions were applied to triplicate samples of wood and concrete. Talcum powder was used to simulate the particulate nature of common radioactive materials of high probability in dirty bombs such as cesium chloride. The samples were allowed to dry and were then shaken. The mass of powder lost and the cumulative mass of the samples were recorded to document capture efficiency. Particulate capture densities (20.4 to 39.2 g cm⁻³) exceeded those expected after denotation of a RDD.

1:15 CHARACTERIZATION OF MISSISSIPPI LANDFILL LEACHATES

Pao-Chiang Yuan* and Ana L. Balarezo, Jackson State University, Jackson, MS 39217

In the past three decades, electronic waste has been the fastest growing solid waste problem in the U.S.A. According to a recent Environmental Protection Agency (EPA) study, electronic waste is only 10% of the municipal solid waste (MSW), 50% of American homes have one computer, and there will be approximately 130 million cellular phone subscribers at the end of year 2005. This increasing usage of electronic materials may cause a problem in MSW landfill residues, especially in the leaching process. This paper focuses on possible contaminant changes in recent years, and health risks due to massive electronic waste being dumped into MSW landfills. In early 2004, a survey letter was mailed to the 14 existing MSW landfills in Mississippi to ask them to participate

in this study. Six landfills were willing to participate. We sent out two sampling teams to the sites to collect samples, one in the spring and another in early summer. Physical and chemical properties of Resource Conservation and Recovery Act (RCRA) regulated metals were analyzed in the lab; including pH value, COD, BOD, Total Solids, Dissolved Solids, Suspended Solids, Conductivity and Metals. The results are compared with the National Pollutant Discharge Elimination System (NPDES) and RCRA hazardous waste standards. The Atomic Absorption (AA) technique is used to analyze the metals. We found some sites with high levels of suspended solids but most metal concentration did not exceed the RCRA regulated level.

1:30 EARTHQUAKE DAMAGE ASSESSMENT AND LIQUEFACTION POTENTIAL IN NORTH MISSISSIPPI

Chris Mullen*, Khalid-Ahmed B Desai, K.P. George, and Charles Swann, University of Mississippi, University, MS 38677

The State of Mississippi has potential to experience ground shaking from an earthquake within the New Madrid Seismic Zone in Arkansas, and other locations within Mississippi. In this study, earthquake damage assessment for the State of Mississippi is carried out for four different earthquake scenarios using HAZUS-MH software. Peak ground acceleration (PGA) for different counties is computed and damage to building stock, essential facilities, transportation systems and utility systems are compared for different scenarios. Economic impacts of all four scenarios are calculated to rank counties based on dollar loss. Analysis reveals that the New Madrid earthquake scenario causes the maximum damage as compared to other scenarios, and DeSoto County ranks highest in economic loss as compared to all other counties. The damage and economic losses reported in this study do not include liquefaction induced damage. Therefore, liquefaction analysis is performed using a stress-based approach and PGA computed from HAZUS. Standard penetration test (SPT) data on bridges and casino location is obtained from MDOT and other private agency to perform the stress-based approach. The result indicates significant liquefaction potential in DeSoto and Tunica counties. Based on the available SPT data and calculations, it reveals that all casinos in Tunica may experience liquefaction if an earthquake of magnitude 8 occurs in New Madrid seismic zone. Employing standard penetration test data, lateral spread analysis is performed for casino locations indicating lateral spread of the order of 10 to 20 centimeters.

1:45 THE FIRES OF CANNETO DI CARONIA: VOLCANO PHYSICS IN ACTION?

Robert Fritzius, Shade Tree Physics, Starkville, MS 39759

In January 2004 electrical appliances and pieces of furniture began bursting into flames in Canneto di Caronia, a small town on the northern coast of Sicily. A number of electronic devices in the area were also reported to have malfunctioned. As of the date of this abstract, the nature of these *combustion/electronic events*, which appeared to be initiated by some kind of strong electrical field discharges, but fueled by some, as yet unidentified, combustible material remains to be completely explained. A description of publicly

available information about the fires, the local geographic/environmental setting, and related events will be presented. This will be followed by the author's *armchair volcano physics* version as to what may have been, and is still happening in the Mt. Etna environs. The *volcano physics* approach involves Mt. Etna's extended vertically plugged magma plumbing system that may have been reaching out horizontally to *touch* Canneto di Caronia.

2:00 Break

Manufacturing Physics

2:15 EFFECTS OF MOISTURE, SALTWATER, AND TEMPERATURE ON AN AOC P920 POLYESTER E-GLASS PULTRUDED COMPOSITE

Jarrad Zaiser* and Ellen Lackey, University of Mississippi, University, MS 38677

As engineers work to design bigger, better and more efficient structures, they begin to look for newer and better materials with which to do so. One field that has been getting a lot of attention is the composites field. There are many different composites that have and have not been examined by researchers and some have yet to be discovered. Some composites that have been discovered and experimented with have not yet been tested in every environmental and loading condition. This needs to be done so that the composites can be classified and put to use in the areas where they have performed well. The objective of this study was to experiment, analyze, and to document the results of how AOC P920 polyester/E-glass pultruded composite, a unidirectional fiberglass reinforced composite, will react to various environmental conditions. The conditions examined are elevated relative humidity, increased temperature, saltwater submersion, and preloading. These conditions were evaluated over several periods of time. The properties that were observed are load weight and flexural stress. The results show that the more moisture that is adsorbed the more the flexural stress is affected. Higher temperatures and relative humidity show this affect much sooner than for lower temperatures and relative humidity.

2:30 MERCHANT—THE PHYSICIST OF MANUFACTURING

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

The term manufacturing denotes here the "discrete" type. A major activity within this type is machining. Since the Industrial Revolution, for almost two hundred years, until the 1940s, machining continued to remain an art. Sixty years ago, M. Eugene Merchant made machining a "respectable" scientific field by investigating the physics of machined metal chip formation. He cleverly based his analysis on the "principle of minimum energy." The forming chips' shearing off from the parent material was illustrated to take place at a certain angle, which could be predicted. The presentation will explain the underpinning of his seminal work and highlight the concept it is based on, along with the concept's ubiquitous nature. The shear angle relationship proved as fundamental to the various machining processes as Newton's laws of motion to the mechanics. Merchant's pioneering work led to hundreds of

Ph.Ds. in an area that was all along perceived to be non-academic. Merchant is not only the physicist of discrete manufacture but also its philosopher. He predicted the role of computers in this type of manufacturing at a time when they were being used primarily in academic research and business transactions. He is one of the only 25 celebrities inducted into the Automation Hall of Fame at the Museum of Science and Industry in Chicago. Even at 91 he has not retired, and continues to devote himself to the application of science to manufacturing.

2:45 CHARACTERIZATION OF PULTRUDED COMPOSITES WITH NATURAL FIBER REINFORCEMENTS

Brittany Hancock*, Ellen Lackey, James G. Vaughan, and Kapil Inamdar, University of Mississippi, University, MS 38677

The objectives of this research are to demonstrate the feasibility of using the cost-effective pultrusion* process to manufacture high quality polymeric composites using natural fiber reinforcements (NFR) and to quantify mechanical property variability for these composites. Natural fiber reinforcements offer value added properties such as the beneficial environmental impact of these renewable resources and the less abrasive nature of the fibers for reduced tool wear and less skin irritation for workers. Industrial hemp and jute, both bast fibers with good mechanical properties, was selected for examination in this research project. These initial pultrusion experiments utilized hybrid reinforcement of E-glass with either hemp yarn or woven jute mat. Pultrusion processing experiments and flexural strength testing results indicate that hemp and jute fiber can be successfully used as reinforcements for pultruded polymeric composites.

*A continuous process for manufacturing composites in rods, tubes, and structural shapes having a constant cross-section.

3:00 Divisional Business Meeting and Awards

PSYCHOLOGY AND SOCIAL SCIENCE

Chair: Ann Marie Kinnell, University of Southern Mississippi

Vice-chair: Sheree Watson, University of Southern Mississippi

FRIDAY MORNING

Classroom B

8:00 Divisional Poster Session

A STUDY TO DETERMINE TRAITS OF ASIAN ANCESTRY THROUGH MEASUREMENT OF THE MANDIBLE.

Evan Lee Garner, University of Southern Mississippi, Hattiesburg, MS 39406

While studies have been done to determine racial

differences apparent in many bones of the human skeleton, there has been limited study concerning the mandible, one of the most frequently preserved elements. Since a preliminary study of Caucasian and African individuals suggests that some metric differences may be present, this study focuses on Asian populations. A prehistoric Native American sample from northern Alabama has been used to prevent any effects of admixture. Observations were made on 50 individuals with an even number of males and females. A total of 17 measurements were taken on each individual using sliding calipers and a mandible board, with 10 of these being standard measurements and 7 being unique to this study. As expected, results suggest that Asians generally have larger jaws than those of white and black populations. Particularly, several vertical dimensions of the mandible, including those in the area of the chin, second molar and ascending ramus were seen to be markedly greater. Several Z mhb b zdiscriminate functions were developed based upon these metric differences found between the races.

USING MOVIES TO TEACH PRINCIPLES OF LOGOTHERAPY

Stefan E. Schulenberg*, Shara Adderholt, Cahryn Anderson, Leah Campbell, Mary Katherine Ulmer, Amanda M.A. Melton, and Heather Foote, University of Mississippi, University, MS 38677

Logotherapy is a way of thinking that emphasizes the importance of meaning in life. There are many books and articles that illustrate principles of Logotherapy. However, one potentially useful way of learning about the importance of purpose in life is through contemporary cinema. Movies often address issues related to life purpose. Examples of meaningful movies include *Cast Away* and *Life as a House* (Schulenberg, in press). Despite the existence of meaningful movies, little has been written on using films to teach principles of Logotherapy. With the aid of graduate and undergraduate psychology students, this issue was examined. After being exposed to readings in Logotherapy, students were asked to watch *Life is Beautiful*, a movie with meaning-laden content (Paden-Levy, 2000). It is the story of a man's love for his family and his passion for life in the midst of their imprisonment in a concentration camp during World War II. Students were then asked the following questions: 1) What Logotherapy themes became evident to you upon viewing the film? 2) What are the pros and cons of using film clips from such movies to teach principles of Logotherapy? Many examples of Logotherapy were noted that involved choice, responsibility, and finding meaning in unavoidable suffering. Many pros of using movies to teach Logotherapy were noted: 1) Modern cinema, with its popularity, can make learning enjoyable; 2) Movies demonstrate concrete examples of very abstract concepts. They apply the principles to life situations that people can see and grasp more clearly than just being taught the principles themselves; and 3) Movies may create an impression that lasts longer than other methods of instruction. Several cons of using movies were noted: 1) Movies may not seem as scientific as other methods of instruction; and 2) The same movie may affect people differently.

THE MEANING IN SUFFERING TEST (MIST): A FACTOR ANALYTIC INVESTIGATION

Stefan E. Schulenberg*, Cahryn Anderson, and Carol L. Gohm, University of Mississippi, University, MS 38677

The Meaning in Suffering Test (MIST; Starck, 1985), grounded in the Logotherapy framework, was designed to assess the amount of meaning people have discovered in unavoidable suffering experiences. The part of the MIST used in research due to ease of quantification is composed of 20-items using a Likert-type response format ranging from 1 to 7. Items are summed to arrive at a total score that ranges from 20 to 140. The MIST has a proposed structure consisting of three subscales (Starck, 1985): A (subjective characteristics of suffering, items 5, 11, 12, 16, 18, 19), B (personal responses to suffering, items 1, 3, 4, 8, 10, 13, 15, 20), and C (meaning of suffering, items 2, 6, 7, 9, 14, 17). In a study of the psychometric properties of the MIST and other measures in a sample of undergraduate students (N = 341), Schulenberg (in press) reported that two of the three MIST subscales (A and B) had unacceptably low reliabilities. Concerns over the proposed factor structure led to the current investigation, a follow-up study examining the internal structure of the MIST with the original data set. We attempted to use Amos 5.0 to confirm the MIST subscale structure. However, the fit of the model with the data was so poor that the analysis failed. Next, exploratory factor analyses were performed using SPSS 11.5. A theoretically useful and statistically viable factor structure was not found. Given the current data, the MIST appears to be a unitary measure.

EFFECTS OF CALCIUM ENRICHED DIETS ON WEIGHT GAIN

Andrew Thaw*, Alexis Lewis, and Ryan Hooper, Millsaps College, Jackson, MS 39210

The effects of calcium enriched diets on weight gain/loss in rats were examined. Current findings with human subjects in short-term studies (less than 3 weeks) have demonstrated that diets with excess calcium lead to decreases in body weight. Proponents of calcium were quick to conclude that calcium leads to weight loss. Popular advertising has even gotten into the mix with such celebrities as Dr. Phil drinking milk while suggesting "the weight is over". However, studies examining the effects of calcium on weight for longer periods of time have not yet surfaced. The study presented here examined the effects of excess calcium (1.2%) on weight gain over a 6-week period in rats. A special calcium enriched diet was fed to 8 rats and a standard laboratory chow was fed to 8 control rats for 6 weeks. Weights for all rats were recorded each week and the total amount of food consumed each day was also noted. Results reveal the calcium diet rats did indeed gain less weight over the first 3 weeks compared to the control diet rats. However, over the next 3 weeks the calcium rats gained weight faster than the control rats and by the end of the study all 16 rats were of similar weight. Thus, the effects of calcium on weight is a short-term effect only and should not be considered effective for weight loss or management.

TRAIT ANGER AND SPIRITUALITY

Theresa Ann Woodard* and Pamela G. Banks, Jackson State University, Jackson, MS 39217

Existing studies (e.g., Deffenbacher et al., 1996) suggest that high trait angry individuals are likely to express

their anger in more intense and dysfunctional ways, are more likely to experience terminated interpersonal relationships and to experience more frequent and severe anger-related consequences. Longitudinal studies of community samples consistently find links between active spiritual/religious involvement and increased chances for living longer and health/mental health (Larson & Larson, 2003; Pargament, 1996). The aim of the present study was to compare spirituality in two groups: those who scored in top quartile of the Trait Anger Scale (TAS) of the State-Trait Anger Expression Inventory (STAXI) (high anger group, $N = 22$) and those who scored in the bottom quartile (low anger group, $N = 72$). A total 145 college students participated in the study. Participants completed the STAXI (Spielberger, 1988), the Multidimensional Anger Inventory (MAI, Seigel, 1986) and the Lifestyle Assessment Questionnaire (LAQ; Hettler, 1981). It was hypothesized that the high anger group would score lower than the low anger group on prayer/meditation and quiet personal reflection, compassion for others and a measure of overall spirituality. These hypotheses were not supported. However, as predicted there was no difference between the High Trait Anger group and the Low Trait Anger group in their *'belief in something greater than self'*. It can be concluded that levels of spirituality are similar for high trait and low trait angry individuals. In the validation analysis, adequate evidence of the relationship between TAS and the MAI scores including Anger In/Anger Out subscales was found. Correlations ranged from 0.41 to 0.54 ($p < 0.001$). This research was supported in part by NIMH-COR Grant MH-16926.

Divisional Talks

9:00 RELATIONSHIP BETWEEN PERSONALITY HARDINESS, ANDROGYNY, STRESS, AND HEALTH

Shaila Khan, Tougaloo College, Tougaloo, MS 39174

Stress can increase the likelihood of illness. Hardiness, a personality dimension that is believed to confer resistance against the effects of psychological stress is worth examining. Hardiness is a composite consisting of internal locus of control (vs. powerlessness), commitment (vs. alienation) and challenge (vs. threat). Hardy personality people seem to be usually resistant to stress. Hardiness appears to promote health independently of stress, rather than operating as a buffer by reducing illness primarily among individuals experiencing high stress levels. Androgynous persons are also more flexible in coping with stressful situations and tend to be more satisfied with their lives. However, it has yet to be demonstrated whether androgynous person are also less susceptible to stress and has less health problems. A study was conducted to assess the independent effect of hardiness and androgynous on stress and health problems. Subjects included 100 African American undergraduate students 18 to 20 years of age. Stress was assessed with the 'Social Readjustment Rating Scale' (SRRS) (Holmes & Masuda). Sample versions of Hardiness Scale (Kobasa, 1984) was used to measure hardy personality. Bem's Sex Role Inventory (Bem 1974) was used to assess androgynous traits. Hardiness and androgyny were found to be highly correlated to health problems suggesting that these may account for explanation why some people with high level of stress do

not necessarily have many health problems. Individuals high in hardiness showed less health problems. Also, androgynous persons were found to have less health problems as a reaction to stress.

9:15 PREDICTORS OF DEPRESSED MOOD IN UNDERGRADUATES

Reid Jones* and Sommer Vickery, Delta State University, Cleveland, MS 38733

According to the Centers for Disease Control, the past decade has shown an increase in suicide rates among young adults. This trend is apparent even among the fortunate subgroup who are able to attend college. Obviously, depression precedes thoughts of suicide. The present study attempted to determine what factors might lead to depression among undergraduates. Seventy students earned course credit for filling out surveys evaluating their levels of depression, introversion/extraversion, neuroticism, anxiety-related states and traits, and a demographics form. Neuroticism, State Anxiety, and Trait Anxiety were significantly ($p < .05$) associated with depression. Extraversion and Grade Point Average were significantly ($p < .05$) negatively associated with depression. Full model regression was used to evaluate the relative contributions of the variables to the dependent variable of depression. The Multiple R was strong [$R = .82$; $F(5,61) = 25.05$; $p < .01$]. The adjusted R Squared still accounted for 64% of the variance in depression scores. Significant contributors to depression included Introversion and Trait Anxiety.

9:30 ATTITUDES AND KNOWLEDGE ABOUT DEPRESSION IN RURAL AND URBAN MEN

Sheree Watson¹*, David Hanbury¹, and Clara Jones², ¹University of Southern Mississippi, Hattiesburg, MS 39406 and ²University of North Carolina, Fayetteville, NC 28301

Although depression is a common form of mental illness, it is often considered a "women's" disease. Men are reluctant to admit depression and are less likely than women to seek treatment for it. Nevertheless, men are more likely than women to make a successful suicide attempt. This contradiction may result from gender role socialization. Men may perceive depression as a condition associated with stigmatization and embarrassment. Provision of accurate information via media campaigns successfully changed attitudes and behaviors regarding several topics, including smoking cessation. Whether provision of information might reduce the stigma associated with depression in middle-aged men is unknown. We examined perceptions about depression among rural and urban men aged 40-65. Approximately half of the men viewed a short informational video before they completed the survey. The survey questions fell into one of four categories: Stigma (e.g., "Depression is a personal weakness"), Knowledge (e.g., "Weight loss is a sign of depression"), Use of Mental Health Professionals (e.g., "If I were depressed, I see a mental health professional), and Spirituality (e.g., "Faith alone can heal depression"). The men who watched the video were significantly less likely to agree with questions in the Stigma category ($p = .03$). The rural respondents, however, were more likely than urban respondents to agree with statements in the Stigma category ($p = .04$). Responses in the other three categories were not influenced by either video or residence. These results indicate

that provision of accurate information may reduce, but do not eliminate, the perception of stigma associated with depression.

9:45 PANIC ATTACKS IN AN AFRICAN AMERICAN SAMPLE: A FAMILY STUDY

Jerome Hales* and Pamela G. Banks, Jackson State University, Jackson, MS 39217

Because African Americans are often underrepresented in mainstream psychological studies, the present study was designed as a family study to examine evidence of family history in persons who have experienced panic attacks. Three hundred fifty-nine individuals (246 females, 113 males) participated in this study. Data from the Panic Attack Questionnaire (PAQ, Cox, Norton, & Swinson, 1992) on personal and family history of the panic attacks were analyzed. The present study compared the family history of panickers and non-panickers. The panickers were regarded as a non-clinical sample because of self-report. The 38 non-panickers were randomly selected from a sample of 321 non-panickers. It was hypothesized that panic attacks would be more frequent in the families of the panickers ($N=38$) than non-panickers ($N=38$). Both fraternal and maternal history of panic attacks was significantly higher in panickers than in non-panickers (15.6% vs. 0%), $C^2(1, N=61) = 4.94, p < .001$; 30.3% vs. 0%, $C^2(1, N=62) = 10.48, p < .001$, respectively. The history of the sisters with panic attacks (not brothers) was significantly higher for panickers vs. non-panickers (25.8% vs. 0%), $C^2(1, N=55) = 7.24, p < .01$. The findings support the notion that "panic attacks run in families" and expand the literature regarding panic experiences in African Americans. This research was supported in part by NIMH-COR Grant MH 16926.

10:00 THE ROLE OF RELIGIOSITY ON ALCOHOL CONSUMPTION AND ALCOHOL EXPECTANCIES AMONG AFRICAN-AMERICAN COLLEGE STUDENTS

Minervia E. Scott* and Kaye Sly, Jackson State University, Jackson, MS 39217

Past studies have found that relative to whites, African-Americans drink less and are more likely to abstain from alcohol consumption. Moreover, these studies have been limited in their explanations of why African-Americans drink less than whites. One plausible yet under examined explanation concerns religiosity, and the beliefs that African-Americans are more religious than their white counterparts. However, these studies have mostly examined religious affiliation. The current study examined the relationship between religiosity, expectations about the effects of alcohol, and alcohol consumption. Religiosity in this study included a composite of religious thoughts, religious feelings, and attendance of religious services. The sample consisted of 135 African-American undergraduates. It was hypothesized that African-American college students who were more religious would consume less alcohol and have less positive expectations about the effects of alcohol. The results indicated that religiosity was negatively correlated with positive expectations about alcohol use. Specifically, the more religious individuals were, the less they expected alcohol to relax them ($r = -.361, p < .01$); to enhance sexual activities ($r = -.270, p < .01$), to increase positive global social and physical pleasures ($r = -.259, p < .01$), to increase

assertiveness ($r = -.290, p < .01$), and to increase social and physical pleasures ($r = -.242, p < .01$). There was no relationship between religiosity and alcohol consumption; however, the number of moderate and heavy drinkers in the present study was relatively small. This research was supported by NIMH-COR Grant MH 16926.

10:15 Break

10:30 AN ANALYSIS OF THE PREHISTORIC CRANIA FROM THE CHICKASAW BAYOU SITE, WARREN CO, MS

Marie Danforth, University of Southern Mississippi, Hattiesburg, MS 39406

This paper evaluates some 50 prehistoric crania from Chickasaw Bayou near Vicksburg, MS. The skeletal material, excavated in 1869 and curated at the Smithsonian, had remained unstudied largely because of poor archaeological context. The mound's shape and type of cranial deformation present, however, date the series to the Mississippian period (1000 and 1500 AD), a time characterized by chiefdoms and maize horticulture. Demographic analysis proved this to be a very biased collection with only two juveniles present. The preference for adult crania was expected, however, since only the best preserved material was chosen for curation. The sex ratio was roughly even. Virtually all of the health indicator frequencies observed fell within ranges typically seen at other sites from the Mississippian. One-third of individuals show linear enamel hypoplasias, and 17% have signs of anemia. The caries rate at 0.51/individual is low, but this is offset by high antemortem tooth loss, which is likely related to the high number of middle-aged adults in the series. Sex differences also conform to expected patterns with males having markedly higher rates of childhood health disruptions, but females having more than twice the rate of caries, presumably due to higher carbohydrate diet. These findings support the archaeological record in that the southern Mississippi Delta was undergoing the same cultural trends seen in most other parts of the river valley.

10:45 THE DEMOGRAPHIC DISASTER: ARCHAEOLOGICAL EVIDENCE FROM COXCATLAN, PUEBLA, MEXICO

Edward Sisson* University of Mississippi, University, MS 38677

During the 1990s revisionist historians questioned the magnitude of the demographic disaster occasioned by the Conquest of Mexico and the attendant spread of infectious diseases. Burial data from the late Pre-Conquest and Early Colonial archaeological site of Coxcatlan, Puebla, Mexico provide a potential means of evaluating mortality estimates. Interpretation of the data is complicated by the difficulties of estimating archaeological populations, dating precisely the burials, and determining the total number of burials. However, the extremely large number of burials, their widespread distribution in all temple precincts, and the nature and quality of the vessels in which cremains were buried appear more consistent with traditional high mortality estimate.

11:00 THE USE OF ANTHROPOMETRIC DATA IN *OTOLEMUR GARNETTII* SUBSPECIES IDENTIFICATION

Stacey Curry*, Sheree Watson, Joseph Curry, and David Hanbury, University of Southern Mississippi, Hattiesburg, MS 39406

The University of Southern Mississippi currently houses a research colony of Garnett's bushbabies. The bushbabies originally were obtained from two sources, The University of Memphis and Duke University. The bushbabies from Duke appear to have broader faces, wider eye spacing, and shorter snouts than the bushbabies from Memphis. Based on these physical differences, we hypothesized that the animals may represent different subspecies. The purpose of the present project was to document similarities and differences among the bushbabies of different origin to determine whether they exhibit systematic morphological differences indicative of subspeciation. Anthropometric measurements were used to compare the physical differences between the Duke bushbabies and the Memphis bushbabies. We measured arm length, leg length, tail-crown length, tail length, ear spacing, eye spacing, snout length, bizygomatic breadth, maximum cranial breadth, and maximum cranial length. The Duke bushbabies had significantly larger maximum cranial length, eye spacing, and bizygomatic breadth ($p < .05$). The Memphis bushbabies had significantly longer arm length than the Duke bushbabies ($p < .05$). These measurements are consistent with the hypothesis that the two groups of bushbabies may represent different subspecies. These results suggest that anthropometric data may be useful in distinguishing between prosimian subspecies.

11:15 MEASURING GENETIC DISTANCE BETWEEN ANCIENT MAYA POPULATIONS USING NON-METRIC DENTAL FEATURES

Gabriel Wrobel, University of Mississippi, University, MS 38677

Nonmetric dental variability was examined in groups of northern Belize Maya from the sites of Chau Hiix, Altun Ha, and Lamanai dating to the Late Preclassic through the end of the Postclassic period (300 B.C. - 1500 A.D.). The northern Belize skeletal samples represent a relatively large and temporally diverse sample, which are used to explore the extent of morphological diversity within geographically discrete groups of Maya over time. In addition, data from other more distant groups, including both Maya and non-Maya populations, were used in the comparisons. These investigations help to establish a Maya Dental Complex and to determine the extent to which Mesoamerican groups are distinguished morphologically from one another. In general, distance values derived from nonmetric dental data increased with greater geographic and temporal distance between the groups being compared. As a group, the Maya were distinguished from other Mesoamerican populations. Dental trait frequencies in the prehistoric individuals were very similar to those reported by Jacobi (2000) from the Colonial Tipu Maya and thus suggest that the Maya Dental Complex is geographically and temporally consistent. Comparisons among Maya groups support a general distinction between geographic regions that corresponds to ancient political/linguistic divisions. Despite differences in sample sizes and inconsistent burial dates, comparisons of temporal

groups composed of the pooled northern Belize sites appeared to show increasing genetic distance over time.

FRIDAY AFTERNOON

Classroom B

1:30 GLOBALIZATION AND ITS IMPACTS ON THE GAMING INDUSTRY

Denise von Herrmann, University of Southern Mississippi, Hattiesburg, MS 39406

The rapid spread of casino gaming in the U.S. has been accompanied by an equally rapid trend toward globalization in the industry. The author begins with an examination of the history of gambling, arguing that globalization is inherent in the industry because of the nature of gambling. Evidence of the global history of gambling and its spread from ancient times is presented. Next, the spread of gambling in the U.S. and abroad is examined, along with various trends in the casino industry. Rapid consolidation, unitary marketing strategies, and the influx of key technologies such as online gambling are considered. Finally, the social, economic, and cultural impacts of gaming are discussed, with special attention to the likely impacts of continued globalization and spread of U.S. casino resorts. The author asserts that casino gambling will likely bring along with it a variety of potentially positive economic impacts, yet will also likely exacerbate a variety of social ills including income inequalities, social stratification, gender stereotyping, and devaluation of the role of "localness" in the culture.

1:45 GLOBAL REPRODUCTION OF THE CASINO AS WORKPLACE

Dena Wittmann, University of Southern Mississippi, Hattiesburg, MS 39406

Gambling is a commodity in and of itself in service-oriented, postindustrial America as well as in its global counterparts. While there is an overwhelming amount of literature devoted to the ways in which casinos market themselves to customers, very few studies have approached the casino "adult playground" as a workplace. Through in-depth interviews with twenty-two casino workers, this research analyzes the experiences of those individuals whose paid work is centered within the casino environment in the relatively new "dockside" market on the Mississippi Gulf Coast. The overarching research aim of my work was to delineate the differences in casino work experiences for women and men, which indicated that casino employers hyper-separate stereotypical masculine and feminine characteristics, a fact that has significant consequences in the sex distribution of the workforce. The casino workplace operates on the basis of gender dualism and accords power and privilege to those who display masculinity. Although women are now as likely as men to be found dealing many casino games, the gender ideologies that have historically supported a masculinized work environment remain intact. The underlying theory guiding this research is that the casino workplace continues to be a gendered institution, regardless of its location or length of time in operation. The dockside casino market in Mississippi reproduces the same gendered social

relations among workers, managers, and customers as has been documented in research on Nevada casinos as well as those internationally.

2:00 CONCURRENT VALIDITY FOR AN EXPERIMENTAL SURVEY OF SELF-DISCLOSURE

Reid Jones*, Colby Harris, Donna Starkey, Jon Grantham, and Kamara Hawkins, Delta State University, Cleveland, MS 38733

The degree to which an individual engages in self-disclosure is an important area of applied research for mental health professionals. When a person is reluctant to reveal sensitive information about herself/himself, therapists would be at a significant disadvantage. Starkey (2004) reasoned that a screening survey which provided a measure of the person's tendencies toward self-disclosure would be very useful during the initial stages of counseling. The Interpersonal Risk Awareness Survey (IRAS), a 40 item self-report inventory, is in initial stages of development for that use. Fifty-one undergraduate students received course credit for completing the IRAS, the Beck Depression Inventory, the Eysenck Personality Inventory, and Spielberger's State and Trait Anxiety Scales. Subjects with high scores on the IRAS had significantly ($p < .05$) higher scores on "Neuroticism," Depression, State Anxiety, and Trait Anxiety. Subjects with high scores on the IRAS also had significantly ($p < .05$) lower scores on Extraversion. Even with a relatively small sample, the IRAS is significantly associated with five well-known surveys measuring related tendencies.

2:15 CONSTRUCT VALIDITY AND LOCAL NORMS FOR THE OQ-45.2

Reid Jones*, Scott Rasmus, Kamara Hawkins, and Jon Grantham, Delta State University, Cleveland, MS 38733

Mental health professionals need validated tools to monitor a client's degree of personal distress and level of functioning. One such instrument, The Outcome Questionnaire (OQ-45.2), has been rather widely used, although normative data must be established for predominantly rural areas such as Mississippi. The OQ-45.2, published by American Professional Credentialing Services, Inc. was intended as a general measure for evaluating a person's functioning and distress. The 45 item self-report inventory provided three subscales including 'Subjective Distress,' 'Interpersonal Functioning and Relationships,' and 'Social Role.' The present research was intended to provide preliminary normative information for rural Mississippi and to determine if the OQ-45.2 maintained construct validity in those local norms. Sixty-nine undergraduate students earned course credit for filling out a background demographics sheet, the OQ-45.2, and several well-validated surveys based on similar issues. The OQ-45.2 showed strong, significant ($p < .01$) associations (r 's ranging from .47 to .80) with measures of personal distress from the Beck Depression Inventory, the Eysenck Personality Inventory, and the Spielberger State-Trait Anxiety Scales. Additionally, the OQ-45.2 was significantly negatively correlated with Extraversion (-.38) and with Grade Point Average (-.41). Local norms showed that OQ-45.2 scores for rural Mississippi showed more distress than scores for typical adults, but less distress than clients in Community Mental Health Centers.

2:30 Break

2:45 A COMPARISON OF IN-CLASS AND ONLINE STUDENT EVALUATIONS

David Swanson, University of Mississippi, University, MS 38677

A comparative analysis of results from simultaneous in-class and online student evaluations taught in a social science department at a large public university strongly suggests that the online evaluations are neither valid nor reliable because of nonrandom error resulting from very high levels of non-response. As a result of this study, the Department decided not to use online evaluations in annual reviews of its faculty until a subsequent and more detailed analysis is found to contradict this finding or average response rates for online evaluations (about 26%) achieve those for in-class evaluations (about 72%).

3:00 LEARNING STYLES IN THE FIRST-YEAR MEDICAL CLASS AT THE UNIVERSITY OF MISSISSIPPI MEDICAL CENTER

James Hutchins¹*, Steve Watson¹, Joanne Olson¹, LouAnn Woodward¹, Robin Rockhold¹, James Brown¹, Jacob Olivier¹, and Connie Schimmel², ¹University of Mississippi Medical Center, Jackson, MS 39216 and ²Millsaps College, Jackson, MS 39210

It is clear that medical students, like students in a variety of other settings, bring different needs and abilities to the classroom. Yet, few medical school faculty adapt their teaching styles to be a good "fit" to student learning styles and curriculum design is blind to the influence of student learning styles. To improve our teaching mission, to help in our ongoing curriculum reform efforts, and to help students be successful in medical school, we have embarked on a longitudinal study to determine which learning styles predominate amongst medical students, how those styles might change over time, and how learning style affects performance. First-year medical students ($N = 100$) were given a battery of often-used learning styles inventories during orientation, before the first day of class. These include: Myers-Briggs Type Indicator (MBTI); Gregorc Style Delineator (www.gregorc.com); VARK (www.vark-learn.com); and the adult version of the Dunn, Dunn and Price instrument (www.learningstyles.com). Students were given a randomly-assigned four-digit code number which will render the investigators blind to the identity of the student. Our Assistant Dean for Academic Affairs will supply course grades keyed to the code numbers so that we may attempt to correlate performance in specific courses with learning style. Characteristics of this population, with comparison to normative populations where available, will be presented. Future work will allow us to examine changes in learning style over time and how learning style affects learning outcomes in the medical school environment.

3:15 U.S. CENSUS CONFLICT: HISTORICAL ROOTS AND FUTURE PROSPECTS

David Swanson* and Paula J. Walashek, University of Mississippi, Hattiesburg, MS 39406 and University of Phoenix, Phoenix, AZ 85034

Although not originally intended as such, the US census has become a "Commons" in which private benefits are gained at the expense of public costs. As such, contentious

litigation and other forms of conflict have become a standard part of the census landscape. We identify historical actions that set the stage for contemporary levels of conflict that place the census at risk - even collapse. We argue that methodological developments are unlikely to reduce this risk and concur with others that an administrative reorganization of the Census Bureau along the lines of the Federal Reserve Board represents a more promising course of action.

3:30 LITERARY ILLUSTRATIONS OF JURISPRUDENCE IN MISSISSIPPI

Angela Dunlap, University of Southern Mississippi, Hattiesburg, MS 39406

This present study concentrates on jurisprudence in Mississippi dating from 1930 to the present. I examine the ways in which various aspects of the Mississippi criminal justice system has been portrayed by four Mississippi writers. Principal characters and/or institutions to be examined include law enforcement officers, attorneys, judges, and prisons/jails. Specifically, I identify and analyze various themes or concepts of justice implied in these works, seeking thereby to extend and clarify an understanding of ethics and justice, and how criminal justice policy is driven by public opinion and the media. In terms of justice or injustice, I will use the literary works to illustrate the conflict between the Roman concepts of *lex* and *jus* in the Aristotelian context of proportional justice. The term *lex* refers to statutory law whereas *jus* refers to law in the abstract or law in general. The writers included in my study are William Faulkner, Elizabeth Spencer, Anne Moody, and Larry Brown.

3:45 Divisional Business Meeting and Awards

SCIENCE EDUCATION

Chair: Sheila Brown, J.L. Scott Marine Education Center

Vice-chair: Kay Baggett, Gautier High School

THURSDAY MORNING

Oak Room B

8:00 THE USE OF SECONDARY SCHOOL STUDENTS TO INSTRUCT PRIMARY SCHOOL STUDENTS THE CONCEPTS OF PHYSICAL SCIENCE

Sarah Hicks, University of Southern Mississippi, Hattiesburg, MS 39406

The GK-12 program places graduate students with local public schools to help math and science teachers. As a GK-12 fellow, I design activities for the high-school physics class at Forrest County Agricultural High School to use while instructing fifth graders at South Forrest Attendance Center on the concepts of physical science. Part One of my paper examines the development of these activities and the incorporation of concepts found in the Mississippi Science Framework and

the National Science Education Standards. Part Two explores how these activities are introduced to the high school physics class and how the high school students, in turn, present them to the fifth-grade classes. The paper concludes by presenting the results of a survey of the attitudes about the activities from the students and the teachers. Results have shown not only that the fifth graders have a more enhanced learning environment, but also that the high school physics students have a more firm grasp in the physical sciences as they prepare to teach. This has been possible by the participation of the schools, the GK-12 program, and funding from the National Science Foundation.

8:15 THE USE OF WEBCT IN AN INTRODUCTORY PHYSICS COURSE

Carl Drake, Jackson State University, Jackson, MS 39217

This paper discusses the use of WebCT to supplement an introductory physics course. There are several problems to consider that is unique to physics and mathematics. In this paper I will talk about the problem of evaluating a student's work. It is important in physics to see the steps that a student takes in solving a problem, sometimes more so than the answer. There are also special symbols that are used to represent certain quantities that are difficult to generate in an online environment. Another problem is the fact that student drawn diagrams are also, in many cases, a part of the solution to a problem. It is rather difficult to draw a diagram using many of today's technology particularly when taking an online test and having a time limit to contend with. Examples of how WebCT can be incorporated into an introductory physics course will be demonstrated.

8:30 USING THE HISTORY OF MATHEMATICS TO IMPROVE STUDENTS' ATTITUDES TOWARDS MATHEMATICS

David Bramlett, Jackson State University, Jackson, MS 39217 and University of Southern Mississippi, Hattiesburg, MS 39406

This paper investigates the use of key significant historical events and how they connect to significant problems and developments in the history of mathematics in an attempt to enhance students' attitudes towards mathematical problems. The main goal of a mathematics class should be to create an awareness of the what, the how, and the why of mathematics so that the student can understand the mathematics and see how mathematics is a unique part of being human. The use of history in mathematics allows students to see how people through out the centuries have placed an emphasis on the knowing and doing of mathematics. Examples of how history can be incorporated into the mathematics classroom will be demonstrated.

8:45 EXPERIENCES AND MONSTERS: HOW THEY CONTRIBUTE TO SCIENCE LEARNING

Kerry Holmes*, Joe Sumrall*, and Emily Witt*, University of Mississippi, University, MS 38677

LEARN, Linking Experiences and Reading Network, is a reading comprehension strategy that requires students to use a "minds-on" approach when learning science vocabulary and basic facts by capitalizing on their real world experiences as they read. The purpose of the quasi-experimental study was to determine whether integrating students' experiences with

science concepts promoted learning. One hundred forty nine fourth and fifth grade students from six classes in northern Mississippi participated in the study. A t-test was used to compare the average change from pre-to posttest for the control and treatment groups. An analysis of covariance was used to isolate the effects of the LEARN method from the effect of reading ability. The reading comprehension strategy, LEARN, enabled students to build knowledge from their prior experiences through the use of a series of three graphic organizers. Students represented information in shapes, and used these shapes to create a monster as they read, asked questions, sought answers, and made inferences about new science information. Students in the treatment groups demonstrated significant improvement in learning basic science vocabulary and facts during the second trial. Results of this study suggest that students who used their prior experiences to construct new learning would be a good follow up to inquiry-based science activities.

9:00 Break

9:15 NATURAL HAZARDS OF THE COASTAL ENVIRONMENT

Todd Adams, J.L. Scott Marine Education Center and Aquarium, Biloxi, MS 39530

The objective of this educational presentation is to facilitate the thinking process in the student. The "thinking process" could easily become a tool students can use to investigate the surrounding environment and the threats/risks that exist that may cause loss of life and property to coastal residents. The hazards addressed include: hurricanes, tornadoes, waterspouts, severe thunderstorms, lightning, and tsunamis. A multi-media approach brings the natural phenomena into the classroom, by using photographs, digital images, and videos. Pre- and posttests will allow analyses to be completed regarding the students' knowledge of natural hazards. I believe the exposure to the threats/risks associated with natural hazards will result in furthering the students' interest in pursuing the sciences behind the hazards.

9:30 RESEARCH THE GENERAL TOPIC OF AQUACULTURE AND DEVELOP A POWER-POINT PRESENTATION FOR DISPLAY AT SCOTT AQUARIUM

Rebekah McKnight^{1,2*} and Samuel Clardy³, ¹Mississippi Gulf Coast Community College, Gautier, MS 39533; ²National Aeronautics and Space Administration, Stennis Space Center, MS 39522; and ³Gulf Coast Research Laboratory's J.L. Scott Marine Education Center and Aquarium, Biloxi, MS 39530

The purpose of this project was to develop a power point presentation that gives the public an overview of the aquaculture industry which will be displayed at the Scott Aquarium's aquaculture exhibit. Onsite visits were conducted at local aquaculture facilities where professionals were interviewed. Interviews were combined with observing, photographing, and studying fish, shrimp, and other aquatic life. The completed product will benefit the guests visiting the Scott Aquarium by showing the importance of aquaculture facilities and highlighting contributions made to the industry by the Gulf Coast Research Laboratory and the Mississippi-Alabama Sea

Grant Consortium.

10:00 MAKING A NEW AND IMPROVED SAFETY VIDEO FOR CHEMISTRY STUDENTS AT MGCCC

Phung Kim Hoang, Phung Lily Nguyen*, and Steve Manis, Mississippi Gulf Coast Community College, Gautier, MS 39533 and National Aeronautics and Space Administration, Stennis Space Center, MS 39522

The purpose of this project was to produce a new version of a Chemistry safety video for Chemistry students before they are allowed to perform any laboratory activities. Several steps were taken to make the new video. First, the old safety video was reviewed for modifications. Information needed for the new video was gathered and a storyboard was created. Volunteer actors/actresses were recruited for each roll and part of the production. Appropriate equipment was acquired to film the video. Subsequent editing was necessary for producing the final product.

10:30 DEVELOPMENT OF AN EDUCATIONAL/INFORMATIONAL CARD SYSTEM USING COASTAL PLANT AND ANIMAL SPECIES FOR ELEMENTARY TEACHERS AND THEIR STUDENTS

Robin Mayo^{1,2*} and Shelia A. Brown³, ¹Mississippi Gulf Coast Community College, Gautier, MS 39533; ²National Aeronautics and Space Administration, Stennis Space Center, MS 39522; and ³University of Southern Mississippi, J.L. Scott Marine Education Center and Aquarium, Biloxi, MS 39530

The purpose of this project was to develop a card system resource for elementary teachers and their students. Fifty coastal organisms were selected for the file system. Both plant and animal species commonly found in the coastal counties of Mississippi (Hancock, Harrison, and Jackson) were included. Selected species were representatives of the Gulf of Mexico, Mississippi Sound, local marshes, maritime forests and beaches. The information cards were categorized by type (plant, bird, fish, etc.) and habitat. Each card contains a photograph of the organism with facts on the biology, ecology and natural history of the species. On the back of each card review questions, vocabulary terms, an art activity, puzzle or word search were included. This card system adheres to state and national curriculum standards and can easily be augmented with additional species in the future. Goals, objectives, and benefits of this project are to enhance the content knowledge of teachers and students (grades 4-6) with scientific information associated with the organisms, provide teaches resource/curricular materials, and deliver a file card system of fifty species that can be added to in the future.

10:45 Break

11:00 COURTYARD REFURBISHMENT AT PECAN PARK ELEMENTARY SCHOOL

Pamela Heiter^{1,2*}, Karen Jarvis^{1,2*}, and Adel Register³, ¹Mississippi Gulf Coast Community College, Gautier, MS 39533; ²National Aeronautics and Space Administration, Stennis Space Center, MS 39522; and ³Pecan Park Elementary School, Ocean Springs, MS 39564

The primary objective of this project was to create an outdoor, interactive, educational and recreational area for the

students and staff of Pecan Park Elementary School. The project consisted of cleaning up the existing courtyard area, redesigning the landscape to include a butterfly garden with a water feature, incorporating a weather station, and enhancing the outdoor classroom area. Research was conducted to identify certain seasonal plants that would attract butterflies and that were indigenous to the Mississippi coastal region. All of the plants that existed in the courtyard at the beginning of the project were relocated and utilized throughout the area. Weather station instruments such as a barometer, thermometer, and rain gauge were placed in different locales in the courtyard to provide an opportunity for teachers to present weather lessons to the students. Based on the Mississippi Science Curriculum Framework, activities will be implemented in nature and weather studies for each grade level. The renovated courtyard affords the students an opportunity to learn to use weather instruments, to identify flowering and non-flowering plants, and to view firsthand the life cycle of butterflies that make this area their home.

11:15 DESIGN AND IMPLEMENTATION OF AN INTERPRETIVE SCIENCE TRAIL FOR GRADES K-12

Jana J. Causey* and Austin W. Trousdale, University of Southern Mississippi, Hattiesburg, MS 39406

Collaboration among educators and scientists offers promise for strengthening scientific literacy in American society. The specific goal of one such partnership begun in 2003 was the establishment of an interpretive trail at Forrest County High School (FCAHS). This effort involved teachers, administrators, and students from FCAHS and Teaching Fellows from the NSF GK-12 program at the University of Southern Mississippi (USM). The anticipated benefits of the trail will be: 1. improved performance of students within academics (via integration of curricula into a novel environment conducive to inquiry); 2. outreach to the surrounding community (by providing a setting for field trips from other schools as well as by opportunities for service by student, civic, and church organizations); 3. conservation and restoration of natural resources showcased by the trail (e.g., providing examples of exotic/invasive species and by monitoring quality of water within a stream). Educators and students from FCAHS facilitated physical improvements to the trail environment, submitted detailed drawings for bridges and signs, and recommended topics to be emphasized within the design of the trail. Content specialists from USM applied their expertise in biology, chemistry, geology, physics, polymer science, and mathematics through development and delivery of demonstrations and activities. The result of our cooperation is a valuable teaching resource for South Mississippi based on its opportunities to educate audiences diverse in age and scientific knowledge.

11:30 CARNIVOROUS PLANTS OF THE MISSISSIPPI GULF COAST

Michael Carley, J. L. Scott Marine Education Center and Aquarium, Biloxi, MS 39530

The purpose of this project is to educate kindergarten through 12th grade students about carnivorous plants indigenous to the coastal region of Mississippi. Integrated as part of a

thematic non-formal teaching unit on adaptations of marine/wetland organisms, this project comprises the botanical portion of the series. The students are introduced to morphological and physiological characteristics of pitcher plants (*Sarracenia* spp.) through the use of lecture, laboratory, and age-appropriate educational activities. The program is presented at the MEC&A to traditional classroom groups, as well as homeschool groups and its value is measured by their instructors using a Likert-scale assessment instrument. This project helps the students better understand the biotic and abiotic factors governing adaptation.

11:45 HERPETOFAUNA IN LOCAL LONGLEAF PINE SAVANNA ECOSYSTEM

Paul Parker^{1,2*}, Chris May³, and David Ruple³, ¹Mississippi Gulf Coast Community College, Gautier, MS 39553; ²National Aeronautics and Space Administration, Stennis Space Center, MS 39522; and ³Grand Bay National Estuarine Research Reserve, Moss Point, MS 39562

Some of the historical longleaf pine savannas on the Grand Bay Reserve have been overgrown by dense slash pine, and are in an unnatural state. One method used to restore the longleaf pine savannas is mechanical thinning. With the use of sampling stations for herpetofauna, we compared two types of areas (natural and dense) and also compared samples before and after thinning. Conclusions were drawn about the effectiveness of the clearing and the effect on the herpetofauna in the area.

THURSDAY AFTERNOON

Oak Room B

1:30 DEVELOPMENT OF A BUTTERFLY HABITAT AT THE J.L. SCOTT MARINE EDUCATION CENTER AND AQUARIUM

Kelli Kibby^{1,2*}, Shelia A. Brown³, and Michael Carley³, ¹Mississippi Gulf Coast Community College, Gautier, MS 39533; ²National Aeronautics and Space Administration, Stennis Space Center, MS 39522; and ³University of Southern Mississippi, J.L. Scott Marine Education Center and Aquarium, Biloxi, MS 39530

The purpose of this project was to develop and maintain an enclosed butterfly habitat at Scott Aquarium. One of the goals of the project was to research and document the life cycle requirements of butterflies so that provisions for successful metamorphosis could be implemented. All information acquired is being utilized to maintain the habitat for many Project Marine Discovery Programs at Scott Aquarium. During the project, new signage, placards, and photographic displays that further enhance and complement the educational experience of the habitat were developed. The butterfly habitat is presently a permanent component of the educational and public outreach endeavors of the Marine Education Center and Aquarium (MEC&A).

1:45 DEFINING WALTER ANDERSON'S INFLUENCE ON LINOLEUM BLOCK PRINTING IN THE UNITED STATES AT THE WALTER ANDERSON MUSEUM OF ART

Erica Peterson^{1,2*} and Patricia Pinson³, ¹Mississippi Gulf Coast Community College, Gautier, MS 39533; ²National Aeronautics and Space Administration, Stennis Space Center, MS 39522; and ³The Walter Anderson Museum of Art, Ocean Springs, MS 39564

The purpose of this project was threefold: to research and identify Walter Anderson's place in the history of American linoleum block printing; to examine the extant blocks themselves, and identify the sources of the subjects depicted by Walter Anderson's blocks. Sources came from local libraries and libraries located across the country accessed through the internet. Additional research came from Walter Anderson's own writings on his 1949 linoleum block print exhibition in the Brooklyn Museum in New York City. Research on the life of Walter Anderson was gathered from both primary and secondary resources at the Walter Anderson Museum of Art. This information will be used for the exhibition on linoleum block prints at the Walter Anderson Museum of Art during 2005. The information will be made available to Mary Anderson Pickard for her use on a book (in-progress) about her father and his work with linoleum block printing.

2:00 DEVELOPING INTERACTIVE INFORMATIVE GRAPHICS FOR THE SNAKE ENCLOSURES DISPLAYED AT THE J.L. SCOTT MARINE EDUCATION CENTER AND AQUARIUM

Jennifer Bond^{1,2*} and Becky Espey³, ¹Mississippi Gulf Coast Community College, Gautier, MS 39533; ²University of Southern Mississippi, J.L. Scott Marine Education Center and Aquarium, Biloxi, MS 39530; and ³National Aeronautics and Space Administration, Stennis Space Center, MS 39522

The J.L. Scott Marine Education Center and Aquarium is home to eleven non-venomous snakes indigenous to our local area. The primary objective of this project was to provide a detailed description of each snake species easily accessed by the general public visiting their respective enclosures at the Scott Aquarium. This information is provided to the public in a ring-binder *Guide* with pages dedicated to each snake. The information regarding the snake display consists of the general description, range, habitat, life history, ecology, and basic classification for each species shown. A few pages are designated to the three ways venomous and non-venomous species are recognized such as myths and characteristics of reptiles. The pages also include maps for the range of the organism and color photos for visual descriptions. This project includes researching and choosing information to be used for each species of snake, formatting and approving of the lay-out for each graphic and the actual construction of the *Guide*.

2:15 CITIZEN SCIENCE AS AN EDUCATIONAL TOOL: EDUCATION ON THE PROBLEM OF INTRODUCED SPECIES AND THE HUNT FOR THE GREEN BANANA ROACH IN MISSISSIPPI

John D. Davis, Mississippi Museum of Natural Science, Jackson, MS 39202

The Mississippi Museum of Natural Science (Jackson,

MS) is charged with doing both research and educating the public on the important problem of introduced species of plants and animals. Citizen Science is the involvement of lay persons in research, in projects which further interest and education. The appearance in Mississippi of the Green Cuban Banana Roach (*Panchlora nivea*), a tropical species established in Florida in the 1970s, offered an opportunity for the practice of Citizen Science in environmental education. The striking appearance and harmlessness of this roach and its attraction to lights makes it easy for citizens to capture and recognize. In September 2003 a description and the address of the MMNS were placed in the statewide Clarion Ledger. These were repeated on the Jackson Television Station WBLT once in 2003 and twice in 2004. On each of these broadcasts there was a brief discussion of the problem of introduced plants and animals in the state. Responses from Walthal, Jones, Laurel, Hinds and Madison Counties have involved all ages and educational levels and more than doubled the specimens in collections. When specimens are brought in, the citizen scientists are given materials on problems caused by introduced species and information on the importance of not releasing exotic "pets" into the environment.

2:30 Divisional Business Meeting

4:00 Divisional Poster Session

RENAL MEDULLARY INFUSION OF AN ENDOTHELIN TYPE B (ET_B) RECEPTOR ANTAGONIST PRODUCES HYPERTENSION IN RATS ON A HIGH SODIUM DIET
Sean R. Abram* and Joey P. Granger, University of Mississippi Medical Center, Jackson, MS 39216

Systemic blockade of ET_B receptors results in hypertension that is salt-sensitive. Although the highest density of receptors has been localized within the renal medulla, the importance of the kidney in mediating the significant hypertension produced by systemic blockade of the ET_B receptors is unknown. The purpose of this study was to determine the long-term effects of ET_B receptor blockade within the renal medulla on urinary sodium excretion (UNaV) and blood pressure. The chronic effects of the selective ET_B receptor antagonist A-192621.1 (1.5 µg/kg/min) were examined in two groups of chronically instrumented Sprague Dawley rats (375-400 g) maintained on a high sodium diet. One group of rats received an intra-medullary infusion (IMED, n = 5) of ET_B receptor antagonist; while the other group (n = 5) was administered the receptor antagonist intravenously (IV) at the same dose. Mean arterial pressure (MAP) in the IMED rats averaged 104 ± 1 mmHg during a 6-day control period and then gradually increased to 164 ± 5 mmHg after 7 days of IMED infusion of A-192621.1. There was a transient reduction in UNaV (from 25 to 22 mEq/day) on the first day of IMED antagonist infusion followed by a return toward control levels. IV infusion of A-192621.1 did increase MAP (127 ± 4 vs. 97 ± 2 mmHg) but the response was much less than in the IMED-treated animals. Moreover, IV infusion of A-192621.1 did not result in transient sodium retention. These results indicate that the ET_B receptors within the kidney play an important role in modulating sodium excretion and blood pressure in rats maintained on a high sodium intake.

STUDY OF LIQUID CRYSTALS

Anil K. Sharma* and Sabriya Caldwell, Mississippi Valley State University, Itta Bena, MS 38941

The most common applications for liquid crystals are LCD's (liquid crystal display) and that such displays are found in watches, calculators, clocks, thermometers, and portable computers. Liquid crystals are phases of matter that lies between the disorder of liquid and the arranged lattices of crystals. Liquid crystals have the fluid properties of liquids and the optical properties of solids. Liquid crystals are observed most commonly in organic compounds that have cylindrically shaped (rod-like) molecules with masses of 200 to 500 u and lengths four to eight times their diameters. Each liquid crystal must have at least one degree of macroscopic order. There are three parameters that each liquid crystal has, which are: Orientational Order, Positional Order, and Bond-Orientational Order. Each order has four phases. They are the nematic (meaning thread-like), smectic (meaning grease-like), columnar, and cholesteric phase. Some liquid crystals are temperature sensing devices while others are liquid crystal display devices. Liquid crystals occur widely in living matter. Liquid crystalline properties have also been identified in synthetic polymers.

PERCEPTIONS OF ELEMENTARY AND MIDDLE SCHOOL TEACHERS IN NORTHEAST MISSISSIPPI TOWARDS INQUIRY SCIENCE TEACHING

Susan Lee* and William J. Sumrall, University of Mississippi, University, MS 38677

The purpose of this descriptive study was to examine elementary and middle school teachers' perceptions regarding the use of inquiry science teaching. A questionnaire was used to survey elementary and middle school teachers in Northeast Mississippi regarding their use of inquiry science teaching. The percentage of the elementary teachers' responses to each of the survey items was tabulated as part of the data analysis. The responses to questions on the survey concerning the barriers to the use of inquiry science teaching were clustered by the grade levels the teachers taught and by the teachers' years of teaching experience. The results suggest that teachers surveyed primarily believe that inquiry science teaching is too time consuming and it cost too much money or requires too much material. The teachers who were surveyed provided suggestions regarding how they overcome some of the barriers of inquiry science teaching.

HYPOTHESIS BASED LEARNING FOR MISSISSIPPI K-12 STUDENTS: USING A WATERSHED MODEL TO CONDUCT EXPERIMENTS

R. Gonzalez^{1*}, C.S. See², and W.L. Kingery², ¹West Lowndes Middle School, Columbus, MS 39701 and ²Mississippi State University, Mississippi State, MS 39762

Learning science is an active process at multiple levels. Hands-on activities alone are not sufficient. Students must have 'minds-on' experiences as well. Science involves learning and applying skills such as, observation, inference, and experimentation. Inquiry is central to science education and includes mastering the ability to describe objects and events, pose questions, formulate explanations, test concepts, and communicate conclusions. Students must learn to identify their subjects, use critical thinking, and consider alternatives. These

acts form the basis of Hypothesis Based Learning. We have designed several hands-on experiments to teach children erosion, run-off, pollution control, watershed processes and natural resource management. These activities are cross-curriculum based. Mathematics, physical, chemical, and biological sciences, and most importantly, language skills will be employed. A relatively inexpensive and easily constructed watershed model is used. It is approximately 64 x 36 x 5 inches and made of Plexiglas. Students are given opportunities to interact with the model to allow them to investigate river dynamics, sediment transport, erosion, and erosion control. Water flow and slope are among the variables students can control. These experiments have been performed by elementary, middle school, and high school students with complexity and expectations adjusted to age. We discuss successes and failures of these models in teaching children, and make recommendations for implementing similar programs for a K-12 curriculum.

FRIDAY MORNING

Oak Room B

8:00 THE GEAR UP MISSISSIPPI SUMMER ENRICHMENT CAMP AT MISSISSIPPI UNIVERSITY FOR WOMEN: SCIENCE AND TECHNOLOGY DISCOVERY

Amy Newton*, and Marty Harvill, Mississippi University for Women, Columbus, MS 39701

The purpose of Science and Technology Discovery was to provide quality, scientific, inquiry-based science activities through exploration and real-world activities to students from GEAR UP. Sixteen rising 9th graders from Lee Middle School and B.F. Liddell Middle School, used Vernier LabPro units, graphing calculators, and computers to conduct 12 different experiments both in the laboratory and outside on topics in biology, environmental science, and physical science. Students took daily pretest and post-test over the topics and the results indicated a significantly higher average for three of the five post-tests and a slight improvement for two post-tests. Surveys conduct on student experiences using microscopes, graphing calculators, LabPro units, and graphing using a computer, indicated few students had experience using microscopes (29%), graphing calculators (29%), LabPro units (0%), and graphing using a computer (23%). Almost 95% of the students participating in this camp were very proficient at using this technology to collect data onto a calculator, transfer data from the calculator to computer, and performing graphing operations with the computer. During the last day of the camp, presentations were giving on importance of graduating from high school and attending college along with information on different careers in science and mathematics.

8:15 GEARING UP FOR A CAREER IN MARINE SCIENCES

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

Gear Up MS is a collaborative effort of the Institutions of Higher Learning, State Board for Community and Junior

Colleges, Mississippi Department of Education, and various organizations and community groups which provides educational support services to partner school districts. The Gear Up Marine Science Camps were designed to acquaint rising ninth grade students with the variety of careers involved in investigating the planet's oceans. Activities pursued introduced students to the complexities of the marine environment, to current problems facing the oceans, and to the education needed for and opportunities provided by the study of ocean sciences. This project participants lived on a college campus, using campus science facilities, participated in content-based laboratory activities, and field trips designed to enhance content knowledge. Participants interacted with a variety of working scientists. Participants maintained individual journals recounting activities and impressions, and worked together to produce a presentation that documented their week's activities.

8:30 INSTRUCTOR SATISFACTION AND ATTITUDE TOWARD ONLINE INSTRUCTION

Karen Elizabeth Ng* and Kenneth J. Curry, University of Southern Mississippi, Hattiesburg, MS 39406

Review of the literature suggests that instructors have mixed feelings with regard to their satisfaction and attitude toward online instruction. With this in mind, one of us (KEN) developed the Satisfaction and Attitude toward online instruction Questionnaire. This instrument is being tested in Fall 2004. It has been sent to 405 instructors who teach completely online at 11 universities and colleges in eight southern states of the United States of America. The data will be analyzed with reference to four sub-scales, namely satisfaction and attitude toward online instruction in general, satisfaction and attitude toward pedagogy, satisfaction and attitude toward online communication, and satisfaction and attitude toward online students. Data will be analyzed using descriptive statistics and MANOVA to be presented at this meeting.

8:45 STUDENT PERCEPTIONS: IMPORTANCE OF AND SATISFACTION WITH VARIOUS ASPECTS OF AN ONLINE BIOLOGY COURSE

Sheila R. Hendry* and Kenneth J. Curry, University of Southern Mississippi, Hattiesburg, MS 39406

Today's busy lifestyles leave many adults questioning how to fulfill the desire to further their education. Increasing numbers of online courses are being offered, accompanied by a corresponding rise in student enrollment. Research of student satisfaction with various facets of an online biology course, as well as the perceived importance of these aspects, will be conducted during the fall 2004 semester within BSC 400/500, History of Biology at the University of Southern Mississippi. This research is based on the theory of transactional distance, which involves dialogue between the teacher and student, the physical environments of both the student and teacher, and the emotional environments of each. One of us (SRH) designed the Student Perceptions Survey used in this study to gather student input for improvement of online courses. Student ratings of importance and satisfaction regarding convenience, grade earned/knowledge learned, emotional health, communication, and student support will be collected toward the end of the semester, via the online course. Correlation statistics with repeated measures ANOVA, using an alpha of .05, will

determine relationships among these aspects. Results of a pilot study conducted during the summer semester of 2004 indicated that convenience was the most important aspect of the online course, as well as the aspect with which they are most satisfied. Many students close to campus were enrolled in the course, indicating that the flexibility of the online format is a benefit for those with busy schedules, whatever their distance to campus.

9:00 Break

9:15 LEARNING STYLES OF COMMUNITY COLLEGE MICROBIOLOGY STUDENTS

Mary F. Lux, University of Southern Mississippi, Hattiesburg, MS 39406

Students have diverse learning styles. Teaching styles, however, tend to be less diverse. Educators often teach in the lecture format. An organized lecture format is best suited for auditory, sequential learners. My limited study demonstrated that current community college students would learn better with formats other than lecture. Microbiology students enrolled at the Forest County Center of Pearl River Community College completed two Learning Style Surveys: Learning Styles (LSR), developed by Colin Rose, and Index of Learning Styles (ILS), developed by Felder and Soloman. Students were surveyed during Summer and Fall 2004. A total of 22 students participated in the survey. All participants were enrolled in a Microbiology course that met once each week for a laboratory component and a laboratory component that 5 hour period. This time period was split into. Results of the LSR survey indicated that most of the students were visual learners and the least number were auditory learners. Results of the ILS survey indicated that most students preferred an active learning environment and the fewest numbers were intuitive learners. The findings indicate that the best learning experiences will occur in classrooms that encourage visual and active learning strategies.

9:30 PROFESSIONAL DEVELOPMENT FOR GRADUATE TEACHING ASSISTANTS

Rosalina V. Hairston* and Aimée T. Lee, University of Southern Mississippi, Hattiesburg, MS 39406

We developed a seminar course to prepare undergraduate and graduate teaching assistants in the Department of Biological Sciences to effectively teach laboratory courses. This was required of teaching assistants who would teach biology labs during the academic year. The seminar included investigative, interactive, and constructivist methods of instruction, effective use of technology, understanding how people learn, and classroom assessment techniques. Teaching assistants were also provided scenarios on how to establish rules and procedures for effective classroom management, resolve conflicts and address various social issues. Pre and posttests were administered using the following tests: Nature of Science Survey, Scientific Attitude Inventory II, and Laboratory procedures and techniques in specific labs (e.g., microbiology, ecology, etc.) developed by the laboratory coordinators. Randomly selected teaching assistants were videotaped early and late in the semester and evaluated using the ESTEEM instruments. Analyses of the changes in the teaching assistants' perception of the nature of science and attitudes toward science,

their use of constructivist teaching methods, and students' evaluation will be discussed. We believe that this professional development for graduate teaching assistants will contribute to the academic preparation of future academic professionals who will be teaching biology in various institutions.

9:45 INCORPORATING MARINE FOSSILS INTO THE SCIENCE CLASSROOM

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

The objective of this project was to develop a classroom program on "Marine Fossils" which inspires students to think about how fossils are formed, what can be learned from fossils, and the completeness of the fossil record. Students were introduced to marine fossils through lectures, interactive games, and hands on experiences with both macrofossils and microfossils. The class was well received by both teachers and students, while the students left the classroom with a better understanding concerning the geologic past and the information gained by studying marine fossils. This class is offered as part of the Project Marine Discovery programs at J.L. Scott Marine Education Center and Aquarium.

10:00 INCORPORATING NON-FORMAL SCIENCE TEACHING STRATEGIES INTO THE CLASSROOM

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

What students learn is greatly influenced by the manner in which they are taught. The decisions concerning content and activities that teachers make, their interactions with students, the selection of assessments, the mind-set that teachers demonstrate and nurture among their students, and the attitudes conveyed all affect the knowledge, understanding, abilities, and attitudes that students develop. "Hands-on" inquiry-based learning is the cornerstone of the activities and programs presented at the Scott Aquarium. The manner in which these skills and activities are incorporated in a formal classroom setting will be addressed in addition to supplementing activities with visits to the Aquarium.

10:15 Break

10:30 PROFESSIONAL DEVELOPMENT OPPORTUNITIES FOR GULF OF MEXICO SCIENTISTS AND MIDDLE SCHOOL TEACHERS-CENTERS FOR OCEAN SCIENCES EDUCATION EXCELLENCE (COSEE)

Sharon H. Walker*, Shelia A. Brown, and Susan Culipher-Ross, University of Southern Mississippi, J.L. Scott Marine Education Center and Aquarium, Biloxi, MS 39530

The focus of this 2003-2005 externally funded professional development program for scientists and middle school teachers was/is to bring these professionals together, so they could/can "collaborate and better" appreciate each other's role in educating our precollege students. Best practices will be shared involving the "face to face and online" components of these three-week Summer Institutes. Thematic content areas included/include: organisms and habitats, marine technologies, and oceanography and coastal processes. Only the MS Insti-

tutes will be discussed; however, identical programs in each of the five Gulf of Mexico states have been synchronously implemented during this timeframe. Data, based on the implementation of annual COSEE Nonformal Workshops offered within the Gulf of Mexico states, will also be discussed during this presentation. Materials will be provided to all attendees.

10:45 APPLICATION OF FORENSIC SCIENCE TO PROFESSIONAL DEVELOPMENT FOR SECONDARY SCHOOL EDUCATORS

Susan Bender^{1*}, Cindy Cook^{2*}, Karen Evans³, Jammy Hemphill⁴, Ben Lundy⁴, Robin Rockhold⁵, Jeff Stokes^{5*}, and Donna Sullivan⁶, ¹Jim Hill High School, Jackson, MS 38204; ²Murrah High School, Jackson, MS 39202; ³Madison Central High School, Madison, MS 39110; ⁴Forest Hill High School, Jackson, MS 39212; and ⁵University of Mississippi Medical Center, Jackson, MS 39216

The 2004 Summer Research Institute, a component of the Base Pair program at the University of Mississippi Medical Center (UMMC), utilized a team approach involving high school and middle school teachers, UMMC faculty, and high school students in the development of an inquiry-based laboratory activity for the high school classroom. The activity, "CSI UMMC, Murder at SHRP," stresses interwoven themes of contemporary biomedical laboratory activities, deductive reasoning, forensic analysis, mathematical skills development, and literature in science. Teachers and high school students created print, CD-ROM and on-line access (<http://basepair.library.umm.edu/csiumc.htm>) to lab manuals for the activities. The activity teaches contemporary biomedical laboratory skills including forensic anthropology and odontology, fingerprint identification, handwriting, blood spatter and simulated serological analysis, as well as gel electrophoresis and nucleic acid determination. While the completed activity is eminently adaptable to state competencies, the objective of the exercise was to establish a mechanism for assisting teachers in curriculum development as a professional development tool. The inclusion of students validated the applicability of the exercise as a part of its development. A similar approach could be widely adopted in teacher training in contemporary bioscience. (Supported by the Howard Hughes Medical Institute).

11:00 TEACHERS TO SEA OPPORTUNITIES FOR U.S. TEACHERS

Shelia A. Brown^{1*}, Sharon H. Walker¹, Susan Culipher-Ross¹, and Mark Jarrett², ¹University of Southern Mississippi, J.L. Scott Marine Education Center and Aquarium, Biloxi, MS 39530 and ²Naval Oceanographic Office, Stennis Space Center, MS 39522

The Centers for Ocean Sciences Education Excellence: Central Gulf of Mexico (COSEE: CGOM) – Sea Scholars Program is a nationally recognized effort funded by the U.S. Navy, the National Science Foundation, and the National Oceanic and Atmospheric Administration in cooperation with the University of Southern Mississippi (USM). The overarching goal of the Sea Scholars component of the COSEE: CGOM is to promote oceanography, coastal processes, and related math, social studies, and technology. The experience is designed to provide small groups of teachers with firsthand

oceanography and geography experiences. Sea Scholars spend time aboard a U.S. Navy oceanographic survey ship working with and learning from an experienced team of Navy Surveyors. Public or private teachers, administrators, and informal educators of (K-12) students are eligible to participate. Candidates who teach grades 4-9 have priority. All applicants must be U.S. citizens.

WORKSHOP

11:15 TEACHING STUDENTS TO COLLECT, ANALYZE, AND INTERPRET GENOMIC DATA

Sherry Herron, University of Southern Mississippi, Hattiesburg, MS 39406

Participants will learn how to use laboratory and bioinformatics techniques to more fully understand protein synthesis, inheritance, and phylogeny. Within the context of certain coding and noncoding DNA sequences, participants will learn about amplification, cycle sequencing, SNPs, and molecular clocks; will perform contig assemblies, multiple alignments, and BLAST searches; and will generate phylogenetic trees. Research-based materials and services from BSCS and Cold Spring Harbor will be utilized. Examples of student work will be shown.

FRIDAY AFTERNOON

Oak Room B

WORKSHOPS

1:00 WORKSHOP ON ACADEMIC SERVICE LEARNING IN TEACHING THE SCIENCES

Ann Marie Kinnell*, Lida McDowell, and Mary Peters, University of Southern Mississippi, Hattiesburg, MS 39406

This purpose of this workshop is to acquaint participants with the pedagogy of academic service learning. Presenters representing the social sciences and math education will discuss what academic service learning is and how they have used it in their courses. Both best practices and problems and pitfalls will be addressed. Materials will also be available as to how to incorporate academic service learning into other science disciplines. Attendees are invited to come with questions and share their own experiences with service learning.

2:00 BIOTECHNOLOGY FOR THE CLASSROOM

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

Throughout recent decades, technological advances have been made allowing for in-depth research in areas previously untouchable. Due to these recent advancements, many organisms and environments are now being studied as potential answers to many problems such as disease and pollution. The goal of this presentation is to help your students understand the importance of research, as well as facilitating thoughts about effective and efficient mechanisms of examining environments through classroom activities. Materials will be provided.

ZOOLOGY AND ENTOMOLOGY

Chair: Alex D.W. Acholonu, Alcorn State University

Vice-chair: Elgenaid Hamadain, Jackson State University

THURSDAY MORNING

Classroom B

8:00 COMPARISON OF ECTO- AND ENDO-PARASITES OF *LEPOMIS MACROCHIRUS* AND *POMOXIS ANNULARIS* IN A CARROLL COUNTY MISSISSIPPI WATERSHED POND

Julius Ikenga* and Richard Wagner, Mississippi Valley State University, Itta Bena, MS 38941

Lepomis macrochirus and *Pomoxis annularis* are the predominant fish species inhabiting a pond northeast of section 23, range 2 East in Carroll County, MS. Both fish species were caught in mid-afternoons, using ZebcoT fishing rods baited with live and, or artificial baits. A 30 gal tank equipped with AquacultureT air pump and diffusion stones, for water aeration and circulation, were used to transport the fishes to the university laboratory for examination. A dissecting and a light compound microscopes equipped with a Bell and HowellT digital camera were used in this study. Scrapings from body mucus and lesions examined revealed that both fishes were infected with a variety of ecto-parasites. *Trichodina* sp., *Ambiphyra ameiuri*, *Trichophyrra* sp., *Cryptobia agitans*, *Brachiomycetes sanguinis*, and *Actionocleidus longus* were identified from specimens of *L. macrochirus*, while *Trichodina* sp., *C. agitans*, *Cleidodiscoides* sp., *B. sanguinis*, *Saprolegnia* sp., and *Lernaia cyprinacea* were identified from specimens of *P. annularis*. Endo-parasites identified from tissue preparations of *L. macrochirus* include *Posthodiplostomum minimum*, *Camallanus oxycephalus*, *Contacaecum spiculigerum*, and *Sebekia mississippiensis*, while those from *P. annularis* were *Spinitectus* sp. along with the first three endoparasites listed above. Three of the nine ecto-parasites found were specific for *P. annularis*, two for *L. macrochirus*, and three were common to both fish species. Of the five endo-parasites found, three were common to both fish species while the specificity of two parasites were inconclusive. Additional studies are needed to resolve the specificity of two endo-parasites and one ecto-parasite.

8:15 SEROPREVALENCE OF *TOXOPLASMA GONDII* INFECTION IN PIGS FROM SOUTHWESTERN MISSISSIPPI

Mary L. Coleman*, Alex D.W. Acholonu, and Abram Dunbar, Alcorn State University, Alcorn State, MS 39096

Toxoplasma gondii infection of swine is considered to be a potential public health concern because the infection can be acquired by humans through handling and consumption of contaminated raw or undercooked meat. Infection in immunocompromised individuals and fetuses are the most severe and

these individuals are mostly likely to develop clinical toxoplasmosis. Since Mississippians consume a lot of pork, there was a significant need to know the extent to which *Toxoplasma gondii* infection poses a health problem in the state. Prior studies had been done in Mississippi, but they were limited to Crystal Springs, MS. This study focused on the Southwestern region of the state of Mississippi. Between July 2003 and March 2004, blood samples were collected from slaughterhouses in Southwestern MS and Alcorn State University Swine Farm in Churchill, MS. The collected blood samples were centrifuged and the sera were collected, labeled and stored in a freezer. The modified agglutination test (MAT) was performed at dilutions of 1:25, 1:50 and 1:500. A titer of 1:25 was considered to be seropositive. Of a total of 302 samples tested, 48 (16%) were seropositive at 1:25; 29 (10%) were positive at a titer of 1:50; 11 (4%) were positive at a titer of 1:500. The prevalence of *T. gondii* in pigs in Southwestern Mississippi is not as high as previous studies done in Mississippi, but the potential for infection still exists.

8:30 HIV/AIDS IN MISSISSIPPI AND NIGERIA

Alex D.W. Acholonu, Alcorn State University, Alcorn State, MS 39096

AIDS is an extremely serious disease in which the ability to mount an immune response is disabled completely. It is caused by the human immunodeficiency virus (HIV). HIV infection virtually always progresses to AIDS after a prepatent period of some years (6 months to about 10 years or longer). The purpose of this study is to assess the extent to which HIV/AIDS has spread in the two geographic areas. Data for this study were obtained from literature review and information from the Mississippi State Department of Health. While the first case of AIDS was reported in 1981, AIDS became reportable in Mississippi in 1983 and HIV infection in 1988. In 2001 the prevalence of HIV/AIDS in Mississippi was reported to be 7,635. The total reported since 1981 is 10,032. (1698 AIDS; 8334 HIV). In terms of public Health Districts, District V was the highest (3728, 37.2%) and District II was the lowest (370, 3.7%); in terms of counties, Hinds County had the highest (2615, 26.0%) and Greene the lowest (8, 0.1%) as of year 2002. A preponderance of HIV/AIDS cases occurred in African Americans (38.4 African Americans vs. 5.6 whites per 100,000 population). The number infected is reported to be declining. The prevalence of HIV/AIDS in Nigeria has steadily increased from 1.8% of the population in 1991 when the first sentinel survey was conducted to 5.8% in 2001. The latest sentinel survey was conducted in 2003. The following were reported: HIV population was 4,046,701; new AIDS cases, 235,146; AIDS deaths in 2003, 198,184. Relentless effort must be made to educate people on HIV/AIDS. It is necessary to teach and preach safe sex for the sexually active ages and continence. It should be mandatory for pregnant women to undergo HIV/AIDS tests. Effective treatment drugs should be made available to the rich and poor alike.

8:45 THE FIRST RECORD OF THE GENUS *POLYERGUS* (HYMENOPTERA: FORMICIDAE) IN MISSISSIPPI

JoVonn G. Hill* and Richard L. Brown, Mississippi State

University, Mississippi State, MS 39762

Polyergus is a biologically and behaviorally interesting genus of ants whose members have no worker caste, but rather have a well-developed soldier caste. Soldiers are obligatory slave-makers of various ant species in the genus *Formica*, which assume all worker activities after they are captured as pupae in slaving raids. In June 2003, *P. lucidus lucidus* Mayr and *P. lucidus longicornus* Smith were discovered at three locations in the Black Belt Prairie region of Mississippi, representing the first record of this genus for the state. *Polyergus l. lucidus* was previously known from New England to Florida, west to the Rocky Mountains. Eight individuals of this subspecies, some holding pupae of a *Formica* species in their mandibles, and several adults of *Formica pallidefulva* Latreille were collected with a pitfall trap in an oak-hickory forest in Lowndes County. Subsequently, pitfall traps in a prairie remnant of the Tombigbee National Forest (Trace Unit) in Chickasaw County yielded 48 individuals of *P. l. lucidus* and several individuals of *Formica schaufussi dolosa* Buren, the dominant *Formica* at this prairie. A second subspecies, *Polyergus l. longicornus*, was previously known only from the Carolinas and Georgia. A slave raid of this subspecies was observed in a one-hectare oak-hickory forest near the Osborn Prairie in Oktibbeha County about 5:30 p.m. on 5:30 on 19 June 2003. Approximately 100 individuals were moving as a group in a southeasterly direction, but the *Formica* slave of this subspecies was not discovered. Specimens of both subspecies are deposited in the Mississippi Entomological Museum.

9:00 Break

9:15 ASSESSMENT OF WATER QUALITY IN TWO LOTIC BODIES OF WATER IN JEFFERSON COUNTY, MISSISSIPPI

Rosie Hopkins* and Alex D.W. Acholonu, Alcorn State University, Alcorn State, MS 39096

This study was conducted to find out if Coles Creek and Mud Island Creek located off the Natchez Trace Parkway, in the picnic areas, are polluted or meet the Mississippi Water Quality Standard. The main thrust was to eventually check the distribution of pollutants and/or human contamination in all seasons of the year. During the summer and the fall of 2002 and the winter and spring of 2003, water samples were collected in three replicates from three sites, 50 meters apart, and at one week intervals for three consecutive weeks. This was done in each of the two bodies of water. They were taken to the laboratory and tested according to the manufacturers of LaMotte Test Kits. The chemical parameters tested and recorded as parts per million (ppm) were total alkalinity, ammonia-nitrogen, carbon dioxide, chloride, chlorine, chromium, copper, fluoride, hardness, iron, manganese, magnesium, nitrate-nitrogen, pH, phosphate, silica, sulfate, sulfide, and zinc. The physical parameters tested on site were atmospheric temperature (°C), surface temperature, (°C), conductivity (mS, micro Siemens), dissolved oxygen (DO), salinity (ppt, parts per thousand) and turbidity (NTU, Nephelometric Turbidity Units). The parameters, namely, conductivity, and salinity, were added in the fall of 2002. There were no significant differences found in their habitat profiles and they meet the Mississippi Water Quality Standard.



9:30 USE OF BURROWS AND TURRETS BY FEMALES OF THE WOLF SPIDERS *RABIDOSA PUNCTULATA* AND *R. RABIDA* (ARANEAE, LYCOSIDAE)

Gail Stratton*, Amy Nicholas, and David Reed, University of Mississippi, University, MS 38677

Among wolf spiders, burrow construction and use is best known in the obligate burrowers, the *Geolycosa*. However, a growing number of species from several genera have now been documented to use burrows. We document the construction and use of burrows and turrets by *Rabidosa punctulata* and *R. rabida*. In the southeast U.S.A. *R. punctulata* mature and mate in the fall, females overwinter and construct egg sacs in the spring. As part of a large population study, 36 females of *R. punctulata* were brought into the lab prior to egg sac construction, were placed in containers and monitored for burrow construction. Containers were 14 cm wide x 21 cm tall and were provided with an avg of 6.7 cm of top soil and 8 cm of dried grass). Of the 36 females, 30 constructed burrows and 34 constructed turrets made of silk and grass prior to making their egg sacs. The average burrow depth was 4.0 cm and width was 2.2. Silken turrets were conspicuous, heavily silked and varied from 0 to 12 cm (average height was 4.7 mm). In the field, we have noted that at the time when females are laying egg sacs, they become difficult to find and may be in burrows. This study provides insight into the evolution of burrow construction and use in the Lycosidae.

9:45 BEHAVIORAL ROLE OF STRIDULATION IN THE ACOUSTIC COMMUNICATION OF THE

BLACK IMPORTED FIRE ANT, *SOLENOPSIS RICHTERI* FOREL

Jake R. Marquess* and James B. Anderson, University of Mississippi, CWWR/UMFS, Abbeville, MS 38601

Stridulation, a form of acoustic communication, is an important yet poorly studied component of ant communication. Although many ants are capable of stridulation (Markl 1973), little is known of the behavioral implications of this signal. The leaf-cutting ant, *Atta cephalotes*, is the only well studied species where the behavioral role of stridulation was investigated. Markl (1965) observed workers dig out buried nest mates, when buried workers were stridulating. Similarly when workers encountered good quality leaves, they stridulated to recruit nearby nest mates (Roces et al. 1993). Stridulation has been observed in both the red and black imported fire ant (*S. invicta* and *S. richteri*, respectively), but little is known of the behavioral implications of these signals. Preliminary results suggest that *S. richteri* stridulate from a variety of different cues: nest disturbance, discovery of a new food source, physical restraint, and interactions with ants of intra or inter-specific colonies. Recordings of the acoustic signal with corresponding real-time video of the stridulating ants and surrounding nestmates will provide evidence of the role of stridulation in the behavior of *S. richteri*. This approach will also be used to investigate the interspecific difference of the stridulatory signals between *S. invicta* and *S. richteri*. Intra-specific differences of stridulatory signals will also be investigated in the polymorphic worker caste of both species.

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