

## ABSTRACTS OF PAPERS PRESENTED AT THE SPRING 1992 COLLEGIATE MEETINGS

## EASTERN REGION

LINCOLN MEMORIAL UNIVERSITY,  
HARROGATE, TENNESSEE

PETROFABRICS OF METASEDIMENTARY ROCKS ACROSS UNICOI MOUNTAINS, SOUTHEASTERN TENNESSEE BLUE RIDGE. *Jerry R. Fields, Jr., University of Tennessee at Chattanooga, Chattanooga, Tennessee.* This study concerns a description of structures observed in an outcrop located on United States Highway 68 in the Unicoi Mountains, 12.2 miles from Tellico Plains. The outcrop exposes turbidites, meta-siltstones, and black shale sequences that can be assigned to the Precambrian Ocoee Series. Measurement of linear and planar fabrics (bedding planes, cleavage planes, intersection lineations of planes) has given evidence that the southeast portion of the outcrop is the overturned limb of a fold.

LOCALIZED TIDAL FLAT COMPLEX ATOP TIDAL BAR IN THE MISSISSIPPIAN MONTEAGLE LIMESTONE, MONTEAGLE MOUNTAIN, TENNESSEE. *Leonard P. Raulston and James Lence, University of Tennessee at Chattanooga, Chattanooga, Tennessee.* A portion of the Mississippian Monteagle Limestone is exposed in a roadcut adjacent to the westbound lane of Interstate 24 on Monteagle mountain in Marion County, Tennessee, and was examined for sedimentary structures as well as rock texture and composition in order to determine its environment of deposition. Handford (1978) described a vertical sequence of sedimentary structures in the Monteagle Limestone. The vertical sequence begins with subtidal, fragmental carbonates which give way vertically to large-scale, planar-tabular, oolitic-rich, foreset beds capped by isolated tidal flat exposures. The detail of one of these tidal flat exposures is the subject of this paper.

HATCHING SUCCESS OF A POPULATION OF *CARETTA CARETTA*, THE LOGGERHEAD SEA TURTLE, AT CAPE HATTERAS NATIONAL SEASHORE. *Tina Minor, Lincoln Memorial University, Harrogate, Tennessee.* *Caretta caretta*, the loggerhead sea turtle, is currently listed as threatened by the United States Fish and Wildlife Service. Loggerhead sea turtles are subject to numerous threats to their survival both natural and anthropogenic. Several steps have been taken in the conservation of these sea turtles. One conservation method is location-relocation which entails movement of nests from high-risk areas to enhance survivorship. On 5 and 6 October 1991, the Cumberland Mountain Research Center in cooperation with Cape Hatteras National Seashore conducted a study on the nesting beaches of Cape Hatteras and Ocracoke Island on the Outer Banks of North Carolina. Fieldwork was conducted in which marked *C. caretta* nests, both relocated and unrelocated, were dug up after the known hatching date had occurred. The number of hatched and unhatched eggs were counted in order to calculate a hatching success rate. These data were combined with previous data from 1986 through 1991. The percent hatching success for relocated nests was 75% ( $n = 75$ ), and the hatching success for unrelocated nests was 83% ( $n = 13$ ). These percentages were not significantly different at the 0.05 level. This demonstrates the effectiveness of the location-relocation program. Results were calculated using a two-tailed *t*-test.

ALPHA<sub>2</sub> AND BETA ADRENERGIC RECEPTOR INTERACTION WITH NE. *Shawn Dennison, Lee College, Cleveland, Tennessee.* This presentation deals with the opposing roles of the alpha<sub>2</sub> and beta receptors in the human brain. By utilizing the SKMNC cell line, desensitization studies were performed to determine which receptor desensitized first to prolonged treatment of norepinephrine (NE). The research to date demonstrates that the beta adrenergic receptors desensitize first over a period of 16 h. To determine which receptor desensitizes first, the ATP pool was treated with a radioactive isotope of hydrogen. This isotope was then incorporated into cAMP which was collected and measured. As a result of the testing, five conclusions can be drawn: 1) both beta and alpha<sub>2</sub> contribute to NE cAMP; 2) ISO is slightly more potent than NE for increasing cAMP (beta 4 receptor); 3) the beta-response is potently desensitized by ISO or NE pretreatment; 4) the beta-reponse is not completely desensitized after chronic ISO or NE; 5) the role of alpha<sub>2</sub> still remains to be defined.

COMPARISON OF BOTTLED WATER WITH EAST TENNESSEE WELL WATER. *Shalene Trent and Lawrence F. Kennard, Walters State Community College, Morristown, Tennessee.* Hach's DR-EL/4 water analysis test equipment was used in the analysis of water samples. Three imported and three domestic bottled water samples were compared with water samples taken from deep wells in Cocke, Grainger, and Jefferson counties in Tennessee. All water samples were analyzed for several minerals common to well water. The results of this study will be presented.

DETERMINATION OF THE PROOF OF MOONSHINE BY GAS CHROMATOGRAPHY. *David Ray Morrow and Lawrence F. Kennard, Walters State Community College, Morristown, Tennessee.* We are frequently asked to assist our crime laboratory in some type of analysis. In a recent case, we were asked to determine the proof of a moonshine sample by taking the specific gravity of the sample. Although specific gravity is the standard method for determining proof of alcohol mixtures, we wanted to examine the sample by gas chromatography. We will present the results of our study.

SOAP PRODUCTION WITH USED FATS AND OILS. *Kevin Lopkins and Lawrence F. Kennard, Walters State Community College, Morristown, Tennessee.* Because we are running out of space in our landfills, it is imperative that we reduce our biomass. We have found that the grease from the grilling of hamburgers, bacon, and sausage and the oil from deep-oil fryers can be used to make soap. We will discuss our results and present suggestions for taking some stress off our landfills.

CHEMISTRY WITH CONSUMER PRODUCTS--CALCIUM HYPOCHLORITE OXIDATION OF SECONDARY ALCOHOLS. *Dale Gregg and Lawrence F. Kennard, Walters State Community College, Morristown, Tennessee.* Because of the environmental hazards associated with chromium (VI) compounds and our interest in doing chemistry with consumer products, we have investigated the oxidation of some secondary alcohols with HTH (calcium hypochlorite). We will present our findings.

**SYNTHESIS OF BASIC RESOLVING AGENTS.** *Chad Hadden and Lawrence F. Kennard, Walters State Community College, Morristown, Tennessee.* Although much current research involves stereospecific synthesis of enantiomers, we feel that resolution remains an important technique for separating enantiomers. We have investigated the hydrogenation of glucosyl amines, which were prepared from glucose and primary amines. We will present our results.

**A STUDY OF THE TASTEABLE DIFFERENCES BETWEEN NUTRASWEET AND SUGAR.** *Phillip W. Marshall, Holly Solomon, Victoria A. Borlaug, and Lawrence F. Kennard, Walters State Community College, Morristown, Tennessee.* An associate of Dr. Kennard's works for a company that produces Nutrasweet, and he claims that they have a great deal of research indicating that people cannot tell a difference between Nutrasweet and sugar, but we always hear people saying that they can tell a difference. We decided to try our own taste test on campus and see what it found. We will present our findings.

**CORAL GROWTH ON A NEAR SHORE ARTIFICIAL REEF IN GRAHAM'S HARBOR, SAN SALVADOR ISLAND, THE BAHAMAS.** *Jack Pickett, Kevin Schrumpp, Scott Martin, and Ellie Pickett, University of Tennessee at Chattanooga, Chattanooga, Tennessee.* Data on the sizes and types of corals present on construction debris placed into Graham's Harbor in 1957 were taken as part of a study on patch reef deterioration and recovery. Seven hard corals and two soft corals were located on the artificial reef; the largest specimen was an elkhorn coral. The deep zone of the reef contained seven types of coral. The shallow zone contained three types of coral. Minimum growth rates were estimated for some of the major reef builders. Growth at this site was compared with the corals present on five other reefs located at the southern end and the eastern side of the island.

**GARBOLOGY SURVEY OF SANDY POINT, SAN SALVADOR, BAHAMAS.** *Debra Eaker, Brian Gunter, Nancy Stewart, and Mimi Trotter, University of Tennessee at Chattanooga, Chattanooga, Tennessee.* Sandy Point, a high energy beach, is located on the southern end of San Salvador Island, The Bahamas. Garbage was collected and classified on site and deposited in an approved landfill. The petroleum products and glass fractions represented the highest percentage of the collection.

**SOME MOLLUSCS OF SAN SALVADOR ISLAND, THE BAHAMAS.** *Ellie Pickett, Bryan College, Dayton, Tennessee.* Collections of abandoned shells (live specimens were not taken, only observed) were made on some of the beaches at the northern, southern, southeastern, and eastern portions of the island. Over 50 species were represented, some of which are not included in the museum of the Bahamian Field Station.

**SPECIES IDENTIFICATION OF ZOOPLANKTON OFF NORTHPIER OF SAN SALVADOR, BAHAMAS.** *Debra Eaker, Brian Gunter, Nancy Stewart, and Mimi Trotter, University of Tennessee at Chattanooga, Chattanooga, Tennessee.* Marine plankton samples were taken from Graham's Harbor on the north end of San Salvador Island, The Bahamas, and analyzed for the presence of zooplankton. Samples were taken on a diurnal time schedule within 2 m of the surface. Individuals were isolated and ethanol-preserved within 2 h of capture. The zooplankton were identified as predominantly barnacle and copepod larvae.

**BIOLOGY AND ECOLOGY OF THE TENNESSEE SNUBNOSE DARTER, *ETHEOSTOMA SIMOTERUM* (COPE), AND THE REDLINE DARTER, *ETHEOSTOMA RUFILINEATUM*, IN SELECTED TRIBUTARIES OF THE CLINCH AND POWELL RIVER**

**DRAINAGES.** *Stefanie England and Rob Wilmoth, Lincoln Memorial University, Harrogate, Tennessee.* The Tennessee snubnose darter, *Etheostoma simoterum*, and the redline darter, *Etheostoma rufilineatum*, can both be found in the tributaries of the Clinch and Powell river drainages in Claiborne, Hancock, and Grainger counties, Tennessee. Samples of these two species were taken from May 1991 through August 1991. Through the random sampling of clear, rock-bottomed pools and adjacent riffles, a total of 16 redline darters and 27 Tennessee snubnose darters was collected from the selected tributaries of the Clinch River drainage, while 15 redline darters and 88 snubnose darters were collected from the selected tributaries of the Powell River drainages. Specimens were then preserved in 10% formalin and later measured, weighed, and aged. A stomach analysis was performed, resulting in Diptera being the predominant food item of both species. Sampling of the invertebrate population, substrate, and water quality were also collected. Results from the water quality showed no significant differences between the two drainages.

**AQUATIC VERTEBRATE DIVERSITY IN SELECTED TRIBUTARIES OF THE CLINCH AND POWELL RIVERS.** *Amy L. Thornton, Lincoln Memorial University, Harrogate, Tennessee.* During the summer of 1991, the ichthyofauna of eight tributaries of the Clinch and Powell river drainages were sampled to determine if there were differences in their diversity. Shannon diversity indices were determined for each drainage and compared using Student's *t*. Results showed similar diversities between the two systems when tested at a 0.05 significance level. Therefore, we accepted the null hypothesis that there is no difference concerning the fish diversities of the two drainages.

**AQUATIC INVERTEBRATE DIVERSITY IN SELECTED TRIBUTARIES OF THE CLINCH AND POWELL RIVERS.** *W. Ryan Fannon and Jennifer L. Fannon, Lincoln Memorial University, Harrogate, Tennessee.* During the summer of 1991, the aquatic invertebrates of eight tributaries of the Clinch and Powell river drainages were sampled to determine if there were differences in their diversity. Shannon diversity indices were determined for each drainage and compared using Student's *t*. Results showed similar diversities between the two systems when tested at a 0.05 significance level. Therefore, we accepted the null hypothesis that there is no difference concerning the invertebrate diversities of the two drainages.

**ASSESSING AGE CLASSES IN SELECTED SORICIDAE USING TOOTH WEAR PATTERNS.** *Denton L. Loving and G. Bradley Thompson, Lincoln Memorial University, Harrogate, Tennessee.* Between June and August 1991, 15 individuals of three species of Soricidae were collected in Democrat Hollow of Lincoln Memorial University in Claiborne County, Tennessee. These specimens were caught using 40 pitfall traps. *Sorex fumeus*, *Sorex cinereus*, and *Blarina carolinensis* were used to compare tooth wear patterns to age. To compare this relationship, we measured the surface area and the length of the unicuspid tooth row with an IBM PS/2 Image Analysis System. Our results, shown on a regression line, show that as the surface area decreases, the length of the unicuspid tooth row increases.

**FURTHER STUDIES OF THE AGE AND GROWTH PATTERNS OF THE BANDED SCULPIN, *COTTUS CAROLINAE*, IN SELECTED TRIBUTARIES OF THE CLINCH AND POWELL RIVER DRAINAGES.** *Robert J. Wilmoth and Stefanie R. England, Lincoln Memorial University, Harrogate, Tennessee.* The purpose of this study was to compare growth rates of the banded sculpin, *Cottus caroliniae*, in selected tributaries of the Clinch and Powell river drainages. Samples were taken from May 1991 through August 1991. Specimens were preserved in 10% formalin and later weighed and measured. Ages were

determined by counting the annuli of the otoliths. Student's *t*-test analysis and linear regression were calculated to determine differences in growth between the two drainages. Significant differences were found in the 1- and 2-year old individuals at  $\alpha = 0.05$ . Sampling of the invertebrate population, substrate, and water quality was also done. However, there were no significant differences observed for the water quality or invertebrate samples between the two drainages.

**ELECTROPHORETIC ANALYSIS OF THE BIG BROWN BAT, *EPTESICUS FUSCUS* (DE BEAUVOIS), IN CLAIBORNE COUNTY, TENNESSEE.** *Aaron L. Cadle, Lincoln Memorial University, Harrogate, Tennessee.* Polyacrylamide-gel electrophoresis of liver tissue extracts from eight individuals of *Eptesicus fuscus*, big brown bat, was performed. The specimens were collected from the chimney of LaFrentz-Poole Hall on the campus of Lincoln Memorial University. Four enzymes were investigated. Glucose-6-phosphate dehydrogenase, isocitrate dehydrogenase, 6-phosphogluconate dehydrogenase, and leucine amino peptidase. All individuals were found to be homozygous in all loci except 6-phosphogluconate dehydrogenase. One individual was found to be heterozygous at this locus. Therefore, the population sample was determined to be 12.5% heterozygous at this locus.

### MIDDLE REGION

AUSTIN PEAY STATE UNIVERSITY,  
CLARKSVILLE, TENNESSEE

**BYPASS OF A PRIMASE REQUIREMENT FOR BACTERIOPHAGE T4 DNA REPLICATION IN VIVO BY A RECOMBINATION ENZYME, ENDONUCLEASE VII.** *Anita R. Ernest and Gisela Mosig, Vanderbilt University, Nashville, Tennessee.* A primase, the product of phase T4 gene 61, is required to initiate synthesis of Okazaki pieces and to allow bidirectional replication from several T4 origins. However, primase-defective T4 gene 61 mutants are viable. In these mutants, leading-strand DNA synthesis starts at the same time as in wild type infections, but, in contrast to wild type, initiation is unidirectional and the first replicative intermediates are large displacement loops (Luder, 1981; Mosig et al., 1981; Mosig et al., 1980). Rapid double-strand DNA replication occurs later after infection, generating multiple branched concatemers, which are cut and packaged into viable progeny particles, as in wild-type T4. Evidence is presented that this late double-strand DNA replication requires functional endonuclease VII (endo VII), the product of the T4 gene 49. We propose that endo VII can provide a backup mechanism when primase is defective, because it cuts recombinational junctions, generating 3' ends. These ends can prime DNA synthesis to copy the DNA strands that had been displaced during the initial origin-dependent replication. We explain the DNA delay phenotype and commonly observed temperature dependence of DNA replication in primase deficient gene 61 mutants as a consequence of temperature-dependent translational control of gene 49 expression (Barth et al., 1988). In the presence or absence of functional primase, endo VII is essential for correct packaging of DNA (Kemper et al., 1984). The powerful selection that keeps the function of endo VII and expression of its gene at levels that are optimal for T4 development determines both the efficiency and the limitations of the bypass mechanism.

**DEVELOPMENT OF SOMATIC EMBRYOS FROM VARIOUS EXPLANTS OF SOYBEAN.** *Chaunceia Hughley, Sarabjit M. Bhatti, and Prem S. Kahlon, Tennessee State University, Nashville, Tennessee.* The formation of somatic embryos from immature cotyledons of soybean has been a topic of great interest in recent years. All studies, however, had two things in common. Very early-state immature embryos were

used as the source of explant, and high amounts of 2,4-D were added to the media. The present study was conducted to determine if other explant sources could be induced to form somatic embryos and if high amounts of 2,4-D were necessary for somatic embryogenesis to take place. Two soybean cultivars, Pella and Weber were germinated, and cotyledons, roots, leaves, and hypocotyls were excised and plated on modified Murashige-Skoog media containing 2 mg/l 2,4-D. Results at the end of a 6-week period showed the formation of embryogenic callus from all explants at varying frequencies. The highest number of embryos was obtained from leaf explants.

**A TURBO C++ BASED SYSTEM FOR LOCALIZATION OF VENTRICULAR ACTIVATION.** *Jeannette Cox and Phillip J. Ollapally, Tennessee State University, Nashville, Tennessee.* The treatment of ventricular arrhythmias remains a major challenge in the management of heart disease. Current therapies include drugs, surgery, and implantable devices, all of which have adverse effects. Localization and ablation using a catheter is a relatively low-cost, low-risk procedure. The success rate depends on accurately localizing the site of the origin of the arrhythmia. In this project, a computer assisted technique for localizing the point of origin has been developed. It uses pace mapping to localize the source of the arrhythmia. In early testing on dogs and human patients, the system appears to be able to resolve points on pacing well within 1 cm.

**IDENTIFICATION AND ISOLATION OF A GENE THAT CONTRIBUTES TO THE VIRULENCE OF *SALMONELLA*.** *Andre Scott, Carolyn Alexander-Caudle, and E. L. Myles, Tennessee State University, Nashville, Tennessee.* Salmonellosis caused by *Salmonella enteritidis* (SE) has increased steadily and causes gastroenteritis in humans. Recent outbreaks have been traced to eggs and chickens. The SE can be transmitted from infected laying hens directly to the interior of the eggs before the shells are formed or to the egg shell. Existing procedures for screening poultry and detection of infested flocks remains one of the most unsolved problems in the poultry industry. This study was designed with two objectives: to determine the effect of exposing SE to non-ionizing radiation for various time periods and to clone gene(s) for two outer membrane proteins (43KD and 46KD) which have been reported by Nagaraja (1991) to contribute to the virulence of SE.

**VARIED EXPRESSION OF VESTIGIAL WING PHENOTYPE IN *DROSOPHILA MELANOGASTER* DUE TO TEMPERATURE OF INCUBATION.** *Sharie Ball and Margaret F. Hicks, David Lipscomb University, Nashville, Tennessee.* Vestigial wings in *Drosophila melanogaster* are shriveled and perpendicular to the body. Wild-type wings are long and smooth and fold over the thorax and abdomen. Vestigial flies incubated at elevated temperatures (27 to 30°C) express an intermediate wing shape; portions of the wing are unfolded, producing a scalloped edge. The wing protrudes at a 45° angle from the body. The extent of the unfolding depends on the temperature of incubation. This phenomenon was previously shown to be due to the expression of temperature-sensitive modifier genes (Stanley, 1935). This characteristic serves as a marker to indicate fluctuations in incubator temperature.

**DESCRIPTION OF *DROSOPHILA MELANOGASTER* THORACIC AND ABDOMINAL ANOMALIES.** *Robert M. Yates, Mark Ewing, Margaret F. Hicks, and Larry N. Latson, David Lipscomb University, Nashville, Tennessee.* *Drosophila melanogaster* is sensitive to an increase in temperature during development. Abnormalities were identified in the head and thorax of a female fly and in the abdomen of a male fly. In the female, thoracic segments were fused resulting in an arching of the distal portion of the scutellum. Proximal portions of the wing margins were fused. Convex and concave surface anomalies also

occurred on the head. The male fly possessed two bilaterally fused abdomens. A weakened condition of the flies prevented crossing to determine if the defect was developmental or genetic.

**ABDOMINAL BANDING ANOMALIES IN *DROSOPHILA MELANOGASTER* INDUCED BY AN INCREASE IN INCUBATION TEMPERATURE DURING PUPAL DEVELOPMENT.** *Mark Ewing and Margaret F. Hicks, David Lipscomb University, Nashville, Tennessee.* Following an increase in incubation temperature, the incidence of *Drosophila melanogaster* with unusual abdominal banding patterns rises. Abdominal bands are broken or fused or run diagonally across the dorsal surface. The segmentation of the flies also appears to be affected. At 25°C, the frequency of this anomaly is slightly higher in vestigial sepia (vg se) flies than in the wild-type flies. Males of the vg se genotype express the unusual banding patterns most frequently (9.5%); female vg se and wild-type flies of both sexes express the bands with a frequency of 1 to 3%. Selection for the trait does not result in an increased frequency of expression, suggesting a non-genetic cause. Rather, an elevation of incubation temperature by 2° results in greater expression of the diagonal or fused bands within 3 to 5 days. This result is obtained regardless of the initial temperature of incubation and corresponds with a sensitivity to temperature change during the pupal stage of development. Wild-type female flies showed the greatest level (12%) of irregular abdominal banding patterns following treatment at elevated temperatures.

**INCREASE OF STRESS TOLERANCE IN CROP PLANTS.** *Lynn Harding, Anta Kato, E. L. Myles, and Carolyn Alexander-Caudle, Tennessee State University, Nashville, Tennessee.* An understanding of the stress physiology of agricultural plants can lead to an increase in productivity. The objective of this study is to examine protein synthesis after exposure to methionine sulfoximine. Methionine sulfoximine is a compound that mimics a bacterial infection. Investigations of a plant's response when infected with a pathogen can help elucidate their natural defense mechanisms. Plants were grown for 1 month on Murashige and Skoog (1962) media supplemented with a 1 mg/l 2,4-dichlorophenoxy acetic acid, 0.5 mg/l benzyladenine, and various concentrations of methionine sulfoximine. Protein was extracted from cells by using a glass homogenizer or mortar and pestle in Tris buffer. Protein concentrations were determined by Bradford (1976), and protein analysis was determined by electrophoresis.

**A PRELIMINARY INVESTIGATION OF THE EGG-LAYING HABITS OF ADULT NEOTENIC MOLE SALAMANDERS (*AMBYSTOMA TALPOIDEUM*) IN MONTGOMERY COUNTY, TENNESSEE.** *Charles A. Rozelle and A. Floyd Scott, Austin Peay State University, Clarksville, Tennessee.* The egg-laying habits of normal adult and neotenic mole salamanders, *Ambystoma talpoideum*, were investigated at a woodland pond in northern Montgomery County, Tennessee, from 3 January to 11 February 1992. Individuals of each type were captured in minnow traps and introduced into separate plastic swimming pools, each partially filled with pond water and provided with a substrate of decaying leaves and tree branches. Both pools were partially immersed in the study pond and checked regularly for evidence of oviposition. Several egg masses were discovered before vandals terminated the project. Egg masses laid by normal adults generally were larger and contained more ova. Although more study is needed to confirm these results, female *Ambystoma talpoideum* in north-central Tennessee appear to lay egg masses similar in shape and egg number to those described in other parts of the range. No singly laid eggs, similar to those presumed to represent the species in one South Carolina study, were found.

**EFFECTS OF VERAPAMIL, EGTA, AND CALCIUM CHLORIDE ON GA-ENHANCED LETTUCE SEEDLING HYPOCOTYL ELONGATION.** *M. C. Wallace, P. L. Digby, and B. P. Stone, Austin Peay State University, Clarksville, Tennessee.* The objectives of this study were to determine the interactions of a calcium channel-blocking agent (verapamil), a calcium chelating agent (EGTA), and calcium chloride (CaCl<sub>2</sub>) on GA-specific stimulation of Grand Rapids lettuce seedling hypocotyl elongation (72 h). A biphasic response in GA-enhanced hypocotyl elongation was observed in the presence of verapamil. Verapamil both inhibited and accentuated GA-enhanced hypocotyl elongation dependent upon concentration. Treatments of verapamil and EGTA which inhibited GA-enhanced hypocotyl elongation were reversed by presence of CaCl<sub>2</sub>. The presence of calcium produced a significant enhancement of GA stimulation of hypocotyl elongation. These studies suggest calcium interaction in GA stimulation of (72 h) Grand Rapids lettuce seedling hypocotyl elongation.

**THE EFFECTS OF WATER STRESS ON CROP PLANTS.** *Kitt Kirk, Tomar Johnson, E. L. Myles, and Carolyn Alexander-Caudle, Tennessee State University, Nashville, Tennessee.* Legumes are second only to the cereals in nutritional value and economic importance. Tissue culture provides an opportunity to study plant cells under a wide variety of conditions which include water and salt stress as well as disease resistance. The purpose of this study was to examine the proteins synthesized under water stress. Plants were grown for 1 month on Murashige and Skoog (1962) media supplemented with 1 mg/l 2,4-dichlorophenoxy acetic acid, 0.5 mg/l benzyladenine, and various concentrations of polyethylene glycol (PEG). Plants were grown on control and experimental media for 2- to 3-week periods. The experimental groups (10 and 20% PEG) had an increased level of protein synthesis.

**EFFECTS OF DES AND ESTRADIOL ON GA STIMULATION OF LETTUCE SEEDLING HYPOCOTYL ELONGATION.** *E. B. Ellis, Joy M. Popelka, and B. P. Stone, Austin Peay State University, Clarksville, Tennessee.* Objectives of this study were to determine the effects of a natural (estradiol) or synthetic (diethylstilbestrol) estrogen upon GA-specific stimulation of Grand Rapids lettuce seedling hypocotyl elongation (72 h). Both β-estradiol (ES) and diethylstilbestrol (DES), dependent upon concentration, negated or amplified GA stimulation of lettuce seedling hypocotyl elongation. β-estradiol, 0.1 ppm, produced a 70% stimulation of lettuce seedling elongation. Diethylstilbestrol, in the presence of GA, had the same effect on root initiation. The DES effects upon secondary and tertiary root initiation was not observed with ES.

**THE EFFECTS OF PROLONGED EXPOSURE OF MSO ON *PHASEOLUS VALGARIS* CV APPLAUSE.** *Nikol Atterberry, E. L. Myles, and Carolyn Alexander-Caudle, Tennessee State University, Nashville, Tennessee.* The ability of crop plants to survive in unfavorable environmental conditions may be adaptive. Plants may have the genetic capability to cope with specific external stress factors if given time to adapt. The present study used tissue culture to examine salt and disease resistance in the kidney bean. Callus growth was measured and used as an indicator of stress or resistance. Two stressors were used, salt and methionine sulfoximine (MSO). Leaf explants were surface sterilized and placed on Murashige and Skoog (1962) supplemented with 1 mg/l 2,4-dichlorophenoxy acetic acid and 0.5 mg/l benzylaminopurine. One gram of callus was placed on control media as well as media containing different concentrations of either salt or MSO. After 3 weeks, callus was removed, weighed, and frozen. Proteins were extracted using a mortar and pestle in Tris buffer. Total soluble protein was determined using the Bradford technique (1976). Although there

were no significant difference in the tolerance levels, there were higher levels of protein synthesis among the experimental groups when compared with the control.

**DISEASE STRESS AND UV IRRADIATION OF AGRICULTURAL PLANTS.** *Felicia Venable, E. L. Myles, and Carolyn Alexander-Caudle, Tennessee State University, Nashville, Tennessee.* It is well understood that constant exposure to ultraviolet radiation (UV) is a threat to all organisms, from bacteria to humans. The repair mechanism of photoreactivation is well known and very effective in correcting the damage caused by UV. The deterioration of the ozone layer means more intense radiation on the earth's surface, and plants will not be protected from the harmful effect. The present study examined the effect of UV on kidney beans. Leaves were surface sterilized and placed on Murashige and Skoog (MS) media supplemented with 1 mg/l 2,4-dichlorophenoxy acetic acid and 0.5 mg/l benzyladenine. After 3 weeks, 1 g of callus was placed on the same media and irradiated in the dark for 40, 50, 60, 70, 80, and 90 sec. The plates were wrapped with aluminum foil and placed in an incubator at 26°C for 2 weeks. The weight was recorded, and the callus tissue was frozen and ground with mortar and pestle to extract proteins. Protein quantity was determined using the Bradford technique (1976), and SDS polyacrylamide-gel electrophoresis was performed. The growth weight had no effect on any of the irradiation times; however, the total protein synthesized appears to be less at the 80- and 90-sec irradiation times.

**THE SYNTHESIS OF STRESS-RELATED PROTEINS IN TISSUE CULTURE.** *Melanie Arnold, Benjamin Gayle, E. L. Myles, and Carolyn Alexander-Caudle, Tennessee State University, Nashville, Tennessee.* Plants are exposed to unfavorable environments under both natural and agricultural conditions. The present study looks at disease and resistance and protein synthesis of *Phaseolus vulgaris* in tissue culture. Methionine sulfoximine (MSO) is a compound that inhibits the enzyme glutamine synthetase, which is the same enzyme inhibited by the pathogenic organism *Pseudomonas syringe*. Methionine sulfoximine is used because it is stable in tissue culture. Plants were grown for 1 month on Murashige and Skoog (1962) media supplemented with 1 mg/l 2,4-dichlorophenoxy acetic acid, 0.5 mg/l benzyladenine, and various concentrations of MSO. Protein was extracted from cells by using a glass homogenizer or mortar and pestle in Tris buffer. Callus tissue was grown on control and 4 and 8  $\mu$ M MSO. Electrophoretic analysis reveal no difference between 4 and 8  $\mu$ M MSO.

**EXTRACTION OF DIESEL FUEL FROM CONTAMINATED SOIL WITH LIQUID CARBON DIOXIDE.** *Laura Partin, Gerald A. Nyssen, and Byron D. Taylor, Hillsboro Comprehensive High School, Trevecca Nazarene College, and TVG Environmental Consultants, Nashville, Tennessee.* Five hours of Soxhlet extraction by liquid carbon dioxide with the aid of Freon 113 yields consistently better recovery and analysis of hydrocarbon contaminants in soil samples compared to sonication and conventional liquid-liquid procedures.

**A COMPARISON OF MOLECULAR CHARACTERISTICS CALCULATED BY MOLECULAR MODELING PROGRAMS AND NMR CHEMICAL SHIFTS OF SUBSTITUTED PORPHORINES COMPLEXED WITH TRINITROBENZENE.** *Virginia Crabtree, Sharon Parker, and Harvey Blanck, Austin Peay State University, Clarksville, Tennessee.* Molecular modeling programs are very useful in quantifying molecular properties and structures of molecules. PCMODEL, which is a molecular mechanics program available from Serena Software, was used for global energy minimization of the structure and to generate a coordinate table used as an input of MOPAC, which is a molecular orbital package available from QCPE. MOPAC

obtained a local energy minimum and calculated electron densities, dipole moments, bond angles, and bond lengths of these molecules. The structure resulting from MOPAC calculations could then be displayed using PCMODEL. The two application software packages work quite well with one another provided metals are not present. Transfer of files containing metals has not been successful, but it may simply be a slight file incompatibility. There are three versions of PCMODEL. PCM, PH4, and MMX versions will not do pi bonds, global energy minimization, and CRT structure display, respectively. Files may be easily formed with PCM or PH4 using the CRT and then transferred to MMX for global energy minimization including pi bonding. The resulting molecular mechanics structural characteristics may then be compared to those using the molecular orbital calculations from MOPAC. Electron densities of porphine derivatives including *pheophytin a* were calculated using molecular modeling and compared with the NMR spectra of *pheophytin a* and *pheophytin a* complexed with trinitrobenzene.

**AB-INITIO DETERMINATION OF DIPOLE MOMENT IN A PHYSICAL CHEMISTRY LABORATORY.** *Kimberly A. Grimes and William A. Tallon, David Lipscomb University, Nashville, Tennessee.* The experimental determination of dipole moments is a common part of the physical chemistry laboratory curriculum. The computational estimation of a dipole moment can now be accomplished with readily available microcomputer programs. The results of such calculations using an INDO calculation approach will be described. The usefulness of a molecular mechanics program to provide the input geometry for the dipole moment calculation will be discussed. Finally, a program, currently under development, which will present a user-friendly interface and link the molecular mechanics and dipole moment calculations together will be described.

**MICROBIAL DEGRADATION OF TRACE ORGANICS.** *Sherry L. Collins and Ramage, Belmont College, Nashville, Tennessee.* Advances in microbial ecology have shown that microbial communities play a critical role in the biosphere, primarily in recycling. They utilize major biochemical elements such as carbon, nitrogen, sulphur, and oxygen to support their own life systems. Compounds containing these elements existing within a microbe's environment can be utilized as a source of nutrients through a series of biochemical and enzymatic processes, breaking the compound down. An understanding of these processes is critical not only in determining what role microbes play in the ecosystem but also as a source of information to secure a healthier environment and world condition. Motivated by the levels of industrial pollutants released into the biosphere, I tested the degradation of three known persistent toxins using microbes and then analyzed the end products for signs of enzyme activity. Then microorganisms were isolated from soil, and water samples were obtained from the Cumberland River, metropolitan Davidson County, Nashville, Tennessee. They were then inoculated into a medium enriched with phenol, chlorobenzene, or sulfuric acid. Infrared analysis revealed positive enzymatic activity in biodegradation of the compounds by the microbes.

**DETERMINATION OF RADON CONCENTRATION AT DAVID LIPSCOMB UNIVERSITY.** *Korey J. Risley and Paul B. Langford, David Lipscomb University, Nashville, Tennessee.* The main buildings on the campus of David Lipscomb University were monitored for radon gas in the fall and winter of 1991-1992. Gas concentrations were recorded at 4-h intervals for a period of at least 1 week at each site. Barometric pressure was recorded daily in order to correlate weather systems and gas concentrations. Also, measurements were taken at different levels within a building to correlate heights at which data are recorded with concentrations. The concentration data were collected using an electronic device that measured in units of picocuries per liter.



Detected levels were compared with the standard level of 4 picocuries/l. A direct relationship was found between the radon concentrations and barometric pressure. Also, the height at which data are collected has a definite effect upon radon levels.

**DETERMINATION OF TRACE METALS IN STREAM WATERS IN TENNESSEE USING ATOMIC ABSORPTION SPECTROPHOTOMETRY.** *Pam Dahl, William Jones, Joanne Jones, Sharon Parker, and Fred Matthews, Austin Peay State University, Clarksville, Tennessee.* Studying the trace metals in the water of the surrounding area is an effective way of examining the pollution present in such waters. The Red River and its tributaries were examined for the contamination of lead. Large samples were taken, and those samples were reduced in volume and measured. The measurement of the dissolved content of lead and of the total content of lead was used to determine the content of the suspended lead. The actual measurements of the concentrations were performed by atomic absorption spectroscopy. Finally, this information was calibrated and plotted. These plots were used to indicate the concentrations of the samples within the sample water. This method combined with other methods has the potential to examine the concentrations of the trace metals within surface water systems, focusing on the contribution of each tributary to a particular system.

**FIRST REPORT OF PREVIOUSLY UNRECOGNIZED CONODONT ZONES NEAR THE MAURY SHALE-FORT PAYNE FORMATION (MISSISSIPPIAN, KINDERHOOKIAN) CONTACT ON OUTCROP IN SOUTH-CENTRAL TENNESSEE.** *Edward P. Eastburn and Larry W. Knox, Tennessee Technological University, Cookeville, Tennessee.* At a single locality near Campbells Station in south-central Tennessee, the Maury Shale is 10 cm thick and consists of greenish clayshale containing phosphate nodules in the lower part. Above the Maury occur two thin argillaceous crinoidal packstones. The packstones are separated and overlain by thin green clayshale beds of lithology similar to the Maury but lacking phosphate nodules. Overlying the uppermost shale is a sequence of crinoidal packstones of the Fort Payne Formation. Conodonts from the thin packstones and interbedded shales have yielded a large number of conodont elements. The conodonts belong to several standard Mississippi Valley conodont zones not previously recognized in Tennessee. In ascending order, they are the *Siphonodella duplicata* Zone, the *Siphonodella quadruplicata* Zone, and *Siphonodella isosticha-S. cooperi* Zone. It is possible that sequentially younger conodont zones may be present in rocks overlying the studied interval, but the conodont faunas in the overlying strata have not yet been studied. The conodont zones reported here are missing in north-central and east-central Tennessee where a significant disconformity separates the Fort Payne and the Maury. The presence of at least three conodont zones within 1 m indicates that the section is condensed. It is not clear yet if conodonts of all three zones are completely admixed through the entire interval or whether the zones occur in order with only partial admixture.

**NONLINEAR OPTICS IN AN UNDERGRADUATE OPTICS LABORATORY.** *Hobson Lane, Thomas Jones, Richard F. Haglung, Jr., Vanderbilt University, Nashville, Tennessee.* Light and matter seldom interact in the linear fashion taught in the undergraduate optics course. We have observed nonlinear distortions in low-power He-Ne and Ce-Cd laser beams transmitted through such nonlinear media as Chinese green tea. The intensity distribution of laser light is measured by digitizing video-camera images of the laser spot on a screen at some distance from a cuvette containing the nonlinear optical material. Comparisons of experimental results and theory are made by calculating the expected intensity distributions using the *Mathematica* language. We will show data from an experiment in which He-Cd laser passes through Chinese green tea in ethylene glycol, with a far-field intensity exhibiting self-

focussing, self-defocussing, and filamentation. A Nd:YAG laser and other exotic nonlinear media are being developed as part of the advanced undergraduate laboratory in optics.

**THE EFFECTS OF THE COMPRESSED WORKWEEK ON ABSENTEEISM, TURNOVER, AND PRODUCTIVITY.** *Terry A. Carroll and Michael Hein, Middle Tennessee State University, Murfreesboro, Tennessee.* This field study examined the effect on absenteeism, turnover, and productivity in a small rural factory that switched from the traditional 5 day-8 h work week to a compressed work week of 4 days-10 h. The factory employed approximately 110 production workers and 20 supervisors. Data were collected for 28 weeks before the intervention and 31 weeks after. All data were collected on a factory-wide basis, with no individual data being examined. Based upon previous research, it was hypothesized that productivity would increase while turnover and absenteeism would decrease. The hypotheses for turnover and absenteeism were strongly supported. However, the hypothesis concerning productivity was not supported.

**A LOW-COST TERMINAL-BASED INFORMATION SERVICE BUREAU SYSTEM.** *Edward Quint Martin, Rajeshwari Nagarajan, Rachel Washburn, Jama Metcalf, and James Holloway, Tennessee State University, Nashville, Tennessee.* This project deals with the design and implementation of a personal computer-based information service bureau accessed by low-cost terminals. A low-cost remote terminal has been designed by the Electrical Engineering Department at Tennessee State University. It consists of a four-line, 20-character display and is designed to interface with a standard telephone line. Data for transmission and reception are encoded using Dual Tone Multi Frequency signalling (also known as Touch Tone). These remote terminals can then access a host system that can contain information such as movie schedules, vendor catalogs, and ordering information. The host system has been designed and implemented on an IBM compatible PC. It consists of a communication module, an interface to a database management system, and a database management system called informix. Data on courses offered at Tennessee State University have been compiled into the database.

**APSU PROJECT WEATHER.** *K. B. Austin, J. C. Clark, J. H. Newton, and J. M. McCluskey, Austin Peay State University, Clarksville, Tennessee.* APSU Project Weather was started in the spring of 1992. Its purpose is to establish a local meteorological station with computer-aided weather-forecasting capabilities, to maintain computer links with WeatherBank, Inc. (a vendor of current national meteorological data) to acquire national weather information, and to collect data for a comprehensive state climatological database. The purpose of this presentation is to summarize the various components of the project and to review the progress which has been made to date.

**GROUNDWATER FLOW CHARACTERISTICS IN THE KARST OF CENTRAL CLARKSVILLE: EMPHASIS ON SPRING TYPE AND CONTAMINANT CONCENTRATIONS.** *Jason Repsher, Sharon Parker, and Phil Kemmerly, Austin Peay State University, Clarksville, Tennessee.* Fieldwork identified (67) spring sites in the central city area of Clarksville, Tennessee. Springs are both structurally and stratigraphically controlled. Springs along the St. Louis Limestone and Warsaw Limestone contact are dominant; others occur along three joint sets oriented N 10°-30°W, N 70°-90°E, N 40°-60°E, and bedding planes. Preliminary data allow estimates of discharge volume versus spring type and the establishment of groundwater basin characteristics for groundwater flow-path determination. A chemical analysis of water quality also showed differences between spring types and the amount of urbanization in the springs' local groundwater basin. These findings

will enable city planners, state and federal agencies, and geologists to identify contaminant flow paths in the groundwater basin underlying this portion of the city.

**COMPUTER APPROXIMATION OF  $\pi$ .** *Danny H. Osborne, Jr., and Thomas Ray Hamel, Austin Peay State University, Clarksville, Tennessee.* The irrational constant  $\pi$ , which is the ratio of the circumference of a circle to its diameter, has been approximated in many ways. With the use of a computer,  $\pi$  can be approximated to billions of digits, a feat impossible with paper-and-pencil techniques. Often used algorithms include strategies that involve square roots, fourth roots, and series approximations of trigonometric functions. Several of these and other algorithms were converted to the C and Pascal programming languages and have been run on a VAX 8530. Some of the algorithms were much easier to implement, while others were more efficient in terms of computer run-time and memory considerations.

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**INTRACELLULAR RECORDING AND LABELLING OF SUPRAOPTIC NUCLEUS NEURONS IN THE RAT.** *Sanjiv Desai, Christian Brothers University, Memphis, Tennessee.* The neurohypophysial hormones vasopressin and oxytocin are synthesized in the supraoptic (SON) and paraventricular nuclei of the hypothalamus. In mammals, the SON has been divided into two parts, the principal, or anterior SON (SONa), and the retrochiasmatic, or tuberal portion (SONt). Most of the studies on the SONt suggest that it is morphologically similar to the SONa. Both divisions project to the neurohypophysis. While accounting for about one-sixth of all SON neurons in the rat, the SONt itself is composed of a majority of (75 to 85%) of vasopressin-producing cells. A majority of the morphological and electrophysiological studies performed on the supraoptic nucleus neurons have been concentrated on the SONa.

**AN ATTEMPT TO DETERMINE THE EFFECT OF CHRONIC HYPERINSULINEMIA ON THE PHOSPHOLIPIDS COMPOSITION OF THE ENDOTHELIAL AND SMOOTH MUSCLES COMPONENT OF THE RAT AORTA.** *Dhuc Hanh Diep and Ellen S. Kang, Christian Brothers University, Memphis, Tennessee.* My experiment was to see whether an increase in insulin causes changes in the aorta and fat tissue enzymes that lead to alterations in the composition of the membrane phospholipids of tissues and organs involved in the regulation of blood pressure. I worked with 24 rats; half were given streptocytosin, and the

other half were given food pellets and water. The rats that were injected with streptocytosin were given glucose twice a day. We checked the glucose level with an acute stat. The animals were then sacrificed. I took the aorta and used TLC technique to separate phospholipids from membrane cells. Half was sent to be examined by Dr. Henry Wilcox, and, on the other half, I ran a phosphate assay.

**ANATOMICAL EVIDENCE FOR FUNCTIONAL CONVERGENCE ONTO SINGLE NEURONS IN PRIMARY SOMATOSENSORY CORTEX IN THE CAT.** *Robert S. Waters and Anna M. D'Angelo, Christian Brothers University, Memphis, Tennessee.* Neurons of primary somatosensory cortex were recorded from intracellularly and labeled with biocytin in order to investigate the possibility of convergence of multiple nerves onto single nerve cells of the primary input layer (cortical layer IV). Extensive data have been compiled in regard to receptive fields of the primary somatosensory cortex and convergence of multiple nerves onto neurons of all cortical lamina with the exception of layer IV. Coupling occurred in labeled neurons, and it is unknown whether this phenomenon is the result of the chemical properties of biocytin or whether the neurons possess unique communication networks which might form the basis for receptive field reorganization.

**UNLOCKING THE POLYAMINE PUZZLE: THE ROLE OF POLYAMINES IN CELLULAR DIFFERENTIATION.** *Paul Trombley, Christian Brothers University, Memphis, Tennessee.* This study was undertaken to determine the effect of polyamines on cell differentiation. DFMO is an irreversible inhibitor of ornithine decarboxylase, a rate-limiting enzyme for polyamine biosynthesis and, as such, can be used to deplete cells of intracellular polyamines. Dose-response experiments at days 4, 8, and 15 post-plating showed that 0.5 to 5.0 mM concentrations of DFMO could prevent cell differentiation as assessed by enzyme markers sucrose and maltase. In a second set of experiments, putrescine, the diamine from which polyamines are synthesized, was added in increasing concentrations in conjunction with a concomitant inhibiting dose of DFMO in order to establish whether differentiation could be re-established along with intracellular polyamine pools. It was found that 0.5 mM putrescine was able to increase maltase activity in the presence of DFMO (with sucrose activity less responsive). These experiments support the conclusion that the polyamines do play a role in cell differentiation in this cell line.

**ENZYME DEACTIVATION STUDY OF ALPHA AMYLASE IN A PRIMARY STARCH LIQUEFACTION SYSTEM.** *Hamp W. McCary, II, Christian Brothers University, Memphis, Tennessee.* The intent of this project was to design, modify, and test a method to determine percent alpha amylase inactivation in the primary starch liquefaction reactor at Cargill's Wet Corn Milling Division in Memphis, Tennessee. This method is useful for comparison of before and after changes made in the process that may affect percent alpha amylase inactivation or when new enzymes are tested. The deactivation of alpha amylase in a primary starch liquefaction reactor was examined by the technique of determining the change in the dextrose equivalent of the starch liquor over time. Due to the high volume and price of the enzyme used, this technique is a vital source of loss prevention. After several modifications, the method was used to test a replacement jet cooker which aids in the breakdown of starch by cooking it before entering the primary reactor. Results from this study showed 46 to 50% alpha amylase inactivation through the primary reactor when the new jet cooker was put on line. With the old jet cooker on line, there was 21% alpha amylase inactivation. This suggested that some modification in production should be achieved to alleviate this inactivation.

**GALACTOSE UTILIZATION IN *AZOTOBACTER VINELANDII*.** *Scott Craig and Tit-Yee Wong, Christian Brothers University, Memphis, Tennessee.* Many organisms use various sugars for energy by converting them into glucose. *Azotobacter vinelandii* was used in this study of sugar metabolism because cell yield increased threefold when grown on galactose rather than glucose, a rather unusual occurrence considering most organisms have higher biomass when grown on glucose. This suggested that the galactose metabolic pathway is different from that of glucose. Cytoplasmic fractions separated from *Azotobacter* cultures were used to determine the metabolic pathways of both glucose and galactose. Results showed that galactose was broken down by a galactose dehydrogenase, an enzyme found in the DeLey-Duodoroff pathway of galactose utilization documented in species of *Pseudomonas*.

**HYPERINSULINEMIC EFFECTS ON RATS.** *Monte E. Martin, Christian Brothers University, Memphis, Tennessee.* This study was undertaken to determine the effects of chronic hyperinsulinemia on liver desaturase activity and their subsequent effect on the fatty acid components of phospholipids in rat kidneys. Experimental rats were injected with streptozotocin which destroys the beta-cells of the pancreas, thus allowing for better control of the insulin levels. Two experimental groups were used, each group consisting of six rats. The group injections were separated by 1 week to determine if duration of injection had any effect on fatty acid composition. The second group received injections for 2 weeks to determine change due to length of the duration of hyperinsulinemia. Upon dissection, the kidneys were separated into cortex and medulla, and the lipid portions were extracted with chloroform:methanol after homogenization with a shear homogenizer. After drying with nitrogen gas, the lipid samples were separated by class by thin layer chromatography, eluted, converted to their methylesters, and analyzed by gas chromatography. The amount of phospholipid was found to remain unchanged by phosphate assay analysis. The fatty acid content of the phospholipid was found to change from palmitic acid to palmitoleic acid in the cortices of the experimental samples, suggesting that the A9 desaturase was responsible for the concentration change. This is the first time that streptozotocin-induced diabetic rats given hyperinsulinemic doses displayed the consequences of an increase in desaturase activity, which has been shown in several other *in vitro* systems. The effect of injection duration was also displayed in this experiment on fatty acid concentration. This leaves the question of what effect does hyperinsulinemic doses have on the organs themselves or on their activity. To this point, research is still needed to determine these effects on diabetic patients.

**PRODUCTION OF TUMOR NECROSIS FACTOR (TNF) IN ACUTE PANCREATITIS AND ITS SUBSEQUENT REDUCTION FOLLOWING HEPATIC PASSAGE.** *Hani Grewal, Keith W. Novak, and A. Osama Graber, Christian Brothers University, Memphis, Tennessee.* TNF is rapidly gaining recognition as one of the early, critical mediators of several inflammatory conditions, most notably endotoxin shock. The purpose of our study was to determine whether TNF levels were raised in severe acute pancreatitis, thus pointing to its role as a potential mediator of the inflammatory process. We also researched for the possible site of production and uptake of TNF. TNF levels were measured over a 2-h period in a rat model of acute pancreatitis. TNF levels increased proportionately with time and serum amylase reaching a maximum of 2,700 pg/ml at 2 h ( $P = 0.001$ ) in comparison to sham-operated rats. TNF levels in unoperated controls were undetectable. These measurements were found to be independent of endotoxin production. In addition, selective sampling from the portal vein, hepatic vein, and femoral artery demonstrated hepatic degradation of TNF ( $P < 0.005$ ) indicating that the liver may play an important role in protecting

the host from multiple organ failure which is known to occur with the presence of high TNF levels. Our results demonstrate that TNF levels are elevated in acute pancreatitis and may play an important role for this cytokine in the pathogenesis of the disease.

**COMPARISON OF PROGESTERONE- AND INSULIN-INDUCED OOCYTE MATURATION IN *RANA PIPIENS* USING CALCIUM MICROINJECTION TO ASSESS COMPETENCE FOR CELL CLEAVAGE.** *Jonathan D. McAllister, II, Memphis State University, Memphis, Tennessee.* As a part of an overall research goal of comparing progesterone- and insulin-induced oocyte maturation in *Rana pipiens*, calcium chloride microinjection was employed to assess cell excitability. Oocytes were induced to mature *in vitro* with insulin or progesterone treatment. After maturation (about 24-h post-treatment), micromolar amounts of calcium chloride were injected into the oocytes to determine if the matured eggs were capable of forming cleavage furrows. It has previously been demonstrated that progesterone-matured oocytes undergo cleavage within 20 min of calcium microinjection. Preliminary experiments confirmed this report and further indicated that insulin-induced oocytes rarely cleaved with calcium microinjection. This observation suggests that preparation of the cytoskeleton for the cleavage event is probably not a common part of the insulin and progesterone maturation pathways.

**THE EFFECTS OF BACTERIAL SPENT MEDIA ON EUKARYOTIC CELLS.** *Torrance R. Lewis, Memphis State University, Memphis, Tennessee.* I tested the hypothesis that the spent media produced by the bacteria *Azotobacter vinelandii* contains a factor that will act as a free radical reductant in eukaryotic cells. My hypothesis was tested by using a set of control cells and a set of spent media-exposed cells; the eukaryotic cell line used for this experiment was *Carassius auratus* (goldfish CCL-71). Both the control and factor-treated cell replicates were exposed to varying time intervals of ultraviolet radiation. The preliminary results of the experiment supported my hypothesis that the spent media-treated cells seem to tolerate the ultraviolet irradiation better than the control cells.

**CENTRAL NERVOUS SYSTEM HISTAMINE CONTROL OF CUTANEOUS BLOOD VESSELS.** *Stefane Williams, Christian Brothers University, Memphis, Tennessee.* The role of histamine (HA) in the redistribution of blood flow was investigated in anesthetized Syrian golden hamsters. Intracerebroventricular (icv) injections of HA caused increases in mean arterial pressure (MAP) as well as cutaneous arteriolar diameter. Icv pyrilamine, a H1 receptor antagonist, pretreatment prevented significant HA-induced changes in either MAP or arteriolar diameter from the control. However, after H2 receptor blockade with cimetidine, icv HA increased MAP but decreased arteriolar diameter. The mechanism of central HA-induced effects on skin arterioles was also investigated by local blockade of arteriolar receptors during icv administration of HA. Peripheral blockade of arterioles with the alpha receptor antagonist, prazosin, did not alter the response to icv HA. In contrast, propranolol, a beta receptor antagonist, was able to block dilation following icv HA. These results support the conclusion that HA is involved in blood flow redistribution by activation of the central H1 and H2 receptors, and vasodilation results from stimulation of the peripheral beta receptor.

**EFFECT OF CHEMICAL AGING UPON THERMOLUMINESCENCE IN GAMMA-IRRADIATED POLYETHYLENE.** *S. Aldridge, M. S. Jahan, and C. P. Vu, Memphis State University, Memphis, Tennessee.* The thermally-stimulated-discharge-current technique, along with the resultant glow curves, is rapidly becoming a productive source of information in the study of polymers. The method is quite simple.



Thermoluminescence (TL) is produced by exposing a sample to radiation at low temperatures and then allowing the material to warm up. Using this (TL) approach, data were collected on individual samples of ultra-high molecular weight polyethylene which had been submerged in lipid, hydrogen peroxide, nitric acid, or saline solutions at 37°C following 2.5, 20, and 100 MR of cobalt-60 gamma irradiation. Measurements were conducted at five intervals ranging from 1 day to 12 weeks. Then, the resultant glow curves were combined in various groups in order to look for relationships among the irradiated samples. The most apparent decrease in TL occurred in the 20- and 100-MR samples which were exposed to nitric acid. This result correlates directly with the data that have been obtained using a completely different means, the electron-spin-resonance technique, suggesting that the TL mechanism is associated with free radical reactions.

THE EFFECT OF SUSTAINED INCREASES IN ARTERIAL PRESSURE ON BARORECEPTOR NERVE ACTIVITY. **R. A. Picerno and M. J. Kenney**, *Rhodes College, Memphis, Tennessee*. The arterial baroreceptor reflex plays a key role in the regulation of cardiovascular function. Aortic depressor nerve (ADN) activity remains increased from control in spontaneously hypertensive rats after sustained phenylephrine-induced increases in arterial pressure (AP) despite the return of AP to control levels. However, since phenylephrine can have a direct excitatory effect on the arterial baroreceptors, it is difficult to determine whether the prolonged increase in ADN activity results from the sustained increase in AP or is a direct drug-induced effect. In the current study, we increased AP by mechanical occlusion of the abdominal aorta in chloralose-anesthetized, spontaneously hypertensive rats. During aortic occlusion, AP and ADN activity were increased from control levels. After aortic occlusion, despite the return of AP to control levels, ADN activity tended to be increased from control levels. These results suggest that afferent baroreceptor nerve activity can be altered by sustained increases in AP.

AN ULTRASTRUCTURAL STUDY OF THE TEMPORAL ABILITY OF MITOCHONDRIAL SELF REPAIR WITHIN CARDIAC TISSUE OF MICE FED ETHANOL IN UTERO. **Carl E. Vest and Carolyn R. Jaslow**, *Rhodes College, Memphis, Tennessee*. Swiss albino mice were prenatally exposed to ethanol, and a number were sacrificed at parturition. The remainder of the offspring were to be sacrificed at 1-month intervals for the next 3 months; however, difficulties were experienced in keeping the remaining alcohol-fed mice alive due to technical problems. Therefore, 1-year old alcohol-fed and control mice remaining from a previous study were substituted for this portion of the project. Cardiac tissue was excised and prepared for study under the electron microscope. Control tissue for both groups was obtained and prepared for electron microscopic study as well. Micrographs of the cardiac tissue of all groups were obtained and analyzed to determine degrees of mitochondrial degradation due to prenatal exposure to ethanol. The primary focus of this study was to determine whether ethanol-damaged cardiac mitochondria undergo repair with age, and, if so, to what degrees at different age intervals. However, because of the technical difficulties experienced, the focus of this study will simply be to determine if mitochondrial repair to ethanol-damaged tissue occurs at all with age.

IS THE RHIZOBIUM SYMPLASMID REQUIRED FOR CYTOKININ PRODUCTION? **Alok Kumar, Charles Cuvelier, and Barbara Taller**, *Memphis State University, Memphis, Tennessee*. Many plant-associated bacteria manipulate plants by the production of plant hormones such as cytokinins. Since cytokinin genes are plasmid-borne in several plant pathogens, it was of interest to determine whether such genes occurred on the symbiotic plasmid (pSym) of *Rhizobium*. Cytokinin production was examined in a pair of *Rhizobium leguminosarum* bv.

*phaseoli* strains, one of which had been cured of pSym. In addition, pSym was mobilized into a plasmid-less strain of *Agrobacterium tumefaciens* C58, and cytokinin synthesis was analyzed. Status of pSym was verified using nodulation and melanin assays and agarose-gel electrophoresis. Cytokinins were isolated from bacterial culture filtrates and analyzed with the tobacco callus bioassay. Cytokinin production from the pSym-cured *Rhizobium* strain was qualitatively similar to that of its parental strain. While *R. phaseoli* produced both zeatin and isopentenyladenine-type cytokinins, *A. tumefaciens* C58 pSym produced mostly isopentenyladenine, characteristic of strain C58 when cured of the Ti plasmid. Thus, the Sym plasmid does not appear to direct cytokinin synthesis.

THE RUSSELL-TAYLOR HUMERAL NAIL: A PRELIMINARY REPORT. **Patrick C. Finney**, *Christian Brothers University, Memphis, Tennessee*. This was a retrospective study undertaken to determine the effectiveness of the Russell-Taylor interlocking intramedullary humeral nail. The study was made up of 41 cases, each with one of three surgical indications for the use of the humeral nail: 1) preoperative nonunions, 2) fractures from trauma, 3) pathological lesions. The success rates were 80% for the 10 nonunions, 100% for the 25 standard fractures, and 100% for the 4 pathologic fractures with follow up. This compares favorably with treatments previously reported with regard to desired outcomes as well as complication rates.

ANALYSIS OF DNA FROM OVARIAN AND ENDOMETRIAL TUMORS. **Travis Phillips and Jill Jenkins**, *Christian Brothers University, Memphis, Tennessee*. The c-myc, ki-ras, and p53 oncogenes, among others, have been implicated in the development of genital cancers in women. We evaluated amplification of these genes in 10 cases of endometrial adenocarcinoma and 11 cases of papillary ovarian adenocarcinoma. High molecular weight DNA was recovered by laboratory protocol. DNA samples were digested to completion with EcoR1, fixed to nylon filters according to the slot blot method, and hybridized with probes for c-myc, ki-ras, p53, and beta-tubulin as a control. Among the 10 cases of endometrial adenocarcinoma, the c-myc sequence was amplified in one. Among the 11 cases of ovarian adenocarcinoma, c-myc alone was amplified in two others, and all three genes were amplified in another. Amplification appears to be a relatively infrequent phenomenon and may tend to be limited to adenocarcinoma.

SEED BANK COMPOSITION. **John Elsom**, *Christian Brothers University, Memphis, Tennessee*. The purpose of this experiment was to determine whether or not a seed bank contributes to the rejuvenation of a newly plowed field, and to determine if life forms vary from upper and lower fields. Thirty-one soil cores were taken from two fields (upper and lower.) One-half of each core was planted immediately on flats, while the other half was stratified for 4 weeks. Fifteen different species and a total number of 336 plants were identified. A test for association of the two fields showed no significant association for either field. As a result, neither field, upper nor lower, displayed any significant change in life form distribution. The seed bank did not contribute to the rejuvenation of the first-year fields. However, the second-year fields did exhibit an increase in seed bank contribution.

NEAREST NEIGHBOR ANALYSIS OF CONE PHOTORECEPTORS IN THE HUMAN RETINA. **Toya D. Hurt**, *Christian Brothers University, Memphis, Tennessee*. Ten human retina were studied to assess the regularity of the cone photoreceptor mosaic and to determine if there was any change associated with aging. A nearest neighbor analysis of the temporal dorsal region of the retina was performed on retina of humans between the ages of 15 and 83. Micrographs of the mosaic were

generated using video-enhancement imaging, and a pseud-random distribution was generated using pennies to compare with the human distribution. Comparisons of the distance between each cone and its nearest neighbor were made between a younger and an older retina or the same sex. As a result, the regularity of the human retina was verified, and it was found that the regularity did decrease with age.

**GROWTH OF *AZOTOBACTER VINELANDII*.** *Tit-Yee Wong and Deborah R. Watson, Memphis State University, Memphis, Tennessee.* *Azotobacter vinelandii* is an aerobic free-living, nitrogen-fixing, soil bacterium. It was known for many years that after inoculating to a nitrogen-free medium, cells would have to sit still for 2 h before shaking, or the cells would not divide. The inability of cell growth was believed to have been caused by oxygen toxicity. This inability of growth is dependent on the type of sugar used (glucose proved to be the worse substrate), the size of the inoculum, and the aeration rate. A factor was found in the spent medium of pre-grown *Azotobacter*. This factor exhibited modulating effects on cell growth, but, by itself, it could not support growth. The factor increased biomass formation in glucose medium even at extremely high aeration rates.

**A COMPARISON OF THE TWO WAYS TO CONDUCT NULL AUTOMATED ELLIPSOmetry.** *Neal Watkins, Christian Brothers University, Memphis, Tennessee.* Two ways to perform null ellipsometry are the method of swings, which will estimate the optical null based on two measurements, or the method of least squares, which uses statistics to calculate the optical null. For the ellipsometer in question, the first part of the project was to find the correct settings for the 1170 analog to digital converter (the converter digitizes voltage readings which are proportional to the intensity that the photodiode detects). These settings proved to be a 166.7-msec integration time with an 18-bit storage format. The results from the second part of the project showed that the method of least squares was both more accurate and faster than the method of swings in determining optical nulls. These results were obtained with a metal surface in air. Finally, the method of linear squares was applied to a metal surface that was immersed in water.

**DETERMINATION OF ED50 OF PROGESTERONE IN ORDER TO STUDY EFFECTS OF ESTROGEN AND H+ CONCENTRATION ON PROGESTERONE-INDUCED MATURATION IN *RANA PIPIENS*.** *Angela K. Ventura and Julie R. Dunn, Memphis State University, Memphis, Tennessee.* The oocyte, defined as the immature female gamete as it resides in the ovary, must undergo maturation before it can participate in the fertilization process. This maturation process is physiologically induced by the steroid hormone progesterone. Previous studies performed on *Xenopus laevis* and *Rana pipiens* indicate that the presence of the hormone estrogen inhibits progesterone-induced maturation. These studies also illustrate the pronounced effect of pH on the maturation process. In order to perform these studies, the effective dosage to elicit a 50% response (ED50) of progesterone on the oocytes of each frog must be determined before the estrogen and pH factors are studied. The hypothesis being tested in this study is that specific estrogen concentrations coupled with various pH ranges affect progesterone-induced oocyte maturation in *Rana pipiens*.

**REACTION TIMES AND MOVEMENT TIMES DURING WRIST FLEXION AND EXTENSION MOVEMENTS.** *Erica Thomas and Randall Nelson, Christian Brothers University, Memphis, Tennessee.* This study was conducted to determine if the accuracy or speed of motor performance is affected by increasing task complexity or by using go-cues of other sensory modalities in addition to vision. Reaction time (RT) and movement time (MT) measurements were collected for 14 days while subjects performed wrist flexion and extension movements.

Male and female subjects, ages 20 to 40, participated voluntarily. Go-cues of two types were presented pseudorandomly to eliminate predictability. Flexion or extension wrist movements were made to a target at one of three distances from a previously held, center location. Subjects attained a steady performance level during the first 9 days. Data collected during the final 5 days were analyzed in detail. Subjects had shorter RTs and similar MTs for movements made in response to visual plus vibratory as compared with visual only go-cues. Possible use of this paradigm for early detection of sensorimotor deficits is discussed.

**EFFECTS OF GLYBURIDE ON STREPTOZOCIN-INDUCED DIABETIC RATS.** *Saptarsi K. Ganguli, Christian Brothers University, Memphis, Tennessee.* Cyclic AMP phosphodiesterase (PDE) activity is inhibited in tissues of rats with type I ketosis-prone diabetes and is restored to normal by insulin treatment. To determine whether the oral hypoglycemic agent glyburide affected tissue cAMP PDE activity in non-insulin-dependent oral agent-treatable diabetes, cAMP PDE activity was measured in the liver of animals rendered diabetic by low-dose streptozocin and treated for 5 weeks with oral glyburide (360 µg/kg). The results were compared with PDE activity in the liver of untreated streptozocin-induced diabetic rats and normal control rats. It was found that PDE activity was restored towards normal by glyburide treatment. Calmodulin and calmodulin-like activity (PDE-activator activity) in the liver was decreased in diabetes and restored towards normal after glyburide treatment. This experiment demonstrates that oral agents as well as insulin can restore the activity of cAMP PDE in the low-dose streptozocin model, which is in some ways similar to type II diabetes.

**COEXISTENCE OF *POLYGONUM* CONGENERS: COMPETITION IN CONTRASTING LIGHT AND WATER ENVIRONMENTS.** *Beverly Collins and Tracey Hickox, Memphis State University, Memphis, Tennessee.* Two annual herbs, native *Polygonum punctatum* and immigrant *Polygonum caespitosum*, coexist in mixed plots along forest margins on Meeman Biological Station near Memphis, Tennessee. Species coexistence is influenced by plant-plant interactions, including competition for shared resources. We varied light levels, water levels, and the identity and density of neighbors around target plants of each species to determine influence of each factor on competition and coexistence of the *Polygonum* congeners. Performance of each target species and effect of neighbors was measured by height, by biomass allocation to root, stem, and racemes, and by the number and size of leaves. Alone, both species grew taller in sun than in shade and in low compared to high water. Plants in high water had higher root:shoot ratios than plants in low water. Increasing number of congener neighbors had no effect on *P. punctatum* but led to much shorter *P. caespitosum*. These results indicate that, although both species are sensitive to the light and water environment, *P. punctatum* is the superior competitor for these resources. However, *P. caespitosum* is tolerant of competition. Coexistence of the *Polygonum* congeners reflects the balance of competitive superiority and tolerance.

**FREQUENCY COMPONENTS OF SYMPATHETIC NERVE DISCHARGE.** *K. E. Lichtermann and M. J. Kenney, Rhodes College, Memphis, Tennessee.* Sympathetic nerves involved in the control of cardiovascular function are tonically active under basal conditions. In the present study, the frequency components in sympathetic nerve discharge were characterized using autospectral and coherence analysis in chloralose-anesthetized, Sprague-Dawley rats ( $n = 23$ ). The autospectrum of a signal shows how much power is present at each frequency. Coherence analysis shows how the linear correlation between the activity in two sympathetic nerves varies as a function of frequency. Activity was recorded from the splanchnic, renal, and lumbar sympathetic nerves. Autospectral analysis revealed that most of the

power in sympathetic nerve discharge was between 1 and 10 Hz. Coherence analysis revealed a significant coupling which extended from approximately 1 to 20 Hz when the discharges of two sympathetic nerves were simultaneously recorded. These results provide information concerning the frequency characteristics of basal sympathetic nerve discharge in anesthetized rats.

**EFFECTS OF ESTROGEN AND H<sup>+</sup> CONCENTRATION ON PROGESTERONE-INDUCED OOCYTE MATURATION IN *RANA PIFIENS*.** *Angela K. Ventura, Memphis State University, Memphis, Tennessee.* The oocyte, defined as the immature female gamete as it resides in the ovary, must undergo maturation before it can participate in the fertilization process. This maturation process is physiologically induced by the steroid hormone progesterone. Previous studies performed on *Xenopus laevis* and *Rana pipiens* indicate that the presence of the hormone estrogen inhibits progesterone-induced maturation. These studies have also illustrated the pronounced effect of pH on the maturation process. The hypothesis being tested in this study is that specific estrogen concentrations coupled with various pH ranges affect progesterone-induced oocyte maturation in *Rana pipiens*.

**SEARCHING FOR DIFFERENCES IN THE IN VITRO OOCYTE MATURATION INDUCED BY INSULIN AND PROGESTERONE.** *J. M. Freeman and J. D. McAllister, II, Memphis State University, Memphis, Tennessee.* In vitro progesterone and insulin treatment of fully grown oocytes induces maturation. Presumably, each hormone binds unique surface receptors and, therefore, at least early in the pathway, has molecular events in its induction process that are distinct from that produced by the other hormone. This study focuses on revealing any physiological differences in membrane electrical activity concurrent with the maturation induced by insulin and progesterone. Two approaches are being employed. First, longitudinal membrane potential measurements are being used to determine the overall slope of the membrane depolarization concurrent with the maturation induced by the two hormones. Second, external calcium is being introduced into matured oocytes to determine the membrane excitability (i.e., ability to fire an activation potential) induced by the two hormones.

**PRODUCTION, ISOLATION, AND CHARACTERIZATION OF ANTI-G-13 MONOSPECIFIC ANTIBODIES AND COMPLIMENTARY ANTIIDOTYPES.** *Jerry Derrick and Don Taylor, Memphis State University, Memphis, Tennessee.* The peptide G-13 (GDGRHDLVGLAPL), a presumptive fibrinogen binding site, corresponds to residue 300-312 in the a subunit of integrin  $\alpha$ IIb $\beta$ 3. The role of  $\alpha$ IIb $\beta$ 3 in hemostasis, as a receptor for fibrinogen, is essential. Antibodies raised against G-13 were shown to bind specifically to both G-13 peptide and the platelet surface. These antibodies also block adhesion of platelets to specific ligands. We are producing anti-idiotypes to monospecific anti-G-13 antibodies. Preliminary results using salt-cut fractions of immune serum from rabbits immunized with anti-G-13 antibodies suggest that anti-idiotypes are present. These anti-idiotypes will be characterized regarding their effects on platelet functions and epitope recognition.

**METABOLISM OF NITRO-POLYCYCLIC AROMATIC HYDROCARBONS BY SELECTED BACTERIA.** *King-Thom Chung, Kurt M. Kleier, S. Edward Stevens, Jr., and Peter P. Fu, Memphis State University, Memphis, Tennessee.* Attempts were made to examine whether bacteria that can reduce free nitrogen-containing oxides (i.e., nitrate, nitrite) can also reduce nitro groups of nitro-polycyclic aromatic hydrocarbons (nitro-PAHs). Five bacteria (*Yersinia enterocolitica*, *Salmonella enteritidis*, *Enterobacter aerogenes*, *Klebsiella pneumoniae*, and *Shigella flexneri*) were tested to see whether they could reduce nitrate, nitrite, and 4-nitrobenzoic acid. All five were able to reduce nitrate as well as nitrite, but only four were able to reduce 4-nitrobenzoic acid. Two of the bacteria which tested positive for 4-nitrobenzoic acid reduction (*S. enteritidis* and *K. pneumoniae*) were subsequently incubated anaerobically with two nitro-PAHs (1-nitropyrene and 3-nitrofluoranthene). After incubation, the metabolites were extracted with ethyl acetate and examined with high-pressure liquid chromatography, thin-layer chromatography, and UV spectrophotometry. Results indicate that nitro-reduction of 3-nitrofluoranthene and 1-nitropyrene does occur.

**INHIBITORY EFFECTS OF PEPTIDES ON THE GASTRULATION OF THE EARLY EMBRYO.** *Xuning Wang, Memphis State University, Memphis, Tennessee.* Gastrulation during embryogenesis generates three germ layers which are crucial for morphogenesis of animal tissues and organs. Gastrulation is characterized by dramatic cell migration which may require the interaction of cellular receptors with fibronectin in the extracellular matrix of the embryos. Accordingly, two peptides which can inhibit the interaction of cell receptors with fibronectin were tested for the ability to inhibit gastrulation of embryos of the frog *Rana pipiens*. Specifically, microinjection of peptide Gly-Arg-Gly-Asp-Ser-Pro (GRGDSP) into blastula-stage embryo inhibited gastrulation. These results indicate that fibronectin-receptor interaction may be required to mediate gastrulation in *Rana pipiens*.

**MICROTUBULES AND TUBULIN IN BRAIN AND OOCYTES OF THE FROG *RANA PIFIENS*.** *Tao Wang, Memphis State University, Memphis, Tennessee.* Microtubules are hypothesized to play an important role in brain function and oocyte maturation. This experiment investigated the assembly and disassembly process of brain and oocyte tubulin, in vitro, from the frog *Rana pipiens*. After several steps of centrifugation, the tubulin in these tissues was extracted and analyzed by gel electrophoresis and western blotting. The distribution of tubulin in subcellular fractions was investigated by using differential and density-gradient centrifugation.