

## ABSTRACTS OF PAPERS PRESENTED AT THE SPRING 1993 COLLEGIATE MEETINGS

**EASTERN REGION**  
TUSCULUM COLLEGE,  
GREENEVILLE, TENNESSEE

DOWN AND DEAD WOODY SURVEY, OBED WILD AND SCENIC RIVER, MORGAN COUNTY, TENNESSEE. **Gary L. Vaughn, Roane State Community College, Harrison, Tennessee.** On 15 June 1988, lightning started a wildfire that burned 85 ha at Clear Creek Junction on the Obed Wild and Scenic River. This fire spread for the north rim of the Obed River gorge at mile point 5 northward into Clear Creek gorge. Approximately 41 ha of the burn area above the gorge rim is still devastated in 1993 and the subject of this study. The down-and-dead-fuel-load-intercept method used in this study was developed by James Brown for the National Park Service to standardize and facilitate the exchange of wildfire- and prescription-burn information nationally. Brown's method surveys fuel loads by size classification and expresses results in tons per acre for woody fuels, duff, and litter. Results from this study classifies the fire's level of severity and is the basis for evaluating the area's down and dead fuel as a potential threat to the surrounding environment.

AQUATIC INVERTEBRATE SIMILARITY IN SELECTED TRIBUTARIES OF THE CLINCH AND POWELL RIVER DRAINAGES. **Denton L. Loving and G. Bradley Thompson, Lincoln Memorial University, Harrogate, Tennessee.** During the summer of 1992, the aquatic invertebrates of eight tributaries of the Clinch and Powell river drainages were studied to determine the invertebrate similarity between the two drainages. Jaccard's coefficient of similarity was used to make this determination. The invertebrate communities of the two drainages were found to be 66% similar.

THE IMMUNOLOGICAL RESPONSE OF THE TOBACCO HORNWORM, *MANDUCA SEXTA*. **Michael Condry, Carson-Newman College, Jefferson City, Tennessee.** The tobacco hornworm has been previously shown to synthesize proteins as a direct response to bacterial injection. The proteins produced by the worm in both the larval and pupal stage have been extensively characterized in terms of molecular weight by polyacrylamide-gel electrophoresis. I have hypothesized that this response to bacteria can also be mounted against other cells such as sheep erythrocytes and also to certain physical trauma such as needle puncture and temperature-elevated environment. Research at the Carson-Newman laboratory has shown that the worm can indeed synthesize protein in response to sheep-erythrocyte injection. Additional experimentation in the Carson-Newman laboratory has also shown that there is a possibility that the worm can synthesize proteins in response to trauma such as needle puncture and that this response may indeed be characteristic of an "acute-phase" type response. Other research has recently shown that the tobacco hornworm can indeed synthesize proteins as a response to elevated temperatures and that these proteins are considered to be of a "heat-shock" nature. The information gained by this experimentation suggests that the response of the tobacco hornworm as previously documented may, in fact, not be specific to bacteria but more generally related to the trauma of the needle that

injects the bacteria or other cell type. The experimentation presented has been concerned primarily with the polyacrylamide-gel electrophoresis of hemolymph samples from hornworms and additional BCA protein quantitation of overall protein concentration in hemolymph.

THE UPTAKE AND CYTOTOXIC EFFECTS OF A PHOTOACTIVATED DRUG IN CANCER CELLS. **Kelly Silas and Stephen Wright, Carson-Newman College, Jefferson City, Tennessee.** Photodynamic therapy of cancer relies upon selective cellular uptake of photosensitive dyes followed by light activation which generates forms of the compound which are cytotoxic to the cancer cell. We have investigated the in vitro uptake and cytotoxic potential of the photosensitizer aluminum sulfonated phthalocyanine (AISPc) in several cell types. A human T-cell leukemia line (CEM) was found to take up AISPc in direct proportion to its extracellular concentration in the range of 1 to 25  $\mu\text{g}/\text{ml}$  when the drug was followed using fluorescence quantitation. This nonsaturable type of uptake is consistent with an endocytic mechanism of cellular accumulation which has been reported for other cell types. In addition, intracellular accumulation of AISPc over time demonstrated that uptake leveled off after about 18 h at 37°C in the presence of 15  $\mu\text{g}/\text{ml}$  drug. Cell viability of CEM in the presence of the drug was proportional to the concentration of both drug and light. The concentration of AISPc which reduced cell viability of CEM to 50% of control ( $\text{IC}_{50}$ ) was 20  $\mu\text{g}/\text{ml}$  at low light intensity but was reduced to 5  $\mu\text{g}/\text{ml}$  at higher light intensities. The drug was nontoxic to nonilluminated cells even under conditions of continuous, drug exposure. A human breast-cancer cell line (MCF7) was also sensitive to AISPc following illumination with an  $\text{IC}_{50}$  of 20  $\mu\text{g}/\text{ml}$  at low-light doses. Peripheral blood lymphocytes have been isolated also, and their sensitivity to AISPc evaluated. These cells were much less sensitive to the drug than the cancer cells under comparable low-light conditions. At AISPc concentrations of 25  $\mu\text{g}/\text{ml}$ , cells were at least 70% viable by a dye-exclusion assay. Additional studies with blood-cell sensitivity and combination-drug therapy are in progress.

QUANTITATIVE ANALYSIS OF THE CHEMOTHERAPEUTIC AGENT TENIPOSIDE (VM26) IN MOUSE SERUM. **Aleshia L. Cantwell, Michelle Sisk, Stephen Wright, and Ken Morton, Carson-Newman College, Jefferson City, Tennessee.** The anticancer agent VM26 belongs to a group of semisynthetic compounds known as the epipodophyllotoxins. These drugs are derivatives of podophyllotoxin, a naturally-occurring, microtubule inhibitor which is extracted from the roots of the American mandrake plant. These epipodophyllotoxins have been used to treat a variety of leukemias and lymphomas, and VM26 is one of the most potent derivatives of this series. We are interested in making new derivatives of VM26 to enhance its drug-delivery potential and pharmacokinetics. In order to determine serum concentrations of VM26 in mice, we have been developing a high-pressure-liquid-chromatography quantitative assay. The drug is very hydrophobic, associating tightly with albumin in serum, and can be extracted from serum using nonpolar solvents such as chloroform. Extraction was conducted by adding 5 volumes of chloroform and 1 volume of methanol to mouse serum which had been spiked with various amounts of VM26.

The aqueous phase was removed, and a portion of the chloroform extract was evaporated to dryness and redissolved in methanol for high-pressure-liquid-chromatography analysis. VM26 eluted at 7 min from a  $C_{18}$  reverse-phase column using a mobile phase of methanol:water (60:40; 1 ml/min) with ultraviolet detection at 280 nm. Recovery of VM26 from serum was 93% at therapeutic drug concentrations (10 to 50  $\mu$ M). Background peaks were minor even at high levels of sensitivity. From this serum-extracted standard curve, we are now able to determine concentrations of drug in mice treated with VM26. We hope to employ this methodology in future studies for the analysis of various VM26 derivatives or degradation products.

**PREPARATION AND CHARACTERIZATION OF TENIPOSIDE PHOSPHATE.** *Christopher S. Mathews, Heather K. Moss, and Stephen E. Wright, Carson-Newman College, Jefferson City, Tennessee.* This project involves taking the anticancer drug teniposide (VM26), which has shown efficacy in the treatment of several types of cancer, and modifying it for more efficient targeting to specific cancer cells. We have phosphorylated VM26 using  $POCl_3$  and characterized the product by both chemical and biological assays. We have obtained separation by thin-layer chromatography employing a mobile phase of chloroform:methanol:acetic acid (70:30:3). A new product appeared which had a lower  $R_f$  value which confirmed that VM26 is being modified to a more polar product. This new product was then isolated by preparative thin-layer chromatography. Analytical high-pressure liquid chromatography utilizing a reverse-phase column confirmed derivatization to a more polar product. When the time course of the reaction was followed by thin-layer and high-pressure liquid chromatography, the reaction proceeded to completion after 30 min of reaction. The stability of the polar product, teniposide phosphate, was evaluated in various solvents over a 6-day observation period and analyzed by high-pressure liquid chromatography. Of the solvents evaluated, no degradation was observed except in a phosphate-buffered solution at pH 3. Under these conditions, an additional product was appearing 24 h following initiation of the stability study. An in vitro cytotoxicity study was conducted against the breast-cancer cell line, MCF7. Native teniposide was cytotoxic to 50% of the cells at a concentration of 2.0  $\mu$ M, whereas the phosphorylated product was cytotoxic to only 10% of the cells. This demonstrated that the polar product, teniposide phosphate, was significantly less cytotoxic to the cells compared to the native teniposide. This confirmed results obtained previously when the sister drug of teniposide, etoposide, also was not affective in cell death when phosphorylated. Future studies will include reversability of the teniposide phosphate and incorporation into drug carriers.

**AQUATIC VERTEBRATE SIMILARITY IN SELECTED TRIBUTARIES OF THE CLINCH AND POWELL RIVER DRAINAGES.** *Robin L. McMurray, Lincoln Memorial University, Harrogate, Tennessee.* During the summer of 1992, the ichthyofauna of eight tributaries of the Clinch and Powell river drainages were sampled to determine the vertebrate similarity between the two drainages. Jaccard's coefficient of similarity was used to make this determination. The vertebrate communities of the two drainages were found to be 84.6% similar.

**BIOCHEMICAL GENETICS OF THE TENNESSEE SNUBNOSED DARTER, *ETHEOSTOMA SIMOTERUM* (COPE).** *Stefanie R. Englund, Lincoln Memorial University, Harrogate, Tennessee.* Polyacrylamide-gel electrophoresis of tissue extracts of liver, pancreas, and gonad from 32 individuals of *Etheostoma simoterum* was performed. Sixteen specimens were collected for the Powell River Drainage, and 16 specimens were collected from the Clinch River Drainage. Four enzyme systems were investigated: isocitrate dehydrogenase; leucine amino-

peptidase; glucose-6-phosphate dehydrogenase; 6-phosphogluconate dehydrogenase. All individuals from the Clinch River Drainage were homozygous at all loci examined. However, two individuals for the Powell River Drainage were heterozygous at two loci, glucose-6-phosphate dehydrogenase and leucine aminopeptidase. This sample was determined to be 10% heterozygous at these loci. Four individuals were heterozygous at the 6-phosphogluconate dehydrogenase locus. This sample was determined to be 20% heterozygous at this locus. All individuals collected from the Powell River Drainage were homozygous at the isocitrate dehydrogenase locus.

**LAND SNAILS OF CLINCH MOUNTAIN.** *John B. Melvin, Lincoln Memorial University, Harrogate, Tennessee.* A study of the gastropod fauna of a north-facing slope on Clinch Mountain was conducted to determine the species composition and diversity. Specimens were collected from different habitats. All specimens found were kept and identified. This information was used to compile a species list and compute a species diversity index of the area. Identification was based on shell characteristics: diameter; shape and texture; umbilicus features; lip features; denticle number and arrangement; whorl numbers. Results indicate a high species diversity. They also revealed some new state and county records. *Gastrocopta pellucida* (slim snaggletooth) was the only state record. County records were *Anguispira alternata* (flamed disc), *Gastrocopta armifera* (armed snaggletooth), *Euconulus fulvus* (brown hive), *Strobilops aenea* (bronze pinecone), *Stenotrema edwardsi* (Ridge-and-Valley slitmouth), and *Mesodon inflectus* (shagreen). The greatest range extension was for *G. pellucida* which, in the eastern United States, are found in the coastal areas of Virginia. Additional studies have indicated that this species may be a cedar-glade associate outside the coastal areas.

**SCORPIONS AND FLUORESCENCE UNDER ULTRAVIOLET LIGHT.** *Kerri Kidd-Dill, Maryville College, Maryville, Tennessee.* The exuvia of scorpions, *Centruroides vittatus*, was ground and placed in either ethanol, hot acetone, cold acetone, hexanes, or hydrochloric acid in an attempt to extract the fluorescent substance. None of these solvents extracted the fluorescent substance. The fluorescent intensity of *C. vittatus* was mapped. The scorpion fluoresced most brightly on the dorsal side of the prosoma and upper mesosoma, the dorsal sides of the legs, patches on the lower dorsal mesosoma, and low intersegmental areas on the ventral side of the metasoma.

**INTERPRETATION OF ENVIRONMENTS OF DEPOSITION OF DELTAIC SEQUENCES IN THE LOWER PART OF PENNSYLVANIAN RACCOON MOUNTAIN FORMATION EXPOSED IN HUGDEN BRANCH, RACCOON MOUNTAIN, MARION COUNTY, TENNESSEE.** *Troy Keith and R. E. Bergenback, University of Tennessee at Chattanooga, Chattanooga, Tennessee.* The Pennsylvanian Raccoon Mountain Formation is exposed in Hugden Branch which is located on the north slope of Raccoon Mountain (Tennessee River Gorge) in Marion County, Tennessee. This study examined the lower part (elevation of 132.3 to 229.8 m above highway 41/64) of the Raccoon Mountain section that is composed largely of dark-graywacke siltstone and sandstone. Sedimentary structures here include: massive-bedded, structureless graywacke sandstone that in fills scours; trough crossbeds (composed of graywacke); and thin-bedded, rippled graywacke-rich sandstone and siltstone units plus rippled shale units. These sedimentary sequences in the lower Raccoon Mountain are interpreted as prodelta, or delta front, deposits overlain by deltaic distributary channel and interdistributary bayfill units which are, in turn, overlain by crevasse splays.

INTERPRETATION OF ENVIRONMENTS OF DEPOSITION OF STREAM SEQUENCES IN THE UPPER PART OF PENNSYLVANIAN RACCOON MOUNTAIN FORMATION IN HUGDEN BRANCH, RACCOON MOUNTAIN, MARION COUNTY, TENNESSEE. *Crystal Wooten and R. E. Bergenback, University of Tennessee at Chattanooga, Chattanooga, Tennessee.* The Pennsylvanian Raccoon Mountain Formation is exposed in Hugden Branch which is located on the north slope of Raccoon Mountain (Tennessee River Gorge) in Marion County, Tennessee. This study examined the upper part (elevation of 229.8 to 292.0 m above highway 41/64) of the Raccoon Mountain section that is composed largely of graywacke sandstone and dark-gray shale. Sedimentary structures here include: structureless, graywacke-filled scours; trough crossbeds (composed of graywacke); and thin-bedded, rippled, graywacke-rich units. These sedimentary sequences in the upper Raccoon Mountain are interpreted as a low-sinuosity meandering stream because of the lack of laterally-accreting point bar sedimentary structures. Further, graywacke-rich, fining-upward, in-channel sequences with associated levee and chute and neck cut-offs of meanders are dominant. Shale-rich units are in the minority (the opposite situation from high-sinuosity meandering streams).

DEPOSITIONAL MODEL OF MISSISSIPPIAN PENNINGTON FORMATION EXPOSED IN HUGDEN BRANCH, RACCOON MOUNTAIN, MARION COUNTY, TENNESSEE. *Nannette Johnson and R. E. Bergenback, University of Tennessee at Chattanooga, Chattanooga, Tennessee.* The Mississippian Pennington Formation is exposed in Hugden Branch which is located on the north slope of Raccoon Mountain (Tennessee River Gorge) in Marion County, Tennessee. This study examined the stratigraphic interval from 70.1 to 132.3 m above Dixie Lee Highway (route 41/64). Four major Pennington rock types have been recognized here. Types 1 and 2 are red and green shales. Type 3 is dolomitic with type-4 gray limestones subdivided into types a and b. Type 1, red shales, was oxidized to its red color during exposure to the paleoatmosphere, and type 2, green shales, likely represents reduction to its green color under a cover of sea water. The type-3 dolomitic (well-formed crystals of dolomite that formed in lime mud-micrite-deposits) are interpreted as tidal channel infillings with scoured bases and associated mud crack structures (exposure to atmosphere) and birdseye structures that form in high intertidal depositional environments. Type-4a gray limestone represents tidal channels (with scoured bases) filled with fossil debris that accumulated during a rise in sea level. Type-4b gray limestone is composed of rippled fossil debris that formed on a tidal flat during a rise in sea level. Thus, the Pennington Formation represents a high intertidal environment of deposition in a Mississippian tidal flat complex.

CONSIDERATION OF PALEODEPOSITIONAL CONDITIONS OF THE ORDOVICIAN CATHEYS FORMATION EXPOSED IN A QUARRY, LOOKOUT VALLEY, DADE COUNTY, GEORGIA. *Randal Hale, Richard Orr, and R. E. Bergenback, University of Tennessee at Chattanooga, Chattanooga, Tennessee.* A quarry has been opened in the Ordovician Catheys Formation in the east limb of anticlinal Lookout Valley in Dade County, Georgia. Cyclic, generally through-going units of the Catheys consist of body fossil clast layers known as calcirudites (with scoured bases) which are abruptly overlain in a transitional way by green-gray shale units. Neither the bottom nor the top of the Catheys is exposed in this quarry. Here, the Catheys sequences is 27.78 m thick. Calcirudites range in thickness from 1 cm to 1.05 m, and the green-gray shales from 0.5 to 14.0 cm. Also, there are 161 cycles of calcirudite-green-gray shale present here. Branching and encrusting bryozoans as well as several species of brachiopods form the major types of body fossil clasts in the calcirudites. Thin-section analysis of the calcirudites show them to be grain-supported packstone

(Dunham) or biomicrite (Folk) with body fossil clasts of bryozoans, brachiopods, gastropods, and trilobites associated with numerous peloids and silt-sized quartz grains. Vari-sized, euhedral, zoned, saddled dolomite rhombs are ubiquitous in these rocks. It is tempting to interpret the calcirudites as storm deposits (tempestites), but they may be merely normal Ordovician, high-energy, tidal deposits (close proximity of the moon during the Ordovician) with the overlying suspension deposits of green-gray shale formed as graded beds during one depositional episode.

SUBSURFACE DISTRIBUTION OF POROUS ZONES (PRODUCTIVE OF OIL AND GAS) IN THE MISSISSIPPIAN MONTEAGLE LIMESTONE, UNDER FENTRESS, MORGAN, AND SCOTT COUNTIES, NORTHEASTERN CUMBERLAND PLATEAU, TENNESSEE. *Leah Cantrell, John Reinert, Jerry Partap, Kevin Spann, and R. E. Bergenback, University of Tennessee at Chattanooga, Chattanooga, Tennessee.* Tidal bar structure have been recognized in 18 outcrop stratigraphic sections of the Mississippian Monteagle Limestone in southeastern Tennessee, northwestern Georgia, and northeastern Alabama. An idealized vertical sequence in a tidal bar begins with massive-to lenticular-bedded fragmental carbonate sands (broken up fossil shells) which are overlain by northeast-southwest trending carbonate-sand tidal bars which are capped by emergent tidal flat deposits. In the subsurface of Fentress, Morgan, and Scott counties, Cumberland Plateau in northeastern Tennessee, maps of the thickness of the Monteagle (based on drill records) show a number of mound-like buildups (reminiscent of tidal bars located in southeastern Tennessee) that trend northeast-southwest and have up to 18 to 21 m of relief and extend over 1.5 km in length. Porous zones in the Monteagle, productive of oil and gas, are largely confined to these mound-like buildups (i.e., in the subsurface, they are laterally discontinuous) and occur at a number of distinct stratigraphic levels.

SURVEY OF CORAL GROWTH ON NEAR-SHORE REEFS OF SAN SALVADOR, BAHAMAS. *Jack Pickett and Tracey Carraway, University of Tennessee at Chattanooga, Chattanooga, Tennessee.* Reefs at four sites in Graham's Harbor, San Salvador, Bahamas, were studied by belt transects, photography, and sand-grain measurements. We observed and recorded coral types and their approximate size and numbers. Elkhorn corals were most abundant at Dump Beach (the eastern site) whereas boulder-forming corals were present only at North Point (the western site). The recent growth of major reef-building corals at some sites suggests the reversal of a period of reef deterioration.

ZOOPLANKTON IDENTIFICATION STUDY ON THE NORTH END OF SAN SALVADOR, BAHAMAS. *Darla Chauncey, Debra Eaker, and Nancy Stewart, University of Tennessee at Chattanooga, Chattanooga, Tennessee.* An identification study of zooplankton was conducted near a sewage-overflow pipe, a pier, and a freshwater lake on the north end of San Salvador Island, Bahamas. Little diversity was found at the pier and the freshwater lake, but abundant life was found at the pipe before an overflow occurred.

ESCHERICHIA COLI ANALYSIS OF SAN SALVADOR ISLAND'S OPEN PUBLIC WELLS. *Darris A. Gentry, Brian W. Gunter, and Kristy L. Smedley, University of Tennessee at Chattanooga, Chattanooga, Tennessee.* San Salvador Island, also known as Watling's Island, is located 24°N, 74°W and is the easternmost island of the Bahamian chain. A repeat study of nine public wells was conducted as a confirmation of previous coliform contamination, with emphasis placed on *Escherichia coli*. Two presumptive tests to determine the presence of coliform (a Hach mug test and a Lauryl tryptose broth test) were used. When a positive Lauryl tryptose test occurred, an EC-medium test was

performed. The EC-medium test is specific for fecal bacteria, and, from this, a total of *E. coli* can be determined per 100 ml of well water. Data comparison with a 1991 study revealed a sharp decrease in the level of *E. coli* contamination of the public wells tested.

USE OF REMOTE-SENSING APPLICATIONS AND GIS (GEOGRAPHIC INFORMATION SYSTEMS) PROCEDURES IN DELINEATING WETLANDS AND WILDLIFE AND FAUNAL ASSESSMENT AT CHICKAMAUGA CREEK IN HAMILTON COUNTY, TENNESSEE. *Tracey Carraway, James Macrellis, Steven Silvers, and Robert Alverson, University of Tennessee at Chattanooga, Chattanooga, Tennessee.* Through the use of photography, landuse maps, topographic maps, and Geographic Information Systems (GIS) software, we assessed a portion of Chickamauga Creek in response to the proposed upcoming expansion of the Chattanooga Metropolitan Airport. The assessment will be used to determine the rerouting of the Chickamauga Creek due to the needed space to develop a longer runway. The focus of the project was mainly on the fauna in the area to be rerouted. Particular attention was given to the possibility of any fauna that might be endangered. Several forms of wildlife were found, including deer, beaver, rabbit, squirrel, and blue heron. All wildlife found were indigenous to North America, and none was an endangered species. We also used Arcinfo 3.4D to digitize and map the areas of habitat of the animals. We were able to successfully exploit the uses of remote-sensing principles and GIS to aid us in the project.

COMPARATIVE EFFECTS OF TEMPERATURE VERSUS THYROXINE ON GROWTH IN THE COMMON GUPPY (*POECILIA RETICULATA*). *Gregory DeLozier, Maryville College, Maryville, Tennessee.* Thyroxine is a hormone that is responsible for promoting growth of tissue in many vertebrates. However, when the effects of high levels of thyroxine are studied in teleosts, results often conflict. By subjecting the common guppy, *Poecilia reticulata*, to unnatural levels of thyroxine in the blood at different temperatures, some conclusions could be made about the nature of this hormone in teleosts. Individuals with high levels of thyroxine at 15°C had significantly less mass and length growth than individuals with the same levels of thyroxine at 20°C. Individuals with normal levels of thyroxine at 20°C had significantly greater length growth than the control individuals at 15°C. Thus, it seems that temperature and high thyroid levels together cause a greater rate of growth in *P. reticulata*.

GAY PARENTS AND THEIR CHILDREN. *Alison A. Frost, Maryville, College, Maryville, Tennessee.* The purpose of this study was to explore the issues concerning homosexual parents. Previous literature has emphasized the gay parent's role reconciliation, previous marriages and their quality, social-psychological support, homosexual relationships and their quality, parental attitudes and behaviors, and revelation of his or her sexual orientation to the child. Issues concerning the welfare of the gay parent's child include the child's relationships with peers and others and gender-role development. A questionnaire that addressed these issues was developed. Twelve gay parents (nine females and three males) in the East Tennessee region were interviewed in person or by telephone. Results will be discussed, and suggestions made for future research.

THE EFFECTS OF TEMPERATURE AND THYROXINE IN YOUNG SNAPPING TURTLES, *CHELYDRA SERPENTINA*. *Shannon Ray Linginfelter, Maryville College, Maryville, Tennessee.* The effect of temperature and thyroxine hormone on oxygen consumption in young snapping turtles, *Chelydra serpentina*, was examined in this study. I hypothesized that, as temperature increased, oxygen consumption would increase and that thyroid hormone injections (0.01 mg/g body mass)

would increase the amount of oxygen consumed per gram of body weight. After collecting data from both experiments, I concluded that oxygen consumption increased in snapping turtles as temperature increased. Injections of thyroxine did not change the amount of oxygen consumed.

EFFECT OF MELATONIN AND CHLORPROMAZINE ON THERMOREGULATORY BEHAVIOR OF *BUFO AMERICANUS*. *Jennifer Poore, Maryville College, Maryville, Tennessee.* *Bufo americanus* was used to test the thermoregulatory effects of melatonin and chlorpromazine. Animals were acclimated to  $21 \pm 2^\circ\text{C}$  for a minimum of 2 weeks with a L10:D14 photoperiod before testing. Injections of melatonin, amphibian saline with ethanol, chlorpromazine, or amphibian saline solution were given on the day of testing, and the toads were placed individually in a linear, thermal gradient. Body temperatures were measured at 10-min intervals for a 24-h period. A two-way analysis of variance with repeated measures was used to determine if there were differences between the mean  $T_b$ s selected over a 24-h period between treatment groups and to determine if selected  $T_b$ s changed over time within each treatment group. The melatonin versus saline-with-ethanol treatment groups showed no difference in mean  $T_b$ s over the 24-h period ( $P = 0.64$ ). Time did not have an effect on the groups, and the plotted curves were the same. The chlorpromazine versus saline treatment groups showed a marginal difference in  $T_b$ s ( $P = 0.058$ ). Time proved to have an effect on  $T_b$ s ( $P < 0.01$ ), and there was no difference in the curves. The saline versus saline-with-ethanol treatment groups showed no difference in mean  $T_b$ s ( $P = 0.184$ ). However, there was a significant time effect ( $P < 0.01$ ), and the two curves are very different ( $P < 0.01$ ).

CHEMICAL TESTING OF WATER WELLS IN NORTH VICTORIA HILLS IN SAN SALVADOR, BAHAMAS. *Bill Burley, Carolyn Jones, and Tatum Stewart, University of Tennessee at Chattanooga, Chattanooga, Tennessee.* Samples were collected from six different water wells in the North Victoria Hills area, San Salvador, Bahamas, and chemical tests were conducted. Dissolved oxygen, dissolved carbon dioxide, and total hardness were determined by the titration method. Low-range nitrite, high-range nitrite, phosphorus, sulfate, and nitrogen ammonia were measured by the Hach spectrophotometer method. Samples for the first series of tests were collected on 15 and 16 March, and samples for the second series of tests were collected on 17 and 18 March. Logistical problems and weather conditions varied, resulting in considerable differences between the data gathered on the first collection and data gathered on the second collection.

## MIDDLE REGION

AUSTIN PEAY STATE UNIVERSITY,  
CLARKSVILLE, TENNESSEE

PRELIMINARY SURVEY OF BASIDIOMYCETES AT FOUR HABITATS IN RUTHERFORD COUNTY, TENNESSEE. *Rebecca Baskin and Linda D. Roberson, David Lipscomb University, Nashville, Tennessee.* A wooded area on a farm in Rutherford County, Tennessee, was observed to have a variety of species of Basidiomycetes inhabiting four different regions of the area: a region of deciduous trees; a region of cedar glade with young deciduous trees on the borders of the area; an area which contains many boulders; an area of dead and dying cedar trees. Approximately 30 species of mushrooms and shelf fungi were observed during the months of January, February, and April in 1993, mapped within the regions, and identified. Measurements of air temperature and humidity, soil temperature and moisture, and substrate pH were made.

**EFFECT OF SUCROSE CONCENTRATION ON EMBRYO FORMATION IN SOYBEAN.** *Tonya Howard, S. M. Bhatti, and P. S. Kahlon, Tennessee State University, Nashville, Tennessee.* There has been considerable research on soybean during the last several years, with the major emphasis being on regeneration. A variety of structures ranging from well-formed embryos to obvious clumps of callus-bearing buds and roots to poorly defined forms of uncertain affinity have been reported under a bewildering variety of names. Many different approaches have been tried to find an ideal media for high-frequency, embryo formation. In the past years, our laboratory has reported the formation of somatic embryos from immature seeds of soybean using a variety of hormones and a wide range of sugars. The objective of this study was to see if the amount of sugar (sucrose in this case) added to the media has any effect on the number of cultures producing somatic embryos. Two soybean cultivars, Weber and Pella, were grown aseptically for 2 weeks. Cotyledons, roots, hypocotyls, and leaves were excised and placed on L6 media supplemented with the auxin 2,4-D. Sucrose was added to the media at different concentrations (2, 4, 6, and 8%). The cultures were evaluated for the presence of somatic embryos at the end of 6 to 8 weeks. Results showed a major difference between the two cultivars in their ability to form somatic embryos. No somatic embryos were obtained from cultivar Pella at any sucrose concentration. Cultivar Weber showed variation in the frequency of embryos formed from the explants. However, the amount of sucrose added did not improve the frequency.

**EFFECTS OF METHIONINE SULFOXIMINE ON PROTEIN SYNTHESIS IN SOYBEAN.** *Min Zheng, E. Lewis Myles, and Carolyn Alexander-Caudle, Tennessee State University, Nashville, Tennessee.* The use of soybean as a food source is rapidly increasing. To reduce its yield losses due to disease, research in soybean disease resistance is of great significance. Two-dimensional, gel electrophoresis can separate complex mixtures of proteins into many more components than that of one-dimensional electrophoresis. It also makes it easy to analyze and compare synthesis and modification of proteins during disease resistance. The leaves from *Glycine max* cv. Weber were used to initiate callus growth. After formation of callus tissue, 0.5 g of callus was placed on media containing 0.0, 4.0, 8.0, and 12.0  $\mu\text{M}$  methionine sulfoximine. Methionine sulfoximine can mimic the effects of abtotoxin (bacterial toxin) in tissue culture. Callus was exposed to various concentrations of methionine sulfoximine in culture for 4 weeks. Then, the callus was weighed, and protein extracted. One-dimensional and two-dimensional, gel electrophoreses were performed. Weights of the callus grown on 0.0, 4.0, 8.0, and 12.0  $\mu\text{M}$  were 3.26, 3.42, 2.51, and 1.48 g, respectively. Total protein was determined using a Pharmacia Ultraspec Plus at wavelength 280 nm. The total protein from callus tissue grown on media containing 0.0, 4.0, 8.0, and 12.0  $\mu\text{M}$  were 4294.6, 6844.0, 3251.5, and 2131.0  $\mu\text{M}$ , respectively. These indicate that methionine sulfoximine may inhibit protein synthesis in soybean.

**THE EFFECT OF POLYETHYLENE GLYCOL ON CROP PLANTS.** *Tomar Johnson, Angela Watson, E. Lewis Myles, and Carolyn Alexander-Caudle, Tennessee State University, Nashville, Tennessee.* *Phaseolus vulgaris* (field bean) is a high-protein crop. This crop is not only important in industrialized countries but also even more important in countries where meat is not accessible such as in underdeveloped countries. Often in poor countries, the lack of food is due to conditions that affected the growth of their crops. A problem affecting crops is drought. The objectives of the project were to determine the amount of polyethylene glycol that inhibits growth and to identify the proteins induced by the chemical agent polyethylene glycol. Cultivars Labrador, Flo, and 15R were grown on media containing 0, 5, and 10% polyethylene glycol for 3 weeks. The weight, total protein, and total protein per gram of tissue were found after the 3-week growing period. Labrador,

Flo, and 15R show reduced growth when exposed to 5% polyethylene glycol. Also, the cultivar Labrador synthesized at least one additional protein when exposed to 10% polyethylene glycol.

**SELECTION FOR INCREASED STRESS TOLERANCE IN PHASEOLUS VULGARIS.** *Jason House, Lynn Harding, E. Lewis Myles, and Carolyn Alexander-Caudle, Tennessee State University, Nashville, Tennessee.* Beans are second only to cereals as being the most nutritious food. In the Southeast and Midwest, beans are one of the most economically valuable agricultural crops. This crop plant is even more important in underdeveloped countries where a protein source is rare. Often times in poor countries, the lack of food is due to conditions that affect the growth of their crops. Some of the most common problems affecting crops are diseases and the increase of salt in soil. The objectives of this study were to identify cultivars of *Phaseolus vulgaris* that demonstrate salt tolerance and disease resistance. To determine salt tolerance, various concentrations of NaCl were used, and, for disease resistance, various concentrations of methionine sulfoximine were used. Methionine sulfoximine is an amino-acid analog which acts as a bacterial toxin when added to culture media. The cultivars Laureat and Flo were grown on media that had increasing concentrations of salt and methionine sulfoximine. Laureat and Flo showed no increase in their tolerance level for methionine sulfoximine. Flo showed 30% more tolerance to NaCl when compared to the control. All cultivars exposed to methionine sulfoximine and NaCl showed an increase in protein synthesis that exceeded the control.

**THE EFFECTS OF SODIUM CHLORIDE ON THE GROWTH RATE OF CULTIVARS OF PHASEOLUS VULGARIS.** *James Jackson, Wendy Reader, Lurette Williams, E. Lewis Myles, and Carolyn Alexander-Caudle, Tennessee State University, Nashville, Tennessee.* This study involves screening cultivars to determine their adaptability to high salt concentrations. The field bean, *Phaseolus vulgaris*, is a very economically profitable plant, and it is rich in protein. Field bean is the subject of extensive research, and plant breeders have developed cultivars that will grow in a wide range of geographical locations. The objectives of the study were to determine the effect of high salt concentration on the synthesis of proteins and identify the germplasms tolerant to high, salt concentrations. The cultivars used in this project were Flo, 15R, Laureat, and Sentry. These cultivars were obtained from the University of Wisconsin, Madison, Department of Plant Science. All four cultivars showed no difference in callus growth at 0.2% NaCl. Also, all cultivars had reduced callus growth at 0.4% NaCl. Cultivar Laureat had more protein synthesized per gram of tissue at both 0.2 and 0.4% NaCl.

**PURIFICATION OF STEM BROMELAIN, A THIOL-PROTEASE FOUND IN PINEAPPLE.** *Dean L. Lenz and Kent Clinger, David Lipscomb University, Nashville, Tennessee.* Stem bromelain, a thiol-protease found in the pineapple plant *Ananas comosus*, has been purified 17-fold from a crude preparation. Chromatographic fractions were obtained from a Sephadex G-100 gel filtration column. The activity of the crude enzyme and the isolated fractions was obtained by a caseinolytic-activity assay. The protein content was determined by the Bradford procedure, and the protein purity was monitored by SDS-polyacrylamide-gel electrophoresis with Coomassie-blue staining.

**THE EXAMINATION OF THE THREE-DIMENSIONAL STRUCTURES OF PAPAINE AND ACTINIDIN AND THEIR RELATIONSHIP TO BROMELAIN.** *Johanna Prather and Kent Clinger, David Lipscomb University, Nashville, Tennessee.* Bromelain, papain, and actinidin are all members of a family of thiol-proteases. Because they are all thiol-proteases with similar amino-acid sequences, they all should have

similar structures. The amino-acid sequences of papain and actinidin are very similar to the sequence of bromelain. A computer program called MacMolecule was used to examine the three-dimensional structures of papain and actinidin to better understand the possible structure of bromelain. These computer models, the amino-acid sequences, and the general method of action for the proteases are to be used to construct a model of the bromelain structure.

THE HIGH-PRESSURE-LIQUID-CHROMATOGRAPHY SEPARATION OF PHOSPHONATO COMPLEXES OF PLATINUM(II). **Bradley W. Lake and Lori L. Slavin**, *Austin Peay State University, Clarksville, Tennessee*. Phosphonate ligands in general have been reported to exhibit antiviral activities towards herpes, influenza, and viruses. The possibility of appropriately designed platinum(II) phosphonate complexes might prove to be active against viruses is being pursued. Reactions of cis-diamminedichloroplatinum(II) with phosphonoformic acid and phosphonoacetic acid yield five-membered and six-membered phosphonatoplatinum(II) chelates, respectively. The chelates were separated by high-pressure, liquid chromatography utilizing a reversed-phase column and three different mobile phases: formic acid-sodium formate buffer (pH 3.91); phosphate buffer (pH 6.77); sodium acetate (pH 7.96). The chelates elute with longer retention times than the free ligands. Platinum(II) coordination to the phosphonate ligand leads to a decrease in charge, and the complexes are expected to be less polar than the corresponding free ligand. Optimum resolution was achieved for the platinum(II)-phosphonoacetic acid reaction with the phosphate buffer. An additional peak was observed for the phosphonoacetic acid system and is perhaps a hydrolyzed product. Sodium acetate was the best mobile phase to achieve optimum resolution for the phosphonoformic acid system. It was concluded that the chelates are stable in a pH range of 4.0 to 8.5.

ANALYSIS OF DRINKING WATER FOR LEAD USING A GRAPHITE-FURNACE-AA METHOD AND A COLORIMETRIC METHOD. **Danielle Christian and William A. Tallon**, *David Lipscomb University, Nashville, Tennessee*. Exposure to lead causes serious detrimental effects in children such as emotional and behavioral problems, kidney damage, lowering of IQ, slowing of neural transmissions, and metabolizing problems of enzymes. Lead can also severely hinder the proper physical and mental maturation of a fetus. Much of lead's poisonous effect is attributed to its ionic nature and substitutability for zinc and calcium in enzymatic activities. Drinking water is a definite source for lead contamination, along with lead-based paint and gasoline emissions. This study summarizes the literature on physiological effects and presents results from some analyses of drinking water. Two methods were used for determination of lead concentrations in drinking water, atomic absorption graphite furnace spectrometry and colorimetry. For both methods, a calibration curve was constructed, and the data were analyzed using this curve. Lead levels were basically in accordance with federal regulations for the concentration of lead in drinking water.

LEAD ANALYSIS OF FREE-FLOWING WATERWAYS USING ATOMIC ABSORPTION SPECTROSCOPY. **Stephen Cole, Marty Gamble, and Fred J. Matthews**, *Austin Peay State University, Clarksville, Tennessee*. Lead concentrations in the environment are of critical concern due to its negative effects on organic systems. The maximum acceptable level of lead (Environmental Protection Agency) is 15 ppb. Analysis of the Red River and Sulfur Fork Creek in Montgomery and Robertson counties of Tennessee indicated lead levels ranging from 2 to 6 ppb, well below the maximum allowed by the Environmental Protection Agency. Sampling was performed at sites above and below the confluence of the two free-flowing waterways on

two different occasions. Atomic absorption analyses were performed using a chelation(APDC)-extraction(MIBK) method to concentrate the lead sample.

LEAD MIGRATION IN SOIL. **Anne Kinney and Ron Robertson**, *Austin Peay State University, Clarksville, Tennessee*. Lead is a heavy metal which has been known to man for thousands of years. It has been used in the production of automobile batteries and, until recently, as an anti-knock agent in gasoline. Lead is deposited on and retained in the soil from mining, smelting, and industrial operations as well as in the form of lead salts and alkyl lead from the anti-knock, automobile fuels. It poses problems for man through ingestion of soil or other lead products, bioaccumulation by plants and animals, and movement into the water table. Lead affects the central nervous system and even causes mental retardation in young children. Our concern was with the measurement of available or mobile lead in the soil which might possibly migrate or bioaccumulate. Soil samples were taken near four roads in Montgomery County, Tennessee, at various soil depths. The mobile lead was extracted using a leaching procedure with acetic acid-sodium acetate and was analyzed by atomic absorption spectrometry. Appreciable amounts of mobile lead (30 to 100 ppm) were found in topsoil from two areas which were adjacent to roads that were heavily traveled before the removal of lead from gasoline. The highest concentrations of lead were found at the surface, indicating that lead movement through the soil has been limited. Lead levels at a depth of 45.7 cm at these sites ranged from 2 to 35 ppm. These levels are consistent with those found by other researchers.

DETECTION OF THE THIRD EQUIVALENCE POINT FOR THE REACTION OF PHOSPHORIC ACID WITH SODIUM HYDROXIDE BY CONDUCTOMETRIC TITRIMETRY. **Billy Pruett, Stacey West, and Harvey Blanck**, *Austin Peay State University, Clarksville, Tennessee*. Conductometric titrations may be done in undergraduate, analytical or physical chemistry classes primarily to demonstrate the relative conductances of ions. Often a strong acid such as HCl or a weak acid such as acetic acid are selected for titration with NaOH. Both of these equivalence points may be detected far more rapidly by monitoring the pH with indicators or electrodes. We have found that as predicted from equivalent conductances the conductometric titration of phosphoric acid with NaOH produces a change in slope at the third equivalence point when excess OH<sup>-</sup> is present since it has a much greater equivalent conductance (199) than PO<sub>4</sub><sup>3-</sup>(69). The first two equivalence points cannot be detected because of the similarity of equivalent conductances of H<sub>2</sub>PO<sub>4</sub><sup>-</sup>(36), HPO<sub>4</sub><sup>2-</sup>(57), and PO<sub>4</sub><sup>3-</sup>. Rather than duplicating, this complements the titration of H<sub>3</sub>PO<sub>4</sub> with NaOH using glass electrodes or indicators in which the first two equivalence points are well defined but the third is not detectable. Thus, by changing from the monitoring of similar basic properties to the monitoring of dissimilar conductance properties, the impossible becomes possible.

PREDICTING THE TIME REQUIRED TO DOUBLE OR TRIPLE A FIXED SUM OF MONEY. **Jacquelyn M. Perigen and Abu K. Sarwar**, *Austin Peay State University, Clarksville, Tennessee*. The "rule of 70" used in Engineering Economy to estimate the number of years required to double a sum of money was studied. The results obtained from the study were found to compare very favorably with the exact results. The study was then extended to derive another approximate rule, "the rule of 114." This new rule could be used to make a reliable estimate as to how many years a sum of money at a given interest rate should stay invested to become tripled in value.

COMPUTERIZED ANALYSIS AND DESIGN OF BEAMS DUE TO MOMENT, SHEAR, AND DEFLECTION. *Philippe A. Catoire and Abu K. Sarwar, Austin Peay State University, Clarksville, Tennessee.* With the use of Mathcad software, a substantial time savings can be realized in analyzing and designing beams with multiple forces applied. Mathcad also allows for rapid recalculation of all forces and dimensions when the given parameters are modified.

A SURVEY OF PRIME NUMBER GENERATION METHODS USING C. *Roger L. Smith, Thomas Hamel, and William Glunt, Austin Peay State University, Clarksville, Tennessee.* Prime-number generation is an age-old pursuit which has moved from the realm of mathematical theory into real-world applications. As the computer age begins to come into its own, the need for very large prime numbers for the generation of encryption keys for data security is rapidly growing. This means that prime numbers are more important today than they have ever been, and the need for fast, easy-to-use programs which are capable of finding large prime numbers is growing in many such applications. These programs are finally beginning to leave the desks of theoretical mathematicians and entering mainstream society. There are many methods for prime-number generation ranging from very simple algorithms which may take hours (or days) to complete, to somewhat more advanced techniques which can perform these tasks in seconds. This research focuses on three methods for counting the quantity of prime numbers over a closed interval and compares and contrasts these techniques. Differences in the algorithms are analyzed in general as well as in language-specific terms. All algorithms are implemented using the C Programming Language.

INNUMERACY IN ALGEBRA. *Barbara E. Mullins, Austin Peay State University, Clarksville, Tennessee.* "Innumeracy in Algebra" examines the decreasing algebraic skills of American high-school students and adults. It poses two questions: 1) what is the cause of this increasing trend toward innumeracy; 2) what is the cure to this trend. The presentation examines the negative attitudes of the American public toward algebra. It argues that the American public has failed to recognize the value of education in algebra in a society of increasing technological advances and that the American public has forgotten the need for diversity of knowledge. Motivation and success are cited as necessary elements for student learning in algebra. Strategies from the standards of the National Council of Teachers of Mathematics are listed as ways of providing self-directed learning. Strategies that should be de-emphasized in the classroom are also cited. The presentation concludes that all mathematicians and educators must bear the burden of eliminating innumeracy in algebra.

PREDICTORS OF COLOR RESPONSE TO BENHAM'S TOP: SUGGESTIBILITY, GENDER, AND MOOD. *Jennifer M. Nicholas, Tennessee Technological University, Cookeville, Tennessee.* Twenty-four undergraduates (12 males and 12 females) at Tennessee Technological University, Cookeville, Tennessee, were exposed to the Benham's top apparatus to test color response. Three white discs with black designs were used. To enhance color perception, five different colors of light bulbs (including white) were used for illumination. Subjects were asked to report on the hue and saturation of different specified sectors of the discs. Since perception of colors may include a suggestibility component, measures for imagination and mood were included as a degree of predictor response to Benham's top. Responses to two discs (not the control disc) supported the hypothesis that wide individual differences would be noted between discs and sectors, with respect to both hue and saturation. There does not appear to be a standard frequency-pattern neural code between individuals. The responses to

disc 3 (with more colors being seen in each section until the last one) partially supported the hypothesis that there is a learning adjustment, i.e., subsequent presentations will generate increasing reports of high-frequency colors. Disc 1 supported this hypothesis, while disc 2 (the control) had the opposite pattern. The idea that imaginative people were more likely to perceive more colors was supported for males and females combined. For males, a positive mood was associated with responses of brighter shades of color, while a negative mood was associated with such responses for females. The use of Benham's top as a research tool may clarify basic theoretical issues in visual neuroscience.

PERCEPTIONS OF FLAVOR MAGNITUDE AS A FUNCTION OF COLOR OF BEVERAGE AND EXPOSURE TO TOBACCO SMOKE. *Richard W. Boswell, Tennessee Technological University, Cookeville, Tennessee.* Twenty-four subjects (15 females and nine males) with a mean age of 28.4 years from Tennessee Technological University, Cookeville, Tennessee, tasted, smelled, and rated the flavor and sugar content of three flavors (lemon-lime, rootbeer, and raspberry) of clear New York Seltzer soft drinks. The subjects were divided into three groups: 1) 7 nonsmokers; 2) 10 subjects who were exposed to second-hand smoke; 3) 7 smokers (at least 10 cigarettes/day). Each flavor of soft drink was colored red, green, and brown, resulting in nine color-flavor combinations which were presented to the subjects in a laboratory setting at the university. Split-plot analysis of variance was used to test for differences in perception of flavor and sugar content. Results showed that smokers relied more on the color of the drink to rate perception of the flavor ( $F = 1.81$ ;  $d.f. = 8,84$ ;  $P < 0.008$ ). Smokers also relied on the color of the drink to rate perception of the amount of sugar in the drink ( $F = 2.83$ ;  $d.f. = 4,84$ ;  $P < 0.008$ ). It was concluded that exposure to cigarette smoke dulls flavor and sweetness sensations, and, thus, smokers are more influenced by the color of the beverage.

ONSET OF RECOGNITION OF ILLUSIONS IN SCHOOL-AGE CHILDREN: PREDICTORS OF SCHOOL PERFORMANCE? *Angela R. Broyles, Tennessee Technological University, Cookeville, Tennessee.* A study using impossible-figure illusions was conducted with three groups (16 subjects in each equally divided by gender) of children with mean ages of 9.5 (fourth grade), 10.4 (fifth grade), and 11.7 years (sixth grade). Subjects were individually presented with 12 black-and-white illusions consisting of four impossible figures with realistic distortions, four impossible figures in isolation, and four inhibitory-process illusions. Data was gathered with an ordinal scale. Teachers provided a rating category by the percentile ranking of the subjects on math and reading scores (using Stanine measures from their T-CAP test) and indicated if the subjects attended Chapter One Math or Reading or Resource Math or Reading classes. The overall findings based on a split-plot analysis of variance indicated that the fifth grade had a significantly higher perception of illusions than the fourth and sixth grades ( $F = 10.305$ ;  $d.f. = 2,42$ ;  $P < 0.001$ ). There was not a significant difference between genders in perception of illusions. The fifth grade scored significantly higher on the impossible figure with realistic distortions and the inhibitory-process illusions than the fourth and sixth grades ( $F = 2.604$ ;  $d.f. = 4,84$ ;  $P < 0.001$ ). A significant correlation between math and reading scores and perception of illusions was observed for the fourth and sixth grades but not for the fifth grade. This implies that both math and reading abilities may influence perception of illusions. There was a significant relationship between the perception of illusions and attendance of chapter one or resource classes in the sixth grade ( $F = 0.733$ ,  $P < 0.02$ ). The response to illusions may be predictive of learning problems.

THE EFFECT OF ULTRAVIOLET RADIATION ON 3T3 MOUSE FIBROBLAST CELLS. *Denise Arrington, Melanie Arnold, E. Lewis Myles, and Carolyn Alexander-Caudle, Tennessee State University, Nashville, Tennessee.* The effects of electromagnetic radiation (non-ionizing radiation) has increased in recent years. There have been great concerns regarding the hazardous nature of electromagnetic radiation because it has been implicated in the induction of certain kinds of cancer. This study used ultraviolet radiation to determine its effect on mouse fibroblast cultures. The results from this study will be compared with other forms of non-ionizing radiation to determine their carcinogenic capability. Mouse fibroblast cells were used to investigate cellular and molecular effects of extremely-low-frequency radiation. Data obtained from such studies can contribute to and establish guidelines for individuals who may be exposed to high or low levels of electromagnetic radiation. The results of this study show decreased cell viability after 15, 30, and 60 sec of ultraviolet irradiation; there was no detectable difference in viability between irradiating cells for 30 and 60 sec, and there is more total RNA synthesized at 15 and 30 sec of ultraviolet irradiation than the control. Polyacrylamide-gel electrophoresis of cells irradiated at 15 and 30 sec show the synthesis of two proteins with a molecular weight <100 kd.

SUBCELLULAR LOCALIZATION OF CHONDROITINASE ACTIVITY IN *EDWARDSIELLA ICTALURI*. *Michael C. Wallace and Don C. Dailey, Austin Peay State University, Clarksville, Tennessee.* *Edwardsiella ictaluri* is a Gram-negative bacillus that is the most common cause of bacterial mortality in farm-raised channel catfish. This bacterium causes the disease enteric septicemia of catfish. The acute form of the disease follows ingestion of the bacterium by the catfish with the subsequent dissemination of the bacterium from the intestinal tract into the circulatory system. The chronic form of disease results from infection through the nares with the bacterium slowly eroding the tissues in the head forming a characteristic ulcer referred to as "hole-in-the-head disease." Both the acute and chronic forms of the disease result in a highly fatal septicemia. In both forms of enteric septicemia of catfish, the bacterium demonstrates a very invasive and tissue-destructive characteristic. A chondroitinase enzyme activity in the bacterium has been hypothesized as a key virulence determinant in the disease process. The substrate for chondroitinase is chondroitin sulfate, a key component of such tissues as cartilage, tendon, and mucus. It was hypothesized that the enzyme was located on the surface of the bacterium and possibly secreted into the environment. Experiments were performed to assay subcellular fractions and cell-free culture supernatants for enzyme activity. Chondroitinase activity was detected in CHAPS detergent extracts of *E. ictaluri*. This detergent selectively solubilizes membrane proteins. The enzyme was detected also in cell-free culture supernatants. The data suggest that chondroitinase is a membrane-associated protein in *E. ictaluri* and that this enzyme is released by some unknown mechanism from the bacterium.

INDUCTION OF CHONDROITINASE ACTIVITY IN *EDWARDSIELLA ICTALURI*. *Eric A. Marcum and Don C. Dailey, Austin Peay State University, Clarksville, Tennessee.* *Edwardsiella ictaluri* is responsible for millions of dollars in losses to the catfish-farming industry nationwide. This bacterium causes the highly infectious and fatal disease enteric septicemia of catfish. Chondroitinase enzyme activity has been hypothesized as a major component in initiating the disease process. It has been well documented that chondroitinase enzymes in other bacteria represent inducible systems. This project was designed to investigate the molecular biology of the chondroitinase enzyme in *E. ictaluri*. The enzyme was not detected in the bacterium until the culture had reached the late stationary phase of growth and required the culture to be pretreated with chondroitin sulfate. To ascertain if chondroitin sulfate

was acting as an allosteric regulator of enzyme activity or was inducing gene expression, experiments were performed under conditions that block gene expression. Protein synthesis was blocked by including kanamycin with the chondroitin sulfate pretreatment. There was a significant decrease in enzyme activity when protein synthesis was blocked indicating that gene expression is needed in part for maximum expression of chondroitinase activity. It is important to note that not all enzyme activity was inhibited by kanamycin suggesting that some allosteric control of enzyme activity may also be present.

ANALYZING AND SEQUENCING OF CEPHALOPOD MITOCHONDRIAL DNA FOR USE IN PHYLOGENETIC ANALYSIS. *Hayes McDonald, Henrietta Croom, and Ronald Toll, University of the South, Sewanee, Tennessee.* DNA-sequence information can be used as a powerful tool for the elucidation of phylogenetic relationships among taxa. Universal primers allow the amplification of specific sections of DNA through the polymerase chain reaction. These segments of DNA may be sequenced rapidly through the Sanger dideoxy-chain-termination technique. We isolated the total DNA from frozen tissue of squid (*Loligo opalescens*) and live tissue of octopus (*Octopus cf. ornatus*) through phenol and chloroform extractions followed by ethanol precipitation. The section of the mitochondrial DNA that codes for a segment of the 12s ribosomal DNA was amplified and sequenced using two highly-conserved primers. The sequences across a 123-base region were aligned with two other mollusks (*Cellena tramoscerica* and *Ischnochiton australis*) and two oligochaetes (*Aporrectodea rosea* and an immature representative of the Lumbricidae) which served as outgroups for the analysis. A cladogram was generated from these sequences, using a maximum parsimony algorithm (PAUP 3.0s), and bootstrap analysis was used to test the significance of each branch of the tree. The preliminary data suggest that cephalopods represent a monophyletic clade (at a 95% or higher confidence interval). The branch of the tree differentiating between the other two classes of mollusks was supported at only a 67% confidence interval. Further sequences will be required to resolve that branch. The observation that there are polymorphisms between the two octopods suggest that the techniques used in this experiment should be useful for elucidating intragenetic relationships.

COMPARISON OF MECHANICAL AND MANUAL TECHNIQUES OF HEMATOLOGICAL ANALYSIS. *Jeffrey C. Richardson and Larry N. Latson, David Lipscomb University, Nashville, Tennessee.* The data obtained from complete blood counts of dogs and cats using a veterinary hematology analyzer was compared with data obtained by manual techniques. The means of 33 replications showed no significant difference (0.05 significance level) between the instrumental and manual techniques. The manual technique required an average of 30 min for sample analysis; the instrumental technique required only 7 min/sample. The manual technique was one-third more costly per sample than the instrumental technique. This study supported the use of the QBC veterinary hematology analyzer for hematological counts by showing its accuracy and savings in time and money.

CATALOGING OF AN AVIAN EGG COLLECTION. *Robert Matlock and Larry N. Latson, David Lipscomb University, Nashville, Tennessee.* Thirty-one of 1,024 bird eggs were identified to species. The David Lipscomb University bird collection of 1,024 eggs contained >240 eggs possessing distinguishable types of features. The eggs identified displayed the following pattern markings: dotted; spotted; blotched; streaked; scrawled; marbled; capped; overlaid; wreathed. The collection included eggs with spherical, elliptical, cylindrical, oval, and pyriform shapes. A caliper was used to measure the length and width of each identified egg. The smallest egg measured 16 by 13 mm; the



largest measured egg was 80 by 50 mm. An avian numbering system was applied to the identified egg collection and display mounts.

**DEVELOPMENT OF A TECHNIQUE FOR IDENTIFICATION OF HUMAN CHROMOSOMES USING SCANNING ELECTRON MICROSCOPY.** *Jennifer J. Hershman and Daniel W. Bath, Austin Peay State University, Clarksville, Tennessee.* The surface ultrastructure of trypsin-banded chromosomes was examined by scanning electron microscopy. Peripheral blood lymphocytes were cultured for 72 h and fixed in ethanol-acetic acid (3:1) by conventional techniques. Chromosomal spreads were made by flame-drying a few drops of cell suspension on a wet cover glass. The slides were then stained in 4% Giemsa with 0.25% trypsin added. After drying completely, chromosomes were coated for 3 min with gold-palladium and examined with the scanning electron microscope. Bands observed with the scanning electron microscope appeared as alternating greater and lesser concentrations of chromatin fibrils along the chromosomes. These fibril-concentration patterns correspond to dark- and light-staining Giemsa bands as seen with light microscopy. By comparing the patterns of fibril concentration observed with the scanning electron microscope to Giemsa-stained banding patterns seen with the light microscope, it is possible to identify individual chromosomes.

**SUBSTRATE PREFERENCE IN JUVENILE ALLIGATOR SNAPPING TURTLES, *MACROCLEMYS TEMMINCKII*: RESULTS OF LABORATORY TESTS.** *Colleen M. White and A. Floyd Scott, Austin Peay State University, Clarksville, Tennessee.* Juvenile alligator snapping turtles, *Macrochelys temminckii*, were tested in the laboratory to determine 1) if they would choose equally or unequally from among a variety of substrates, and 2) whether the addition of cover would alter their initial choice of substrates. To answer the first question, 18 second-year individuals were placed, one at a time, in the center of a circular arena containing equal areas of mud, sand, fine gravel, and coarse gravel. Then, at the end of a 10 min. acclimation period and every 5 min thereafter for 20 min, the substrate supporting the turtle was noted. This procedure was performed four times. To answer the second question, the first experiment was repeated (using 16 of the original 18 turtles) with artificial cover (a small, green, plastic flower pot) present on a different substrate throughout each trial. Chi-square analyses of the results indicate that, under controlled laboratory conditions, juvenile *M. temminckii* exhibit a significantly disproportionate ( $P < 0.05$ ) affinity for the substrates tested (with coarse gravel topping the list) and that the presence of cover significantly influences their choice of substrate.

### WESTERN REGION

CHRISTIAN BROTHERS UNIVERSITY,  
MEMPHIS, TENNESSEE

**CELL-ADHESION MOLECULE EXPRESSION ON SENSORY NEURONAL GROWTH CONES AND AXONS.** *Joseph Kueter, Christian Brothers University, Memphis, Tennessee.* During embryonic development in the chick hindlimb, some sensory axons associate with other sensory axons and grow along cutaneous nerves to the skin, and other sensory axons associate with motor neurons and grow to muscle. The expression of various cell-adhesion molecules (CAMs) on the surface of these two types of sensory neuron growth cones was characterized. The experiments were done in vitro using a combination of retrograde and immunofluorescent labelling to visualize three selected CAMs: L1; neural cell adhesion molecule (NCAM); polysialylated neural cell adhesion molecule (PSA-NCAM). It was found that higher levels of PSA-NCAM were expressed on muscle sensory growth cones than on

cutaneous sensory growth cones. The difference in expression may be related to how the muscle and cutaneous afferents interact with other cellular cues and choose the correct pathway(s) to follow during development. The results of L1 and NCAM expression were inconclusive.

**ISOLATION OF ALGALVTIC MICROORGANISMS FROM AN AQUATIC ENVIRONMENT.** *Karen Terry and T. Y. Wong, Memphis State University, Memphis, Tennessee.* The single-cell alga *Selenastum capricornatum* is a common, freshwater inhabitant. This organism has been used by many researchers as an environmental indicator. To further study the reactions of the cell in the environment, a better understanding of the physiology and genetics of the cell is needed. One major problem in studying this organism is the difficulty involved in breaking up the cell gently. Various cellulytic enzymes were tested without effects. The goal of this experiment was to isolate an organism that has the capacity to degrade the extracellular carbohydrate of *S. capricornatum*. The algal cell wall was obtained by centrifugation. This carbohydrate material was then added to Burke's media containing 0.1% yeast extract, 0.1% ammonium sulfate, and 2% agar. Samples of pond water and mud were treated with a neutral detergent to release the microorganisms and then inoculated on plates of the modified media. As a result, at least one bacterial species and one mold species were able to exist on the algal carbohydrate as its sole carbon source.

**EFFECT OF NOVEL ANTIPLATELET AGENTS ON BLEEDING TIMES OF MICE AND RATS.** *W. P. Conn, R. Gollamundi, and B. A. Lyman, University of Tennessee, Memphis, Tennessee.* Vaso-occlusive thrombosis is one of the major causes of morbidity and mortality in the United States and throughout the world. Inhibition of the aggregation of platelets involved in this process is, therefore, an important therapeutic goal. In vivo and in vitro test results on a series of novel antiplatelet agents (carbamoypiperidines) synthesized in our laboratory were reviewed for their ability to inhibit induced platelet aggregation. Three of the most promising compounds were selected and tested for their ability to prolong bleeding in mice and rats, as measured by the bleeding time. These compounds were  $\alpha, \alpha$ -bis[3-(N,N-diethylcarbamoypiperidino-*p*-xylene dihydrobromide (A-1) and one of its stereoisomers (A-1C) and A-4C, an enantiomer of  $\alpha, \alpha$ '-bis[3-(N-benzyl-N-methylcarbamoypiperidino-*p*-xylene dihydrobromide (A-4). A bleeding-time protocol using either a 5-mm lancet or a Simplate™ bleeding-time device was adapted for these studies. The three compounds were administered to rats and mice at doses shown to be effective for 50% of the animals (ED<sub>50</sub>) in previous studies. When administered to rats, A-1 at either 164.4  $\mu\text{M}/\text{kg}$  (its ED<sub>50</sub>) or 328.8  $\mu\text{M}/\text{kg}$  (two times its ED<sub>50</sub>), A-1C (71.2  $\mu\text{M}/\text{kg}$ ), and A-4C (19.4  $\mu\text{M}/\text{kg}$ ) significantly prolonged the bleeding times. The same compounds administered to mice at the same doses did not significantly prolong bleeding times. These results indicated that rats may be a more sensitive and reproducible model. The data obtained from bleeding-time studies with rats correlated well with previous in vivo and in vitro results. It is suggested that bleeding-time studies with rats are effective in evaluating the efficacy of potential antithrombotic agents.

**HEADCOCKING IN *GALAGO MOHOLI* IN A VISUAL DISCRIMINATION TASK.** *Frank B. Blacknall and Jeannette P. Ward, Christian Brothers University, Memphis, Tennessee.* This study was undertaken to determine if the headcocking observed in the lesser bushbaby (*Galago moholi*) is due to the novelty of an observed stimulus or if it is an innate response for improvement of visual acuity. Two adult female bushbabies were trained to recognize stimulus-display targets containing strips of varying orientation and size when displayed opposite targets consisting of one of three shades of gray. Near the end of the

study, a third set of stimuli consisting of a whole and a split annulus was used for the novelty stimuli. Frequencies and angles of headcocking were scored for only one bush baby due to a lack of any such rotational head movements observed in the other. The performance of both animals in discriminating the striped stimuli declined as the stripes became smaller, but a marked decline was observed in the performance of the bushbaby that displayed headcocking. When the whole- and split-annulus targets were presented, a novelty effect was suggested in that headcocking decreased in frequency from the first to the third session. There was no appreciable change in the frequency of headcocks as the stripes diminished in size and, thus, became more indistinguishable from the grays.

**THE SECOND-ORDER DOPPLER SHIFT OF IRON-57 GAMMA-RAY PHOTONS UTILIZING THE MOSSBAUER EFFECT.** *James E. Dickens, Jr., Rhodes College, Memphis, Tennessee.* Gamma-ray resonance spectroscopy utilizing the Mossbauer Effect is a powerful tool for investigating the properties of atomic nuclei. An experiment was conducted using enriched iron-57 as both a gamma-ray photon source and an absorber to determine the relativistic effects associated with thermal vibrations of the nuclei. When the absorber was heated to a higher temperature than the source, the energy of the emitted, gamma-ray photon was seen to be shifted to a higher energy due to the relativistic, temperature-dependent, second-order Doppler Shift. The fractional shift in energy of the resonance-absorption spectrum was measured and expressed as a temperature coefficient.

**HYPERINSULINEMIA IN NON-DIABETIC CANINE MODEL: EFFECTS ON BLOOD PRESSURE AND LIPOPROTEINS.** *Jon Martin, Atef Salem, Lillian Graber, and Osama Gaber, Christian Brothers University, Memphis, Tennessee.* Despite evidence suggesting hyperinsulinemia is a risk factor for cardiovascular disease, few studies describe its effects on the development of hypertension and lipoprotein abnormalities. The objective of this study was to establish a model capable of determining the effects of hyperinsulinemia on blood pressure and lipoproteins. Sixteen experimental animals underwent selective diversion of pancreatic portal flow to the systemic circulation by anastomosing the splenic vein and pancreatic-duodenal vein separately to the inferior vena cava. Sixteen control animals underwent a sham operation. Fasting plasma insulin, weight, and blood pressure were measured monthly for 6 months. Plasma glucose, total cholesterol, triglycerides, HDL cholesterol, LDL cholesterol, and VLDL cholesterol were measured at 3-month intervals. Fasting plasma insulins were significantly increased from baseline (control = 8.4  $\mu\text{u/ml}$ , hyperinsulinemic = 5.6  $\mu\text{u/ml}$ ;  $P > 0.05$ ) for the hyperinsulinemic group at 3- and 6-months measurements (26.1 and 24.7  $\mu\text{u/ml}$ , respectively,  $P < 0.0001$ ) but not for the control group. Lipid profiles demonstrated that induction of hyperinsulinemia increased total cholesterol, triglycerides, low-density lipoproteins (LDL), very-low-density lipoproteins (VLDL), and the LDL:HDL ratio. These results suggest hyperinsulinemia may be an independent risk factor for hypertension as well as lipoprotein abnormalities.

**A COMPARISON OF LIGHT TRANSMISSION THROUGH WHITE AND YELLOW MILK BOTTLES.** *H. C. Smith, IV, and M. S. Jahan, Memphis State University, Memphis, Tennessee.* A comparison of the transmission of ultraviolet (UV) and visible (VIS) light by translucent white and yellow milk bottles was performed using three types of measurements. The first one was a full-spectrum test between 200 and 800 nm using a UV/VIS spectrophotometer. The second method involved measurements of characteristic wavelengths of fluorescent light using a light meter and a diode-array-based, optical, multichannel analyzer (OMA). The third method, however, employed a broad-band

light meter. The results show that the yellow material transmits little light below approximately 560 nm whereas the white transmits a significantly higher amount until below approximately 250 nm. For example, at 360 nm (a Hg line of the fluorescent light), 16 times more light transmitted through a white milk bottle than through a yellow one.

**QUANTIFICATION OF POLY-B-HYDROXYBUTYRATE.** *Martha Candebat, T. Y. Wong, Howard Berg, Memphis State University, Memphis, Tennessee.* Poly-B-hydroxybutyrate, a naturally-occurring lipid polymer, shows great promise as a raw material for biodegradable plastic. Poly-B-hydroxybutyrate is stored by host bacteria for later use when nutrients are unavailable. Normally, the cell does not use the stored poly-B-hydroxybutyrate for growth. By changing the physiological conditions, *Azotobacter winlandii* cells can grow using the stored poly-B-hydroxybutyrate as their carbon source. A new procedure was used to determine the amount of poly-B-hydroxybutyrate in cells, based on the ability of Nile red to fluoresce in a lipid environment. The fluorescent light was captured by a high-resolution, CCD camera. The amount of photons produced was a function of the lipid (poly-B-hydroxybutyrate) content of the cell. The photons produced were also proportional to the amount of poly-B-hydroxybutyrate extracted by chemical methods.

**STRUCTURAL DESIGN USING GENETIC ALGORITHM.** *Dean Halizan, Christian Brothers University, Memphis, Tennessee.* A typical design of a structural element, such as beams, columns, or slabs involves the trial-and-error process. The designer first makes an educated guess on a trial section and then verifies the adequacy of the section. If the section does not work, a new section is chosen. This trial-and-error process goes through several iterations. This presentation describes an application of genetic-algorithm method in structural design. Sections are selected using the evolution process. Even though this natural-selection process does not guarantee the optimum section, it does generally give a reasonable result. A reinforced-concrete beam is used as an example to demonstrate the application of the genetic algorithm to structural-design problems. The genetic-algorithm method randomly creates the first generation of the population. An individual population is represented as a chromosome. A chromosome consists of several genes which represents section dimensions. Each individual has a certain fitness value which is derived from its strength. Subsequent generations are created by cross-over and mutation based on probability, i.e., those individuals that have higher fitness have more chances to generate offspring. After a number of generations, the best section is selected.

**SUCKLING BEHAVIOR IN CALIFORNIA SEA LION PUPS AND JUVENILES AT LOS ISLOTES BAY OF LA PAZ, MEXICO.** *Courtney Schwarten, Robyn Draheim, and Nadine Paffett-Lugassy, Rhodes College, Memphis, Tennessee.* Age-related changes in suckling strategies of California sea lions were studied at Los Islotes, in the Bay of La Paz, Mexico, from 21 September through 24 November 1992. Suckling data were recorded for pups and juveniles using 1-min-scan sampling which looked for three states of behavior: suckling; resting; active. The pup data indicated the mean suckling-bout length to be  $22.97 \pm 1.6$  min, inter-bout interval to be  $32.95 \pm 3.6$  min, and percent-time-spent-suckling to be  $21.32 \pm 1.9$  min. These data were compared with prior suckling data collected on the same cohort July through August 1992. Significance of these comparisons was determined by *t*-tests. Mean suckling-bout length had a significant increase, inter-bout interval showed no significant change, and percent-time-spent-suckling showed a decrease. The increase in mean suckling-bout length was determined to be a good indication of age-related changes in the suckling behavior of the California sea lion.

ALTERATIONS OF MORPHOMETRIC PARAMETERS OF CORPUS CALLOSUM CELLS IN DEVELOPING CAT AND RAT. **Vikki L. Murphree and Andrea J. Elberger**, *Christian Brothers University, Memphis, Tennessee*. The development of callosal cells of rats and cats was quantified, and comparisons were made between different-aged animals within the same species. Cats from ages 7, 14, 31, and 88 postnatal days and rats from ages 0, 7, 14, and 26 postnatal days were studied using the lipophilic membrane tracer, Dil. Two different patterns appeared in the results. The soma size increased with age in both the cat and rat. The primary dendrite length, terminal branch length, and number of terminal branches make up the dendritic arbor. In the cat, the dendritic arbor appears to peak at postnatal week 1. In the rat, the dendritic arbor continues to grow from birth until postnatal week 1, where a peak is observed. After postnatal week 1, the dendritic arbor of the rat begins to regress significantly. This study observed that as the brain and corpus callosum somata continue to grow, the size and complexity of the dendritic arbor of the corpus callosum continues to shrink. This indicates that the development of the dendritic arbor of the corpus callosum progresses on a different time course than that of the rest of the brain.

DO PLANT FACTORS AFFECT BACTERIAL CYTOKININ SYNTHESIS? **Dawn H. Dawson and Barbara J. Taller**, *Memphis State University, Memphis, Tennessee*. Cytokinins are plant hormones which promote cell division and morphogenesis. These compounds are also produced by prokaryotes which form associations with plants and may be employed by them to manipulate plant development. Therefore, it was of interest to determine if cytokinin production by microbes is altered in response to plant signals. The legume-*Rhizobium* system was chosen because of its agricultural significance as the major source of biologically fixed nitrogen in temperate regions. *Rhizobium phaseoli* was cultured with and without bean-seed extract, an aqueous extract from seeds which contains a mixture of plant compounds. The culture media were analyzed for cytokinin content by solid-phase extraction, LH<sub>2</sub>O fractionation, and tobacco-callus bioassay. Results demonstrated that production of two major types of cytokinins by *Rhizobium* was increased in response to compounds from leguminous plants. The identity of the active compounds in the seed extract is under investigation.

ASSESSMENT OF THE RESISTANCE OF STRIATAL NEURONS CONTAINING CALCIUM-BINDING PROTEINS TO N-METHYL-D-ASPARTATE-RECEPTOR-MEDIATED EXCITOTOXICITY: IMPLICATIONS FOR THE BASIS OF SELECTIVITY OF NEURONAL LOSS IN HUNTINGTON'S DISEASE. **Cynthia Lynn Harris and Anton J. Reiner**, *Christian Brothers University, Memphis, Tennessee*. Huntington's disease is characterized by loss of striatal projection neurons and the relative sparing of striatal interneurons. Neurons containing different neuropeptides display different extents of vulnerability, possibly due to the cell's ability to buffer the influx of calcium that results from excitotoxicity at the N-methyl-D-aspartate receptor. To explore this idea, the vulnerability of striatal neurons containing the calcium-binding proteins calbindin and parvalbumin to a N-methyl-D-aspartate excitotoxin was studied. Analysis of six male rats that had been injected with quinolinic acid, a N-methyl-D-aspartate-receptor excitotoxin, indicated that neither those neurons containing calbindin nor those containing parvalbumin showed significant decreased vulnerability to quinolinic acid compared to other striatal cell types. Therefore, it is possible that the hypothesized calcium buffering by calcium-binding proteins may not help neurons survive in Huntington's disease. It may be that those neurons that survive better lack the NMDA receptors necessary for excitotoxicity. Finally, it is possible that excitotoxicity plays no role in cell death in Huntington's disease.

PREVALENCE OF HUMAN HERPESVIRUS 6 IN COLLEGE STUDENTS AS DETERMINED BY SEROLOGY AND POLYMERASE CHAIN REACTION. **Nichole Holzhauser, Kathleen Donnelly, and Gary Lindquister**, *Rhodes College, Memphis, Tennessee*. Human herpesvirus 6 is the etiologic agent of roseola. Roseola is a childhood infection usually characterized by rapidly rising fever persisting for 3 to 5 days followed by rash persisting for as long as 4 days. Little information concerning other effects of this recently discovered virus on the human body is available. Serologic studies may have linked herpesvirus 6 to adult hepatitis cases and to various lymphoproliferative disorders, but the data are inconclusive. Nothing is known of its effects in immunocompromised hosts. Herpesvirus 6 is currently detected through indirect serological techniques. We have studied the feasibility of a direct method for detection by utilizing polymerase chain reaction. Blood samples were collected from students attending LeMoyne-Owen College and Rhodes College in the fall of 1991 and were then tested in our laboratory using polymerase chain reaction and at the Centers for Disease Control and Prevention using enzyme immunoassays. The polymerase chain reactions were conducted using herpesvirus 6 specific primers and primers for beta-globin as an internal control, and the fragments were identified following gel electrophoresis. Results comparing these assay methods and correlating herpesvirus 6 incidence with racial and socio-economic survey data will be presented.

EFFECT OF CHEMICAL AGING ON THERMOLUMINESCENCE IN STERILIZED POLYETHYLENE. **S. Aldridge, C. P. Vu, and M. S. Jahan**, *Memphis State University, Memphis, Tennessee*. Gamma-ray (0, 2.5, 20, and 100 MRad<sup>60</sup>Co)-sterilized, ultra-high-molecular-weight-polyethylene samples were first stored in air at room temperature for 180 days and then in a chemical environment such as lipid, hydrogen peroxide, saline solution, or nitric acid at 37°C for time intervals ranging from 0 to 400 days. Subsequent heating of each sample from room temperature to 300°C produced a thermoluminescence glow curve (light output as a function of temperature) whose shape and magnitude depend on the sterilization dose and post-sterilization chemical aging. The unsterilized (0 MRad) samples did not produce any thermoluminescence. However, the most apparent decrease in thermoluminescence output occurred in samples immersed in nitric acid. This result correlates directly with the data that have been obtained using the ESR technique, suggesting that the thermoluminescence mechanism is associated with free radical reactions. Furthermore, this study demonstrates that the thermoluminescence technique, which is simple and fast, can be employed to measure the radiation effects in and post-sterilization chemical aging of ultra-high-molecular-weight polyethylene.

CELL MIGRATION: THE EFFECT OF POLYAMINE DEPLETION ON ACTIN-BINDING PROTEINS IN IEC-6 CELLS. **Kimberly A. Howerton**, *Christian Brothers University, Memphis, Tennessee*. Although the cytoskeleton plays a vital role in cell migration and early healing of the mucosa of the gastrointestinal tract, no attempts have been made to study the effect of polyamine depletion on the actin-binding proteins. Therefore, we attempted to study the effects of DFMO and putrescine replacement on the distribution and concentration of tropomyosin, spectrin, filamin, and  $\alpha$ -actinin in the small intestinal epithelial crypt cell line IEC-6. We found that polyamine depletion by DFMO altered the distribution of filamin and spectrin but not tropomyosin and  $\alpha$ -actinin. Also, putrescine replacement in the DFMO-treated cells restored the original distribution of filamin and spectrin in the IEC-6 cells. Therefore, the depletion of polyamines may inhibit cell migration by altering the functions of filamin and spectrin.

EFFECTS OF POLYAMINES ON IEC-6 CELL DIFFERENTIATION. *L. M. Burks and M. J. Viar, University of Tennessee, Memphis, Tennessee.* Polyamines are known to be necessary for growth in all cells, but their involvement in cell differentiation is not clearly understood. The rapid turnover of gastrointestinal tract cells has made these cells a useful model for cell growth and related processes. This study investigated the effect of polyamine depletion on differentiation of rat intestinal epithelial crypt (IEC-6) cells, which represent the undifferentiated proliferative cells of the intestinal mucosa. Polyamines were depleted in cells grown on plastic culture ware, representing the undifferentiated state, and on an extracellular matrix (Matrigel™) to induce differentiation. Depletion of polyamines resulted in increased activity of maltase, an enzyme marker for differentiation; this suggested an inhibitory effect of polyamines on differentiation. An additional finding was that after several days of growth, IEC-6 cells differentiated on plastic ware as well as on Matrigel™. These findings may be important in establishing polyamine depletion as a method for controlling abnormal growth and differentiation in cancer cells. In addition, information was gained about the characteristics of IEC-6 cells as an *in vitro* model.

AN ANALYSIS OF CARBON-FIXATION PATHWAYS IN THE ROOTS OF SUSPECTED FACULTATIVE C4/CAM EPIPHYTIC ORCHIDS. *B. W. Walker, J. Davis, and C. L. Stinemetz, Rhodes College, Memphis, Tennessee.* Orchid shoots and roots have been seen to possess different carbon-fixation pathways. Some have argued for divergent evolution of carbon-fixation pathways in *Orchidaceae* centered around the idea that form follows function. Others have suggested a linear evolution of carbon-fixation pathways based on the premise that more-derived CO<sub>2</sub>-fixation pathways are simple biochemical modifications of previously existing pathways. An examination of orchid CO<sub>2</sub>-fixation pathways was undertaken to see if there was any evidence for the latter by measuring diurnal variation of stomatal resistance in leaves, titration for total acidity in leaf and root tissue, and light microscopy of cross-sections of orchid tissue. It was possible for independent evolution of different carbon-fixation pathways to have occurred in the leaves and roots of some tropical epiphytic orchids, though further research is needed to determine the exact nature of C3 or C4 pathways in orchid tissues.

THE ROLE OF PHOSPHORYLATION IN CYTIDYLTRANSFERASE ACTIVITY. *Jennifer Daniel, Suzanne Jackowski, and Chuck Rock, Christian Brothers University, Memphis, Tennessee.* The membrane-bound protein cytidyltransferase is the rate-limiting enzyme in the phospholipid-biosynthesis pathway. When cytidyltransferase is dephosphorylated in early G1 of the cell cycle, phosphocholine is converted to CDP-choline, "turning on" phospholipid biosynthesis. Throughout the remainder of the cell cycle, cytidyltransferase is phosphorylated, and phospholipid biosynthesis ceases as the cell divides. Phospholipase C, another plasma-membrane enzyme found in normal cells, degrades phosphatidylcholine, triggering cytidyltransferase dephosphorylation and progression through the cell cycle. The focus of these experiments was to study how cytidyltransferase responds to phospholipase C. In the BAC1.2F5 cell line, removal of the growth factor, colony-stimulating factor-1 (CSF-1), arrests the cells in G1, synchronizing the cells. Treatment of synchronized BAC1.2F5 cells with phospholipase C results in cytidyltransferase dephosphorylation and gradual phosphorylation similar to that observed upon addition of the growth factor. Hence, phospholipase C mimics CSF-1 in BAC1.2F5 cells.

DETERMINING THE EFFECTIVE TEMPERATURE OF OZONE IN THE UPPER ATMOSPHERE FROM THE ROTATIONAL LINE SPECTRUM. *William E. Godbold, Rhodes College, Memphis, Tennessee.* The infrared absorption spectrum of ozone reveals information about its state in the Earth's atmosphere. The equivalent widths of the observed lines depend on the temperature of the absorbing ozone through the population of the upper and lower states of the molecular transitions. Observations of the ratios of several rotation lines due to atmospheric ozone have been conducted with an infrared, grating spectrometer. A resolution of 0.25 cm<sup>-1</sup> was obtained in the second order of a 75-lines/mm, 64-by 64-mm grating while using a LN<sub>2</sub>-cooled detector and phase-sensitive amplification. These observations are compared with theoretical predictions.

THE EFFECTS OF INTERLEUKIN-1 RECEPTOR ANTAGONIST PEPTIDES OF CD4-RECEPTOR SYNTHESIS AND HIV-1 INFECTION IN HUMAN LYMPHOCYTES. *Julie Jackson, Linda Pifer, and Arnold Postlethwaite, Christian Brothers University, Memphis, Tennessee.* Tests were performed on H9/HTLV-IIIb cells and human, peripheral blood lymphocytes in order to determine if any one of six synthesized interleukin-1 receptor antagonist peptides would down-regulate the synthesis of CD4 receptors and, consequently, prevent HIV-1 infection of the cells. Cells treated with interleukin-1 receptor antagonist peptides exhibited diminished fluorescence for HIV-1 p24 antigen in indirect immunofluorescence assays. Peptide 6 was the most effective suppressor of this antigen. Furthermore, all but one of the six peptides induced a transient, capsule-like exudate around the cells which suggested that some cell-surface glycoprotein or mucopolysaccharide had been modified. However, flow cytometry suggested that CD4 receptors were not down-regulated. Possibly, HIV-1 was inactivated by chemical contaminants produced during peptide synthesis. It is also possible that the p24 antigens were being expressed on the cell surfaces but were obscured by the capsular substance.

USES OF COMPUTERS FOR HIGH-ENERGY PHYSICS SIMULATIONS. *Matthew C. Cummings, Memphis State University, Memphis, Tennessee.* This project covers the problems involved with designing particle detectors for the Superconducting Supercollider and the software designs needed to research them. Though the software was originally written for one computer, the program was changed to run on a variety of research computer platforms and produce constant results in an easy-to-use capacity. However, the software was not changed to the point that it was no longer the work of the original authors.

PYROPHOSPHATASE OF YEAST. *Njeri Njoroge, Christian Brothers University, Memphis, Tennessee.* This research involves techniques in the purification of an enzyme, pyrophosphatase, and some of the enzyme's properties. Pyrophosphatase is the enzyme which catalyzes the hydrolysis of inorganic pyrophosphate. Pyrophosphatase was first prepared from a yeast suspension. In the first experiment, a series of dilutions of the enzyme were made. From these dilutions, an ideal concentration of the enzyme was determined. The concentration of the enzyme from the crude yeast extract was also determined. The next experiment involved determining the effect of magnesium on pyrophosphatase. To determine this, different concentrations of MgCl<sub>2</sub> were employed. Once the experiment was completed, micromoles of orthophosphatase versus the molar concentration of Mg<sup>2+</sup> were plotted. These data were used to plot a Michaelis-Menten graph and a Lineweaver-Burk graph. In the final experiment, the concentration of substrate, Na<sub>2</sub>P<sub>2</sub>O<sub>7</sub> (sodium pyrophosphate), was varied. Graphs were plotted to determine the effect of different amounts of substrate on enzyme activity. The data collected were analyzed, and conclusions on the kinetics of pyrophosphatase were made.