

## ABSTRACTS OF PAPERS PRESENTED AT THE SPRING 1991 COLLEGIATE MEETINGS

### EASTERN REGION Tusculum College

*Description and Interpretation of Sedimentary Structures in Pennsylvanian Warren Point Sandstone Exposed Along Taft Highway, Signal Mountain, Tennessee*, Richard E. Bergenback and Richard F. Clinton Jr., The University of Tennessee at Chattanooga. Roadcut exposures of the Pennsylvanian Warren Point Sandstone along Taft Highway (127) atop Signal Mountain, Tennessee were examined for their sedimentary rock type and sedimentary structures with the view of determining their environment of deposition.

In a regional sense, the Warren Point Sandstone is part of a major clastic wedge that built from east to west (prograded) during Pennsylvanian time.

The major rock type of this exposure is quartz arenite (associated with relatively high water energy) along with lesser amounts of thin-bedded, rippled graywacke (relatively low water energy), gray shale with siderite nodules, and a thin coal seam (formed in essentially stagnant water).

Sedimentary structures associated with the quartz arenite consist of scour structures infilled with planar tabular and trough crossbeds which are considered as in-channel deposits of a braided stream complex. These planar tabular and trough crossbedded sedimentary structures originated as megaripple and dune bedforms in the soft sediment of ancient stream channels.

The thin-bedded, rippled graywacke sandstone units are considered to have formed as overbank, or floodplain deposits in sloughs (low places) in an enormous braided stream system. The siderite-bearing shales and the coal seam also formed in stagnant ponds in sloughs within the braided stream complex.

*Depositional Model of Deltaic Sequence, Lower Portion of Pennsylvanian Raccoon Mountain Formation Exposed in Hugden Branch, Raccoon Mountain, Marion County, Tennessee*, Richard E. Bergenback, Ronnie Fields and Troy Keith, The University of Tennessee at Chattanooga. 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. In this exposure, the Raccoon Mountain overlies the Mississippian Pennington Formation in transitional relationship and underlies the Pennsylvanian Warren Point Sandstone also in transitional relationship.

In this east Tennessee area the Raccoon Mountain Formation is part of a regional sedimentologic complex that prograded from east to west during Pennsylvanian time.

This study deals with the lower part (434'-754') of the Raccoon Mountain Formation section that is composed largely of dark-gray shale with siderite nodules and bands, as well as graywacke siltstone and sandstone. Sedimentary structures observed in this exposure include: 1) massive-bedded graywacke sandstone that infills scours; 2) trough crossbeds (composed of graywacke); and 3) thin-bedded, rippled graywacke-rich sandstone and siltstone units plus rippled shale units.

From 434'-568', the section is made up of dark-gray shale with siderite nodules and bands. These data are interpreted as marking the beginning of infilling of a localized sedimentary basin by the generally stagnant waters of a lagoon or bay.

In the interval 568'-620', there are three scour structures, two of which are filled with massive-bedded graywacke, and the third with graywacke containing graywacke, siderite and limestone clasts. In addition, there are two dark gray shale units, one of which contains siderite nodules and scattered horn coral fossils (not in growth position). At the top of this unit there is shallow scour structure (3"-4" thick) filled with lime sand. This interval is considered to represent storm deposits derived from a carbonate platform situated to the west.

Dark silty shale with siderite nodules and graywacke sandstone concretions (diagenetic feature) mark the interval from 620'-672', as a sometimes stagnant bay fill deposit. From 672'-685' there is a basal scour structure, filled with massive-bedded graywacke, which is overlain by graywacke-rich trough crossbeds, all of which are considered as part of a delta finger channel deposit that becomes finer grained in a vertical sense (fines upward).

From 685'-754', the interval contains several crevasse splay, or evulsion, deposits that increase in grain size in a vertical sense (coarsen upward). The deposits formed as the levee, or overbank, of a delta finger channel was breached and a shallow bay was filled in first with clay, then silt and finally sand.

*Depositional Model of Mississippian Pennington Formation Exposed in Hugden Branch, Raccoon Mountain, Marion County, Tennessee*, Richard E. Bergenback and Mickey Landreth, The University of Tennessee at Chattanooga. The Mississippian Pennington Formation is exposed in Hugden Branch which is located along Dixie Lee Highway (41/64), in the Tennessee River Gorge on the north slope of Raccoon Mountain in Marion County, Tennessee.

The Pennington is interpreted as a high intertidal, (supratidal?), tidal flat complex that is the time equivalent of the underlying Mississippian Bangor Limestone. Five rock types have been recognized, described and interpreted: 1) Red, or maroon, shale: oxidation of previously deposited shale during a fall of sea level, (regression), interpreted (especially in upper part of section) as part of main mass of tidal flat (mud flat); 2) Green, or greenish-gray, shale—formed in a reducing environment during a rise in sea level (transgression); interpreted as part of main mass of intertidal mud flat. Green shales are frequently associated with dolomitic units (linked with sea level fall), and so there is a question as to whether or not the original red shale color has been altered to a green shale color during its association with dolomitic; 3) Buff dolomitic—occurs as in filling of scour structures, which is composed largely of lime mud peloids that have been extensively dolomitized—associated birdseye and mud cracked structures; interpreted as tidal channel infillings during a fall in sea level (regression); 4) Gray limestone—contains thin-bedded, rippled and small-scale trough crossed units that are cyclic and are composed of fining-upward deposits of lime sand and lime mud; interpreted as part of the main mass of the tidal flat (especially in lower part of section) associated with a rise in sea level (transgression); 5) Gray limestone—associated with scour structures with infilling of lime mud and lime sand; interpreted as tidal channel fill deposits associated with sea level advance (transgressive) phases.

This exposure of the Pennington contains five transgressive and four regressive phases.

*Depositional Model of Mississippian Bangor Limestone Exposed in Hugden Branch, Raccoon Mountain, Marion County, Tennessee*, Richard E. Bergenback and James Lence, The University of Tennessee at Chattanooga. The Mississippian Bangor Limestone is exposed in Hugden Branch, which empties into the Tennessee River (Gorge) underneath Dixie Lee Highway (41/64) along the northern edge of Raccoon Mountain in Marion County, Tennessee.

The Bangor is interpreted as a lower tidal flat time equivalent of the overlying Pennington Formation. Four rock types have been recognized and interpreted: 1) gray, dark gray shale; interpreted as pond filling. 2) Buff dolomitic—associated with scour, mud-cracked and birdseye sedimentary structures: interpreted as tidal channel infilling associated with sea level retreat (regressive) phases. 3) Gray limestone associated with scour structures with infilling of lime mud and lime sand: interpreted as tidal channel fill deposits associated with sea level advance (transgressive) phases. 4) Gray limestone with thin bedded, rippled structures composed of cyclic (fining upward) lime mud and lime sand units: interpreted as the main mass of this predominantly carbonate tidal flat deposit (transgressive phase).

*Depositional Model of Meandering Stream Sequence, Upper Portion of Pennsylvanian Raccoon Mountain Formation Exposed in Hugden Branch, Raccoon Mountain, Marion County, Tennessee*, Richard E. Bergenback, Jodie Uren and Crystal Wooten, The University of Tennessee at Chattanooga. The Pennsylvanian Raccoon Mountain Formation is exposed in Hugden Branch which is situated along the northern edge of Raccoon Mountain in Marion County, Tennessee. In Hugden Branch, the Raccoon Mountain is in transitional relationship with the overlying Pennsylvanian Warren Point Sandstone and the underlying Mississippian Pennington Formation.

In the east Tennessee area, the Raccoon Mountain is part of regional sedimentologic complex that prograded from east to west during Pennsylvanian time.

This study deals with the upper part, (754'-958'), of the Raccoon Mountain section that is composed largely of graywacke sandstone and dark-gray shale. Sedimentary structures displayed in this exposure include: 1) graywacke-filled scours; 2) trough crossbeds (composed of graywacke); and 3) thin-bedded, rippled, graywacke-rich units. Dark-gray shale units with small sandstone lenses are associated with these graywacke sandstone deposits.

These structures are arranged in such a fashion that basal scour-fillings are overlain by trough crossbeds which are, in turn, overlain by thin-bedded, rippled units, and, in some cases, by dark-gray shale with small sand lenses. This arrangement is considered to become finer-grained in a vertical sense; hence, the term "fines upward." This architecture is interpreted as having formed in ancient channels and floodplains (overbank deposits) of meandering streams in areas of low gradient.

*Using Thin Layer Chromatography to Identify the Essential Oils in Plant Material: An Organic Chemistry Experiment.* Karen L. Brown and Dr. Robert Ziegler, Lincoln Memorial University. I was given an organic experiment to make it more feasible for a laboratory class to perform. The experiment dealt with extracting essential oils through steam and simple distillation, and analysis of the oil through thin layer chromatography. The organic materials I researched were White Pine, Norwegian Spruce, Sage, and Mint.

*A Study of Drying Agent Efficiencies in the Organic Chemistry Laboratory Using Karl Fisher Titration.* Charles R. Buchanan and Lawrence F. Kennard, Walters State Community College.

Drying of an organic solvent with an anhydrous inorganic is a common technique in the organic chemistry laboratory. The presumed dry liquid is removed from the salt, then usually distilled. We have found that the distillate is frequently cloudy and turbid even when freshly opened drying agent is used. We have investigated this liquid-water-dessicant problem using Karl Fisher titration with a Labindustries Aquametry I apparatus. We will present our findings.

*Sandwich Immunoassays.* Mark Burton, Carson-Newman College, and Michael Sepaniak, The University of Tennessee, Knoxville. The goal of this project was to develop a solid phase sandwich immunoassay for Immunoglobulin IgG. Time permitted technique development in preparing the affinity solid support and the determination of binding capacities for the sandwich assays. First, techniques were perfected for the preparation of the silica bead solid support for the immobilization reaction with the first antibody of the sandwich. The coverage of the bead by the antibody was monitored by fluorescence. Ultraviolet spectroscopy was used to measure the binding in the completed sandwich assay. The regenerable fiber optic fluoroimmunosensor developed in Dr. Sepaniak's laboratory was used to perform an interference study using bovine serum albumin.

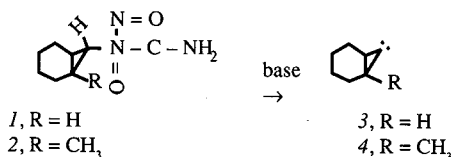
*Coliform Examination of San Salvador Island Public Well Water.* Mark C. Carder, Debra A. Eaker, and Jack Pickett, The University of Tennessee at Chattanooga. San Salvador Island is located on the easternmost edge of the Bahamian platform off the coast of Florida. A comprehensive study of the public well water has not been conducted since 1974. It is the intent of this study to examine eight public shallow wells in an unconfined aquifer for coliform contamination with a particular interest in fecal bacteria populations. A HACH MUG test was the initial test which was utilized as an indicator for coliform. In the event of a positive MUG test a MPN-LT presumptive examination was conducted. On the result of a positive presumptive test an EC-Medium test, specific for *Escherichia coli*, was conducted. From the number of positive test tubes the Most Probable Number of coliform per hundred per milliliter was determined for each well. All the wells tested were contaminated and the average of the most probable number of organisms was 1224 coliforms per 100 milliliters.

*Determination of Tooth Patterns and Age Classes of Soricidae in the Cumberland Mountain Range.* Amy Coffey, Lincoln Memorial University. Tooth patterns were studied for three species of the shrew family Soricidae. Between 28 June 1990 and 8 September 1990, *Sorex fumeus*, *Sorex cinereus*, and *Sorex (Microsorex) hoyi*, which represents the first pygmy shrew found in the Cumberland Mountains of Tennessee (collected 11 July 1990, Claiborne County, Tennessee, 83° 40' 15", 36° 35' 0", elevation 1375 feet), were collected.

Previous tooth wear studies have employed a relative scale using a visual comparative index. We sought to quantify this parameter more accurately by assessment with image analysis. Surface area of the unicuspid and molariform tooth rows were taken using this technique and employing frequent distributions to distinguish groups within species. This research was supported in part by the Junior Division of the Tennessee Academy of Science.

*Synthesis of N-(F-exo-bicyclo[4.1.0]heptyl)-N-nitrosourea and its reaction with alcohols.* Laura Cross and I-Shan Chu, King College.

As part of our efforts to understand the chemistry of cyclopropylidenes in solution, compounds 1 and 2 have been synthesized. The reactions of these norcaradiylenes, 3 and 4 in alcohols will be investigated.



*The Effect of Banning Leaded Gasoline on Lead in Soil.* Carol Ann Goodman and Truett Patterson, Carson-Newman College. Using  $\text{HNO}_3$  extraction followed by analysis with AA, the lead content of soil at various distances perpendicular to US 11E at two locations near Jefferson City, Tennessee was measured and compared statistically with values found in studies of the same locations in 1975 and 1978. As hypothesized, the lead levels of most samples in 1990 were found, at the 95% confidence level, to be lower than those measured in 1975 and 1978.

*Microbial Contamination of Pharmacy-prepared Enteral Feeding Solutions.* Jean Goodwill, Lee College. Seven nutrient feeding solutions (Vital, Amin-Aid, Standard Vivonex, Ensure, Ensure Plus, Magnacal, Osmolite) were evaluated for bacterial and fungal contamination. The solutions were prepared in the pharmacy utilizing a standardized technique. Filtered tap water was used for dilution and reconstitution. 250ml to 300ml of each product was transferred into five separate enteral feeding containers (Flexitainer). Two sets of solution were prepared. One set was stored for 24 hours at room temperature (27°C) and the other set refrigerated (8°C). Culture samples were obtained at 0, 8, 16, and 24 hours post preparation. Acceptable microbial contamination patterns (i.e. <20,000 c.f.u./ml) were observed with the ready to use products. Variation in storage temperature produced no significant change ( $P > 0.05$ ) in total microbial growth. In addition, dilution of ready to use products with filtered tap water did not produce a significant change ( $P > 0.05$ ) in total microbial growth when compared to undiluted products. Ready to use products, whether full strength or diluted with filtered tap water, can be administered over periods not exceeding 24 hours. Elemental solutions exhibited considerably more microbial growth compared to the ready to use products. Refrigeration of these products limited organism proliferation. After preparation, elemental solutions should be refrigerated and administered over periods not exceeding eight hours.

*Spectrophotometric Determination of Chromium (VI) in Spent Machine Tool Coolant and Removal of Chromium (VI) From the Waste Stream.* Chad Hadden, Beth Henson, and Lawrence F. Kennard, Walters State Community College. Because chromium (VI) is an extreme environmental hazard, its presence in waste water is closely monitored. We are assisting an industrial firm in analyzing spent machine tool coolant for chromium (VI) and in treating this effluent chemically to reduce chromium to the allowable 5 ppm level. The waste stream used in this investigation cannot be analyzed with our water quality test equipment. Problems associated with the analysis of the waste stream are: the coolant is made using a proprietary formulation, the coolant has been used for several weeks in industrial equipment, the coolant is very impure and heterogeneous, and the most important factor, the coolant contains a fluorescent dye. We are studying the analysis/removal problem on model solutions and will report our results.

*Fourier's Seventeen Lines Problem.* David Jonas, King College. Fourier's Seventeen Lines Problem was proposed by the famous French mathematician Joseph Fourier to his friend and teacher C.L. Bonard. The problem is stated, "Arrange seventeen lines in the same plane so that they give 101 points of intersection. It is to be assumed that the lines extend into infinity, and that no point of intersection belongs to more than two lines." The problem is solved first by deriving a general formula that accounts for all intersections for N lines. This formula is then manipulated into an equation that includes a sum of triangular numbers. These numbers are directly related to the number of sets of parallel lines and the number of lines in each set for each solution. From this observation, it can be shown that there are four unique solutions to the problem.

*Measurement of Chemical and Biological Pollutants in Private Wells on San Salvador Island, Bahamas.* Jeff Kent, Phil MacAlexander, and Harry Hudson, The University of Tennessee at Chattanooga. The beauty and remoteness of San Salvador Island in the Bahamas can be misleading when one looks at the quality of the water in the island's drinking-water wells. A total of eight wells were tested for both chemical and biological pollutants. Fecal coliform numbers were high in the vast majority of the wells, but chemical pollution was found to be surprisingly minimal. However, the high level of biological contamination found in the well water is reason enough to label the wells as unsafe to obtain drinking water from unless methods are used to thoroughly sterilize the water before consumption.

*A Statistical Comparison Between Mathematics Scores of Students from Single-parent and Two-parent Home Environments.* Sharon M. Lindsay, Roane State Community College. In a study of 89 students from three seventh grade mathematics classes observed for two six-weeks periods, it was found that the mean for 43 students from single-parent homes was  $\bar{X}_1=77$  with  $s_1=13.5$  while the mean for 46 students from two-parent homes was  $\bar{X}_2=85.4$  with  $s_2=9.5$ . It was concluded that the mean mathematics score is significantly higher for students from two-parent homes than for students from single-parent homes ( $\alpha=.01$ ). However, the variance between students from single-parent homes is significantly higher than the variance between students from two-parent homes ( $\alpha=.05$ ).

*Chemical Analysis of Eight Open Wells on San Salvador, Bahamas.* Amy Lyle, Mitchell Masengil and Nancy Stewart. Eight open hand-dug wells were tested for eleven water quality parameters on the island. Samples were analyzed using titrimetric and spectrometric methods included in the DREL/5 manual. Each well's chemical composition was clearly unique in that each displayed widely different values for each parameter.

*Designation of Reef Study Areas at San Salvador, Bahamas.* Mitchell Masengil, Jack Pickett, and Phil McAlexander. There is evidence of coral reef deterioration throughout the Caribbean. In this study, reference areas at Rocky Point were established for future reef research. A comparison was also made of the present state of the reefs in reference to a 1973 study. The reference areas were constructed by driving eight two-foot copper coated steel stakes into predetermined positions in the reefs. These positions were established by shooting a transect line from Rocky Point through the reefs. Underwater photographs were taken of reefs along transect lines and also along a line perpendicular to transect on the shore side of the third reef. The reef closest to shore showed signs of continuing deterioration from silt infiltration. Ongoing deterioration was also present in the other two reefs. This was, however, not due to silt infiltration.

*Regeneration in Planaria.* Natalie Maxwell, Pellissippi State Technical Community College. Planaria are Platyhelminths in the class Turbellaria and family Tricladida. The genus Planariidae and genus Dugesia are both referred to as Planaria here. They are free-living flatworms with a simplified digestive system consisting of a "mouth" opening, pharynx, and branched intestine. The excretory system includes two tubes extending the length of the body with protonephridia branches ending in flame cells. The reproductive system can be sexual (hermaphroditic), but is usually by fission. The nervous system consists of a simple brain (two masses of nervous tissue-ganglia) in the head region with two nerve cords continuing the length of the body connected by nerves in a ladder-rung method. They have eyespots in the head region which orient them toward or away from light. They are quite complex with the interesting characteristic of regeneration. The Planaria, when cut in certain ways, will regenerate its missing parts. The head can be cut down the middle to "create" a two-headed organism. The flatworm can be taught to memorize a simple maze pattern. Then, part of the nervous system can be transplanted into a different Planaria resulting in an organism with a new memory. The regeneration events are lesion or part of the organism removed, extensive mitosis, cell migration to damaged site, aggregation by cells causing swelling at the site, changes in cell shape, differentiation (or dedifferentiation with redifferentiation), elongation with regulation factors (folding of sheets of cells), outward protrusion, formation of new "part," and controlled cell death to terminate growth. The Planaria respond to genetic predisposition, growth factors and inhibiting factors. Polyploidy is extremely prevalent in the species which are capable of regeneration. Other species of Helminths are not polyploid. In humans, liver cells are also polyploid. The liver can respond rapidly to damage, regenerating liver tissue. Immunosuppressors enhance the liver cell regeneration process. Polyploidy produces harder, more fruitful varieties of plants. This characteristic may contribute to the Planaria's regeneration abilities. The Planaria has incredible capabilities which deserve further attention. Understanding the molecular processes involved in regeneration suggests endless possibilities in the search for ways to cultivate regeneration for use in humans, avoiding the fetal cell issues.

*Conductometric Study of Esterification Using a Carbodiimide Dehydrating Agent.* Chadwick McDonald, Brian Lane, and Irving T. Glover, Roane State Community College. Esterification of benzoic acid in methanol using dicyclohexylcarbodiimide as a dehydrating agent was studied by conductometric measurements. The conductance of reactants (benzoic acid, methanol, dicyclohexylcarbodiimide) and products (methylbenzoate, dicyclohexylurea) were found to be directly proportional to their concentrations. Measurements made during the reaction were two to seven times higher than the calculated values,

and high conductance persisted for as long as three days. This result was interpreted as due to a long-lived, ionic intermediate in the reaction.

*Electromorphs of Triodopsis claibornensis (Lutz, 1950).* Travis C. Moyers, Lincoln Memorial University. Polyacrylamide gel electrophoresis of whole body tissue extracts from six individuals of the land snail *Triodopsis claibornensis* (Lutz) was performed. The specimens were collected from the type locality located in north Claiborne County, Tennessee (83°38'40", 36°36'15", elev. 1400 ft.). Two enzymes, isocitrate dehydrogenase and glucose-6-phosphate dehydrogenase were investigated. From this sample, isocitrate dehydrogenase was found to be represented by one electromorph. Glucose-6-phosphate dehydrogenase was found to be represented by three electromorphs.

*Herpes Simplex Encephalitis.* Lisa Michelle Nichols, King College. The herpetic simplex virus has existed for about 2,000 years but has only been formally studied for approximately 50 years. Researchers are just now beginning to make progress in understanding the composition and mechanisms of these complex viruses. The herpes simplex encephalitis virus is a Type I herpesvirus and is considered to be the most severe of all the herpetic infections. Study or even observation is very difficult because of the delicacy of brain tissue. However, the composition of this virus has been observed and documented, as well as some of the functions of some of the individual parts. Treatment of this disease is still in an early pioneer stage. The prominent drug used today is Adenosine Arabinoside, although the medical profession hopes to begin the use of interferon in the near future. The herpetic virus has the ability to completely destroy the brain, killing its victims very quickly. Survival rates are extremely low and those who do survive sustain significant neurological damage. However, the progress in combatting and destroying this dangerous virus is steadily moving forward each day.

*Cerebral Palsy: Rehabilitation of Spastic Diplegia.* Sheri Owens, Lee College. Spastic diplegic cerebral palsy remains a therapeutic challenge. Diagnosis is usually possible within the first year of life, but the uncertain etiology frustrates proper prevention and/or rehabilitation of the condition. Treatment has been successful and hope for improvement remains when evaluation addresses all issues in a reasonable amount of time and there exists open communication between family and clinicians.

*A Comparison of Growth Rates of Cottus caroliniae in the Clinch and Powell River Drainages.* Rob Wilmoth and Jason Lowe, Lincoln Memorial University. The purpose of this study was to compare growth rates of *Cottus caroliniae* (Banded Sculpin) from tributaries of the Clinch and Powell rivers. Total length was determined for each of the sixty-six sculpins captured after killing in 10% formalin. Ages were determined by counting the annuli of the otoliths. T-test analysis was conducted to determine differences in growth. No difference was found between growth of the one year old sculpins. However, growth of the two year old sculpins in the two river systems did differ,  $p<.05$ . Possible reasons for this difference are discussed. Backcalculations of sculpins from the same river systems revealed no differences in length between year classes when compared at one year of age. This research was supported in part by a grant from the Junior Division of the Tennessee Academy of Science.

## MIDDLE REGION

Austin Peay State University

*Distribution of Calmodulin-binding Proteins in Trophozoites and Pre-cysts of Acanthamoeba castellanii.* J. Ajala, A. Adibi and G. Tomlinson, Tennessee State University. Trophozoites and pre-cyst stages of *Acanthamoeba* were studied for calmodulin-binding protein content using SDS-PAGE and iodinated calmodulin. Bovine-brain calmodulin was iodinated by the lactoperoxidase method. Samples were lysed and run in SDS-Poly Gel. Gel was fixed, washed, blocked, then reacted with iodinated calmodulin overnight. The gel was washed again for several hours and stained with coomassie blue, destained, dried and exposed to X-ray film. Results showed that all bands present in trophozoites were also present in pre-cyst stages but that some bands in pre-cyst stages were clearly less dense than those in trophozoites. The results of binding analysis and interpretation will be presented.

*Statistical Analysis of Data on Joint and Stream Orientations, Stewart Creek Basin, Smyrna Quadrangle, Tennessee.* Robert P. Antrobus, Sean Caley, John B. Shortess, Richard G. Stearns, Vanderbilt University. Stewart Creek and many other streams in the Smyrna Quad seem to follow joint fractures in the bedrock. This paper determines statistically whether straight streams and joint are both

related to the same set of cracks in the bedrock trending parallel to Stewart Creek at 26° and also at 120° and 150°.

We use the t-test to prove our hypothesis. The t-test can only be used on samples having the same variance and a normal distribution. An f-test was used to test variance, and in both stream and joint analyses the results were satisfactory for the t-test. Comparison of observed and expected stream and joint orientation parallel to Stewart Creek showed a normal distribution.

The means of joints and streams parallel to Stewart Creek are almost exactly equal. By the t-test, there is no way to reject the null hypothesis that Stewart Creek and the joints follow the same set of fractures in the bedrock. Around the 120° orientation the stream and joint means differ by eight degrees. In this case also, the t-test fails to reject the null hypothesis. Near the 150° orientation, the means differ by three degrees. The t-statistic is close to the rejection value for a 5% level of significance so the null hypothesis can be rejected with a 5% or greater chance of being wrong.

*The Effect of a Bacterial Toxin on the Soluble Protein of Phaseolus vulgaris.* Nikol Atterberry and E. L. Myles, Tennessee State University. Bacterial infection is one of the many pathogens that causes damage to agricultural crops. This study investigates the use of tissue culture techniques to determine the effects of a bacterial toxin on the soluble proteins of *Phaseolus vulgaris* cv *Flo*. Leaf explants were grown on Murashige and Skog media for approximately one month. The media contained a compound that mimics the effect of bacterial pathogens by causing chlorosis. Leaf explants were weighed before being placed on the media and allowed to grow into callus tissue. The weight was recorded after one month. Increase in weight was used as an indication of growth. The protein was extracted from cells with a Bransonic sonicator. Total soluble protein was determined using the Bradford technique (1976). Results indicate an increase in synthesis of one protein of approximately 45 kd.

*Heat Mutagenesis of Drosophila melanogaster.* Sharie Ball and Margaret F. Hicks, David Lipscomb University. Wild type and mutant fruit flies (*Drosophila melanogaster*) that are maintained at 24°C for several generations retain the given phenotypes. However, at least two new traits have been identified following treatment of newly emerged flies at 30°C for as little as 16 hours. These traits are expressed in only a few of the offspring ( $F_2$ ) of the heat-treated flies, but the traits have been generated on more than one occasion and continue to be expressed in later generations. Wild type flies have yielded female offspring with unusual abdominal banding patterns. Following heat treatment, vestigial winged flies produce some offspring with wings that extend laterally at 45° from the abdomen and exhibit ruffled edges. Analysis of these phenotypes is ongoing to determine if they are due to mutations or to differential expression of existing genes. Expression of heat-shock proteins or transposable elements has not yet been ruled out.

*Converging Synthesis of Chiral Biaryls. Part A—Synthesis of 2-Bromo-1-t-butylidimethylsilyloxymethyl-3,4,5-trimethoxybenzene (3).* Joseph D. Barnes and Fred J. Matthews, Austin Peay State University. 2-Bromo-1-t-butylidimethylsilyloxymethyl-3,4,5-trimethoxybenzene (3) was synthesized from 3,4,5-trimethoxybenzyl alcohol (1) in two steps with 2-Bromo-3,4,5-trimethoxybenzyl alcohol (2) being produced as the intermediate. The starting material (1) was brominated using N-bromosuccinimide to give the intermediate (2). Intermediate (2) was reacted with triethylamine and t-butylidimethylsilyl trifluoromethanesulfonate to produce the final product (3). Purification techniques included flash chromatography and product purities and identities were observed using GLC and IR. This species will be coupled with (+)-2-(2,3,4,5-tetramethoxyphenyl)-4(S)-(methoxymethyl)-5(S)-phenyl-2-oxazoline (9) to produce chiral biaryl molecules.

*Retention Behavior of  $\beta$ -Cyclodextrin Complexes of Substituted Anthracenes and Pyrenes in Reversed-Phase Liquid Chromatography.* Patrick Collins, Thomas Martin, and V.C. Anigbogu, Austin Peay State University; T.T. Ndou and I.M. Warner, Emory University.  $\beta$ -Cyclodextrins are torus-shaped, cyclic oligosaccharides that form stable inclusion complexes with a variety of molecules and ions. Their ability to include guest molecules depends on several factors including the dimension and the polarity of the guest, the pH, the ionic strength, and the nature of concomitants in the medium. In this study, the effects of substituents on the formation of anthracene- and pyrene- $\beta$ -CD complexes are examined using reversed-phase liquid chromatography. The degree of inclusion of these compounds by  $\beta$ -CD is assessed using plots of capacity factor versus concentration of  $\beta$ -CD in the mobile phase. The results will be presented and the relationship between capacity factor and the molecular shape parameter of the solutes, and

some promising applications of these effects will also be discussed.

*Determination of Apparent Formation Constants of  $\beta$ -Cyclodextrin Complexes of Substituted Anthracene and Pyrene Compounds Using Reversed-Phase Liquid Chromatography.* Patrick Collins, Thomas Martin, and V.C. Anigbogu, Austin Peay State University; T.T. Ndou and I.M. Warner, Emory University. The inclusion phenomenon of Cyclodextrins (CDs) has been used in chromatography and electrophoresis to resolve optical isomers; in fluorescence to enhance intensity and to isolate analytes from an otherwise interferent matrix; in pharmaceuticals to improve stability, solubility, dissolution rate and bio-availability of drugs; in food industry as additives; and in cosmetic industry as beauty aids. Full exploitation of this inclusion chemistry would require knowledge of formation constants for various cyclodextrin:guest complexes and the effects of molecular properties, solution matrix, and experimental parameters on the magnitude of these values. This paper discussed the effects of the nature and position of substituents on the formation constants of anthracene and pyrene: $\beta$ -CD complexes as determined using reversed-phase liquid chromatography.

*Using Molecular Modeling (PCMODEL) and Molecular Orbital (MOPAC) Software to Study Chiral Biphenyl Molecules.* Kathryn E. Dowlen and Harvey F. Blanck, Austin Peay State University. Studies of structural and physical properties of chiral biphenyl molecules were performed using MOPAC (QCPE), having first used PCMODEL (Serena Software) to minimize the energy of the structure. Although input/output files for the two programs are compatible, resonance and pi bonding characteristics require careful interpretation. The evidence of chirality was clearly supported through dihedral energies in rotation. While hydrogen bonding stabilization may be a factor, the extent is presently uncertain and is being investigated. The electron densities of the phenyl rings correspond to those suggested by the reactivity of the molecules. MOPAC and PCMODEL produce molecular structural and electron density information that may be beneficial in predicting molecular properties and reaction mechanisms.

*Correlation Between Joint and Stream Orientations, Stewart Creek Basin, Smyrna Quadrangle, Tennessee.* Patricia Drake, Robert Lewis, John McCutchan, and Lynn Myrick, Vanderbilt University. Qualitative assessment of joint patterns and stream flow patterns in the Stewart Creek Basin, Smyrna Quadrangle, Central Tennessee suggests that there is a positive relationship between joints and some stream segments. Stewart Creek is straight overall, oriented NE-SW with shorter extremely straight segments. Several of the tributaries are also straight and join Stewart Creek perpendicularly. The orientation of Stewart Creek mimics other regional structural trends such as the elongation of the Nashville Dome and the orientation of the Appalachian chain. Analysis of 300 1000-foot straight stream segments within Stewart Creek Basin reveal modes of approximately 26, 65, 127 and 155 degrees. Analysis of 259 joint measurements made in the Stewart Creek Basin also reveal modes at approximately 26, 70-80, 127 and 160 degrees. Comparative analysis of the data sets suggests correlation between streams and joints to the NNE, ESE and SSE.

*Concurrent Tolerance to AMPH's Motivational and Psychomotor Effects.* Bryant K. Ford, P. Kahlon, Tennessee State University. There is good evidence that amphetamine decreases an animal's motivation to eat and also produces changes in activity that would prevent the animal from eating even if it wanted to do so. It follows that, in order for amphetamine's effects on eating to tolerate, both its motivational and psychomotor effects must tolerate. In a recent study 0, 1, 2, and 5 mg/kg amphetamine was administered to independent groups of rats so that the drug's effect could be assessed at 1, 3, 5, and 7 h post-injection (Jones and Caul, 1989). The results suggested that the response to the initial dose of drug was biphasic (i.e. anorexia followed in time by hyperphagia) and clearly showed an increase in the hyperphagic response over repeated doses. According to their analysis, such a biphasic response indicates that tolerance to the motivational effects was due to conditioning of a homeostatic response. However, measures of activity were not included in that study. Consequently, the mechanism of tolerance to the psychomotor effects cannot be discerned. Therefore, the purpose of this pilot study was to replicate some of the procedures of Jones and Caul (1989) while at the same time collecting a measure of activity. To do this, rats were maintained with a 12:12 h light/dark cycle with white overhead lighting during the day and dim red overhead lighting during the night. The rats had access to food only during the night. One group (n=2) was injected with distilled water, whereas the other group was injected with 5 mg/kg amphetamine. The injections were timed each day for 12 consecutive days so that the onset of darkness coincided with the third hour post-injection. At that time, the animals were given access to food and their behavior videotaped for

one hour. Although the drug's effect on eating appeared to tolerate, hyperphagia similar to that observed by Jones and Caul (1989) was not evident. Furthermore, amphetamine had little consistent effect on activity in the animals. These data suggest that modifications in both the protocol and the sensitivity of the scoring of stereotypy are needed before conducting a full scale experiment.

*Karyotype Analysis of a Male Exhibiting Meckel's Diverticulum and Aural Atresia.* Bart Frizzell and Margaret F. Hicks, David Lipscomb University. Patau's Syndrome is caused by inheritance of an extra chromosome 13. It is characterized primarily by severe mental retardation, cleft palate, and retarded growth. Most fetuses expressing Patau's Syndrome spontaneously abort, and those that are born usually die before one year. Both Meckel's diverticulum and aural atresia are defects found in patients with Patau's at levels higher than those in the general population. An otherwise asymptomatic male expressing only Meckel's diverticulum and aural atresia has a female sibling whose son expressed Patau's syndrome. Twenty percent of patients with Patau's show a translocation of part of chromosome 13 to another D chromosome. If a translocation were the cause of the expression of Patau's in this family, it is possible that the normal male inherited a balanced translocation and the Patau's male received an unbalanced translocation. A karyotype analysis of the non-Patau's male was done to determine if such a translocation were present.

*Electrophoretic Analysis of Proteins from Leguminosae Cells Grown Under Stress Conditions.* Benjamin Gayle and E.L. Myles. The reactions of plants to environmental stress are complex and involve many kinds of physiological response, from simple chemical or biochemical direct responses, through complex hormonal or developmental responses, to inheritable effects that appear to be genetic in character. Our investigation focused on the response of legumes when cultured in different concentrations of a toxin that mimics the effects of a bacterial pathogen. Plants were grown for one month on Murashige and Skoog (1962) media containing various concentrations of methionine sulfoximine (MSO). Protein was extracted from cells by using a glass homogenizer and/or mortar and pestle. Various fractions and protein samples were obtained by using differential centrifugation up to 100,000 xg. The results show one protein synthesized in the soluble fraction and an overall reduction of synthesis in all fractions examined. (Supported by CARP).

*Computer analysis of DNA sequences for Structural Homology with Hammerhead Ribozymes.* J. Christopher Holmes and Margaret F. Hicks, David Lipscomb University. Ribozymes are RNA molecules which have the ability to self-process. Most small ribozymes (less than 100 bases) form a hammerhead structure consisting of three double-helical regions converging at an apex. The consensus sequence for these catalytic molecules has been used to search the GenBank database to identify other potential ribozymes. Over a thousand molecules have been identified, but only three have a secondary structure that conforms to the hammerhead consensus. These sequences are all located in the gene family encoding the mouse  $\tau$  complex responder, which is preferentially expressed in sperm cells. Some of these sequences contain regions which differ from the ribozyme consensus by four bases. The other sequences have a portion of the 5' regulatory region spliced out. Evidence is presented that spliced out regions of these sequences may be due to removal by an active ribozyme.

*The Use of Computer Mapping as an Aid to Regional Development.* Amy E. Honning and James M. McCluskey, Austin Peay State University. Computer mapping is rapidly becoming an essential aid to the process of regional development and can be applied in demographic, economic, transportation, emergency management, and land use studies. The use of computers has greatly accelerated the cartographic processes. Production quality maps that once took hours or days to draw by traditional pen and ink methods now can be constructed in a matter of minutes. The technology of computer cartography allows for the widespread visual presentation of spatial data via maps, making the interpretation of complex geographic patterns more readily discernable.

*A PC Data Base for Kentucky Lake.* Robert A. Hudson and John A. Gordon, Tennessee Technological University. A data base covering the hydrological, meteorological, and water quality data for Kentucky Lake has been prepared for personal computer users. The data base spans the area from Pickwick Dam to Paducah and includes data collected from TVA, USGS, NOAA, water utilities and other sources. The period of record begins in 1944 when Kentucky Dam was built and continues through 1990. The data files are available on either 5 1/4 inch floppies or on 3 1/2 inch diskettes. Data files are either in ASCII or LOTUS 1-2-3 file configurations. Some software is provided with the files for viewing and

analysis, but after 30 days trial, the software must be purchased. The data are accessible with IBM compatible computers having 640 KB base memory.

*Floristic Studies in Cross Creeks National Wildlife Refuge, Stewart County, Tennessee.* James Joyner and Edward W. Chester, Austin Peay State University. The study site is an 8,862-acre (3,566.4-ha) tract established in 1962 as a feeding and resting area for migratory waterfowl and other water birds. It extends for about 121 miles on both sides of the impounded Cumberland River (Lake Barkley) between Dover and Cumberland City. Most of the refuge is within the flood zone of the river and occasionally may receive floodwaters. In addition, a network of dikes and water-control structures allow for manipulation of water levels in 16 pools, providing habitat management regimer ranging from moist soil to standing water. Also, reservoirs of the Elk and South Cross Creeks provide permanent, deep water. An extensive, but undocumented, wetland flora has developed. We have an ongoing project that will 1) describe habitat types in the refuge, based on current wetland classification systems, 2) document the wetland vascular flora, and 3) provide a floristic analysis, indicating habitat preferenda for the taxa, with special attention given to any rare elements that may occur. Studies were begun during the summer and fall of 1990 and will continue during the 1991 growing season.

*Growth of Articular Cartilage on a Tricalcium Phosphate Substrate.* Eli Khouri and Linda D. Roberson, David Lipscomb University; Mark McAndrew, Vanderbilt University. Articular chondrocytes isolated from rabbit joints and cultured on a tricalcium phosphate (TCP) substrate regenerate tissue similar to the original articular cartilage. This paper presents the rationale for the experiment, describes the culture techniques and notes possible clinical uses for this material.

*Development of Computer Programs for Analysis of DNA Sequence Homology and RNA Secondary Structure.* Steven C. Lowe and Margaret F. Hicks, David Lipscomb University. DNA sequences which lack open reading frames are probably involved in regulation. The function of these non-coding regions may be determined by comparison with similar sequences for which a function is known. Computer programs have been written that allow this type of analysis to be done. One program compares a number of sequences with a given sequence whose function is known to identify regions for further study. Another program will search for sequences that can form the same secondary structure as a test sequence. These programs have been used to search for sequences that are identical to the secondary structure of the hairpin ribozyme of tobacco ringspot virus. Further applications include suggesting functions for non-coding regions identified in sequences identified in the Human Genome Project.

*Separation of Cationic Metal Complexes of 1,10-Phenanthroline by Reversed-phase Ion Pair Liquid Chromatography: The Effects of Cyclodextrins and Organic Co-Modifiers in the Mobile Phase.* Debra Mallory, Caroline Melhado, V.C. Anigbogu, Austin Peay State University; T.T. Ndou and I.M. Warner, Emory University. Quantitative analysis of metal ions in environmental samples have been carried out by the separation of their cationic complexes of 1,10-phenanthroline using a reversed-phase or other columns followed by UV-VID detection. However, many of 1,10-phenanthroline metal ion complexes are labile and often disintegrate in the column. As such only a few cationic metal complexes of this chelate including Fe(III), Ru(II), and Ni(II), have been successfully separated and detected. We present here our findings on the use of mobile phase mixtures modified with  $\beta$ -cyclodextrin, organic co-modifiers and different pairing anions as means of stabilizing and/or resolving some of these metal ion complexes.

*Characterization of Starch Grains of Chasmanthium Latifolium.* Christina C. Matthews and Harris O. Yates, David Lipscomb University. A population of *Chasmanthium latifolium* was located in Cheatham County, Tennessee, along Brush Creek. Plants were collected and caryopses removed. Starch grains from the endosperm were examined utilizing bright field, fluorescent, polarizing and scanning electron microscopy. Histochemical tests were also performed. The starch grains were characterized as being irregular in shape, according to the classification system described by Tateoka. Taxonomic implications were also noted.

*Separation of Cationic Metal Complexes of 8-Hydroxyquinoline by Reversed-Phase Ion-Pair Liquid Chromatography: The Effects of Cyclodextrins and Secondary Modifiers in the Mobile Phase.* Caroline Melhado, Debra Mallory, and V.C. Anigbogu, Austin State University; T. T. Ndou and I.M. Warner, Emory University. There is a growing need for fast, low-cost, selective analytical

methods for the determination of metal ions, especially those of environmental importance. Liquid chromatography has received some attention recently as one such method due to its simplicity, relative speed, selectivity, and potential speciation information that can be obtained. A typical procedure involves formation of stable organic metal ion chelates, separation of these complexes using a reversed-phase or other suitable column, and detection by UV-VIS absorption or fluorescence. However, the usefulness of this method is hampered, unfortunately, by severe peak overlap and formation of labile (unstable) complexes for many metals; hence, only a limited number of elements (usually less than seven) can be determined and many others are yet to be detected. This study involves the use of mobile phase mixtures containing  $\beta$ -cyclodextrin, organic co-modifiers, and/or different pairing anions to resolve these severely overlapping peaks and/or stabilize some of the labile complexes.

*Network and Database Design for Project MASET (Minorities in Science, Engineering and Technology).* Charles A. Murray, Robert E. Blalock and Kade P. Lincoln, Tennessee State University. Project MASET is a research project in database, network and human-computer interfacing. Its goal is to demonstrate, through the development of a prototype MASET system, the largely untapped potential of utilizing technology (computer databases and networks) to broaden the participation of minorities in science, engineering and technology (a national problem). This will require support for greatly increased connection and utilization of networks by minority scientists (many at minority institutions, particularly historically black colleges and universities). Also, data must be collected (databases), analyzed and made available (via networks) on the locations and needs of minority scientists and science students and on available local and national resources (government, industry, community, ...). The MASET databases and network (connected to international networks, like BITNET) will serve as a platform for research on the factors affecting broadened minority scientific participation and for research on improvements to the human-computer interface to the MASET databases and network using artificial intelligence.

*The Color CRT as a Light Source in Spectrophotometry.* James Murray and Roy W. Clark, Middle Tennessee State University. This is a report on progress in a three stage project to use the color computer monitor as a light source for a simple Beer's law experiment. Part one of the project was to obtain emission spectra of the phosphors of the CRT. Part two was to construct a cuvette holder and photovoltaic cell to be held up to the CRT for purposes of measuring the absorbed light. Part three is to write a computer program which chooses the correct color for best absorption by the sample. Then the software will direct the user through the Beer's law experiment.

Part one and part two are largely completed, but part three is in the design stage now. An I/O card for the PC must be added before this stage can be completed.

*Converging Synthesis of Chiral Biaryls. Part B—Synthesis of (+)-2-(2,3,4,5-Tetramethoxyphenyl)-4(S)-(methoxymethyl)-5(S)-phenyl-2-oxazoline(9).* R. Brad Newton and Fred J. Matthews, Austin Peay State University. Synthesis of (+)-2-(2,3,4,5-Tetramethoxyphenyl)-4(S)-(methoxymethyl)-5(S)-phenyl-2-oxazoline(9) is to be synthesized from 3,4,5-trimethoxybenzoic acid (4) through a multistep synthesis in which 2,3,4,5-tetramethoxybenzoic acid (6) is the second intermediate. The starting material (4) was brominated using  $\text{Br}_2/\text{H}_2\text{O}/\text{CHCl}_3$  to produce 2-bromo-3,4,5-trimethoxybenzoic acid (5). The methoxy substitution for the bromo substituent on (5) was performed using sodium methoxide/copper to produce the tetramethoxy intermediate (6). This intermediate is to be converted into oxazoline (9) via a three step synthesis. The oxazoline (9) is to be coupled with the silyxy-bromide (3) to produce chiral biaryl molecules.

*Aquatic Phycocyanins of Percy Warner Park and Percy Priest Lake.* David Panboon, Melinda Harper, and Norman Fox, David Lipscomb University. Collections from Percy Priest Lake and various streams in and near Percy Warner Park revealed the presence of numerous aquatic phycocyanins. The collections were made from September 1990 to March 1991. When water levels were low, especially at Percy Priest Lake, sampling was done both from water, soil and debris along the vegetation line. Molds were isolated by baiting with boiled hemp halves in Petri plates containing sterile distilled water. Isolated species included *Achlya maericensis*, *Saprolegnia ferax*, *Saprolegnia dieliana*, *Dictyuchus monosporous*, and *Olpidiopsis saprolegniae*. Some plates yielded more than one species which necessitated isolating these fungi into axenic culture by growth on cornmeal agar.

*The Effects of Cyclopentyl and Tertiary-Butyl Compounds on the Retention of*

*$\beta$ -Cyclodextrin Inclusion Complexes in Reversed-Phase Liquid Chromatography.* Sharon M. Parker, Robert L. Pemberton, and V.C. Anigbogu, Austin Peay State University; T.T Ndou and I.M. Warner, Emory University. In a previous study, we observed that addition of small amounts (<3%) of tertiary-butanol or cyclopentanol decreases the retention time of pyrene rather drastically, but anthracene, only mildly. The formation of ternary complexes, promoted by these modifiers, has been postulated in order to explain the observed enhancement effects. The purpose of this study is to examine the effects of other tertiary-butyl and cyclopentyl compounds. Our findings and the implicated roles of the alkyl moieties and the functional groups on the co-modifiers in the formation of ternary complexes will be discussed.

*The Effects of Cyclopentyl and Tertiary-Butyl Compounds on the Apparent Formation Constants of  $\beta$ -Cyclodextrin Inclusion Complexes Determined Using Reversed-phase Liquid Chromatography.* Robert L. Pemberton, Sharon M. Parker, V.C. Anigbogu, Austin Peay State University; T.T Ndou and I.M. Warner, Emory University. The concomitant effects of cyclopentyl and tertiary-butyl compounds on the apparent formation constants of anthracene and pyrene have been evaluated by plotting the reciprocal of capacity factor versus  $\beta$ -CD concentration. The apparent formation constant for pyrene is largest in 1% t-butylcarbamate followed, in decreasing order, by t-butyl acetate, t-butyl acetic acid, and t-butyl alcohol. Tertiary-butyl amine exhibited a suppression effect. As for the cyclopentyl compounds, the alcohol exhibited the largest enhancement effect, the diol a slight enhancement while the amine exhibited a suppression effect as in the t-butyl compound. These results and the suggested molecular dynamics in these systems will be discussed.

*Determination of Proteins Produced in Salt Stressed Soybean Cells.* Angie Reynolds and Prem S. Kahlon, Tennessee State University. There has been increased interest in the use of cell cultures to obtain germplasm for biological stress tolerance. There are several reports in the literature regarding changes in protein patterns in response to stress. Heat shock proteins and anaerobic proteins have been reported for drosophila and maize respectively. It has been suggested that the synthesis of these proteins can protect cells from biological stresses. The objective of this study was to determine the protein patterns of soybean cells exposed to salt stresses. Cells were grown in 0, 0.1, 0.2, and 0.3% NaCl and growth rate was measured by pack cell volume. The growth rate of control and 0.1% NaCl treatment was considerably less for the first week as compared to the control; however, these cells adapted to this stress and grew at the same rate as the control during the second and third weeks. The cells grown in 0.3% NaCl on the other hand, showed considerable reduction in growth. Bio-Rad Protein Assay (modified Bradford method) was used to determine the concentration of proteins in stressed and nonstressed cells. The data showed that the stressed cells had three to four times more proteins than the non-stressed cells suggesting a possible protective role of proteins in stressed soybean cells.

*Composition of Gasolines.* David Shive and Paul B. Langford, David Lipscomb University. Distillation curves, infrared spectra and other tests were performed on several brands of regular unleaded and premium gasolines to determine ethanol and MTBE content. Composition of gasolines was generally found to be as advertised with respect to ethanol content. A simple test was devised to determine approximate amount of ethanol in gasoline.

*The Effect of Methionine Sulfoximine on Membrane Bound Proteins in Phaseolus vulgaris.* Susan Siddiqi and E.L. Myles, Tennessee State University. Screening crop plants for disease resistance and/or tolerance can result in a lower cost of production. Methionine sulfoximine simulates the bacterial toxin produced by *Pseudomonas syringae* which causes halo blight in legumes. The objective of this study was to examine the effect of this compound on membranebound proteins using polyacrylamide gel electrophoresis. *Phaseolus vulgaris* cv *Flo* were grown on Murashige and Skoogs median containing an Auxin and 0.0, 0.125, 0.5, 1.0, and 2.0  $\mu\text{M}$  of methionine sulfoximine. The protein was extracted from cells with a Bransen sonicator. Cells were centrifuged at 15000 xg and the pellet was homogenized in extraction buffer with 0.5% tritonX-100. Protein was quantitated using the Bradford technique (1976). Our results indicated a general reduction in protein synthesis.

*Weekly and Seasonal Variations in Acid Mine Drainage in Grundy County, Tennessee.* Laura Splichal, Douglas T. Durig, The University of the South. Five sites in Grundy County affected by acid mine drainage from mining of the Sewanee coal seam were used in the study. Each site represented a different aquatic environment associated with strip mines. The sites contained water sources that

were accessible year-round, and water samples were collected each week from the sites over a six month period. The pH of the water was measured, and the water was analyzed for iron, sulfate and manganese using a Hach direct reading 2000 spectrophotometer. The Surface Mining Reclamation and Control Act (SMCRA), established in 1977, sets legal standards for the amounts of these substances allowed in water associated with reclaimed coal mines. The level of contamination followed trends based on weekly amounts of rainfall. Seasonal changes were also evident in some of the sites. Four of the five sites sampled violated the guidelines set by SMCRA for pH, iron, sulfate and manganese content.

*Protein Kinase Activity in Leishmania donovani.* Venetta Thomas and Abiodun Adibi, Tennessee State University. Protein kinase, an enzyme responsible for phosphorylating protein in membrane and cytosol fraction of *L. donovani* was investigated using an in vitro phosphorylating method. Known quantity of each fraction was used in the presence of magnesium, EGTA, calcium, calcium and calmodulin, and gamma-32P ATP. Reaction was allowed to proceed at 30° C for 20 minutes and was terminated by adding equal volume of 2X SDS-PAGE sample buffer. Proteins in each reaction vial were separated by SDS-PAGE, stained, destained, dried, and exposed to Kodak-XAR film at -70°C. Results showed that protein kinase activity was present in both the membrane and cytosol fractions as evidenced by the phosphorylation of different protein substrates.

*The Effect of Different Hormone Concentrations on the Growth Rate of Phaseolus vulgaris.* Felicia Venable, Carolyn Alexander-Caudle and E.L. Myles. The family of legumes is second only to the cereals in nutritional value and economic importance. Tissue culture provides an opportunity to study plant cells under a wide variety of conditions which include water and salt stress, as well as disease resistance. The purpose of this study was to determine the optimum hormone combinations and concentrations for culturing leaf explants on solid media. The auxins used in the experiment were 2,4-dichlorophenoxyacetic acid (2,4-D) and Naphthalene acetic acid (NAA). The cytokinins used were 6-benzyl aminopurine (BA) and Kinetin (K). The hormones were tested alone (1 mg/l) and in combinations (1 mg/l auxin and 0.5 mg/l cytokinin). The control media consisted of Murashige and Skoog salts and vitamins (1962) with no hormone added. Four leaf explants were surface sterilized and placed on media. Results indicated that callus formation is optimum with 2,4D and BA. (Supported by CARP).

#### WESTERN REGION Rhodes College

*Effects of In Vitro Prepared Immune Complexes on Rat Hepatic Lipase.* Jacqueline A. Aiken, Christian Brothers University. High levels of lipoprotein lipase and hepatic lipase are found in the plasma in Reye's syndrome (RS). The role of these lipases is to degrade the predominant lipid, triglyceride (TG), found in plasma lipoproteins. TGs accumulate in the liver and are secreted by this organ. TG is not cleaved into free fatty acids (FFA) by the lipase until it is released into the plasma. In RS, there is an increase in lipoprotein lipase (LPL) and hepatic lipase (HL). The role of immune complexes (IC) in RS is not clearly understood. HL is inhibited by in vitro prepared IC while LPL is stimulated by IC. This is an interesting finding because one would believe all lipases might react similarly. The findings in this study could help give a better understanding of Reye's syndrome and could be later applied to research on other immune complex diseases such as Lupus and Lyme disease.

Anderson, Dwight Gales, and Tonia Jenkin, LeMoyné-Owen College. Results of the radial part of the Schroedinger equation are presented using Lotus 1-2-3 and presented graphically using QUATTRO PRO version 2.0.

*Localization of Cold-Sensitive Defect in ØX174.* Scott Michael Anfinson,\* Christian Brothers University. An attempt was successfully made to quantitatively elucidate whether the cold-sensitive (cs) mutation seen in ØX174 was in an early step or a late step of two mutants', cs33 and cs45, replication cycles. During the "early" phase of ØX174's replication cycle (during the first 10-15 minutes) it has been found that injection of the viral DNA into a host cell occurs. In the "late" phase (the last 10-15 minutes of the replication cycle) there is assembly of the viral head and packaging of the DNA. Cs33 had previously been semiquantitatively classified as an "early" mutant while cs45 had been classified as a "late" mutant. To determine whether this was the case, it was first necessary to grow a high titer stock of each mutant. One-step growth curves were then performed for each mutant with an accompanying temperature shift from 37° Celsius to 25° Celsius. If the defect was in an early stage of replication, a normal

\*Honorable Mention

burst size was expected to be obtained; if the defect was in a late stage, no yield, or a drastically reduced one, was expected. The cs33 mutant did exhibit a normal burst size while the cs45 mutant provided a much reduced burst size. These results do indeed indicate that cs33 was an early mutant and cs45 was a late mutant.

*Glucose and Galactose Metabolism of Azotobacter vinelandii.* Edwin Arigbe, Memphis State University. Both glucose and galactose can support the growth of the soil bacterium *Azotobacter vinelandii*. However, glucose produced less biomass than galactose. In this report, we demonstrated *Azotobacter vinelandii* diauxic growth in media containing galactose and glucose. Diauxic growth occurred only when *Azotobacter vinelandii* was pregrown on galactose and only when the galactose concentration was higher than glucose. This pattern of growth exhibited by *Azotobacter vinelandii* is contrary to the better known glucose regulated diauxic of *Escherichia coli* and this may be related to the environmental differences of these two organisms.

*Regulation of Intestinal Ornithine Decarboxylase by the Polyamines, Spermidine and Spermine.* Traci Lee Bailey,\* University of Tennessee. Ornithine decarboxylase (ODC) is the enzyme which catalyzes the conversion of ornithine to putrescine, the first step in the synthetic pathway of polyamines. ODC levels are low in most tissues but as cell proliferation begins, a rise in ODC activity occurs. Recent studies have found that this increase in ODC activity can be inhibited by the polyamine precursor, putrescine. Still, the mechanism responsible for the regulation of ODC remains to be clearly defined. This study investigates the ability of the polyamines spermidine and spermine to regulate intestinal ODC activity. A standard technique for measurement of ODC activity, incubation of the enzyme preparation with ornithine labeled in the 1-carbon position with subsequent trapping of <sup>14</sup>CO<sub>2</sub> was used. It was found that spermidine and spermine inhibited the activity of ODC in IEC-6 cells, a normal rat small intestinal epithelial cell line, stimulated with asparagine. Spermine was found to be a better inhibitor of ODC activity decreasing enzyme activity at concentrations as low as 10<sup>-8</sup>M. These results suggest that spermidine and spermine contribute to the regulation of ODC activity.

*Molecular Analysis of the Human Herpesvirus 6 Genome.* Joseph W. Castelli, Rhodes College. Human herpesvirus 6 (HHV-6), which was first isolated from AIDS patients in 1986 during the search for the AIDS virus, is the probable cause of roseola infantum (exanthem subitum, sixth disease). It is similar to other herpesviruses in structure: its double stranded DNA is surrounded by an icosahedral capsid which is surrounded by a lipid membrane. Initial studies of the genome indicate a G+C content of around 42%. We have been working on generating a restriction map of the genome, as well as cloning the entire genome for the purpose of further analysis. To this date, restriction maps of the endonucleases BamHI, KpnI, and HindIII have been generated. After completing the cloning of the internal fragments of the HHV-6 genome we plan to clone the DNA termini, which will require manipulation of the terminal ends.

*Comparison of the Uptake of Glucose and Galactose by Azotobacter vinelandii.* D. Hankley, A. Huggins, and T. Y. Wong, Memphis State University. *A. vinelandii* can transport both glucose and galactose, possibly by two separate permeases. Initially, viable populations were obtained by growing *A. vinelandii* in separate flasks, containing either glucose or galactose. Uptake was measured on both glucose grown and galactose grown cells using radioactive glucose. Similarly, galactose uptake was measured using radioactive galactose. In addition, inhibition was measured using deoxyglucose and fucose. Results indicated that glucose uptake was more efficient in glucose grown cells, since measured uptake was at least five times higher when compared with galactose grown cells. Galactose uptake in glucose and galactose grown cells was more identical. Inhibition was found to be negligible.

*The Role of C5 and T-Cell Receptor Vβ Genes in Susceptibility to Collagen-Induced Arthritis.* John R. Jeffers, Christian Brothers University. Collagen-induced arthritis (CIA) is a rodent arthritis model in which immunization with heterologous type II collagen induces an inflammatory polyarthritis. Susceptibility to the disease is mediated by class II MHC genes as well as genes at other loci. Previous studies of the SWR/J mouse strain, which is resistant to CIA despite bearing the susceptible H-2q haplotype, have suggested that this resistance is the result of a deletion of the T-cell receptor (Tcr) V-beta gene segments which is carried by this strain. Other studies have implicated a deficiency in complement component C5 as the cause for the resistance. In order to assess the relative importance of these two genes in susceptibility to CIA, we have analyzed 196 F2 progeny of a (DBA/1xSWR/J) cross for arthritis susceptibility, and expression of both the C5 and Tcr genes. Thirty of the F2

progeny developed arthritis. All of the arthritic mice had at least one copy of the wild-type allele, while the Tcr V-beta haplotypes were distributed in a Mendelian fashion. These results demonstrate that C5 sufficiency is an absolute requirement for susceptibility to CIA, but that Tcr V-beta genes located within the SWR deletion have little influence. Genetic analysis of the incidence rate suggests that there is polygenic control of susceptibility to CIA and that five to six independent loci (including C5) may be involved.

*Effects of O<sub>2</sub> on the Components of the Electron Transport Chain in Azotobacter vinelandii.* Robyn Johnson, T. Y. Wong, Memphis State University. *Azotobacter vinelandii* was grown under high or low aeration. Cell membrane fractions were used to analyze spectrophotometrically the cytochrome composition. Results showed at high aeration, cells produce higher concentrations of cytochrome d as the terminal oxidase. At low aeration, the cytochrome o concentration is greatly enhanced. This suggests that the electron transport chain in *A. vinelandii* is regulated by O<sub>2</sub>.

*An ESR Analysis of the Effects of the Reductive Methylation of Band 3 and Spermine-2,3-DPG Interactions with the Human Erythrocyte Cytoskeleton.* Gary J. Latham\*, Christian Brothers University. In the course of this research two central questions have been addressed: 1) what is the reductive methylation of band 3, which causes a fourfold inhibition of chloride ion exchange, upon the human erythrocyte cytoskeleton? and 2) what is the consequence of the sequential addition of spermine and 2,3-diphosphoglycerate, which independently demonstrate contrary effects upon cytoskeletal protein-protein interactions, upon the red cell cytoskeleton? Electron spin resonance analysis, made possible by MAL-6 spin labeling, has shown conclusively that band 3 methylation causes no outward change in the degree of association of the predominant cytoskeletal protein, spectrin, while successive additions of physiological concentrations of spermine and 2,3-diphosphoglycerate to hosts effect a significant decrease in spectrin-spectrin interactions.

*Determinations of Ground and Excited State Potential Energy Curves of K<sub>2</sub> Using an Effective Core Potential.* Lanya L. Lester,\*\* Christian Brothers University. The ground and excited state potential energy curves of K<sub>2</sub> using a small basis set, were determined theoretically utilizing an antisymmetrized geminal power wavefunction (AGP) for the ground state and a polarization propagator method for the excited states. An effective core potential (ECP), which replaces the core electrons, was added to reduce computer time and minimize cost. There was good agreement with previously published data.

*Boundaries Of the Barrelettes Defined by Adhesion Molecules.* Mario B. Miller\*\* and Nigel G. F. Cooper, Christian Brothers University. The distribution of glycoproteins within the developing vibrissae-related barrelet of the mouse trigeminal nucleus was studied by immunocytochemistry using a monoclonal antibody. Glycoprotein/lectin barrel-like structures are visible in the nucleus between 24 and 48 hours after birth.

*The Response of in vitro Hepatocytes to Atriopeptin III, Or What I have in Common with Thomas Edison.* Joseph Mixon, Bipin Nair, Hani Rashed, Tarun B. Patel, Christian Brothers University. In perfused rat hepatocytes, which mock the regenerating liver, we have found an increase in the number of EGF receptors. The EGF receptor, with its associated G protein, produces an increase in cGMP, which increases cell growth. ANF is a drug that causes the same cGMP increase in cells as EGF, but it is not mediated by the EGF receptor. Our investigation is in the response of hepatocytes to atriopeptin III (AP III), an ANF analog. By incubation of cells in varying concentrations of fetal bovine serum, we were able to attain different cell growths (10% FBS, 5% FBS, 0.5% FBS). We found an increase in cell growth with the use of AP III that is proportional with cell growth (0.5% FBS giving the greatest growth and 10% being the lowest growth). These results were confirmed by <sup>3</sup>H labeled thymine uptake which is proportional to cell growth, and direct spectroscopic analysis of cGMP content.

*The Analytical Distribution of EDTA as a Function of pH.* Vincent Redmond, Brigitte Wesley, Redmond Wiley, and Gholam Zainalian, LeMoyne-Owen College. Ethylenediaminetetraacetic acid (EDTA) being a tetraprotic acid poses a formidable challenge to the analytical chemistry students for establishing the distribution of the equilibrium concentration of EDTA plotted at various values of pH. The common spreadsheet software makes drawing such plots convenient through the built-in graphics feature of the software. The unusually involved calculations together with the need to plot the accurate data have been observed to

turn off the interest of the student towards understanding the concept of equilibrium. This presentation is aimed at alleviating this problem and exhibits that using the spreadsheet power, it becomes much more interesting to not only handle the otherwise complicated data but also to interpret the curves so obtained.

*Anaerobic Microorganisms from the Deep Subsurface.* Elizabeth B. Sullivan, Tracy Hendrix, K.-T. Chung, and S. Edward Stevens, Jr., Memphis State University. Anaerobic microorganisms were enumerated and characterized from samples obtained at two deep subsurface sites; the Idaho National Engineering Laboratory and the Hanford National Laboratory in Washington State. These samples were originally plated on four types of media, both all purpose and enriched, before being transferred to a pre-reduced medium for isolation. Numerous anaerobes were found in samples from both boreholes. Hanford, the less arid site, had the greater amount of anaerobic life. The quantity of microorganisms generally decreased as sample depth increased, but there were pockets of greater numbers of colonies at certain depths. A wide variety of morphologies was discovered from both locations. The predominant form observed was gram negative unicellular rods. Physiological characterization of the isolates has involved gas chromatographic analysis and API strips.

*A Phosphinothricin Resistant Mutant of the Cyanobacterium Synechococcus PR-6000 Overexpresses Glutamine Synthetase.* Selwin P. Thomas and S. Edward Stevens, Jr., Memphis State University. Phosphinothricin is an extracellular product of *Streptomyces hygroscopicus*. It is an analog of glutamic acid which irreversibly inhibits glutamine synthetase (GS). Due to its specific inhibition of this ammonium assimilating enzyme, ammonium accumulates intracellularly and becomes toxic to the cells. Because of this property phosphinothricin is widely used in herbicide formulations. We have isolated phosphinothricin resistant mutants of *Synechococcus* PR-6000 at a spontaneous frequency of 3x10<sup>-6</sup> on gradient plates containing 1 mM phosphinothricin. One mutant designated as PR-6103 exhibited a two fold increase in GS activity when grown in the presence of phosphinothricin. Interestingly the mutant grows slower and has a longer generation time than the wild type. The overexpression of GS activity may be due to the amplification of GS coding sequences, a longer GS mRNA half-life, or to changes in regulation which affect expression of GS.

*Predator Defenses: Recognition by Crotalids of Skin-borne Lipids in Kingsnakes.* Carri Tucker, Christian Brothers University. In many areas of the world, the presence of poisonous snakes is a concern to those who wish to engage in outdoor activities. In the United States, crotalids (rattlesnakes, copperheads, and cottonmouths) cause the greatest number of bites by poisonous snakes. These organisms have a reputation for "unprovoked" attacks, although the designation "unprovoked" is anthropocentric. Interestingly, these snakes are preyed upon by a non-poisonous group of snakes called kingsnakes. In response to the presence of a kingsnake, many crotalids exhibit a suite of defensive behaviors which does not include striking. The purpose of this study was to determine the cue that elicits the defensive response in crotalids when confronted by kingsnakes. In a series of tests, we discovered that skin-borne lipids elicit this defensive response. As there are at least 1500 such compounds in the skin of kingsnakes, a study was performed by extraction and refraction of kingsnake skin to determine which fraction elicited the desired response in crotalids. These chemicals were fractionated using high pressure liquid and thin layer chromatography and presented to the poisonous snakes. Two fractions were active, yet an exact lipid has not yet been identified. However, great progress has been made in singling out the skin-borne lipid(s) that is involved in eliciting this defensive mechanism in crotalids.

*Possible Allelopathy in Magnolia grandiflora.* Blake Walker\* and Brad Diestelhorst, Rhodes College. The base of southern magnolia trees (*Magnolia grandiflora* L.) are devoid of most grasses. This absence of grasses may be due to a lack of light, moisture, or some chemical released from the magnolia. We have investigated the possibility that southern magnolia trees release a chemical which delays or inhibits the germination of rye and bluegrass. We found that germination of both ryegrass and bluegrass was retarded by magnolia extract. Inhibition of germination in the bluegrass seedlings was much greater than in ryegrass. The germination inhibiting substance has been characterized with regard to the temperature sensitivity of the extract. Studies with seeds planted in a transect from the base of the tree to the dripline of the tree exhibit lower germination rates than seeds planted in soils originating outside the dripline. These studies suggest that *Magnolia grandiflora* L. releases an allelopathic substance into the soil which inhibits the germination of grass seeds.

\*Best Presentation Award

\*\*Honorable Mention