

ABSTRACTS OF PAPERS PRESENTED AT THE SPRING 1995 COLLEGIATE MEETINGS

EASTERN REGION
MARYVILLE COLLEGE
MARYVILLE, TENNESSEE

A STUDY OF THE UPTAKE OF CARBARYL BY THE BURPEE CRIMSON GIANT RADISH. *Maureen M. Ables, Pellissippi State Technical Community College, Tennessee.* Many chemicals can be taken up by plants and incorporated into the plant matrix. In this study, the physical effects and chemical uptake of 1-naphthyl N-methyl carbamate (carbaryl-active ingredient in "Sevin" pesticide) by the Burpee Crimson Giant Radish was examined. The purpose of the exercise was to obtain a relationship of uptake to time for the chemical and a correlative relationship between the effect of germination condition uptake by the plant. One group of radishes was planted in potting soil containing the contaminant while a second group was planted in uncontaminated soil as a control-germination group. The concentration of contaminant in the soil was ca. 2 g of carbaryl/1 kg of soil. The high concentration was used to maximize uptake. At 13 days from planting, designated plants were transplanted either from the controlled soil environment to a carbaryl contaminated environment or from the carbaryl-contaminated environment to a soil environment. Growth was monitored through the 25th day. Samples of plants were taken at intervals of 5, 13, 25, and 39 days to determine the uptake of the chemical with respect to time. Plants grown in carbaryl-contaminated soil were analyzed by organic extraction and mass spectroscopy. Preliminary qualitative analysis suggests that 1-naphthol, a degradation-product carbaryl, is being taken up by the plants. The existence of a variety of compounds not found in the normal plants indicates either decomposition of the 1-naphthol within the plant or metabolism of the 1-naphthol by the plants. Further analysis will help determine if the obviously stunted growth of the plants is caused by the presence of the 1-naphthol in the plant or by the presence of the contaminants in the soil.

MEDIA INFLUENCE AND BODY IMAGE IN WOMEN BODY-BUILDERS. *Sandy Akins, Maryville College, Maryville, Tennessee.* Media influence on female attendees at gyms was investigated in this study. Prior research has shown that media influence exerts enormous power over individuals and women in particular. Gym attendees who engage in body-defining activities such as weight-resistance programs or aerobic programs were hypothesized to be adversely affected by media pictures. Additionally, body dissatisfaction and behavior consistent with eating disorders, particularly bulimia, was expected among the weight-resistance-program group. Subjects ($n = 40$) were assigned to either an experimental group receiving media pictures or a control group that received no exposure to media pictures. Afterwards, they completed the body image scale and the eating disorder inventory. A 2 x 2 analysis of variance was conducted and indicated that the participants of both programs were affected significantly by exposure to media pictures. Furthermore, both groups exhibited high levels of body dissatisfaction. Although the weight-resistance-program group exhibited higher incidence of bulimic behavior, no statistical difference was noted

between the two groups. Due to the small sample size in this study, more research is needed to adequately determine the full effects of media influence on body shape among women.

MATERIAL PARTICLES AS PHOTON GROUPS WHOSE BEHAVIOR IS MODIFIED BY SPATIAL SCALING. *Jonathan D. Baugh and Eric T. Lane, The University of Tennessee at Chattanooga, Chattanooga, Tennessee.* Spatial scaling defines a space whose structure is inhomogeneous, so that it varies with respect to the propagation of light. For example, an inhomogeneous, one-dimensional space may be thought of as a piece of tape that originally has marks at equal intervals on it, which is stretched in some places and compressed in others according to a scaling function. A bug appearing to crawl at a constant speed with respect to the marks on the tape would actually move at varying speeds. If the bug represents a photon and the observed constant speed of the bug with respect to the tape represents the constant velocity of light in real space, the actual speed of light would vary with the scaling of the tape. Scaling may explain the properties of material particles (mass, charge, and momentum) as the properties of groups of photons acted on by a scaling function. Quantum mechanical wave functions are assumed to carry the scaling information, so that the wave nature of matter is taken into account. Simple wave functions, such as the free particle or standing waves, are analyzed to yield the associated photon densities and material particle behavior.

POPULATION SURVEY OF ENDANGERED ROCK IGUANAS, CYCLURA RILEYI RILEYI ON GUANA CAY IN SAN SALVADOR, BAHAMAS. *Patrick Birchfield, Jennifer Conner, Paul Grant, Mark Gregory, Gayle Livingston, and Lance Nunley, The University of Tennessee at Chattanooga, Chattanooga, Tennessee.* Guana Cay, San Salvador, Bahamas, was surveyed 1 year ago. An apparent decline in the population of an endangered rock iguana, *Cyclura rileyi rileyi*, prompted a follow-up survey of the Cay. Inclement weather during the research period may have biased the data. However, based on observations and photography of the individual animals, development of a nonintrusive individual identification system is feasible. Additional research is required to add to the information and understanding of population dynamics of *C. r. rileyi* on San Salvador Island. Additional research is in the planning stages.

APOLIPOPROTEIN E SYNTHESIS BY TRANSPLANTED BONE-MARROW-DERIVED CELLS IN APO E-DEFICIENT MICE. *Dana M. Brantley, Maryville College, Maryville, Tennessee.* Apolipoprotein E (apo E) is a surface protein associated with several lipoprotein classes, such as chylomicrons, very low-density lipoprotein (VLDL), and high-density lipoprotein (LDL) receptor and the LDL receptor-related protein (LRP), apo E mediates the binding and internalization of lipoproteins by various cell types, including hepatocytes, adipocytes, and macrophages. Transplantation of apo E-deficient mice, which develop hyperlipidemia and atherosclerosis, with normal murine bone marrow made possible the investigation of lipoprotein and cholesterol metabolism specifically by macrophages and possibly other marrow-derived cells, excluding he-

patic and other pathways. Biosynthesis of apo E by resident macrophages in liver, kidney, lung, spleen, and brain tissues was comparatively investigated in apo E-deficient mice 3 months after transplantation through a RNase protection assay. Virtually no apo E mRNA was detected in resident macrophages of the liver and brain. Apo E mRNA levels in spleen macrophages were comparable to levels in normal control mice. Elevated levels of apo E mRNA were detected in renal and pulmonary macrophages, supporting the link between atherosclerosis and glomerulosclerosis and the proposed role for the macrophage in pulmonary surfactant metabolism.

PREPARATION AND EXAMINATION OF ALTERNATIVE SINGLE-SOURCE GROUP 13-15 MOLECULAR PRECURSORS.

Jennifer J. Cowan, Devin D. Gripper, Jaye A. Burns, William T. Pennington, and Gregory H. Robinson, Maryville College, Maryville, Tennessee (JJC), and Clemson University, Clemson, South Carolina (DDG, JAB, WTP, GHR). The creation of covalent bonds between elements of group 13 and 15 has been of great importance to the semiconductor industry in the synthesis of compounds like gallium arsenide, gallium phosphide, and aluminum nitride. Current methods for making these compounds are dangerous and inconvenient, and the purity and uniformity of the thin films produced often is unpredictable. Extensive work during the past 15 years has focused on new methods to generate covalent bonds between elements of group 13 and 15. This study focuses on the reactions of tris (trimethyls-tannyl) phosphine with gallium chloride, diisobutyl aluminum chloride, and dimethyl gallium chloride. Vacuum line and Schlenk techniques were employed due to the air-sensitive nature of the reactants and products. Structures were determined using single-crystal x-ray diffraction studies and carbon-13 NMR.

PLANKTON POPULATION DENSITY ANALYSIS RELATIVE TO THE WASTEWATER-EJECTION SITE IN GRAHAM'S HARBOUR ON SAN SALVADOR.

Lara Crawley, Tabitha Sommer, and Ginger Wallace, The University of Tennessee at Chattanooga, Chattanooga, Tennessee. The population density analysis of plankton was conducted in March 1995 at Graham's Harbour, located on the northern side of San Salvador Island, an eastern island of the Bahamas group. Water samples for population density analysis of plankton were taken in Graham's harbour at the sewage-outfall site of the Bahamian Field Station and five other sites of varied distances to the outfall point at relative times. At each testing site, three samples were taken with a Henson modified plankton net at three uniform depths: 0.61 m (2.0 feet); 0.76 m (2.5 feet); 0.91 m (3.0 feet). The biological effects of a low-volume, partially degraded, public sewage discharge were studied in March 1995. No treatment other than natural degradation occurred according to the field-station blueprints. Samples were taken from two man-holes from the outgoing pipes to determine the state of the sewage entering Graham's Harbour. The results of population density analysis indicated an increased density at the sites with closer proximity to the outfall point. Therefore, the potential food biomass for larger animals is increased.

A VIDEO SURVEY OF THE SAN SALVADOR REEF SYSTEM.

Gregory L. Cunningham, The University of Tennessee Chattanooga, Chattanooga, Tennessee. In March 1995, a research team from The University of Tennessee at Chattanooga conducted a video survey of two reef systems on the west side of San Salvador Island in Hernandez Bay. In 1987, biologists discovered that the coral reef systems were turning white. Bleaching was killing the algae that lived within each coral system. With the use of underwater video equipment, the survey made it possible for the research team to better identify fish, coral, and reef creatures. Video-taping the reef also allowed the damage to be seen by the nondiving members of the team for the first time.

SPELLING DEVELOPMENT IN ELEMENTARY SCHOOL. *Rosa R. Duncan, Maryville College, Maryville, Tennessee.* Spelling as a developmental process is not fully accepted in the psychological realm. Some studies have supported the developmental view of learning to spell, showing that levels of spelling development are reached at generally outlined ages, much the same way that language and cognitive development stages proceed, but movement through the stages is dependent upon the individual child's experience with language and their level of cognitive maturation. Data collected for this study were scores from basal-based spelling tests for the first 6 weeks of the school year, spelling test and creative-writing sample from each student, and spelling scores from the Tennessee Comprehensive Assessment Program achievement test for 56 third-graders; and the second-, third-, and fourth-grade spelling scores from the Tennessee Comprehensive Assessment Program for 25 students who are currently fifth-graders. There were significant positive correlations found between the weekly basal-based spelling averages and achievement test scores and the number of errors evidenced in spelling test versus creative-writing samples. Significant growth was found between grade levels in spelling scores. Results of this study support learning to spell as gradual movement through developmental stages, with overlap between stages, as children grow in cognitive ability and gain experience with language.

THE BAHAMIAN FIELD RESEARCH EXPERIENCE.

Tonia Fields, The University of Tennessee at Chattanooga, Chattanooga, Tennessee. Research is a good learning tool for the budding science student. It broadens the student's horizons and opens new doors to opportunities. Bahamian field research was quite an experience for me. My participation involved helping the diving team in their preparation for daily activities. Although I was not directly involved with the research, my observations brought forth a research idea that I would like to conduct, perhaps next year, involving the iguanas on Green Cay. San Salvador is a beautiful island with much to discover. After only a few short days on the island, I discovered a wonderful culture with beautiful people, dazzling reefs teaming with life, and new friends. The one big thing I discovered was that the whole research experience gave structure, purpose, and meaning to all that I have learned in my academic career.

EFFECTS OF BAROMETRIC PRESSURE CHANGES ON THE FORAGING ACTIVITY OF INSECTIVOROUS BATS.

Stephanie C. French, Maryville College, Maryville, Tennessee. A maternity colony of *Eptesicus fuscus* (big brown bat) and another species of bats, *Myotis lucifugus* (little brown bat), were monitored to see if barometric pressure changes had any effect on the bats' foraging behavior. The bats were studied over the summer of 1994. Biotic (insect abundance) and abiotic (barometric pressure, temperature, humidity, light intensity, cloud coverage, and moon face coverage) information was recorded at 0.5-h intervals from 30 min before sunset to 0200 h. Average barometric pressure was the abiotic factor that caused the most variability in the bats' foraging activity.

WORKING MEMORY AND MNEMONIC STRATEGIES ACROSS THE ADULT LIFESPAN.

Stephanie Fugate, Maryville College, Maryville, Tennessee. This study focused on the relationship between working memory, age, and use of mnemonic strategy. Sixty subjects between the ages of 18 and 83 years completed a battery of cognitive tasks, including a working-memory task and two mnemonic-strategy tasks in an organization and elaboration condition. Use of mnemonic strategy was found to have a significant positive correlation with level of working memory, and age was found to have negative correlation with both tasks. It was hypothesized that the inherent meaning in the elaboration strategy would facilitate more word recall than in the organization strategy for elderly subjects and low working-memory

subjects. Results supported neither of these hypotheses. Implications of the discrepancies in the findings and the hypotheses are discussed along with the possible attribution of hypothesis failure to the fact that the organization word list may have been easier to learn or, perhaps, their instructions for the mnemonic strategies may have been too vague.

PERFORMANCE AND CONSTRUCTION OF CREATED WETLAND FOR WASTEWATER TREATMENT AT SINGLE AND MULTIFAMILY RESIDENCES. *William Gooding and Rick Gehrke, The University of Tennessee at Chattanooga, Chattanooga, Tennessee.* The construction and performance of created wetlands for wastewater treatment of single and multifamily residences was studied from August 1994 to April 1995. For the construction portion of the study, a created wetland was built at a residence in Walker Co., Georgia. All phases of construction were documented and completed in conjunction with guidelines set by the Walker County Department of Environmental Health. BOD, dissolved oxygen, pH, NO₃, PO₄, and *Escherichia coli* were monitored at the inflow and outflows of an existing system in use at a multifamily complex in Walker Co. All parameters showed compliance with established surface-water criteria for the State of Georgia.

CORAL REEF ECOLOGY OF SAN SALVADOR, BAHAMAS. *Alex Hixon and Tiffany Messier, The University of Tennessee at Chattanooga, Chattanooga, Tennessee.* As part of a continuing study, a group of scuba divers and students from The University of Tennessee at Chattanooga have been studying the bleaching of coral reefs. This study takes place on the island of San Salvador, which is part of the Bahamian chain. It is located ca. 322 km southeast of Nassau. The data-collection and survey processes took place from 12 through 18 March 1995. The team consisted of six surveyors, two divemasters, one cameraperson, and a support crew of two people. Their efforts included the mapping of the area and studies in coral reef and fish populations. One of the main goals was to address the possible bleaching of coral. The location of the dive sites was Hernandez Bay. We present our findings on the reefs.

ART DEVELOPMENT: ITS RELATIONSHIP TO TEACHER JUDGEMENTS OF CHILDRENS' COGNITION AND EMOTIONAL CHARACTERISTICS. *Carrie Hooper, Maryville College, Maryville, Tennessee.* Cognitive and art development have been conceived of as stages, and children's art work often has been used as a source of information about their thinking and emotions. Twenty-one students (ages 5-7 years) completed two drawings (a depiction of a person and a free drawing). For each child, an art stage was determined, and a cognitive level and emotional labels were assigned based on the art stage and chronological age. The children's teacher also assigned a cognitive level and emotional label based on her knowledge of their academic achievement and classroom behavior. The results show a significant agreement between the teacher and myself on the cognitive levels but no significant agreement about emotional labels. The findings demonstrate that art development can be used to assist in determining stages of cognitive development.

INTEGRATION OF A CHEMICAL INSTRUMENTATION LABORATORY USING MICROSOFT WINDOWS AND LOTUS 1-2-3. *Lance Klosterman, Maryville College, Maryville, Tennessee.* Modern chemical instruments have an RS-232C serial port which is utilized to send information to other devices such as computers or printers. Software can be purchased from the instrument manufacturer or from other software vendors to decode this information on a personal computer. However, Microsoft Windows has options that allow easy acquisition of this information; other software, such as Microsoft Write and Lotus 1-2-3, can be used to decode the information and build a spectrum. In all cases, the same steps are taken to interface the personal

computer with the instrument: hardwiring, setting communications parameters, parsing the data, and plotting the data in a spreadsheet form to create a spectrum. The serial signals sent from instruments such as the Perkin-Elmer LS-3B are relatively easy to decode; however, special file formats such as plotter formats sent by the Perkin-Elmer FTIR-1600 are more difficult to decode and may not result in a reproducible spectrum.

A COMPARATIVE STUDY BETWEEN TWO PROTOCOLS OF CONTINUOUS PASSIVE MOTION IN THE REHABILITATION OF PATIENTS WHO HAVE UNDERGONE TOTAL KNEE ARTHROPLASTY. *Amy E. Lee, Maryville College, Maryville, Tennessee.* Total knee arthroplasty is an operative procedure in which a severely damaged knee is replaced with a prosthesis. Postoperative rehabilitation is a crucial step in achieving normal knee function. The use of a continuous passive motion machine is commonly a part of this rehabilitation regimen, but the technical aspects of its use are currently subjects of debate. One such aspect is the time at which continuous-passive-motion administration should be initiated. Blount Memorial Hospital in Maryville, Tennessee, begins continuous passive motion on the second to third postoperative day. In contrast, The University of Tennessee Medical Center begins continuous-passive-motion administration in the recovery room immediately following surgery. Through a retrospective study, I examined data from the records of 20 randomly selected patients who had undergone total knee arthroplasty at each of these hospitals from 1993 to 1995. Data collected included the range of motion at the beginning of continuous-passive-motion administration, the range of motion of continuous passive motion at the time of hospital discharge, net knee-flexion gain, and length of hospital stay. Each parameter was compared between the two protocols using a Mann-Whitney rank sum test. No statistically significant difference existed for net knee-flexion gain ($P = 0.646$). Patients at The University of Tennessee Medical Center had significantly greater range of motion at the beginning of continuous-passive-motion administration ($P < 0.001$) and significantly greater range of motion of continuous passive motion at the time of hospital discharge ($P < 0.001$). This difference can be attributed to the standard practice at The University of Tennessee Medical Center of placing total-knee-arthroplasty patients at a predetermined initial range of motion of continuous passive motion, whereas at response to patient tolerance. These results call into question the benefit of increased range of motion at hospital discharge versus patient comfort during rehabilitation when there is no difference in net knee-flexion gain.

MOLECULAR CHARACTERIZATION OF PUTATIVE Y CHROMOSOME HOMOLOGUES IN REPTILES. *Christian F. Leon, Dale M. Earnest, Edmund J. Zimmer, and Joseph A. Depari, The University of Tennessee at Chattanooga, Chattanooga, Tennessee.* In mammals, sexual development of an embryo as a male is influenced by the sex-determining gene SRY (sex-determining region Y) located in the male Y chromosome (chromosomal sex determination). In some reptiles, sexual development of the embryo is determined by the temperature at which the egg is incubated (temperature-dependent sex determination). The typical mammalian pattern of chromosomal sex determination also is present in reptiles. The occurrence of temperature-dependent sex determination and chromosomal sex determination in reptiles suggests that the fundamental genetic basis of sex determination in both mechanisms may be similar and that mammalian Y chromosome homologues are present and similarly functional in reptiles. Polymerase-chain reaction and southern blotting were used to identify mammalian Y chromosome homologues in the genomes of two species of turtles (the snapping turtle, *Chelydra serpentina*, and the painted turtle, *Chrysemys picta*) that exhibit temperature-dependent sex determination. Primers

derived from the human sex-determining gene SRY amplify a fragment of ca. 860 base pairs from genomic DNA in male and female snapping turtles. Probe pDP1007, derived from the human Y chromosome gene ZFY (Zinc-finger Y), yields identical patterns of hybridization to *EcoRI*-digested genomic blots of male and female snapping turtles. A single, prominent band of ca. 6 kilobases is observed. In male painted turtles, a single band of ca. 6 kilobases also is observed, slightly smaller than the observed for snapping turtles. Both species also exhibit additional high-molecular-weight bands >12 kilobases. ZFY is closely linked to SRY and was proposed as the male sex-determining gene prior to the isolation of SRY. These results from polymerase-chain reaction and southern blotting, while not conclusive, suggest that sequences homologous to mammalian Y chromosome sex-determining and other sequences occur in turtles that exhibit temperature-dependent sex determination and that chromosomal sex determination and temperature-dependent sex determination may be regulated by similar genetic mechanisms.

SUCCESS MARKERS FOR BLACK MALES GROWING UP IN AN INNER CITY. *Shadrick McCall, Maryville College, Maryville, Tennessee.* The purpose of this study was to identify some of the important variables influencing the educational success and increased probability of job success of young black males growing up in an inner city. Twenty-two black males (age 18-24 years) who lived in inner-city sections of Richmond, Virginia, were asked to answer survey questions pertaining to general characteristics of inner-city life, educational achievement, and influential role models. The 22 participants were divided into two groups according to their responses to questions pertaining to education and one question asking if the participants had ever been convicted of a crime. Young black males who were identified as those graduating from high school and with no criminal convictions were considered those with the greatest potential for continuing their education and acquiring a job. Twelve participants met these criteria while the other 10 participants either failed to achieve a high-school education or admitted conviction for a crime. Basically, inner-city characteristics experienced by the two groups were not rated differently by the group participants. Positive family-life experience, positive attitude towards education, and having mother or father or both parents as influential role models were markers for those participants who had achieved a high-school education and avoided conviction for a crime.

A COMPARATIVE STUDY OF PROTEIN ELECTROPHORESIS. *Joseph G. Meyer, Maryville College, Maryville, Tennessee.* There are many diverse protein-separation techniques available to the modern scientist. Each technique uses its own unique method for dividing protein mixtures into very specific groups. Electrophoresis is the utilization of an electric current to exploit the charged surface domains on individual proteins and their subunits. The most common form of electrophoresis used polyacrylamide gel as a support medium because it is highly reproducible and can be used as a sieving agent to further separate proteins by size. Three separate techniques (native protein electrophoresis, molecular-weight determination using sodium-dodecyl sulfate polyacrylamide-gel electrophoresis or SDS-PAGE, and two-dimensional electrophoresis) were used for comparison in this study. Native protein electrophoresis separates proteins by surface charge, while SDS-PAGE uses the detergent sodium-dodecyl sulfate to denature the protein by cleaving sulfide bonds. When this occurs, the migration of the denatured protein is directly related to the molecular weight. The two-dimensional analysis couples these techniques and increases resolution of distinct protein mixtures into four purified proteins (soybean trypsin inhibitor, myoglobin, bovine serum albumin, and B-amylase) was performed. In addition, SDS-PAGE allowed for the experimental determination of molecular weight, within 10% of the actual molecular

weight, of four separate denatured proteins (carbonic anhydrase, ovalbumin, IgG, and B-amylase). When these two techniques were coupled in a two-dimensional analysis, the system was not given adequate time to totally separate; thus, the result was several blurred bands. This phase of the experiment could be redesigned; however, chemical supplies and time were exhausted for this to be considered in this study.

STUN SYNTHESIS OF C_{60} . *John Paul Nichols, Maryville College, Maryville, Tennessee.* Since their discovery in 1985, fullerenes have been the subject of intense research. In particular, buckminsterfullerene, or C_{60} , has received the greatest attention due to its variety of chemical properties. Efficient methods for producing and purifying gram quantities of C_{60} have been available only for the past 3 years. Carbon welding rods of 20-90% graphite were used to produce 1.848 g of soot, from which no detectable fullerene was obtained because of a failure in the flame chromatographic separation method that was used to purify C_{60} from the soot. Infrared and ultraviolet spectra taken on the crude product did not indicate any fullerene synthesis. Purified C_{60} (SES Research) was coevaporated with pure potassium metal in a helium atmosphere at 601°C to yield a small crystalline matrix of KC_{60} . Synthesis of the product was confirmed by flame test and infrared analysis. The infrared spectrum produced absorption peaks at 1473.6 and 1401.0/cm, 1233.1 and 1164.6/cm, and 585.1/cm which compare favorably to the spectra for C_{60} in the literature.

A 9-MONTH COMPARATIVE INVESTIGATION OF FORT LOUDON AND TELlico LAKES USING SELECTED TROPHIC PARAMETERS. *Beth Nuchols, Maryville College, Maryville, Tennessee.* A 9-month, comparative, limnological study of Fort Loudon and Tellico lakes was accomplished by assessing various trophic parameters, including zooplankton analysis, chemical concentrations, and oxygen-temperature relationships. Seven genera of zooplankton were collected and counted using a plankton net and 36-square, integrid petri dish. Chemical analyses and the oxygen-temperature correlations were determined according to HACH chemical methods. For all but two organisms studied, May was the month with the most zooplankton, and the relationships between genera of plankton varied within the months of study. Fort Loudon and Tellico lakes were similar in the presence of chemicals, but Tellico Lake exhibited slightly reduced concentrations of many of the chemicals. Both lakes demonstrated summer stratification, but Tellico Lake showed cooler temperatures and higher oxygen saturation than did Fort Loudon Lake. Analyses suggest that Fort Loudon Lake exists in the late mesotrophic or early eutrophic stage, while conditions suggest that Tellico Lake is late oligotrophic.

PURIFICATION AND STRUCTURAL ANALYSIS OF THE PROTEOLYTIC ENZYME OF *CAPSELLA BURSA-PASTORIS*. *Shane Phillips, Maryville College, Maryville, Tennessee.* Previous studies by John T. Barber and his colleagues have shown that the seeds of *Capsella bursa-pastoris* exhibit chemoattractive and digestive abilities toward nematodes and other microorganisms. Research has linked this phenomenon to a proteolytic enzyme found in the mucilage secretions of the seeds. Several purification methods for the enzyme were examined and enzymatic activities of the fractions were determined spectrophotometrically in an azoalbumin assay procedure. Activity ranged from 0.5 Abs units/ml to 0.70 Abs units/ml for the resuspended pellet using three precipitation methods with acetone, ethanol, and ammonium sulfate. There was no activity observed in the dialyzed supernatants. Ultrafiltration membrane tubes in 30-k and 10-k molecular weight were used to purify the crude extract. Activity was greatly increased in the 10-k retentate after centrifugation, with absorbencies as high as 1.00 Abs units/ml. The filtered extract was separated further by a Biogel P-30 gel filtration column, and the four fractions containing the purified enzyme

were analyzed using a Bradford protein method. Protein content was greatly reduced over the crude extract, but the enzymatic activity was still present at 0.22 cAbs units/ml. An inhibitor study was performed on the purified protein using phenylmethylsulfonylfluorid. The results showed complete inhibition of activity suggesting that the enzyme might be in the serine protease family.

BROMINATION OF 1,4-BIPHENYL-1,3-BUTADIENE. *James Kevyn Smith, Maryville College, Maryville, Tennessee.* Many organic reactions can have a change of mechanism depending upon the ratio of reactants or reaction conditions. By changing the mole fraction of 1,4-biphenyl-1,3-butadiene to bromine as electrophilic or free radical addition can be selectively induced. The products of the bromination reaction are analyzed to determine the attachment sites of bromine to the alkyl chain by using proton NMR, infrared, and ultraviolet spectrometry. These products are observed in this process: 1,4-biphenyl-1,4-dibromo-2-butene; 1,4-biphenyl-2,3-dibromo-2-butene; 1,4-biphenyl-1,3-butadiene-2-butene. Electrophilic bromination occurred when the mole fraction of the biphenyl reactant was between 0.10 and 0.14 and produced the 1,4 and 2,3 dibrominated products. Above 0.15, a free radical reaction mechanism was observed where the products were the 1,3-dibromo-1,4-biphenyl-2-butene.

CURVATURE OF SPACETIME DEMONSTRATION. *Derek Alan Stewart and Eric T. Lane, The University of Tennessee at Chattanooga, Chattanooga, Tennessee.* The "Curvature of Spacetime Demonstration" computer program incorporates text screens and animations to present a simplified discussion of gravity as seen through Einstein's theory of general relativity. Coupled with this computer display is a rubber sheet, representing spacetime, which allows viewers to interact with a physical representation to reinforce the learning experience. The feasibility of using ray-tracer animation in educational displays and how these tools can increase learning will be discussed as well as the problems of creating an educational demonstration.

CHEMICAL ANALYSIS OF MIDDLE CREEK. *Horace Stewart, The University of Tennessee at Chattanooga, Chattanooga, Tennessee.* Middle Creek is located on the side of Signal Mountain. The creek drains Rainbow Lake located on Signal Mountain. The creek also is fed by several small springs. Water samples were taken weekly for 3 weeks. The samples were individually tested for nitrite, phosphate, dissolved oxygen, CO₂, pH, and chlorine. The results suggest that Middle Creek is becoming contaminated from a point source.

FACTORS IN MARRIAGE AND DIVORCE. *Chris Underwood, Hugh Dalton Yates, and Rebecca Howard, Roane State Community College, Tennessee.* A stratified sample of 166 couples including 89 still married after ≥ 20 years and 77 divorced after 1-50 years was interviewed. For those still married and those divorced (respectively), 84.0 and 65.0% ($P < 0.01$) had parental approval of the marriage, 87.5 and 69.0% ($P < 0.01$) had the same religion, 33.0 and 75.0% ($P < 0.001$) argued over money, 69.0 and 44.0% ($P < 0.01$) attended church together, 88.0 and 26.0% ($P < 0.001$) said their spouse was open and honest, and 84.0 and 53.0% ($P < 0.001$) had children together. When couples were self-classified as "neat-neat," "neat-messy," or "messy-messy," 63.0% of "neat-neat," 46.0% of "neat-messy," and 31.0% of "messy-messy" stayed married ($P < 0.05$). Fourteen percent of couples still married argued over household chores, while 27.0% of divorced couples argued over household chores ($P < 0.05$). Neither age nor educational level of male or female at time of marriage was a significant factor. Also, length of courtship and gender of the spouse making the most money were not significant factors.

MIDDLE REGION

AUSTIN PEAY STATE UNIVERSITY
CLARKSVILLE, TENNESSEE

EFFECT OF CONSTANT MAGNETIC FIELDS ON PRIMARY PRODUCTIVITY AND CHLOROPHYLL CONCENTRATION IN BRASSICA RAPA. *Paul J. Chappin and John E. Breeden, David Lipscomb University, Nashville, Tennessee.* *Brassica rapa* was grown in the presence of a constant magnetic field. Number of seedlings grown as well as the length of each growing period varied with the test performed. Primary productivity and chlorophyll concentration were used to measure the effects. Primary productivity of test and control plants showed no observable difference. However, a trend existed between constant magnetic fields, chlorophyll a, chlorophyll b, and total chlorophyll in *Brassica rapa*.

INFLUENCE OF METHIONINE SULFOXIMINE ON LEGUMES. *Kimberly Bird, Larry Hull, E. Lewis Myles, Deborah Baugh, and C. Caudle, Tennessee State University, Nashville, Tennessee.* *Phaseolus vulgaris* (field bean) is a high-protein crop. This crop not only is important in industrialized countries but also is even more important in underdeveloped countries where meat is not easily obtained. Often times in poor countries, the reason for lack of food is due to conditions that affect the growth of their crops. One of the more common problems affecting crops is disease. Our laboratory is studying the effects of methionine sulfoximine on beans using tissue-culture techniques. Seeds were surface-sterilized and germinated on Murshurage and Skoog's medium. Hypocotyls were used as explants, and 0.5 g of callus was placed on media containing 0.0, 1.0, and 2.0 μM of methionine sulfoximine. After 3 weeks, the callus was removed from the medium, weighed, and analyzed by one-dimensional gel electrophoresis. In the experimental groups, electrophoretic analysis showed several bands that had an increased synthesis.

RADIOFREQUENCY RADIATION EFFECTS ON THE COMMON BEAN. *Kevin Thomkins, Lisa Griggs, E. L. Myles, and C. Caudle, Tennessee State University, Nashville, Tennessee.* Our environment is bombarded daily with thousands of objects we can visually detect. However, invisible to humans are the electromagnetic waves that penetrate our environment. Electromagnetic waves consist of a large spectrum of waves including the harmful gamma rays, x-rays, and ultraviolet rays. The question that has increased tremendously is: can low energy electromagnetic waves become harmful to living organisms? The purpose of this study is to determine the effect of radiofrequency radiation on protein synthesis of the common bean. *Phaseolus vulgaris* (kidney bean) was surface-sterilized and allowed to germinate on Murshurage and Skoog's medium for 1 week. Hypocotyls were wounded and placed on media to initiate callus production. Six petri dishes containing 1 g of callus were used in the experiment. Three dishes were exposed to 100 kHz in a Crawford cell for 24 h. The remaining three petri dishes with callus were used as a control. After the exposure period, the protein from callus was extracted and analyzed by one-dimensional gel electrophoresis. The results show that hypocotyl growth was not different between control and experimental groups after 24 h. The result of one-dimensional gel electrophoresis did not show observable differences in protein synthesized by the control and experimental groups. Analysis of protein synthesis is still ongoing.

EFFECTS METHIONINE SULFOXIMINE ON IN-VITRO CULTURE OF SOYBEAN. *Leiah Butler, E. Lewis Myles, Deborah Baugh, and C. Caudle, Tennessee State University, Nashville, Tennessee.* Soybean is a very important crop plant and provides a significant

part of the farm income for many states. Many positive aspects of soybean will result in increasingly greater human use. Soybean protein may have additional health benefits. The most common bacterial disease of soybean is bacterial blight that is caused by *Pseudomonas syringae* pv. *glycinea*. It produces a pathogenic toxin (tabtoxin) that inhibits glutamine synthetase activity. Methionine sulfoximine which is a potent and highly specific inhibitor of glutamine synthetase can mimic the effect of tabtoxin. Methionine sulfoximine may be used on the research of disease resistance of soybeans through means of tissue culture. Seeds were surface-sterilized and germinated on Murshurage and Skoog's medium. Cotyledons were used as explants, and callus was placed in suspension medium containing 0.0, 6.0, and 12.0 μM of methionine sulfoximine. After 48 h of exposure, the callus was removed from the medium, weighed, and analyzed by one-dimensional gel electrophoresis. Both 6.0 and 12.0 μM of methionine sulfoximine reduced the growth significantly when compared to the control groups.

EFFECTS OF METHIONINE SULFOXIMINE ON SOYBEAN (GLYCINE MAX). *Lazette Williams, E. L. Myles, and Deborah Baugh, Tennessee State University, Nashville, Tennessee.* The objective of this study was to determine the effect of methionine sulfoximine on the leaves of soybeans at concentration levels of 12 and 24 μM . Three different cultivars were selected for the study. The seeds of each were placed in pea pellets, and cultivars were germinated in clay pots for 3-4 weeks. Each plant had at least eight to 10 leaves before exposure. After 4 weeks postgermination, the stressor was applied. Methionine sulfoximine was applied as a mist on the leaves every day for 10 days. The leaves were removed and stored at -70°C . Three to four frozen leaves were selected for protein extraction. The protein was phenol-extracted and dissolved in urea buffer for use in two-dimensional gel electrophoresis. One-dimensional gel electrophoresis also was used in the analysis. However, two-dimensional gel electrophoresis gave the better analysis. Our results indicate that several proteins show variable synthesis when compared to the control. To take this research a step further, we must be successful in finding what proteins are being synthesized and what their functions are in soybeans.

EXPOSURE OF SALMONELLA SPECIES TO ACID STRESS. *Tamela Sanders, Carolyn A. Caudle, Yvonne Myles, and E. L. Myles, Tennessee State University, Nashville, Tennessee.* *Salmonella* is an invasive microorganism that can cause food-borne disease. A person suffering with salmonellosis may have unrelenting diarrhea along with headaches, chills, fever, and vomiting. Sources of *Salmonella* include poultry, poultry products, animal products, fruits, and vegetables. In an effort to control the growth of *Salmonella*, our study examined the effect of acid stress on the bacteria. Three species of *Salmonella* (*S. enteritidis*, *S. pullorum*, and *S. typhimurium*) were grown overnight in LB medium at pH 7.4 (control), 5.8 (pre-acid shock), 4.5 (acid shock), and 3.3 (severe acid shock). Cell growth was observed visually and spectrophotometrically. There was no significant difference in cell growth between the control groups and the experimental groups of pre-acid shock and acid shock. Cell growth was dramatically reduced among all three species with severe acid shocked. To investigate the possibility of stress-related proteins being synthesized by the bacteria, protein samples were extracted and sodium-dodecyl sulfate polyacrylamide-gel electrophoresis was performed. Results from this study indicate that the three species of *Salmonella* are able to synthesize new protein(s) when the bacteria are exposed to elevated acidic conditions.

AN ECOSYSTEM ANALYSIS BY COMPARATIVE POND STUDY. *James M. Purrenhage and Willodean D. S. Burton, Austin Peay State University, Clarksville, Tennessee.* The General Ecology Class at Austin Peay State University in the fall of 1994 conducted research to

explore ecosystems. Two freshwater ponds were chosen at Land Between The Lakes National Recreation Area. Brandon Springs Pond is located in a well forested area on a slope. Access to this pond is limited to the wildlife of the area. Bison Field Pond is on flat pasture land and is less vegetated. Bison in the pasture have access to the pond. Four parameters were established to analyze the ponds and relate statistically any differences in the biotic and abiotic factors between the ponds. The tests included water chemistry and comparison of numbers of genera for zooplankton, phytoplankton, and macroinvertebrates and small vertebrates. These data were analyzed using the *t*-test and *F*-test to determine if there were significant differences between the pond ecosystems. The results indicated a statistically significant difference in alkalinity, pH, nitrate, and total hardness. These preliminary data indicate a difference between the two ecosystems and have sparked further investigations to analyze those differences in greater detail.

PARASITIC LIFE CYCLE OF BDELLOVIBRIO BACTERIOVORUS. *Brian Canada and Don Dailey, Austin Peay State University, Clarksville, Tennessee.* *Bdellovibrio bacteriovorus* is a Gram-negative obligate, intracellular parasite of other Gram-negative bacteria. The bdellovibrio will invade the periplasmic space of its host and then cannibalize the host cell's macromolecules for its own growth and reproduction. The host specificity of *B. bacteriovorus* was investigated in this study. The bacterium *Escherichia coli* RR1 was selected as the host for *B. bacteriovorus*. Serial plaquing experiments demonstrated that the bdellovibrio reproducibly plaqued at high efficiencies on *E. coli* RR1. When these experiments were repeated using a different host bacterium such as *Aeromonas hydrophila* and *Pseudomonas aeruginosa*, it was observed that the bdellovibrio passaged through *E. coli* did not plaque very efficiently on these different hosts. These results suggest that *B. bacteriovorus* might have a mechanism that promotes selectivity in the infection of a specific host species.

SYNTHESIS OF ARYLALKYLCHLOROSILANES FOR THIN FILMS. *David C. Jacobs, Rachel D. Roberts, and Andrienne C. Friedli, Middle Tennessee State University, Murfreesboro, Tennessee.* Thin films made from chlorosilanes on hydroxylated substrates are under investigation. Potential applications include microlithography (printed microcircuits) and sensors (patterned biological cell growth). We currently are synthesizing a series of arylalkylchlorosilanes that vary in alkyl chain length, position of the phenyl chromophore in relation to the alkyl chain, and the number of methyl groups attached to the silicon atom in order to find the effects on film structure and photochemistry.

SCANNING DENSITOMETRY OF BARBITURATES ON THIN-LAYER CHROMATOGRAPHY PLATES. *L. Shayne Webb and Judith M. Bonicamp, Middle Tennessee State University, Murfreesboro, Tennessee.* Barbiturate drugs are identifiable in pills, powders, and urine specimens using thin-layer chromatography. A migration solvent carries the drugs up a thin-layer chromatography plate, thus separating them. After detection with suitable color reagents, we compare the suspected barbiturate spots to the color and position of known standards and, hence, can tell which drugs are present. We have completed a study of the color reactions of the barbiturates by spectrum analysis of the derivatives. We are extending the qualitative detection method to allow quantification of barbiturates in our samples. This procedure relies on the linear relationship between concentration and peak area as determined using the densitometer in the spot density mode at a fixed wavelength, the λ_{max} of the colored spot.

COLUMN CHROMATOGRAPHY IN THE QUANT LABORATORY: WORKING TO BEAT THE BANDS. *Elizabeth C. Boice and Judith M. Bonicamp, Middle Tennessee State University, Murfreesboro,*

Tennessee. Quantitative-analysis students have performed the experiment of column chromatographic separation of a dye mixture on alumina followed by spectrophotometric analysis of the eluates and quantification of the dyes using Beer's law in our laboratory for 15 years with generally disappointing results. Previous workers have claimed that the three dyes victoria blue R, methylene blue, and fluorescein are separable under the chromatography conditions. We have tried a variety of modifications to improve separation of the dyes, but all gave the same result as before (loss of dye on the column or poor separation or both). We now have formulated a replacement dye-mixture (victoria blue R, oil red O, and fluorescein) that separates easily with inexpensive solvents. The dyes can be recovered nearly quantitatively from alumina columns. The mud-colored dye mixture becomes aesthetically very pleasing as the dyes move down the column and separate into brightly colored bands, making this experiment useful for classroom demonstrations of the column chromatographic technique.

CAN YOU PASS A DRUGS TEST IF YOU EAT POPPY SEED CAKE? *Ida L. Santana and Judith M. Bonicamp, Middle Tennessee State University, Murfreesboro, Tennessee.* The resurgence of heroin use among young people is alarming. The comeback is due in part to the availability of a form of heroin that can be snorted rather than injected, which reduces the risk of transmission of AIDS. A dilemma encountered in drug testing is distinguishing among the drugs and human metabolites from legal use of prescription opiates (morphine and codeine), innocent ingestion of poppy seeds in food (morphine and codeine), and true drug abuse (heroin, 6-monoacetylmorphine, and morphine). The heroin metabolite 6-monoacetylmorphine does not result from eating poppy seeds, and it is from this distinction that we pursued our experimentation. We can differentiate heroin, codeine, morphine, and their metabolites from each other using a simplified and accelerated thin-layer chromatographic technique employing special sample application discs and a sequence of detection reactions. The detection limit is 1 $\mu\text{g/ml}$ from urine by liquid-liquid extraction. Further improvement in the detection limit results when solid phase extraction columns are employed, giving a detection limit of ca. 200 ng/ml for morphine. The information in our report can prevent innocent poppy-seed eaters from being falsely accused of drug abuse.

DETECTION AND PRELIMINARY KINETIC ANALYSIS OF POLYPHENOL OXIDASE IN SALSIFY (*TRAGOPOGON PORRIFOLIUS*). *Melissa Daggett, Douglas King, Brandon Potter, Jason James, Ashley Morgan, Jon Tomei, and Kent Clinger, David Lipscomb University, Nashville, Tennessee, and Bethany College, Bethany, West Virginia.* A polyphenol oxidase (or tyrosinase) activity has been discovered in the root of the plant salsify (*Tragopogon porrifolius*). An acetone powder was prepared from freshly harvested salsify at -10°C . The acetone powder was stored at $0-4^{\circ}\text{C}$. The enzyme was extracted from the acetone powder with 0.05 M phosphate, pH 6.0, buffer and was prepared further by fractionation with ammonium sulfate and centrifugation at $0-4^{\circ}\text{C}$ in a refrigerated centrifuge. The polyphenol oxidase precipitated in the 35-80% saturated fraction. The enzyme was found to have a K_m of 1.3 mM for DOPA and a K_m of 0.30 mM for catechol with a pH optimum of ca. 6.5. A typical crude preparation had a specific activity of 400 units/mg of protein at pH 6.5.

QUANTITATION OF STEAM DISTILLATION OF ESSENTIAL OILS IN THE ORGANIC CHEMISTRY LABORATORY. *Barry N. Lumpkins and Kent Clinger, David Lipscomb University, Nashville, Tennessee.* Microscale laboratory techniques have contributed much improvement to organic laboratory procedures. However, in some cases, experiments that were quite successful as macroscale procedures do not produce adequate yields when translated into microscale proce-

dures for adequate quantification. One such procedure is the steam-distillation of essential oils from spices. When completed as a macroscale technique, yields are sufficient to quantify by simply weighing products. When performed as a microscale technique, however, yields are too small to accurately quantify by weighing. We will present a method for quantifying the amount of cinnamaldehyde and eugenol distilled from cinnamon and cloves, respectively, using gas chromatography. Results indicate the concentration of cinnamaldehyde in our sample to be 14.42 mg/ml in methylene chloride or 0.039 mg of cinnamaldehyde/mg of ground cinnamon distilled. Results for eugenol from cloves are greater in concentration at 37.9 mg/ml in methylene chloride or 0.226 mg of eugenol/mg of cloves distilled.

EFFECTS OF ELECTRON-DONATING GROUPS ON THE ENE DONOR IN TYPE III INTRAMOLECULAR ENE REACTION. *Mohammad R. Karim, Leon Smith, and Jidong Li, Tennessee State University, Nashville, Tennessee.* Compounds such as nojirimycin and mannojirimycin are known to possess antiviral and anticancer properties through glycosidic inhibition. A special feature of these types of compounds is the presence of polyhydroxy cyclic amides in the core structure. Our research is directed towards the synthesis of highly functionalized cyclic amides via intramolecular type III ene reaction. The study involving the activation of the ene donor has not been studied systematically. Therefore, our initial study involves the synthesis of a few model compounds bearing the electron-donating group on the ene donor and the effect of these activating groups in type III intramolecular ene reaction. Few model compounds have been synthesized, and their ene reaction have been studied. The results of these investigations will be presented.

SPECTROSCOPY OF ORGANIC INTERMEDIATES. *Monique Casey, Constance L. Thomas, Rudy C. Gostowski, Christopher A. Landess, Sharon M. Snapp, and Michael C. Wallace, Austin Peay State University, Clarksville, Tennessee.* Carbanions, carbon radicals, and carbocations can be thought of as different oxidation states of the same atom. These intermediates are involved in many fundamental chemical processes. The electronic absorption spectra of these species has been taken for families of molecules. These families include triphenyl methane, 9-(2,4,6-trimethylphenyl)fluorene, and 9-(2-methylphenyl)fluorene. The absorptions observed have been reconciled with possible transitions predicted by energy-level diagrams.

DETERMINATION OF CADMIUM IN SMOKELESS TOBACCO. *Merla Black, Billy Kilcoyne, and Rudy Gostowski, Austin Peay State University, Clarksville, Tennessee.* Cadmium is responsible for many serious health problems. Therefore, its detection in consumer products is a necessary activity. Tobacco plants are known to accumulate cadmium from the soil as Cd-thioneine complexes. Atomic absorption experiments have found significant levels (0.3 $\mu\text{g/g}$) in smokeless tobacco products.

FAST-SCAN CYCLIC VOLTAMMETRY. *Jeremy Anderson and Rudy Gostowski, Austin Peay State University, Clarksville, Tennessee.* Cyclic voltammetry at rapid scan rates facilitates observation of decay processes of electrogenerated species. Ultramicroelectrodes are required for this experiment. Platinum wires having a diameter of $\leq\mu\text{m}$ have been successfully sealed in soft glass tubing to fabricate the electrode.

INTERACTIONS OF THE GOLD(I) DRUG AURANOFIN WITH GLUTATHIONE. *Rod L. Hartwig, G. Kenneth Weakley, and Lori L. Slavin, Austin Peay State University, Clarksville, Tennessee.* Gold(I) complexes have been used for many years in the treatment of rheumatoid

arthritis. Auranofin is one of three drugs that is approved by the Food and Drug Administration and is a gold(I) phosphine complex, with the metal center bound linearly to sulphur and phosphorus atoms. Gold(I) drugs generally are bound to soft bases to avoid disproportionation to inert elemental gold and toxic gold(III). Glutathione (GSH) is a protein that is involved in detoxification reactions in the body. It is involved in the mercaptic acid pathway, which is a major detoxification mechanism for the body. It was expected that the auranofin would inhibit the reaction between glutathione and chlorodinitrobenzene. The ultraviolet-vis spectra shows a decrease in absorbance for the GSH-CDNB adduct when auranofin is introduced into the system. The P-31 NMR spectrum of free auranofin ($pD = 7.4$) reveals a chemical shift at 39.6 ppm. For the complexed auranofin ($pD = 7.4$), the spectrum shows a chemical shift at 40.8 ppm. Cleavage occurs at the Au(I)-S bond in auranofin leaving available a coordination site. The sulfur atom on the cysteine residue of glutathione then coordinates to the gold(I) atom forming an adduct that may not be readily excreted from the body. Cleavage does not occur at the Au(I)-P bond because the free triethylphosphine would exhibit a peak at ca. 69.3 ppm in the P-31 NMR spectrum.

DETERMINATION OF LEAD CONCENTRATIONS IN WATERS.

Fred J. Matthews, Lamis Joudah, Jonathan Vinson, and Julie Enos, Austin Peay State University, Clarksville, Tennessee. Lead concentrations in the environment are of critical concern due to potential health risks. The maximum acceptable level of lead in water, set by the Environmental Protection Agency, is 15 ppb. Analysis of household waters supplied by submersible pumps and municipalities have been performed, and lead levels of 1-20 ppb were detected. Analyses were performed using atomic absorption spectrometry. Preconcentration of the aqueous samples using the ammonium pyrrolidinedithiocarbamate chelation/methyl isobutyl ketone extraction method was necessary to analyze using flame AA analysis.

PHOSPHATE HYPERSENSITIVITY. *Lisa Schumacher, Stephanie Slate, and Ron Robertson, Austin Peay State University, Clarksville, Tennessee.* Sodium hexametaphosphate, a condensed phosphate, is supposed to be nontoxic and is found on the GRAS list. However, residents of Dickson Co., Tennessee, have alleged that they have had allergic reactions due to the addition of this chemical to their municipal water supply as an anti-corrosive agent. This allergic reaction has been verified by an allergist at the Environmental Health Center in Dallas, Texas. The purpose of our research was to analyze water samples from the Dickson Co. area and to analyze consumer products such as detergents to determine the orthophosphate as well as condensed phosphate concentrations. We used the ascorbic-acid method, obtained from the *Hach Water Analysis Handbook*, to analyze our samples. A Spec20, at 890 nm, was used to analyze the intense blue phosphomolybdate complex formed as a result of the addition of MoO_3 and, then, ascorbic acid to the sample. This method detects only orthophosphates. Therefore, condensed phosphate concentrations, such as sodium hexametaphosphate, can be determined if the samples are digested with sulfuric acid which converts the condensed form to the ortho form prior to analysis. The results of our analyses indicate that Dickson Co. water supplies contain <0.1 ppm phosphorus (our instrument's detection limit) in either ortho or condensed forms. The results of our detergent analyses in 2% solutions indicate that an older detergent formulation has a concentration of 0.5 ppm phosphorus compared to newer detergent products which have <0.1 ppm. This shows that phosphate has been removed from current laundry detergents. The present small concentrations imply that the health problems of residents in Dickson Co. must be due to either a hypersensitivity to condensed phosphates or to impurities in currently used orthophosphate compounds. Further research can be

done to develop a more sensitive method for the detection of condensed phosphates such as ^{31}P NMR techniques.

WESTERN REGION

LANE COLLEGE

JACKSON, TENNESSEE

PERSISTENT INPUT TO THE FIFTH DIGIT FOLLOWING ULNAR NERVE TRANSECTION: A ROLE FOR ANASTOMOSES IN PERIPHERAL INNERVATION. *E. F. Johnson, C. X. Li, C. McCandlish, R. Walters, and T. Beans, The University of Tennessee at Memphis, Memphis, Tennessee.* Existing data indicate that reorganization of the somatosensory cortex occurs following perturbation of peripheral nerves and the fifth digit is supplied exclusively by the ulnar nerve. The purpose of this investigation was to determine if anastomoses of peripheral nerves exists in the forearm of the cat which permits conduction of sensory information from the fifth digit to the somatosensory cortex following surgical severance of the ulnar nerve. A gross dissection of the forearm and paw of 22 cats revealed that ulnar and radial nerves anastomose in the dorsal metacarpal zone proximal to the web between the third and fourth and fifth digits in all cats. An anastomosis also occurred ventrally in the forearm between ulnar and median nerves proximally in the web between the third and fourth digits in 30% of the animals. Anastomosis of peripheral nerves should be considered in any attempt to elucidate central reorganization.

AN EXPLORATORY STUDY ON THE EFFECTS OF HUNTING PRESSURE ON WHITE-TAILED DEER (*ODOCOILEUS VIRGINIANUS*) ACTIVITY IN NATCHEZ TRACE STATE PARK. *Clay Smith and H. W. Wofford, Union University, Jackson, Tennessee.* The effects of hunting pressure on white-tailed deer (*Odocoileus virginianus*) activity were measured at Natchez Trace State Park near Lexington, Tennessee. Data were collected for 5 days (25-30 October 1994) in the area of the Park north of Interstate 40. This area received little or no hunting pressure. A total of 57 events was recorded, with a diurnal: nocturnal activity ratio of 2.2:1.0. The area of the Park south of Interstate 40 also was sampled for 5 days (11-16 November 1994). The number of hunters ranged from ca. 25 to 175, and two events were recorded. The discrepancy between the northern and southern areas was most likely due to the greater hunting pressure south of Interstate 40. The deer south of Interstate 40 may have gone deeper into the woods, into no-hunting zones within the Park, or to areas bordering the Park to avoid human disturbance.

IMMUNOCYTOCHEMICAL ANALYSIS OF HISTAMINE DISTRIBUTION IN *DROSOPHILA* MUTANTS THAT ARE DEFECTIVE IN SYNAPTIC TRANSMISSION. *Keith H. Taylor, Martin G. Burg, and W. L. Pak, Lane College, Jackson, Tennessee (KHT), and Purdue University, West Lafayette, Indiana (MGB, WLP).* For many years, the Pak laboratory has been isolating *Drosophila* mutants that are defective in photoreceptor-cell function. A large subset of these mutants, which identify ≥ 28 different genes, are known as the on-/off-transient-defective mutants. These mutants are missing the on-/off-transient components of the electroretinogram, which is an extracellular electrical recording of light induced current in the retina. The on-/off-transients are thought to arise from activity induced by the photoreceptor cells through synaptic transient-defective mutants was found to encode histidine decarboxylase (*hdc*), the enzyme which synthesizes histamine, the photoreceptor-cell transmitter. Immunocytochemical staining for histamine in the retina has demonstrated that staining differences can be detected in *hcd* mutants and several other transient-defective mutants.

The present work was undertaken to complete the immunocytochemical survey of transient-defective mutants in the Pak laboratory, which will lead to identification of mutants that are defective in synaptic transmission and the distribution of the transmitter histamine in photoreceptors. It is expected that such mutants may have defects in the packaging, transport, or release of histamine. We analyzed four mutants that had not yet been examined for defects in histamine distribution (A68, P7, w;222, and US2985) using established protocols for histamine immunocytochemistry. Tissue sections from positive (wildtype) and negative (*hcd* mutant) controls were placed with mutant fly sections on the same slide, thus allowing a carefully controlled examination of the histamine distribution. Any conclusion concerning alterations in histamine distribution was made only after several experiments gave consistent results. We found that, of the four mutants examined, three had consistent alterations in histamine distribution in the photoreceptor cell. This and previous experiments have now identified at least nine mutations which alter histamine staining and, thus, presumably affect mechanisms of packaging, transport, or release of histamine from the photoreceptor cells. These results will be used to guide further molecular genetic studies of genes and gene products identified by these mutations.

EFFECTS OF SILICONE PARTICULATE DEBRIS AS STUDIED ON THE RAT DORSAL SUBCUTANEOUS AIR-POUCH MODEL AND ON HUMAN TISSUE. *Julie Davis, Daniel G. Baker, and H. Ralph Schumacher, Lane College, Jackson, Tennessee (JD), and University of Pennsylvania, Pennsylvania, Pennsylvania (DGB, HRS).* There has been increased interest in silicone particulate debris as found in breast augmentation and joint replacements. We addressed the effects as studied in the dorsal subcutaneous air pouch of the rat. Silicone implants were ground, filtered through a series of filters to obtain smaller sized particles, and sterilized by gamma irradiation. Male Sprague-Daley rats were injected subcutaneously with 20 ml of sterile air to produce a synovial-like pouch and injected with silicone. At 6 and 24 h, white-blood-cell counts on exudates were at inflammation levels. At 72 h, white-blood-cell counts were at noninflammatory levels, but histologic sections showed two to five layers of lining cells with some PMN and scattered lymphocytes. There were deep vascular congregates of silicone which appeared focal, but massive foamy cells were found. Silicone is capable of producing prolonged inflammatory reactions in the rat air-pouch model. The chronic and relatively prolonged reaction to some silicone suggests that an inflammatory reaction may be seen after human implantation of silicone. The air-pouch model is a good system for assessing a time course of inflammation induced by silicone particles.

EFFECTS OF PHYSIOLOGICAL AND TOXIC METALS ON THE CONTRACTION OF GLYCERINATED RABBIT PSOAS MUSCLE. *Andrea B. Roth and H. W. Wofford, Union University, Jackson, Tennessee.* The effects of three physiological metals (Fe, Zn, and Cu) and three toxic metals (Pb, Cd, and Hg) on the contraction of glycerinated psoas muscle of rabbit were examined. Four different dilutions of each metal solution were added to glycerinated psoas muscle fibers of rabbit. A solution containing 0.25% ATP plus 0.05 M KCl plus 0.001 M MgCl₂ was applied. The lengths of the muscle fibers before and after the addition of the ATP and salt solution were measured. All six metals inhibited muscle contraction in a dose-dependent manner, regardless of whether they were considered physiological or toxic. A possible explanation for the results involving a metal-ATP complex is given.

EFFECTS OF pH AND FERTILIZER CONCENTRATION AND PLACEMENT ON TAP ROOT ELONGATION IN COTTON (*GOSSYPIUM HIRSUTUM*). *Teresa Buck and H. W. Wofford, Union University, Jackson, Tennessee.* Short-term experiments were con-

ducted to determine the effects of hydrogen ion, fertilizer concentration, and fertilizer placement on primary root elongation of cotton (*Gossypium hirsutum*). Growth-chamber experiments were done using a glass-front box and five soil samples with different pH levels. Further studies were conducted to determine the effects of fertilizer concentrations as well as placement on the primary root on growth of cotton plants. It was found that extremes in concentration of hydrogen ion of soil can inhibit root growth. It also was determined that the addition of adequate fertilizer concentrations as well as their placement play a vital role in the development of the primary root and secondary roots.

ANALYSIS OF CELLULOSE ACETATE ELECTROPHORESIS ON THE ESTERASES OF *ANTHONOMUS GRANDIS*. *Valentine C. Emechete and Charles J. Biggers, The University of Memphis, Memphis, Tennessee.* Cellulose acetate electrophoresis was used to examine the esterases of the cotton boll weevil, *Anthonomus grandis*, Boh. The objective of this study was to determine the effectiveness of cellulose acetate in comparison to polyacrylamide-gel electrophoresis. In the study, different buffers, voltages, and durations of current were examined. The following parameters produced the best results: current duration of 25 min; pH 8.8 (HR Buffer); constant voltage of 120. Cellulose acetate electrophoresis exhibited results similar to polyacrylamide-gel electrophoresis. Cellulose acetate has the advantage of requiring less time and less sample. The advantage of using such a small sample (3 μ l) is of particular interest in our laboratory because frass from one weevil can be assayed and the animal can still be used for genetic matings.

EFFECT OF THIAMINE DEFICIENCY UPON CHOLINE, CREATINE, AND N-ACETYLASPARTIC ACID IN THE BRAIN. *Peter R. Martin, Ronald Price, H. Lee, James B. Tarter, and H. W. Wofford, Vanderbilt University Medical Center, Nashville, Tennessee (PRM, RP, HL), and Union University, Jackson, Tennessee (JBT, HWW).* Twenty-two male Sprague-Dawley rats were deprived of thiamine via a regiment of thiamine-deficient chow and daily, intraperitoneal injections of pyriithiamine hydrobromide (0.25 mg/kg body weight) for 12 days. Spectra of the frontal cortex of each rat on days 0, 5, 9, and 12 were obtained by proton nuclear magnetic resonance spectroscopy. Six of the rats received thiamine replacement injections (i.p., three of 5 mg/kg, two of 100 mg/kg, and one of 300 mg/kg) on day 12 2 h prior to scan. Measurements of the relative concentrations of choline-containing compounds [Cho], creatine [Cr], and n-acetylaspartate [NAA] were calculated. The change in [Cr]:[NAA] ratio was insignificant (>50%). A thiamine replacement dosage of 100 mg/kg returned the [Cho]:[NAA] to day 0 levels in 2 h. It is thought that these data reflect a decrease in the amount of free choline synthesized from the fatty acids produced by the pentose phosphate pathway due to the inactivation of the thiamine-dependent transketolase enzyme.

EFFECT OF TEMPERATURE ON HPLC RESOLUTION OF DIPHENOLS IN COCKROACH CUTICLE. *Tara K. Donnelly and Joseph A. Sam, Bethel College, McKenzie, Tennessee.* At ambient temperature (22-27°C), electrochemical HPLC analysis of diphenolic compounds in adult cockroach cuticle showed a major chromatogram peak with a retention time the same as that of catechol (7-8 min). As temperature increases, catechol appears as a separate peak. This major cuticle peak also has the same retention time as N-acetyldopamine at ambient temperature as well as at increased temperature. Analysis of catechol and N-acetyldopamine standards under similar conditions between 20 and 50°C showed no resolution between 22 and 27°C. Increasing or decreasing temperature resulted in separation of these peaks. In cockroach cuticle, some unidentified peaks disappeared as temperature increased.

SYNTHESIS OF LIGANDS AND OXIDATIVE ADDITION WITH W(0) CARBONYL-METAL COMPLEX. *Latorya D. Hicks and Thomas G. Richmond, Lane College, Jackson, Tennessee (LDH), and University of Utah, Salt Lake City, Utah (TGR).* The basis of this research deals with the idea of altering and controlling the properties of metal complexes by the preparation of new types of ligands that are able to activate strong C-heteroatom bonds. The oxidative addition of carbon-halogen bonds is often a key step in metal-catalyzed functionalization of organic substrates. We have prepared a ligand-based system for the cleavage of C-halogen bonds at a tungsten-carbonyl center to form stable oxidative addition products. The ligands are simply prepared and the tungsten-carbonyl center is characterized by infrared and H NMR spectroscopy.

MOBILIZATION OF FERRITIN-BOUND IRON BY TADPOLE ERYTHROCYTE FERRIREDUCTASE: MEMBRANE PROTEIN. *Julie K. Douglass and Charles R. Thomas, The University of Tennessee at Martin, Martin, Tennessee.* Ferrireductase activity was observed in lysates of erythrocytes from tadpoles of *Rana catesbeiana*. It increased the rate of reduction of ferritin iron, releasing Fe(II) ions. The assay was done under N₂ so that FMNH₂ reacted with ferritin and not with O₂. Glucose and glucose oxidase were added to consume O₂ before adding NADH. Gel permeation columns were used to separate ferrireductase from hemoglobin. All or part of the activity eluted in the void volume of every gel tested, with exclusion limits up to 8 x 10⁶ D. However, in 1% Triton X-100 its elution from Bio-gel A 0.5 m gave an estimated molecular weight of 0.2 x 10⁶ D. Triton solubilizes membrane proteins; so, the alteration of elution behavior suggests that ferrireductase may be a membrane protein.

ADDITIVE EFFECTS OF TWO cGMP MECHANISMS ON VASODILATION OF ISOLATED GUINEA PIG AORTAS. *M. L. Morgan, E. Novalija, and D. F. Stowe, Lane College, Jackson, Tennessee (MLM), and Medical College of Wisconsin, Milwaukee, Wisconsin (EN, DFS).* Hearts preserved for long periods by hypothermia demonstrate vasoconstriction with normothermic reperfusion. Our aim was to explore methods to maintain vasodilatory responses after hypothermic preservation. To do so, we conducted experiments where we studied the effects of vasodilator agents on smooth muscle electrophysiology and contractility using the isolated vessel ring preparation. The studies were conducted on rings cut from aortas isolated from hearts after the 4-h reperfusion period. The aortic rings will be measured for cGMP content in future studies. Zaprinast and nitroprusside are two diverse acting vasodilators. Zaprinast prevents a cGMP breakdown by inhibiting the enzyme PKE IV. Nitroprusside directly increases cGMP levels in the tissue. cGMP causes vasodilation and increases coronary flow by reducing the number of intracellular calcium ions. We compared the effects of these two in increasing resting coronary flow, vascular responsiveness, and contractility after cold perfusion. The studies are still underway. We also conducted dose-response curves for nitroprusside and zaprinast in the isolated heart. The concentrations of nitroprusside and zaprinast that individually reduced flow and increased coronary-sinus oxygen tension by 50% were determined. The coronary-flow IC_{50s} for nitroprusside was 0.8 x 10⁻⁶ M and for zaprinast was 6.1 x 10⁻⁶ M. The PO_{2es} IC_{50s} was 0.7 x 10⁻⁶ M for nitroprusside and was 6.9 x 10⁻⁶ M for zaprinast. We found that the coronary-flow increase with zaprinast was ca. 12% and ca. 13% with nitroprusside. The increases in coronary flow with nitroprusside and zaprinast together were more than double (26%) the flow increases with nitroprusside and zaprinast alone. In the aortic rings, the IC_{50s} for a 50% decrease in tension were 0.1 x 10⁻⁶ M for nitroprusside and 3 x 10⁻⁶ M for zaprinast. There are current studies for the effects of the two together.

GENETIC ANALYSIS OF BODY COLOR IN ANTHONOMUS GRANDIS. *Amy L. Crabtree, Bob R. Jones, and Charles J. Biggers, The University of Memphis, Memphis, Tennessee (ALC, CJB) and Rhodes College, Memphis, Tennessee (BRJ).* Analysis of body color in the cotton boll weevil, *Anthonomus grandis* Boh., was done on weevils collected in pheromone traps in Tipton, Haywood, Gibson, Obion, Fayette, Dyer, Madison, and Lauderdale counties in western Tennessee. Three distinct color patterns (ebony, bronze, and red) were found. The weevils from the various counties were classified as to color and subjected to Hardy-Weinberg equilibrium analysis and statistically tested with Chi square. The results showed that the deviation from expected for the individual counties were all out of Hardy-Weinberg equilibrium ($P > 0.001$). Compared to expected, the observed frequencies for ebony and red were found to be low, while the frequency of bronze was found to be high. Reasons for the unexpected deviation are discussed.

COMPOSITION OF RAT INCISORS AS AFFECTED BY GNAWING ACTIVITY. *Carolyn Jaslow and Joel McLure, Rhodes College, Memphis, Tennessee.* The purpose of our experiment was to determine if increased gnawing activity during development of rat incisors could produce changes in dentin and enamel deposition. Rats 21 days old were divided into two groups. The control group was fed a diet of rat chow ad lib.; the experimental group was fed rat chow and chew bones ad lib., assuming the chew bones would impose more vigorous mechanical demands. The two groups were classified further according to rats sacrificed at 3 and 5 months. Right upper and lower incisors were removed and sectioned midway between the point of eruption and the base of the incisor bevel. Measurements of dentin and enamel areas by tracing and widths from four dentin loci and one enamel locus were recorded. Dentin and enamel development differed significantly between 3- and 5-month-old animals and showed trends of variation between controls and experimentals.

MAPPING OF THE INCISOR TOOTH REPRESENTATION IN THE SOMATOSENSORY CORTEX OF THE ADULT RAT. *E. F. Johnson, C. X. Li, C. McCandlish, R. Waters, and A. Dirghangi, The University of Tennessee at Memphis, Memphis, Tennessee.* The purpose of this investigation was to determine the location of the incisor tooth representation in the somatosensory cortex barrel subfield of the adult rat using anatomical and neurophysiological techniques. Determining the location of a specific tooth subfield representation is important in elucidating the consequences of inferior dental nerve perturbation on plasticity of the brain. To date, several investigations have successfully located the upper and lower jaw barrel field representations. However, no one has successfully documented the barrel subfield for the dentition. Mechanical stimulation of the lower incisor teeth produced biphasic evoked potentials in the somatosensory cortex in the three animals of this study. Mapping of electrode penetrations and specifically placed electrolytic lesions indicated that the lower incisor tooth representation of the somatosensory cortex is located in a barrel-free, but cell-dense area that is contiguous with but slightly rostral and medial to the lower jaw barrel subfield.

A STUDY OF IMPROVEMENT OF ELECTROPHORETIC TECHNIQUES ON THE ESTERASES OF ANTHONOMUS GRANDIS. *Reginald C. Udouj, Jr., and Charles J. Biggers, The University of Memphis, Memphis, Tennessee.* This study was made to determine the most effective technique of separation of esterases of the cotton boll weevil (*Anthonomus grandis*). The parameters investigated were pulsed-field electrophoresis and variation in voltage and duration of current. Native polyacrylamide-gel electrophoresis was used throughout the study. The samples used were whole-body specimens and frass