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ABSTRACTS OF PAPERS PRESENTED AT THE 113TH MEETING

BOTANY SECTION

JEFF LEBKUECHER, CHAIR

MANAGING TABLE MOUNTAIN PINE (*PINUS PUNGENS*) FORESTS WITH PRESCRIBED FIRE. ***Nicole Turrill Welch,*** *Middle Tennessee State University, Murfreesboro, Tennessee.* Table Mountain pine (*Pinus pungens* Lamb.) is a fire-dependent species endemic to the southern Appalachian Mountains. Cones of *P. pungens* are serotinous and stand regeneration requires medium to high-intensity fires that release seed, expose mineral soil, and open the forest canopy. Historically, *P. pungens* forests have been maintained by lightning- and human-caused fires. Following more than 65 years of fire suppression, most stands have increased densities of chestnut oak (*Quercus prinus* L.) and scarlet oak (*Q. coccinea* Muench.) as well as fire-intolerant species such as red maple (*Acer rubrum* L.). Regeneration of *P. pungens* is more successful by wildfire than by prescribed fire, as current prescribed burning guidelines limit our ability to achieve medium to high-intensity burns. Furthermore, something seems to be inhibiting *P. pungens* regeneration in some stands, even following medium- or high-intensity prescribed fires. Future studies will assess the effects of soil chemistry on *P. pungens* seed germination and oak competition on seedling survival.

NOTES ON THE DISTRIBUTION OF RARE PLANT SPECIES ON CEDARS OF LEBANON STATE FOREST, WILSON COUNTY, TENNESSEE. ***Claude J. Bailey Jr.,*** *Tennessee Department of Environment and Conservation, Division of Natural Heritage, Nashville, Tennessee.* Cedars of Lebanon State Forest is a 7,986-acre state forest and natural area located within the central basin of southwestern Wilson County, Tennessee. A biological assessment of the various habitats within the forest was conducted by the Division of Natural Heritage to aid Tennessee Division of Forestry in its land management responsibilities. The focus of this presentation is to report the distributions and occurrences of rare plant species both relocated and discovered in our work. The Division of Natural Heritage currently tracks 192 occurrences of 16 rare plant species within Cedars of Lebanon State Forest. Thirteen of these 16 are indicative of the limestone cedar glade habitats found in abundance within the forest boundaries. The abundance of rare cedar glade flora such as *Astragalus tennesseensis, Phlox bifida* ssp. *stellaria,* and *Talinum calcaricum* emphasizes the value of the Cedars of Lebanon State Forest as a globally significant nature preserve.

THE STATUS OF *CASTANEA DENTATA* AT LAND BETWEEN THE LAKES, STEWART COUNTY, TENNESSEE AND TRIGG COUNTY, KENTUCKY. ***Joe Schibig and Michael Hill****, *Volunteer State Community College and Austin Peay State University, Clarksville, Tennessee.* A study of native *Castanea dentata* specimens was conducted in Land Between the Lakes (Trigg County, Kentucky and Stewart County, Tennessee) from May 2002 to October 2003. For each specimen, GPS coordinates, size, flowering status, presence of blight, elevation, soil series, geological formation, openness of canopy, associated tree species, and other notations were recorded in an Excel spreadsheet. A total of 230 live specimens were located, all on the western edge of Land Between the Lakes. Eight had diameters at breast height (dbh) ≥ 10.2 cm; the largest was 28 cm (dbh) and 14 m tall. Twenty-six specimens (11.3%) showed signs of blight. The elevation range for chestnuts was 110–189 m (average elevation, 140 m). All specimens were found on well-drained, gravelly, acidic soils (28.3% on Baxter-Hammock; 23.5% on Bodine Cherty Silt Loam; 18.3% on Brandon-Saffel; 13.9% on Saffel; 8.3% on Brandon Silt Loam; 5.2% on Guin gravelly loam; 1.7% on Nixa Cherty silt loam and 0.9% on Hammack-Baxter). These soils were derived primarily from the cherty Mississippian limestones of the Fort Payne Formation or from Cretaceous gravels. Most (75%) chestnuts were found on very xeric sites (ridges and south to west-facing slopes) and 86 percent of the specimens were in woods with a somewhat open canopy. The species most often associated with *C. dentata* were *Quercus prinus, Q. velutina, Q. coccinea, Acer rubrum, Oxydendrum arboreum,* and *Vaccinium* spp.

FOUR DECADES OF FLORISTIC STUDIES IN LAND BETWEEN THE LAKES, KENTUCKY AND TENNESSEE. ***Edward W. Chester,*** *Austin Peay State University, Clarksville, Tennessee.* Land Between the Lakes (LBL), a National Recreation Area in southwestern Kentucky and northwestern Middle Tennessee, is managed by the United States Department of Agriculture Forest Service (formerly by the Tennessee Valley Authority). The 69,000-ha area is surrounded on three sides by water; the impounded Tennessee River is on the west side, the impounded Cumberland River is on the east, and a canal connecting the two rivers forms the northern boundary. The southern boundary approximates Highway 79. The area is more than 80 percent forested and has been botanically studied for 40 years. This report provides descriptive information as well as floristic analyses that include a numerical summary of the major taxonomic categories, a list of reported but excluded taxa, rare taxa, the woody and introduced components, and floristic affinities. The botanical literature of the area is referenced.

THE VASCULAR FLORA OF FORT DONELSON NATIONAL BATTLEFIELD AND CEMETERY, STEWART COUNTY, TENNESSEE. ***Edward W. Chester,*** *Austin Peay State University, Clarksville, Tennessee.* Fort Donelson National Battlefield and Cemetery is a 250-ha (600-acre) historic site in Stewart County, northwestern Middle Tennessee that preserves the site of a major Civil War battle. The impounded Cumberland River (Lake Barkley) forms the northern boundary. The northwestern boundary

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is Hickman Creek; other boundaries are without natural demarcations. Indian Creek bisects the Park, generally running south to north. The river, and lower sections of both creeks, are subjected to fluctuating water levels of about five feet between winter (low levels) and summer pools. The topography is mostly dissected uplands with ridges, slopes of various aspects, and ravines. Habitat types range from older hardwood forests, successional fields, limestone outcrops, cultural sites, and mudflats as waters decline in autumn. This paper reports the results of floristic studies from 1982–1985 and from 2000–2002, with occasional visits between. As now known, the vascular flora consists of 718 taxa representing 110 families and 395 genera. Nearly 23 percent (163 species) of the flora is not indigenous. The largest families are the Asteraceae, Fabaceae, and Poaceae. The largest genera are *Carex, Eupatorium, Polygonum,* and *Quercus* II (12 each). Six taxa are state-listed; one of these is federal-listed.

FLORISTIC STUDIES WITHIN THE DUCK RIVER UNIT OF THE TENNESSEE NATIONAL WILDLIFE REFUGE, HUMPHREYS COUNTY, TENNESSEE. ***Stephanie M. Gunn* and Edward W. Chester**, Austin Peay State University, Clarksville, Tennessee.* The Duck River Unit of the Tennessee National Wildlife Refuge includes 10,817 ha in Humphreys County, Tennessee. It is managed by the United States Fish and Wildlife Service, primarily to provide food, water, and cover for resident, migratory, and over-wintering waterfowl. Most of the unit is bottomlands of the impounded Tennessee and lower Duck Rivers (Kentucky Reservoir) that were agricultural prior to 1945. Management practices include wildlife plantings, agricultural production, and pools where dams and watergates allow water-level manipulations. Wetland habitat and community types include swamps, sloughs, marshes, wet meadows, dewatered zones, permanent deep water, variable shorelines, and bottomland forests. Although limited in area, uplands with secondary forests, successional fields, bluffs and outcrops, home sites, and cemeteries add to habitat diversity. Forty-nine collecting trips in 2001–2003 documented the vascular flora that is known to include 95 families, 408 genera, and 718 species. Over one-half of the species encountered were county records and one [*Echinochloa walteri* (Pursh) Heller] was a state record. Introduced taxa (121) constitute almost 17 percent of the flora; 145 taxa (20.2 percent) are woody. Large families are the Asteraceae, Cyperaceae, Fabaceae, Fagaceae, Lamiaceae, Poaceae, Rosaceae, and Scrophulariaceae. Large genera are *Carex, Cyperus, Desmodium, Eupatorium, Polygonum, Quercus and Solidago.* Six taxa are on the Tennessee elements of concern list.

DEVELOPMENT OF A COMPUTERIZED HERBARIUM CATALOGUE FOR THE HENNING MUSEUM, BRYAN COLLEGE. ***Colin Plank* and Todd C. Wood**, Bryan College, Dayton, Tennessee.* The herbarium of the Willard Henning Museum contains 2,400 dry-pressed and other specimens collected primarily from the eastern United States. In an attempt to organize the catalogue after a spring, 2000 fire many of the museum exhibits and remaining specimens were catalogued electronically using Microsoft Access. To make these records more accessible, they were moved to MySQL, reducing data redundancy and improving their potential usefulness. Records can now be searched on the Internet by common name, genus, species, and specimen identification number. An advanced search option allows more specific searching of other specimen attributes. The database and all related programs operate on public license software including Linux and Apache, with custom CGI scripts written in Perl. Search results display information and images of specimens as well as integrated search options for GenBank's Taxonomy database, Tree of Life, and the Integrated Taxonomic Information System. The catalogue may be searched at *http://www.bryancore.org/museum/.*

CHARACTERIZATION OF A NOVEL REPETITIVE ELEMENT BOUNDED BY DIRECT TANDEM REPEATS IN THE RICE (*ORYZA SATIVA* L.) GENOME. ***Matthew Croxton* and Todd C. Wood,** Bryan College, Dayton, Tennessee.* Two drafts of the rice (*Oryza sativa*) genome provide opportunity for repetitive and transposable element discovery. We compared the genome of rice subspecies *japonica* to the draft sequence of ssp. *indica* to detect novel repeat sequences. Our results revealed a 1030-nucleotide repetitive element bounded by short, direct repeats in *indica* Contig 462. Based on FASTA searches of the *japonica* and *indica* genome drafts, we discovered that the repeat is almost 14 times more frequent in *japonica* (748) than in *indica* (54). Even when correcting for the unsequenced fraction of *indica,* the discrepancy is still about 10 fold; implying expansion of the element in *japonica* since diverging from its common ancestor with *indica.* BLAST searching of GenBank revealed that the novel repeat shares homology with a 3622-nucleotide LTR of retrotransposon *dagul.* Although derived from the *dagul* LTR, the length discrepancy implies that the novel repeat is probably not a solo LTR.

THE EVOLUTION OF TERMINAL INVERTED REPEATS OF RICE (*ORYZA SATIVA* SSP. *INDICA*) MINIATURE INVERTED-REPEAT TRANSPOSABLE ELEMENTS (MITES). ***Leah Lavoie* and Todd C. Wood,** Bryan College, Dayton, Tennessee.* Miniature Inverted-repeat Transposable Elements (MITEs) are a recently discovered class of transposable elements characterized by small size and short Terminal Inverted Repeats (TIRs). Although the mechanism of MITE transposition is poorly known, the TIRs of MITEs are thought to be important for transposition. If so, the sequences of active MITE TIRs should be highly conserved in the rice genome. We studied MITE TIRs by surveying the rice (*Oryza sativa* ssp. *indica*) genome draft using FASTA. Our results revealed discrete size variations in MITEs *Crackle* and *Castaway.* In *Castaway* MITEs, two independent sets of TIRs mark the boundary of the two size classes. In *Crackle* MITEs, a palindromic sequence that occurs 8–12 times within the MITE accounts for discrete size classes. We discovered one position in the *indica* genome where an internal segment of *Crackle* bounded by palindromic sequences had been excised. This evidence confirms the importance of TIRs for MITE transposition.

SEQUENCE ALIGNMENTS REVEAL TWO CLASSES OF TOURIST MINIATURE INVERTED-REPEAT TRANSPOSABLE ELEMENTS ON RICE (*ORYZA SATIVA* L.) CHROMOSOME 10. ***Todd C. Wood,** Bryan College, Dayton, Tennessee.* Because Miniature Inverted-repeat Transposable Elements (MITEs) transpose by an enzyme not encoded by the MITE, MITE size variation occur frequently. I surveyed the complete sequence of rice (*Oryza sativa japonica* cv. Nipponbare) for the common MITE *Tourist* using FASTA. Although the *Tourist* sequence used as a query for FASTA searching was 165 nucleotides long, a size variant of 150 nucleotides was encountered 101 times, constituting 29% of the 348 *Tourist* elements detected on chromosome 10. Using flanking sequences of one of these trun-

cated *Tourist* elements as a FASTA query, a novel 350-nucleotide repetitive element was discovered. This novel element completely contains the truncated *Tourist* element, but the additional sequence does not correspond to any previously identified transposable elements. Multiple sequence alignments of these longer *Tourist* sequences reveal imperfect 14-nucleotide terminal inverted repeats with a target site duplication of TTA or TAA. I conclude that this longer *Tourist*-containing element is a MITE.

THE RIPARIAN FLORA OF ROCK CREEK IN THE PICKETT STATE FOREST, TENNESSEE. ***Bethany Alley and S. K. Ballal,*** *Tennessee Technological University, Cookeville, Tennessee.* A floristic analysis was conduced at the Pickett Fate Forest, Tennessee for late spring and summer flora of 2003. Emphasis was placed on the riparian flora of Rock Creek, which flows through the state forest. Riparian areas are the interfaces between terrestrial and aquatic ecosystems. The Pickett State Forest is located on the Cumberland Plateau of Tennessee with an average elevation of 2,000 feet above sea level. The Cumberland Plateau is bound on the west of the Highland Rim and overlooking the Great Valley of East Tennessee to the east. In our analysis, six distinct habitats were observed, including: aquatic, alluvial woods, cobble bars, sandy alluvial woods, ruderal, and riparian periphery. The mouth of Rock Creek begins a half-mile off Backhouse Road, crosses under Highway 154, and eventually enters the Big South Pork National River and Recreational Area. The River finally empties into the Cumberland River in Kentucky. In this investigation, fifty-four species from twenty-five families were documented within a twelve-mile study area. It has been suggested by earlier researchers that many rare species are found in the riparian habitats in Tennessee; in the present investigation only one rare species, *Sanicula canadens,* was found.

THE PHYSIOLOGICAL SIGNIFICANCE OF NONPHOTOCHEMICAL DISSIPATION OF EXCESS LIGHT ENERGY BY THE PHOTOSYSTEM-II CORE DURING THE DEVELOPMENT OF PHOTOCHEMISTRY. ***Jefferson G. Lebkuecher, Mandi M. Coleman*, Stephanie M. Gunn*, James O. Harmon*, Rebecca A. Houtman*, Rhonda P. Johnston*, Tanya M. North*, and April S. Warren****, *Austin Peay State University, Clarksville, Tennessee.* Nonphotochemical dissipation of excess absorbed light energy is essential to prevent prolonged reduction of quinones which will damage photosystem (PS)-II. Dissipation of excess light energy by the PS-II core is not physiologically significant in mature leaves relative to the dissipation of excess light energy as heat associated with xanthophyll pigment conversions. We tested the hypothesis that prior to the development of maximum capacities for dissipation of light energy by photosynthesis and as heat, the magnitude of nonphotochemical dissipation by the PS-II core is sufficient to limit prolonged reduction of quinone$_A$. Etiolated *Helianthus annuus* L. cotyledons were exposed to 200-μmol photons.m^{-2}s^{-1} for 6 h to initiate chloroplast development. One-half of the cotyledons were treated with DCMU to inhibit linear electron transport and xanthophyll-associated dissipation of excess light energy as heat. The concentration of oxidized Q_A and the magnitudes of light energy-transduction mechanisms of untreated and DCMU-treated cotyledons were evaluated using modulated chlorophyll *a* fluorescence. The results demonstrate the potential for dissipation of excess light energy by the PS-II core is sufficient to maintain an optimal fraction of oxidized Q_A prior to the development of maximum capacities for photosynthetic electron transport and dissipation of excess light energy as heat.

COMPARATIVE ECOPHYSIOLOGY OF *ASTRAGALUS BIBULLATUS AND ASTRAGALUS CRASSICARPUS* (FABACEAE). ***Carol J. Baskauf and Dustine Reppuhn,*** *Austin Peay State University, Clarksville, Tennessee and Alexandria, Virginia.* In a comparative greenhouse growth experiment, the endangered cedar glade endemic *Astragalus bibullatus* grew best under medium to high light and moisture conditions. Very low soil moisture and dense shade strongly inhibited growth. Its widespread prairie congener, *A. crassicarpus,* grew best with medium light levels and high soil moisture. After two months of growth, *A. bibullatus* averaged almost twice as many leaves as *A. crassicarpus* and 2.5 times as much dry biomass. Leaf number and biomass production were uniformly low for both species under conditions of low light and/or low moisture, but the gap between the species widened as light and/or moisture levels increased. Photosynthetic light response curves indicate that *A. crassicarpus* has higher rates of photosynthesis than *A. bibullatus.* Maximum rates for both species are in the range typical for heliophytes. Water potential decreased as soil dried, but *A. crassicarpus* averaged lower water potentials than did *A. bibullatus.*

THE EFFECTS OF ACID RAIN ON SUNFLOWER PLANT GROWTH. ***J. L. McElhiney*, S. J. Ramos*, and D. S. Burton,*** *Austin Peay State University, Clarksville, Tennessee.* Abstract not available

CELL AND MOLECULAR BIOLOGY

MATT ELROD-ERICKSON, CHAIR

INITIAL PROTOCOL FOR ISOLATING CHICKEN LIVER PHOSPHATASE INVOLVING A PROTOTYPE GRADIENT MAKER. ***Marcia M. Schilling* and Robin B. Reed,*** *Austin Peay State University, Clarksville, Tennessee.* Kinases and phosphatases work to add or remove phosphate groups from molecules in the cell, respectively. In liver cells, phosphatase transfers play vital roles in activating or inhibiting the enzymes of gluconeogenesis and glycolysis that regulate blood sugar in the organism. Isolation of distinct phosphatases from liver tissues might lead to further detailing of these processes. Past protocol revealed that a gradient system was commonly used during column chromatography when isolating phosphatases. A prototype was constructed using lab equipment and tested for its reliability. Chicken liver tissues were then homogenized, applied to a DEAE cellulose column for chromatography, and resulting fractions were tested spectrophotometrically for phosphatase activity using p-nitrophenylphosphate as a substrate. One active fraction was concentrated and subjected to SDS-polyacrylamide gel electrophoresis. The resulting gel displayed a prominent band whose molecular weight was around 33,000 Da.

PROTEIN SORTING INTO TRANSPORT VESICLES AT THE ENDOPLASMIC RETICULUM. ***Matthew J. Elrod-Erickson,*** *Middle Tennessee State University, Murfreesboro, Tennessee.* Eukaryotic cells are comprised of a number of organelles that each perform a unique function. To maintain this organization, organellar proteins must be faithfully targeted and transported from the cytosol to their final destination. Secretory proteins pass

through a series of organelles during their transport, carried in vesicles that bud from one compartment and fuse to the next. A key question is how the appropriate proteins are sorted into these vesicles so that proteins destined for later compartments are moved forward while residents of an organelle are retained. The *bst1* gene of *Saccharomyces cerevisiae* plays an important role in this process at the endoplasmic reticulum (ER). Mutations in this gene cause a variety of non-lethal sorting defects. A subset of proteins leave the ER more slowly in *bst1* mutants, while resident ER proteins are secreted aberrantly. *Bst1p* may influence the membrane in the vicinity of budding vesicles and thereby affect sorting.

PROTEIN MODELING OF RIBOSE-1,5-BISPHOSPHATE CARBOXYLASE OXYGENASE USING RAZMOL. ***T. Justin Durham*, S. K. Ballal, and Scott H. Northrup**, Tennessee Technological University, Cookeville, Tennessee.*
Abstract not available

CLONING AND CHARACTERIZATION OF YEAST LEUKOTRIENE A4 HYDROLASE. ***Carrie Romer*, Daniel Dorset*, Christopher Meyer*, Michael Thompson, and Rebecca Seipelt**, Middle Tennessee State University, Murfreesboro, Tennessee (CR, DD, CM, RS) and Vanderbilt University, Nashville, Tennessee (MT).* Human leukotriene A4 hydrolase is a bifunctional enzyme that converts the eicosanoid intermediate leukotriene A4 into leukotriene B4, a molecule that recruits leukocytes to endothelium. It also possesses an aminopeptidase activity, hydrolyzing one amino acid at a time from the amino terminus of its peptide substrates. Budding yeast possess a gene which encodes a protein that is highly similar to leukotriene A4 hydrolase. To characterize the yeast protein and its substrates more fully, we used polymerase chain reaction (PCR) to amplify the gene from yeast genomic DNA and to add an affinity tag for protein purification. The DNA fragment was ligated into a yeast expression vector and colonies were screened by PCR for the presence and orientation of the DNA insert. Four clones with the correct orientation were identified and transformed into yeast. Further studies will involve protein expression and purification, analysis of substrate specificity, and characterization through mutational analysis.

CHEMISTRY

MARTIN V. STEWART, CHAIR

EVALUATING THE INFORMATION CONTENT OF A NEWLY DEVELOPED MOLECULAR DESCRIPTOR. ***Donald P. Visco Jr.,** Tennessee Technological University, Cookeville, Tennessee.* The recently introduced Signature molecular descriptor is based on an extended valence sequence and belongs to the class of fragmental descriptors including holograms, molecular subgraphs, and tree fingerprints. Like other fragmental descriptors, Signature performs well in QSAR analyses. However, signature appears to be the only descriptor that can fully control degeneracy or, in other words, control the number of molecular structures matching a given descriptor value. Thus, Signature appears to be the descriptor of choice to study information content in QSAR analyses. We study here the effect of increasing the Signature information content, via increasing the Signature height, in two series of QSAR analyses. One for log P prediction and a second for HIV-1 protease inhibitors binding affinities calculations.

THERMODYNAMIC MODELING OF AQUEOUS-HYDROGEN FLUORIDE SYSTEMS. ***Barath Baburao* and Donald P. Visco Jr.,** Tennessee Technological University, Cookeville, Tennessee.* A new model including cross association is proposed to describe the thermodynamic properties of aqueous hydrogen fluoride (HF) mixtures. Pure water and pure HF phase equilibrium properties are modeled using an association scheme that allows only the formation of monomers and dimers (M-D model). The vapor liquid equilibrium data of aqueous HF mixtures at various available experimental conditions are correlated using this M-D model by including cross association. The results are compared with an earlier unconstrained association model and this same M-D model with no cross association terms. The results comment on the significance of the inclusion of cross association terms in aqueous HF mixtures. The model is also used to predict the phase equilibrium properties of this mixture at conditions where experimental determinations have not been attempted before.

BUILDING MACROMOLECULES FROM PSEUDOATOMS. ***Tibor Koritsanszky,** Middle Tennessee State University, Murfreesboro, Tennessee.* A central problem of computational chemistry is to predict electrostatic properties of large systems from those of constituent atoms. Two atoms are chemically equivalent if they have nearly identical local contribution to the total molecular electron density. Any atomic-level decomposition of a molecular density must compromise between transferability and locality. The isolated atom is an extreme reference processing both of these features. Information theory predicts the stockholder partition scheme the one which assimilates the isolated-atom reference information in an optimum manner. Pseudoatoms on the other hand, provide the most economic and precise analytic representation of the density. However their locality and transferability are subject to the radial functions applied in the expansion. We combined these two methods to derive radial functions for bound atoms. The stockholder pseudoatoms obtained can be used not only as building blocks in constructing macromolecules but also as units in density fitting to X-ray diffraction data.

A COMPUTATIONAL LOOK AT SELECTED ORGANOSILYLMAGNESIUM COMPOUNDS. ***William H. Ilsley,** Middle Tennessee State University, Murfreesboro, Tennessee.* Preliminary Hartree-Fock calculations have been performed on several organosilylmagnesium compounds in an attempt to establish base-line geometric parameters for this class of compounds. The calculations were carried out using the 3–21G* and or the 6–31G** basis set using PC Spartan Pro. The results of these calculations will be discussed in relation t o the effect of substitution on bond length and the basic geometry of these compounds. The frontier orbitals and electrostatic potential maps of the compounds will also be discussed.

QUICKSILVER: LEAD'S TOXIC AND ENVIRONMENTAL TWIN. ***Todd Kuiken* and Hong Zhang,** Tennessee Technology University, Cookeville, Tennessee.* Lead and mercury, both highly toxic, pose similar threats to the environment. Both can travel long distances in the atmosphere. Divalent Hg and Pb compounds tend to be ionic and water-soluble and thus can be removed by rain or attach themselves to particles, undergoing dry deposition. Both can be methylated to become highly toxic methyl-species

and thus bioaccumulated along the food chain. Lead was first used on a major industrial scale in gasoline because of its anti-knock properties. The major source of anthropogenic mercury is coal combustion. After years of debate, lead was finally recognized as a public health threat and steps were taken to reduce the amount of lead released into the environment. The same debate is currently taking place regarding mercury. We should take the lessons learned from lead and proactively take steps to protect the public health and the environment against the threats mercury poses.

DRIVING FORCE FOR DIEL CHANGE OF DISSOLVED GASEOUS MERCURY LEVELS IN SURFACE FRESHWATERS. ***Hong Zhang, Chris Dill*, Todd Kuiken*, Jerome Nriagu, and Steve Lindberg,*** *Tennessee Technological University, Cookeville, Tennessee (HZ, CD, TK), School of Public Health, University of Michigan, Ann Arbor, Michigan (JN), and Environmental Sciences Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee (SL).* Dissolved gaseous mercury (DGM) exhibits diel trends peaked around noontime following solar variation. Recent studies at Saginaw Bay (SB), Michigan, further confirmed this phenomenon in freshwaters. The driving force behind it may include Hg(II) photochemical reduction and emission and oxidation of DGM. Our study of DGM photochemodynamics in Cane Creek Lake (CCL) at Cookeville, Tennessee, a small lake with little wind-induced turbulence, also showed the general diel patterns of DGM dynamics in CCL, but interestingly, the post-noontime DGM deceased less and slower than observed in SB. Our in situ freshwater incubations at SB showed little DGM diel pattern. These observations suggest that wind-driven degassing of DGM, not oxidation of DGM, mainly caused rapid afternoon drop of DGM in SB upon solar radiation decreasing. The oxidation driven removal of DGM may be slight and slow as seen in CCL. The mechanism for aquatic DGM removal warrants further investigation.

USE OF THE GLEAMS MODEL TO PREDICT THE FATE OF HERBICIDES USED IN PINE PLANTATIONS ON THE CUMBERLAND PLATEAU. ***Rong Jiang* and John Harwood,*** *Tennessee Technological University, Cookeville, Tennessee.* GLEAMS (Groundwater Loading Effects of Agricultural Management Systems) is a model to simulate the movement of pesticides in surface run-off and movement into, through, and below the effective rooting depth of the soil. In this study, GLEAMS model is used to determine the losses of several herbicides applied to a forestry site in Cumberland Plateau, Tennessee. Site-specific characteristics are taken from the NRCS Soil Survey of Grundy County, Tennessee. A 20-year cycle is simulated. The long-term climatic records are from the weather stations in the plateau. Simulations are made on a series of different conditions, such as the variable application rate of herbicides, the applied date before or after an intense storm, in a higher or lower organic matter soil. Model simulation results of herbicide losses are compared and summarized.

SYNTHESIS OF NOVEL ANALOGS OF *EPI*-PODOPHYLLOTOXIN. ***Ian Romaine* and Norma K. Dunlap,*** *Middle Tennessee State University, Murfreesboro, Tennessee.* Several derivatives of *epi*-podophyllotoxin are used clinically as anti-tumor agents, including the C-4 carbohydrate derivatives etoposide and teniposide. These drugs, as well as C-4 amine-substituted analogs, act as inhibitors of topoisomerase II. We have embarked on a program to synthesize several novel analogs. These include dimers linked at C-4 by either rigid or flexible amines, and monomers possessing either a dimethyl or benzylidene acetal in the A-ring. The syntheses of these compounds will be discussed.

METALLOGELS: ARTIFICIAL GLUTAMATE LIPIDS WITH LEWIS-BASIC SITES AND THEIR METAL COMPLEXES. ***Anthony J. Zucchero* and Robert E. Bachman,*** *The University of the South, Sewanee, Tennessee.* Organogels, viscoelastic materials formed from organic solvent(s) containing a small amount (frequently 2 wt % or less) of a low-molecular-mass gelator molecule, have attracted significant attention in recent years because of their unique physical properties and numerous diverse potential applications. While thousands of gelators have been developed over the last two decades, only a handful have incorporated metal atoms. To address this shortcoming, we are currently developing glutamate-based lipids with Lewis-basic head groups. The incorporated Lewis-basic sites can then be used to create metallogels (metal-containing gels) through well-defined metal binding chemistry. We will present our recent synthetic progress as well as initial studies using both the free ligands and their metal complexes to form gels.

PROPOSED SYNTHESIS AND ANALYSIS OF SELENIUM ALKOXIDES. ***Judith M. Iriarte-Gross and Sorawit Timothy Decha-Umphai*,*** *Middle Tennessee State University, Murfreesboro, Tennessee.* The use of selenium alkoxides as precursors in the sol-gel process has not been studied. We have investigated the synthesis of these compounds in order to study their behavior as reactants in the sol-gel process. The sensitivity of most alkoxides to water has prompted us to investigate a non-hydrolytic synthesis for selenium alkoxides. We will discuss our proposed synthesis. All materials are being characterized using ^{1}H, ^{13}C, and ^{77}Se NMR spectroscopy.

USING WATER FLOW THROUGH A PLASTIC MODEL TO DEMONSTRATE THERMAL CONDUCTIVITY AND IONIC/MOLECULAR DIFFUSION. ***Harvey F. Blanck,*** *Austin Peay State University, Clarksville, Tennessee.* A plastic model may be used to demonstrate thermal conductivity and Fick's first law of ionic/molecular diffusion using water flowing through a series of vertical compartments connected by a hole at the bottom of the partition between cells. The dimensions of the hole determine the resistance to water flow analogous to diffusion. Water introduced at one-end moves from one compartment to the next. If the water level is kept constant in the first cell, a steady state is achieved in which the height of the water columns decrease in a series of constant size steps down to the end cell where the water exits the model. The volume of water exits at a constant rate, analogous to the flux predicted by Fick's first law. Before the steady state is achieved during the period that the cells are filling, a concave curve is present. If the water input is turned off after the steady state is achieved, the water heights have a convex shape as the cells drain. The convex, straight, and concave curves are associated with the mathematical solution to Fick's second law for one dimensional diffusion from a point source in which the Gaussian curve has a convex segment left of the inflection point (the straight line region) and a concave portion to the right of the inflection point.

A PORTABLE DEMONSTRATION OF VAT DYEING SIMULATED WITH INDIGO CARMINE. ***Martin V. Stewart and Da-***

vid G. Figueredo*, *Middle Tennessee State University, Murfreesboro, Tennessee.* An interesting chemical demonstration for young students is the process by which blue jeans are dyed with indigo; however, a two-electron reduction of water insoluble indigo to a soluble leuco form is necessary, which makes this procedure prohibitively lengthy and cumbersome. Blue indigo is reduced to the yellow leuco form by heating it with sodium dithionite (sodium hydrosulfite, $Na_2S_2O_4$) in aqueous base. When a cloth is immersed in the resulting solution and removed, it turns blue because leuco indigo is oxidized back to the original indigo by atmospheric oxygen. Sulfonation of indigo affords indigo carmine, whose sodium salt readily dissolves in water. Substituting indigo carmine for indigo provides a demonstration that simulates the chemical and visual aspects of vat dyeing, but avoids the difficult and time consuming dissolving step. Substituting either chromatography or filter paper for cloth further accelerates the procedure. This demonstration was then packaged in a portable container and given to a diverse population of undergraduates, who presented it at elementary schools during National Chemistry Week, 2002. More recently, a scaled-up version was featured by the MTSU Chemistry Club at its annual Demomania, an event where chemical demonstrations are performed each spring for high school students in a large theater.

EFFECT OF 4,4'-BIPYRIDIN-1-IUM BROMIDE MONOHYDRATE ON GLUTATHIONE LEVELS IN HUMAN MONOCYTIC PROGENITOR (U937) CELLS. ***Justin B. Anderson*, William Y. Boadi, Peter A. Iyere, Lonnie Sharpe, and Samuel E. Adunyah,*** *Tennessee State University, Nashville, Tennessee (WYB, JBA, PAI, LS), and Meharry Medical College, Nashville, Tennessee (SEA).* The effect of 4,4'-bipyridin-1-ium bromide monohydrate (an analog of paraquat), on glutathione (GSH) levels in human monocytic progenitor (U937) cells was investigated. GSH is a tripeptide and plays a critical role in metabolic pathways, as well as in the antioxidant system of most aerobic cells. The detoxification of xenobiotics, thiol-disulfide exchange, and amino acid transport across membranes all require the use of GSH. It also serves as a substrate for various enzymes, such as glutathione peroxidase. U937 cells were treated with 0, 10, 20, 60, and 80 μM of 4,4'-bipyridin-1-ium bromide monohydrate. Cells were incubated at 37°C under 5% CO_2 tension in RPMI 1640 medium containing 10% FBS and 50 units/ml each of penicillin and streptomycin for 24 h. Following incubation, the cells were pelleted by low speed centrifugation (2,300 × *g*, 2 min) and each treated group suspended in 500 μl of a 5% metaphosphoric acid (MPA) solution. Cells were lysed with a-26-gauge syringe, stored in crushed ice and centrifuged at 3,000 × *g* for 10 min at 4°C. The supernatant was used for the analysis of GSH using the GSH Assay Kit from Pierce (Cat. No. 354102). Levels of GSH for the various treatment groups were each expressed as μM per 10^6 cells. GSH levels decreased in a dose dependent manner for the levels of 4,4'-bipyridin-1-ium bromide monohydrate used in the studies. The untreated group had the highest level of GSH with the 80 μM being the lowest. The data suggest that 4,4'-bipyridin-1-ium bromide monohydrate may be a harmful environmental agent and can reduce the antioxidant status of U937 cells. Future studies will investigate the mechanisms of 4,4'-bipyridin-1-ium bromide monohydrate depletion of cellular GSH in U937 cells.

A STUDY OF BIDI CIGARETTE SMOKE ON *SALMONELLA TYPHIMURIUM* STRAINS TA97A AND TA98. ***Stephen B. Naquin*, Zachary T. Frensley*, Ngee S. Chong, and Beng G. Ooi,*** *Middle Tennessee State University, Murfreesboro, Tennessee.* Indian bidi cigarette smoke consists of chemical compounds related to those found in American cigarette smoke. Since these compounds are known to be mutagens or carcinogens, it is important to characterize the chemical profile and the mutagenic potential of the bidi smoke. The chemical analysis of the smoke extract using gas chromatography-mass spectrometry (GC-MS) showed the presence of nicotine, phenols, aromatic amines, indoles, pyridines, and volatile organic compounds. The mutagenicity of bidi smoke constituents in both dimethylsulfoxide or methanol was assayed by the Ames test using *Salmonella typhimurium* TA97a and TA98 with and without the Aroclor 1254-induced rat liver S9 homogenate. Preliminary results indicate that elevated levels of mutagenicity were observed for bidi smoke. The smoke composition and mutagenicity of bidi was compared to those of American cigarettes in order to understand the chemical basis for the variation in the results for mutagenicity.

ENGINEERING AND ENGINEERING TECHNOLOGY

ADEL SALAMA, CHAIR

CHANGES IN CEREBROVASCULAR PRESSURE TRANSMISSION DURING INTRACRANIAL PRESSURE MONITORING. ***Premkumar Balasubramanian* and Michael L. Daley,*** *The University of Memphis, Memphis, Tennessee.* The purpose of this project is to develop a method to continuously assess cerebrovascular autoregulation of patients with brain-injury. Such a method would help devise targeted therapies. Laboratory and clinical pressure recordings were used to examine changes in cerebral arteriolar diameter and the highest modal frequency (HMF) of cerebrovascular pressure transmission of arterial blood pressure (ABP) to intracranial pressure (ICP) with respect to changes in cerebral perfusion pressure (CPP). Laboratory recordings from piglets equipped with a cranial window demonstrate during hypercapnic and hypoxic dilatory challenge significant increases in mean HMF and mean art.-dia and a significant negative correlation between HMF and CPP occur. Constrictive challenge by intravenous norepinephrine produced a decrease in mean HMF and mean art.-dia and a significant negative correlation between HMF and CPP. Clinical recordings ($n = 5$) suggest that for values of CPP below 50 mmHg a positive correlation between HMF and CPP existed indicating loss of autoregulation.

AUTOMATED ARTERIOLAR DIAMETER MEASUREMENTS FROM VIDEO RECORDING. ***Vikram Kollurm, Sudha Pillutia, Ajay Kotha and Michael L. Daley,*** *The University of Memphis, Memphis, Tennessee.* Assessment of the caliber of vessels within the arteriolar cerebrovascular bed (CVB) during physiological challenge is a means of demonstrating arteriolar reactivity and intact autoregulation of cerebral blood flow in the newborn piglet equipped with a cranial window. The purpose of this study was to develop an automated image analysis method to continuously evaluate changes in arteriolar diameter during either dilatory hypercapnic challenge or constrictive challenge with intravenously administered norepinephrine. Taped VHS recordings of 360 OX magnification of pial arterioles were digitally captured at a rate of 15 frame/sec. Matlab (Matlab Inc., Natick, MA) image processing software was used to develop an algorithm to automatically continuous evaluate the diameter of any arteriole

within the image. Changes in the diameter of each arteriole during challenge are obtained and plotted versus time.

AFFORDABLE PART DEVELOPMENT STAGES FOR STUDENT BUILT RACE CARS. ***Adam McGough and Ismail Fidan,*** *Tennessee Technological University, Cookeville, Tennessee.* This presentation reports the part development stages of the 2003 Golden Eagle Formula SAE (The Society of Automotive Engineers), NASA Moonbuggy, and Mini Baja racecars. Members of the teams come from a variety of majors such as Mechanical Engineering, Manufacturing and Industrial Technology, Civil Engineering, Electrical Engineering, and Business. Each person brings a different set of skills to the team necessary to successfully complete the projects and tasks. Parts are usually designed and manufactured with an integrated CAD, CNC, CAM, Casting, Welding, and Post processing schedule. Case studies with sample parts, life cycle analysis, cost estimation, and trouble-shootings will be presented.

DEVELOPING NOVEL HYDROFLUOROETHERS USING THE INVERSE-QSR TECHNIQUE WITH SIGNATURE. ***Derick C. Weis* and Donald P. Visco,*** *Tennessee Technological University, Cookeville, Tennessee.* Hydrofluoroethers (HFEs) are considered possible replacements for the blowing agent HCFC-141b in making polyurethane foam because they are more environmentally friendly. In order for a replacement to work it must have similar properties to the original compound such as low toxicity, stability, low vapor thermal conductivity, non-flammability, short atmospheric lifetime, and a normal boiling point near room temperature. A data set of 77 HFEs with normal boiling point data were obtained to create a quantitative structure-property relationship (QSPR) using the newly developed Signature descriptor. From this set, the inverse QSPR technique was employed to generate candidate replacements outside of the original 77 compounds. Once all the possible solutions were generated, they were filtered to only keep those that have similar properties to HCFC-141b. A manageable number of candidate replacement ethers for HCFC-141b will be presented, and are good targets for further study.

USING X-RAY DIFFRACTION TO MEASURE APPLIED STRAINS IN CEMENT- BASED MATERIALS. ***Joseph J. Biernacki and Carl Parnham****, *Tennessee Technological University, Cookeville, Tennessee.* Understanding the micro- and meso-scale load bearing and load transfer characteristics of concrete could revolutionize the way that this complex heterogeneous material is engineered. A series of experiments were conducted wherein synchrotron X-rays were used to make measurements of micro-scale strains under stresses generated mechanically. Stressors were applied by in situ loading of specimens and diffraction measurements made to establish the stress states of various crystalline phases including calcium hydroxide, unreacted clinker phases and aggregate phases. A broad range of mechanical loads up to near failure were explored.

PROGRAMMABLE LOGIC CONTROLLER CONTROL OF A DUAL PNEUMATIC ROBOT SYSTEM. ***Chin-Zue Chen,*** *Austin Peay State University, Clarksville, Tennessee.* Preventing robots from crashing into each other is a critical issue in a dual robot system when the robot work envelopes overlap. There is no dual robot control system with built-in crash prevention algorithms available on the market; therefore, crash prevention relies on communication between the two robot controllers. If one controller can control both of the robots then the complication of the communication can be reduced greatly. A dual cylindrical robot system constructed with pneumatic linear and rotary actuators was built in the Engineering Technology Department, Austin Peay State University. The system can be controlled by a single programmable logic controller (PLC). A DirectLogic 405 PLC is used to control the system. The stage format control program simplified the crash prevention communication between the two robots.

TEACHING DIGITAL LOGIC DESIGN USING SIMPLE MOBILE ROBOTS. ***Ashraf Saad and Adel Salama,*** *Georgia Institute of Technology, Savannah, Georgia and Austin Peay State University, Clarksville, Tennessee.* Learning digital design is universally fundamental to all electrical and computer engineering students. Developing a deep understanding and appreciation of the subject matter is therefore crucial for student success in more advanced topics, such as computer hardware organization, and microprocessor-based design. Engineering students are traditionally introduced to digital logic design in their second (sophomore) year or at the beginning of their third (junior) year. We were successful in introducing a simple mobile robot as the platform for a project-based approach to teaching digital design in the second semester of the freshman year. The goal of this project is to engage students in active project-based learning of digital logic and digital design concepts. The objective of the project is to use only discrete digital logic components to develop a memory subsystem for a small mobile robot that uses infrared sensors for line tracking, then interface it to the robot in order to make it follow, learn and then retrace on its own a track on the ground. Students incrementally develop and integrate modules of the overall design during their weekly laboratory time. At the end of the academic term, a competition is held for students to demonstrate their completed and functional projects.

Ethics in Science and Technology

RUBYE PRIGMORE-TORREY

ETHICAL DILEMMAS IN INDUSTRY-UNIVERSITY PARTNERSHIPS. ***Michael L. Woodruff,*** *East Tennessee State University, Johnson City, Tennessee.* University-industry partnerships have at least a 100-year history in the United States. Throughout this history the influence of these partnerships can be seen to have a negative correlation with federal funding for research. Thus, industrial support for university research was significant in the 1930s, but declined in the 1950's and 1960's only to resurge in the 1970's and 1980's. With decreasing state and federal support for higher education and increased focus on university-industrial partnerships as desirable in seeking federal funding, universities once again find industry funding for research more attractive. However, increased ethical concerns come with increased reliance on industrial funding for research. These concerns include undue influence by industry on direction of university research programs including decreased research that leads to breakthrough discoveries as opposed to the incremental improvements in existing products and processes, inhibited right to publish, loss of disinterested inquiry, and conflicts of interest and commitment. In contrast to these potential ethical negatives are several elements that may be seen as ethical positives that result

from university-industrial partnerships. These include greater opportunity to move the results of university research creation of products and processes that benefit the public and society, greater opportunity to expose students to real problems that test theory, development of equipment and physical plant infrastructure that strengthens teaching and non-industrial research capability and expanded interaction with colleagues in industry who may broaden the knowledge base of students and faculty. The material in this presentation attempts to weigh the positive and negative consequences of increased industrial support of university research with suggestions as to how to mitigate the potential negative consequences.

ETHICAL TRAPS IN THE PEER REVIEW SYSTEM. ***Rubye P. Torrey,*** *Tennessee Technological University, Cookeville, Tennessee.* For over a century scholars and academicians have published their research findings in professional journals. The route to getting their findings published is via having them reviewed by professional peers engaged in similar work and winning their approval that this is truly new knowledge and publish-worthy. What are some of the pitfalls in this system? The human side of the reviewer quite often raises its "ugly" head to attempt taking over the ownership by telling the author they are somewhat "off-base", or this information is not new, or other similar unpleasant findings. This kind of information will send the researchers back to the drawing board and delay the publishing. This type of activity is damaging to the academician who is under "'fire" to "publish or perish," since this is the route that must be traveled to tenure, promotion and professional recognition and acceptance. How long will it take to find the "ethical pitfall"? Will the system need to be changed? This presentation will be an attempt to point out weaknesses in the system with some suggestions for overcoming this difficulty.

THE ROLE OF TECHNOLOGY IN ACADEMIC DISHONESTY. ***Dawn L. Ellis,*** *University of Tennessee, Chattanooga, Chattanooga, Tennessee.* This paper discusses high tech cheating and high tech ways in which the academic community can protect the integrity of education. Internet paper mills allow students to purchase papers off the Internet on a variety of subjects. Cell phones, PDAs, and text messaging devices are yet another high tech way of cheating. Shared laboratory computers present another avenue of temptation for cheating. Cheating has been occurring for decades, technology has enhanced the way students and faculty are able to cheat. However, there are many commercial and free tools available to help in detecting similar and plagiarized work.

Geology and Geography

MICHAEL GIBSON, CHAIR

THE ROLE OF SINKHOLES IN STORING FLUVIAL SEDIMENT. ***Evan A. Hart,*** *Tennessee Technological University, Cookeville, Tennessee.* Patterns of sediment storage on large floodplains are well documented in many environments. However, comparatively little research has focused on sediment storage along small streams dominated by bedrock. In addition, studies of fluvial sedimentation in karst environments are scarce, perhaps due to the importance of dissolved load in karst streams. However, karst areas contain many natural sediment storage sites including sinkholes, swallow holes, and cave passages. This study documents sediment storage in sinkholes that drain parts of Cookeville, Tennessee. The depth of stored sediment in sinkholes ranges from 1–2 meters. A wide range in soil color (dark brown to light red) and in particle size (clay to gravel) within sinkhole sediments suggests shifts in basin land use. Rapid drainage from one sinkhole during a flood caused entrenching of sinkhole sediments and the loss of approximately 25% of the original stored sediment volume to the cave system below the sinkhole. Sinkholes appear to function similarly to hollows in mountain areas where sediments build up and then are periodically flushed out during high magnitude events.

"HOW DID IT GET THAT WAY?" HELPING STUDENTS INFER GEOMORPHIC PROCESSES FROM FORM AND STRUCTURE. ***Hugh H. Mills,*** *Tennessee Technological University, Cookeville, Tennessee.* One of the main challenges in teaching geomorphology is to get across the idea that the landscape is not static but dynamic. I have tried to do this by presenting students with landforms, preferably in the field, and asking them to explain how they may have formed. Unusual landforms that appear puzzling are particularly good for this, such as natural bridges. In explaining these, students commonly overlook the importance of slope processes and overemphasize fluvial action, indicating that I should spend more time on slope erosion. Another point often overlooked is that for a bridge to form, more-resistant rocks should be underlain by more resistant ones. Incised stream meanders are other attention-grabbers. Topographic profiles across these valleys show extreme asymmetry, and most students are able to infer from this form that the streams are eroding laterally as well as down. Abandoned incised meanders provide another mystery to explain. Other features used include waterfalls, stream terraces, and dry valleys.

TENNMAPS FOR THE FUTURE: AN ENQUIRY-DRIVEN APPROACH TO EARTH SCIENCE TEACHING ACTIVITIES USING MAPS AND REMOTE-SENSING IMAGERY. ***G. Michael Clark, Michael A. Gibson, and Hugh H. Mills,*** *University of Tennessee, Knoxville, Knoxville, Tennessee, University of Tennessee, Martin, Martin, Tennessee, and Tennessee Technological University, Cookeville, Tennessee.* An outgrowth of the highly successful SCMAPS and SEMAPS products now used in approximately 50% of South Carolina Middle Schools is the Tennessee-specific product, TENNMAPS for the Future. Site-specific activities will engage students in exploration of Tennessee's geographical and geological setting, settlement and migration history, and culture and land use. The interdisciplinary nature fosters collaborative teaching. Smoky Mountains activities concentrate on environmental issues, historic floods, landslides, and TVA hydroelectric and flood-control projects. Key features in the Cumberland Plateau include a gigantic breached anticline (Sequatchie Valley), numerous karst features, and the Cumberland Escarpment. The Cumberland Gap/Middlesboro Basin activities explore connections among the geology and early European settlement (Daniel Boone and the Wilderness Road), highway tunnel geological engineering, and problems of landscape origins. Study sites in central and west Tennessee being developed: iron resources and iron furnaces, origin of Reelfoot Lake, the Tennessee River—"Ol' Contrary", New Madrid Seismic Zone earthquakes.

AN ANALYSIS OF A CLIMATE TRANSITION ZONE: THE CASE OF THE MID-MISSISSIPPI RIVER VALLEY. ***Robert M.***

Simpson and Cahit Erkal, *University of Tennessee, Martin, Martin, Tennessee.* The Mid-Mississippi River Valley region serves as a climatic transition zone based on the dynamics of the systems that affect the weather in the region. We compared the structure of the average daily temperatures at Union City, Tennessee, a representative station in the region and the structures of the daily Pacific North American (PNA), North Atlantic Oscillation (NAO) and Arctic Oscillation (AO) and found that the PNA had a more similar structure to daily temperatures than did the NAO or the AO. We fitted a sinusoidal curve function to the mean monthly temperature data for each of 40 stations in the Mid-Mississippi Valley and correlated the residuals with selected teleconnection indices. The results showed evidence of significant spatial variability in the correlations across the area, especially in the winter, and this reaffirms the transitional nature of the climate in the region.

THE CLARKSVILLE-HOPKINSVILLE METROPOLITAN STATISTICAL AREA AS AN OZONE NON-ATTAINMENT AREA: IS A REGULATORY MISTAKE BEING MADE? ***Robert A. Sirk,*** *Austin Peay State University, Clarksville, Tennessee.* As a pollutant, ground-level ozone (O_3) is corrosive to physical and human environments, and a toxin to organic life-systems. It is created through photochemical dissociation requiring specific meteorological and pollutant emission conditions. Controlling creation of Tropospheric O_3 is of critical regulatory concern under Clean Air Act ambient air quality provisions. Increasingly stringent O_3 standards have turned hundreds of urban regions into non-attainment areas, risking for each the loss of federal transportation funds. The Clarksville-Hopkinsville MSA is currently facing a non-attainment designation for O_3. Local and regional geographic, meteorologic, and pollutant emissions site data are used to examine for Clarksville-Hopkinsville the twin questions of: (1) the validity of such a designation, and (2) the protocol for coming into compliance if such a designation were made.

INVERTEBRATE TAPHONOMY IN A PALEO-MARSH ECOSYSTEM SITE (LATE MISSISSIPPIAN), BLACK WARRIOR BASIN, ALABAMA. ***Michael A. Gibson, Robert A. Gastaldo, and Allyn Blanton-Hooks,*** *University of Tennessee, Martin, Martin, Tennessee, Colby College, Waterville, Maine, and Auburn University, Auburn, Alabama.* A 3.5 m alternating quartz sandstone and claystone outcrop of Hartselle Sandstone occurs near Homewood, Alabama. Flora is dominated by the marsh lycopsid *Cormophyton.* Invertebrate-bearing claystones consists of molds of a bivalve-dominated assemblage. Compaction produced composite shells with impressions sporophyl/leaves of *Cormophyton* resembling shell borings; molluscan valves disarticulated or butterflied, oriented horizontally, rarely inclined across claystone lamina, but not in-living-position. No difference exists between claystone infilling valve concave surfaces and exterior convex surfaces. Shells do not appear broken or abraded. Shell size range indicates little or no sorting (no very small or juvenile shells were encountered). No preferred orientation of valves on bedding surfaces, but invertebrates are restricted to discrete claystone horizons and horizons are not laterally continuous. Taken together, these characteristics suggest that the invertebrates represent localized sparse shell accumulations rather than in-situ living assemblages. The assemblage is interpreted as an accumulation of shell debris in a protected marine influenced marsh.

POLLUTION LOADING AND LAND USE PATTERN MODELING IN GEOGRAPHIC INFORMATION SYSTEMS. ***Carl Alexander* and Peter Li,*** *Tennessee Technological University, Cookeville, Tennessee.* Pollution in surface water comes from rainwater carrying agricultural pesticides, herbicides, fertilizers, toxic chemicals, animal wastes, industrial, construction, and transportation wastes into the streams. The urban development in a small watershed has influential impact on local watershed. This study concentrates on estimating pollution loading in a small watershed. The PLOAD program in BASINS was used for calculation. Impervious area of watershed was computed using aerial photos, land use data from local government, and TR-55. Impervious cover percentage ranges from 2% of agricultural area to 85% in commercial areas within the boundary of Cookeville. EMC (Event Mean Concentration) table for the local Results were calibrated using field measurements. The PLOAD calculated TP, DP, NOx, NH3, BOD, COD, and TDS. This study also presents maximum and minimum loadings of BMP and other alternative schemes were compared to show the difference in loading. Temporal variations are also presented. The findings from this study can serve as a reference for the health of local water bodies. Maximum and minimum concentrations and loadings of each pollutant are computed and presented. The study identified the major sub-basins contributing pollutant loading into local streams. A Geographic Information System (GIS)-rasterization process was implemented to show the transition between sub-basins and the overall land use pattern correlating to the pollution loadings. The study provides a tool for management of small urban watershed and the prediction of pollution loading based on proposed BMP.

QUANTITATIVE CRIME ANALYSIS WITH GEOGRAPHIC INFORMATION SYSTEMS. ***Claiborn L. Phillips* and Peter Li,*** *Tennessee Technological University, Cookeville, Tennessee.* This research studied the crime occurrence in the City of Cookeville, Tennessee. A five-year crime data with 2,567 statistics were analyzed, categorized and presented in this presentation. The purpose of this study is to determine the spatial patterns of crime rate, identify hot spots, and provide seasonal patterns of each crime type. The relationships between socio-economic factors and crime rates are documented and analyzed. Spatial buffering zones are created to delineate the crime zones and its correlation to the major streets and commercial zones. A total of 7 crime types were studied and their findings show the distinct patterns in relation to neighborhood and socio-economic factors.

GEOCHEMICAL INVESTIGATION OF THE MECHANISMS OF MAGMA FORMATION BENEATH THE NORTHERN OREGON CASCADES. ***Brian Cosky*, Scott Crombie*, Beverly Buchanan*, Jennifer Baxter*, and Warner Cribb,*** *Middle Tennessee State University, Murfreesboro, Tennessee.* The ~700,000 year history of Mt. Hood volcano, located in the northern Oregon Cascade Range volcanic arc, is dominated by the eruption of andesitic lava flows and pyroclastic deposits. New geochemical studies of Mt. Hood andesites suggest magma formation by partial melting of subducted oceanic lithosphere (adakites), rather than by partial melting of ultramafic rock within the sub-volcanic arc mantle wedge. Most Mt. Hood andesites exhibit major and trace element characteristics similar to those of slab-derived melts identified along other volcanic arcs: $SiO_2 > 56.0$ wt %, $Al_2O_3 > 15.0$ wt %, $Na_2O > 3.5$ wt %, Sr > 400 ppm, Y < 18 ppm, Sr/Y > 40 ppm, Zr/Sm > 50 ppm. MgO concentrations in Mt. Hood andesites (> 2.5 wt % MgO) are characteristic of high-

Mg adakites, suggesting chemical interactions between slab-derived melts and Mg-rich peridotite within the sub-arc mantle wedge. Chemical reactions between slab-derived melts and sub-arc mantle rocks also are indicated by positive correlation between compatible (Nb, Ta) and incompatible (La, Sr) trace elements. The enrichment of high field-strength elements relative to large-ion lithophile elements in Mt. Hood andesites is a possible effect of such reactions within the sub-arc mantle. Melting of subducted oceanic lithosphere may occur beneath Mt. Hood due to a shallow angle of subduction and relative proximity to the Cascadia trench, as compared to other volcanoes in the southern Washington-northern Oregon Cascades. A Mt. Hood slab depth of 75–85 km (the range of experimentally determined depths at which partial melting of subducted oceanic lithosphere may occur) suggests a low angle of subduction, a tectonic attribute proposed for the generation of adakite melts elsewhere. Contrastingly, other major Cascade Range volcanic centers in southern Washington-central Oregon do not exhibit strong geochemical evidence for melting of subducted oceanic lithosphere, suggesting deeper slab depths as a function of greater distance from the Cascadia trench. In this region of the Cascades, Mt. Hood appears most similar to Mt. St. Helens where slab depth is ~75–80 km and melting of subducted lithosphere also has been proposed.

Health and Medical Sciences

M. Gore Ervin, Chair

VASOPRESSIN RECEPTORS AND THE OVINE FETAL CARDIOVASCULAR RESPONSES TO ACUTE HYPOTENSION. ***M. G. Ervin, K. A. Terry, and G. C. Calvario,*** *Middle Tennessee State University, Murfreesboro, Tennessee (MGE) and University of California, Los Angeles School of Medicine, Harbor Medical Center, Torrance, California (KAT, GCC).* We studied the role of arginine vasopressin (AVP) in the fetal baroreflex response to acute hypotension. Chronically catheterized fetal lambs received 80 min infusions of either saline (n = 6; 133 ± 1 days gestation; term = 150 days) or the AVP V_1 receptor antagonist [d(CH_2)$_5^1$,Tyr(Me)^2]-AVP (n = 5; 136 ± 2 days). Basal saline and antagonist-treated fetal plasma AVP levels (4.4 ± 1.4 vs. 4.3 ± 1.1 pg/ml, respectively) and mean arterial blood pressure (MAP) values (41 ± 1 vs. 42 ± 2 mmHg, respectively) did not differ. Fetal hypotension (intravenous nitroprusside; 10 $\mu g.kg^{-1}.min^{-1}$ for 10 min) evoked similar significant decreases in saline and antagonist-treated MAP values (−17 ± 2 vs. −18 ± 2 mmHg, respectively) and increased saline-treated plasma AVP levels (43 ± 16 pg/ml). MAP recovery 5 min after nitroprusside infusion was delayed in the antagonist- vs. saline-treated lambs (−6 ± 1 mmHg; 86 ± 2% vs. +2 ± 1 mmHg; 105 ± 4%). Moreover, heart rate increased in the antagonist-treated animals (63 ± 17 beats/min) and decreased in the saline group (−11 ± 7 beats/min). Arterial pH, pO_2 and pCO_2 values did not change in either group. Conclusions: 1) Acute hypotension is a potent stimulus for fetal AVP secretion, and 2) AVP contributes to fetal MAP recovery following acute hypotension.

THE PRESENCE OF *BORRELIA* SPECIES AMONG TICKS COLLECTED FROM SELECTED EASTERN STATES. ***Sarah L. Collins*, Melissa K. Miller, and Stephen M. Wright,*** *Middle Tennessee State University (SLC, SMW), and United States Army Center for Health Promotion and Preventative Medicine (MKM), Fort Meade, Maryland.* Lyme disease, transmitted by the bite of *Borrelia burgdorferi*-infected *Ixodes scapularis* (Black-legged tick), is the most commonly reported vector-borne disease in the United States. This bacterial infection may result in serious, life threatening illness. Recently *Borrelia lonestari* was discovered in *Amblyomma americanum* (Lone Star tick) and determined to be the causative agent of a novel Lyme-like disease, Southern Tick Associated Rash Illness (STARI). This study examined 200 ticks from eight eastern states to evaluate the epidemiology of *B. lonestari, B. burgdorferi,* and their tick vectors. Polymerase chain reaction was performed using primers that target both *Borrelia* species. Gel electrophoresis, species-specific probe hybridization, and DNA sequencing were used to differentiate *B. lonestari* and *B. burgdorferi.* Ten percent of ticks were positive for *Borrelia* species. Positive tick samples were detected from Kentucky, Virginia, and Massachusetts. This is the first report of *B. lonestari* in these states as well as its presence in Ixodid ticks.

PROBE-DNA HYBRIDIZATION: HOW MANY MISMATCHES WILL A PROBE TOLERATE? ***Kip Phillips* and Stephen M. Wright,*** *Middle Tennessee State University, Murfreesboro, Tennessee.* Complementary probes have long been employed to hybridize and detect DNA. However, one factor often overlooked in hybridization is the extent of complementation between probe and target. The purpose of this investigation was to determine the specific number of mismatches in a 19-mer oligonucleotide probe that would still allow binding to a conserved region of the influenza virus. Fourteen oligonucleotide probes were designed based on the number of mismatches from the conserved influenza sequence and strength of nucleotide binding. Hybridization between influenza and digoxigenin-labeled probes was performed using nylon membranes and detected using anti-digoxigenin antibody. We report that probe binding to target influenza sequences was still detectable with 6 base pair mismatches, representing 32% incorrect base pairing. Identifying and improving the specificity of hybridization can have dramatic effects on the accuracy of medical diagnoses, criminal DNA testing, environmental testing and the recognition of infectious agents used in biowarfare.

FLUORESCENCE BASED DETECTION OF BIOMOLECULES BOUND TO GLASS SUBSTRATE. ***Adam F. Farmer*, Adrienne C. Friedli, and Stephen M. Wright,*** *Middle Tennessee State University, Murfreesboro, Tennessee.* Detection of infectious agents in clinical specimens is of utmost importance in the diagnostic laboratory. The success of any detection method hinges on specificity, sensitivity, and timely completion of the test. A collaborative research group at MTSU is designing a novel biosensor based on surface plasmon resonance in photonic bandgap materials. Initial testing has employed detection of DNA and protein using fluorescently labeled antibodies. Biomolecules were covalently bound to amine terminated organosiloxane coated glass slides after printing via heating and UV exposure. The slide was blocked to defunctionalize the remaining reactive groups, after which the bound biomolecule was allowed to hybridize with a protein labeled probe. Fluorescent antibody was then used to bind to the protein label allowing for detection by a fluorescent microscope. We report specific, sensitive detection of both DNA and protein targets via this method that will allow for numerous diagnostic applications.

THE EFFECTS OF THE INFLAMMATORY CYTOKINE TNF-

α ON TRANSFORMED RAT PANCREATIC BETA-CELLS. ***J. P. LeBoeuf* and Amy E. Jetton,*** *Middle Tennessee State University, Murfreesboro, Tennessee.* New treatments for type II diabetes mellitus block effects of tumor necrosis factor-α (TNF-α), an inflammatory cytokine, on insulin target tissues. Inflammatory cytokines are also known to kill insulin-producing β cells. Our study explored interactions between TNF-α and glucose stimulation of INS-1 cells in culture. INS-1 cells were cultured in 5.5 mM glucose in RPMI 1640 prior to exposure to high or low doses of TNF-α with or without increased glucose (3 x 2 design; n = 6 wells/group; total of 36 wells). After 24 h exposure to TNF-α (0, 0.1 or 100 ng/ml) and glucose (5.5 or 16.5 mM), media was collected for insulin assay by ELISA, and cells were visually assessed for apoptosis using Hoescht and propidium iodide dyes. In contrast to previous work with INS-1, we were unable to demonstrate a correlation between insulin production and TNF-α exposure or between apoptosis rates and TNF-α or glucose exposure.

SYNDROMIC SURVEILLANCE IN TWO RURAL PUBLIC HEALTH REGIONS IN NORTHEAST TENNESSEE: YEAR ONE EXPERIENCES. ***Donna G. Robbins and Mark McCalman,*** *Northeast Tennessee Regional Public Health Office, Johnson City, Tennessee and Sullivan County Regional Health Department, Blountville, Tennessee.* Syndromic surveillance is a non-traditional system of disease monitoring that uses predominantly pre-diagnosis data to signal the probability of disease outbreaks, including those bioterrorism-related. It has typically been designed and used in academic and/or large population-based settings. We are reporting on the Year One syndromic system planning and implementation experiences of two public health regions in rural Northeast Tennessee. After meeting the state Bio terrorism Plan objective of having one system in place by February 1, 2003, these regions expanded their goals to initiate surveillance with additional data sources. To date, there is daily automated data transmission from nine hospital emergency departments, two 911 call centers and two school systems. Establishing syndromic surveillance has strengthened the public health-community agency relationships and improved overall disease monitoring. However, despite the community enthusiasm for system development, there have been challenges such as the administrative agreements, HIPAA concerns, and acquisition of the 911 data.

SEGMENTING AND CLASSIFYING MAGNETIC RESONANCE IMAGES OF THE BRAIN TO STUDY TREATMENT SEQUELAE IN PATIENTS WITH EPENDYMOMA. ***Brian A. Taylor* and Gene Reddick,*** *Union University, Jackson, Tennessee and St. Jude Children's Research Hospital, Memphis, Tennessee.* All methods of cancer therapy appear to carry certain negative side effects. The nature and consequences of these side effects is of great interest to the medical community. Previous studies have shown that there is a decrease of normal appearing white matter (NAWM) in the brain following radiation cancer therapy. Studies are underway to determine whether this decease in NAWM can cause neurocognitive sequelae (side effects). At St. Jude Children's Hospital in Memphis, Tennessee, fifty-nine patients with ependymoma (a brain tumor) were placed on a protocol to study the effects of conformal radiation therapy. Automated segmentation and classification techniques on transverse/axial Magnetic Resonance Images can accurately show changes in the NAWM volumes over time. The results of this study can help coordinate the changes in NAWM to neurocognitive problems experienced by brain tumor patients due to radiation therapy.

HISTORY OF SCIENCE

C. STEVEN MURPHREE, CHAIR

THE "GENESIS ACT" IN HISTORICAL PERSPECTIVE. ***George E. Webb,*** *Tennessee Technological University, Cookeville, Tennessee.* In 1973, the Tennessee Legislature enacted the nation's first "equal time" law. The initial legislative success of the "creation science" movement, this statute was designed to compromise the teaching of evolution in public school science classrooms by requiring the equivalent inclusion of "creation science" concepts and teaching materials. Although struck down on constitutional grounds by both state and federal courts within two years, the "Genesis Act" represents an important chapter in the continuing controversy over the teaching of evolutionary concepts in the public school science curriculum. An analysis of the events surrounding this act (passed only six years after the repeal of the Butler Act that led to the Scopes Trial) provides significant insight concerning the "new" antievolution movement of the 1960s/1970s and reveals intriguing similarities to the current efforts to restrict the teaching of evolution.

ONTOGENY: A LOOK AT PAST, PRESENT, AND FUTURE PARADIGMS. ***David A. Wollert,*** *Northeast State Community College, Blountville, Tennessee.* In the history of research into ontogeny, early scientists were limited in their range of explanatory ideas because they assumed that the organ was the smallest unit of life. This assumption, coupled with religious commitments, led to the competing theories of preformation and epigenesis. Not until the development of the cell theory and the discovery of Mendelian and molecular genetics did scientists begin to have the tools necessary to explain ontogeny in a comprehensive and systematic way. But many biologists are beginning to see the limitations of a thoroughly genocentric view of organisms. A deeper understanding of development may not, in fact, come from further attempts at reductionism, but rather from a search for holistic mechanisms operating simultaneously at multiple explanatory levels. As such, newer paradigms anchored in the concepts of complexity and self-organization may offer new and deep-seated insights into the problem of ontogeny.

OAK RIDGE SCIENCE/ENGINEERING: 1942–1988. ***Ted S. Lundy,*** *Retired Oak Ridge National Laboratory, Oak Ridge, Tennessee and Tennessee Technological University, Cookeville, Tennessee.* The author will give a brief background on key people and events leading to the Manhattan Project of World War Two and establishment of the project's presence in Tennessee within a new city called Oak Ridge. He also will share some of his own personal experiences as an employee of the Oak Ridge National Laboratory during 1957–1988: junior researcher to senior scientist, research group leader, lab-wide planner of both programs and new facilities, and manager of energy conservation programs. Emphasis will be on the great scientific, engineering, and political leaders of the past who have contributed so much to where we are as a society today.

KENTUCKIAN LUKE PRYOR BLACKBURN'S YELLOW

FEVER PLOT: 1865. ***C. Steven Murphree,*** *Belmont University, Nashville, Tennessee.* In October 1865, Dr. Luke Pryor Blackburn, a leading authority on yellow fever, was acquitted by a court in Toronto, Ontario of charges that he had been responsible for the deaths of more than 2000 Union soldiers and civilians at New Bern, North Carolina during 1864. Dr. Blackburn had allegedly packed trunks with the "infected" clothing of victims of a yellow fever outbreak in Bermuda then shipped them to northern cities and army bases to be sold as secondhand clothing. The alleged scheme is inconsistent with Dr. Blackburn's humanitarian acts before and after the Civil War. His only comment regarding the charges was that it was "too preposterous for intelligent gentlemen to believe." Blackburn served as Governor of Kentucky from 1879–1883. The discovery that the mosquito, *Aedes aegypti,* serves as the vector of yellow fever did not occur until 1900, three years after Blackburn's death.

MATH AND COMPUTER SCIENCE

YUNG-WAY LIU, CHAIR

PARAMETER ESTIMATION IN ARMA PROCESSES THROUGH THE USE OF ROBUST DISTRIBUTIONS—A BRIEF HISTORY. ***Michael R. Allen,*** *Tennessee Technological University, Cookeville, Tennessee.* In the past, the sampling distributions of parameter estimates in time series models have been estimated classically by the limiting asymptotic distribution, which, in most cases, is the normal distribution. Also, in modern times, these distributions have been estimated through the use of resampling methods like the bootstrap. My proposal is to use robust distributions, like the t-distribution and χ^2-distribution, in place of the previous techniques to estimate the sampling distributions of the parameter estimates from an ARMA time series model. By doing so, inference of the parameter estimate will be more accurate and not rely as heavily on resampling methodology. But first, let us give a brief history of the problem at hand.

FACTORING FINITE GEOMETRIC SERIES. ***Dennis P. Walsh,*** *Middle Tennessee State University, Murfreesboro, Tennessee.* Finite geometric series arise in many areas of mathematics and science. When a product is preferred to a sum, the process of factoring the sum is important. The question we address is how can we factor $1 + r + r \wedge 2 + \cdots + r \wedge (n\text{-}1)$? Sometimes there are no factorizations. However, when n is composite, the series can always be factored. We first look at a well-established factorization involving cyclotomic polynomials. Next we present an alternate route that uses a simple algorithm to generate multiple factorizations. Each ordered factorization of n will correspond to a unique factorization of the series. For example, when n is 24, the factorization $24 = (2)(2)(2)(3)$ generates the factorization $1 + r + \cdots + r \wedge 23 = (1 + r)(1 + r \wedge 2)(1 + r \wedge 4)(1 + r \wedge 8 + r \wedge 16)$, while $24 = (2)(3)(2)(2)$ generates $1 + r + \cdots + r \wedge 23 = (1 + r)(1 + r \wedge 2 + r \wedge 4)(1 + r \wedge 6)(1 + r \wedge 12)$. After deriving our algorithm, we explore ways to supplement the algorithm to produce irreducible factors.

ROBUST ESTIMATION FOR THE EXTREME VALUE DISTRIBUTION. ***David D. Smith and Jun Ye,*** *Tennessee Technological University, Cookeville, Tennessee.* Suppose we observe random variables X_1, X_2, X_n and hypothesize that {X_i} are independent identically distributed (i.i.d.) random variables from a parametric family {f_theta: theta in theta}. If our sample lacks complete information about theta, contains contamination and/or errors beyond our control, then the hypothesized model will not be exact. Our goal is to have a reliable estimate of theta that can be used to investigate the model and perform test of hypotheses. The maximum likelihood estimator is efficient when the model is true but lacks robustness under contamination while a robust estimator that performs well under contamination can have significant loss of efficiency at the true model. In this paper we examine the performance of the minimum Hellinger distance estimator (MHDE) for the Generalized Extreme Value distribution. Our results will show that the MHDE is asymptotically efficient when the model is true while being robust under contamination.

ARE PURE COMPONENT PARAMETERIZATION PROCEDURES IMPORTANT IN MIXTURE PROPERTY PREDICTION? ***Saravanan Swaminathan* and Donald P. Visco Jr.,*** *Tennessee Technological University, Cookeville, Tennessee.* Modeling the phase behavior of substances using thermodynamic equation of states (EOS) has been a very vital area of research, as it is a quick and inexpensive way of predicting the phase properties at desired conditions. The parameters obtained after parameterising the pure components are used along with appropriate mixing rules to predict the mixture phase behavior of these compounds. The optimization techniques used for parameterization of pure components are methods that converged at a local minimum. The number of local minima varies depending on a wide variety of factors, such as the objective function used, number of data points, the weighting of the data points, etc. The local minimum found and ultimately used to predict mixture properties has a big impact on the quality of the predictions. Recent advances in methods of global optimization however, have enabled us to find all the local minima. This work is a first step to explore these issues using simple and complex EOS.

RELATIONSHIP OF CONVERGENCE AMONGST SOME SPECIAL DISTRIBUTIONS TO THE NORMAL. ***Lynda Buck* and Michael Allen,*** *Tennessee Technological University, Cookeville, Tennessee.* We know with appropriate standardization the sampling distributions of many estimators can be shown to converge asymptotically to the normal distribution. In this paper we investigate Edgeworth expansions and their use as approximations to these sampling distributions. The Edgeworth Expansion can be thought of as the sampling distribution expanded as a power series in $n^{-1/2}$, i.e., $P\{n^{1/2}(\theta - \theta_0)/\sigma(\theta) \leq x\} = \Phi(x) + n^{-1/2}p_1(x)\phi(\mathbf{x}) + \cdots + n^{-j/2}pj(x) + \cdots$ where n is the sample size, $\phi(x)$ is the Standard Normal density function and $\Phi(x)$ is the Standard Normal distribution function. Most importantly, the rate of convergence is calculated for some of well known distributions using the Edgeworth.

BOUND STATES IN TWO QUANTUM WAVEGUIDES COUPLED LATERALLY THROUGH BOUNDARY WINDOWS WITH DIFFERENT CHANNEL WIDTHS. ***Ping Ye* and Yungway Liu,*** *Tennessee Technological University, Cookeville, Tennessee.* Building on the theory of quantum wires laid by P. Exner, et al, we consider two parallel, straight quantum waveguides that are coupled laterally through boundary windows in the common boundaries. We consider the case in which the waveguides have equal widths but in which the windows are of different size centered about a common axis. The corresponding eigenvalues and

eigenfunctions are calculated numerically using the mode-matching method.

MATRIX OPERATOR ON SOME *lp* SPACES. ***Ramesh Garimella and Qiang Zhang*,*** *Tennessee Technological University, Cookeville, Tennessee.* For an infinite lower triangular matrix with non-negative entries, we give some sufficient conditions on the entries which realize the matrix as a bounded linear operator on *lp* spaces where $1 < p < \equiv$.

INSIGHTS TO PHASE EQUILIBRIUM CALCULATIONS VIA EQUATIONS OF STATE. ***Sanjay K. Dube* and Donald P. Visco Jr,*** *Tennessee Technological University, Cookeville, Tennessee.* In this poster, the importance of working with the chemical potential instead of the logarithm of fugacity coefficient in the calculation of phase equilibria has been explored for a cubic equation of state (EOS) as well as for a complex EOS. Also, we have used a numerical integration method, which involves a differential form of the equilibrium conditions to trace out the coexistence curve. This method is used with a higher step size where fixed-point methods (such as Newton-Raphson) fail. We have also shown the relationship between the number of components and the step size for a cubic EOS.

MICROBIOLOGY

JEFF LEBLOND, CHAIR

ANTIMICROBIAL AND ALLELOPATHIC PROPERTIES OF *LUDWIGIA* SP. ***Rebecca D. McWhirter* and John M. Zamora,*** *Middle Tennessee State University, Murfreesboro, Tennessee.* *Ludwigia* sp. or primrose-willow is a genus comprised of 82 species spread throughout the world. Several *Ludwigia* species have acquired a reputation in traditional folk medicine for possessing curative properties. The purpose of this study was to see if extracts of this plant had antimicrobial, allelopathic, or antiviral activity. Alcoholic extracts of the plant were used to determine any antibacterial activity. These extracts were inhibitory to Gram-positive and Gram-negative bacteria. The hot water extract of *Ludwigia* inhibited the growth of bean sprouts. This assay is used as a screening test for allelopathy as well as for anticancer activity. To determine what was occurring microscopically, onion root tip squashes were prepared and fixed onto slides. Altered cell morphology and differences in number of mitotic cells were observed in the hot water extract of *Ludwigia.* Hot water extracts also were tested for antiviral activity against T_4 phage. The extracts did not lower the number of plaque forming units per ml. To determine the solubility of the biologically active compounds, a differential solvent extraction was performed using six different solvents varying from non-polar to polar. Antibacterial activity was used to determine which extracts had biological activity. The most active fractions were ethanol and methanol extracts.

ISOLATION AND IDENTIFICATION OF DIAZINON-DEGRADING BACTERIA. ***Jerry L. Trageser* and John M. Zamora,*** *Middle Tennessee State University, Murfreesboro, Tennessee.* Diazinon is one of a group of organophosphate insecticides. All of the organophosphate insecticides inhibit cholinesterase levels. Diazinon is toxic to the nervous system of insects as well as other animals. It is subject to slow biological degradation and studies show that organophosphates are mobile in the environment. The purpose of this study was to isolate and identify efficient diazinon-degrading microorganisms. Several laboratory strains of organisms were plated onto tryptic soy agar containing diazinon to determine the toxicity of diazinon to microbes. This medium was not very inhibitory. Several laboratory strains of organisms were then plated onto minimal salts agar containing diazinon to determine the selectivity of the media. This medium was inhibitory when compared to tryptic soy agar. Soil samples were inoculated into minimal salts agar containing diazinon. Bacteria capable of growing on this agar were isolated and identified to species. The most efficient diazanon-degraders were determined using biometry (CO_2 evolution) and statistical analysis. These natural isolates may be useful in the biodegradation of diazinon.

INTERACTION OF REOVIRUS WITH A HUMAN MONOCYTE CELL LINE. ***Tiffany E. Guess and Anthony L. Farone,*** *Middle Tennessee State University, Murfreesboro, Tennessee.* Airway inflammation is observed when reovirus serotype 1 Lang (T1L) or serotype 3 Dearing (T3D) is administered in a reovirus pneumonia model in the rat; however, T3D causes more prominent inflammation than T1L while T1L grows to higher levels than T3D. Previous studies have shown that inflammatory molecules are stimulated in a rat alveolar macrophage cell line by reovirus with similar viral replication patterns. The goal of this study is to determine if virus serotype differences observed in rat models are seen in a human monocyte cell line, THP-1. Initial studies have begun with T1L. Cells have been treated with T1L at multiplicity of infection (MOI) of 10 and 100, as well as medium alone. After 24 and 48 h, cell viabilities and viable cell number were determined and plaque assays were done to determine the effect of viral replication. Another set of THP-1 cells will be treated with T3D and observed in the same manner as the T1L. All data collected will be analyzed using an appropriate statistical analysis program. The results will provide further insight into the response of the host response to reovirus and may serve as a model for the interaction of viruses and human monocytes.

LIPID COMPOSITION OF MEMBERS OF THE ALGAL CLASS CHLORARACHNIOPHYCEAE. ***Jeremy L. Dahmen and Jeffrey D. Leblond,*** *Middle Tennessee State University, Murfreesboro, Tennessee.* The algal class Chlorarachniophyceae is comprised of a small group of unicellular eukaryotic algae that are often characterized by an unusual amoeboid morphology. This morphology is hypothesized to be the result of a secondary endosymbiosis in which a green alga was engulfed as prey by a nonphotosynthetic amoeba or amoebaflagellate. Whereas much is known about the phylogenetic relationships of individual chlorarachniophytes to one another, and to possible ancestral host organisms in the genera *Cercomonas* and *Heteromita,* little is known about their physiology, particularly that of their lipids. In an initial effort to characterize the lipids of this algal class, seven organisms were examined for their fatty acid and sterol composition. These included *Bigelowiella natans, Chlorarachnion globusum, Chlorarachnion reptans, Gymnochlora stellata, Lotharella amoeboformis, Lotharelea globosa,* and *Lotharella* sp. Fatty acids associated with chloroplast-associated glycolipids, cytoplasmic membrane-associated phospholipids, and storage triglycerides were characterized. Glycolipid fatty acids were found to be of limited composition, containing principally eicosapentaenoic acid [20:5(n-3)] and hexadecanoic acid (16:0), which ranged

in relative percentage from 67–90% and 10–29%, respectively, in these seven organisms. Triglyceride-associated fatty acids were found to be similar. Phospholipid fatty acid composition was more variable. The principal phospholipid fatty acids, 16:0 (25–32%) and a compound tentatively identified as docosapentaenoic acid [22:5(n-3)] (26–35%), were found along with a number of C_{18} and C_{20} fatty acids. All organisms contained two sterols as free sterols. These were tentatively identified as 24-ethylcholesta-5,22E-dien-3β-ol (stigmasterol; 70–95%) and 24-methylcholesta-5,22E-dien-3β-ol (brassicasterol; 5–30%).

ANTIMICROBIAL PROPERTIES OF *HUMULUS LUPULUS*. ***Nicholas S. Zeger* and John M. Zamora,*** *Middle Tennessee State University, Murfreesboro, Tennessee.* The use of plants in the treatment of disease is as old as folk medicine. Over 1500 antimicrobial and cytotoxic chemicals have been isolated from plants. The most common use of *Humulus lupulus* or hops is in the brewing of beer. Hops provide flavor and aroma to the beer. Hops also have been attributed with helping preserve beer. The purpose of this study was to see if extracts of *Humulus lupulus* had antimicrobial activity. Alcoholic extracts of the plant were used to determine any antibacterial activity. These extracts were inhibitory to Gram-positive and Gram-negative bacteria including *Escherichia coli* and *Bacillus* sp. To determine the solubility of the biologically active compounds, a differential solvent extraction was performed using six different solvents varying from non-polar to polar. Antibacterial activity was used to determine which extracts had biological activity. The most active fractions were the petroleum ether and ethanol extracts.

PHYSICS AND ASTRONOMY

ROBERT MARLOWE, CHAIR

THE IMPACT OF HIGH WIND EVENTS ON THE CENTRAL BUSINESS DISTRICT OF OKLAHOMA CITY. ***Dustin Rapp and Jeffrey B. Basara,*** *Oklahoma Weather Center Research Experience for Undergraduates and Union University, Jackson, Tennessee and Oklahoma Climatological Survey, University of Oklahoma, Norman, Oklahoma.* It is critical to understand airflow through cities due to the possibilities of biological and chemical terrorist attacks, pollution, and accidental chemical spills. Currently, few studies have used continuous field measurements of wind conditions within a city to study urban air flow. This paper investigates the airflow at specific locations within the central business district (CBD) of Oklahoma City, Oklahoma during two synoptic high wind events and one convective high wind event using data collected at fifteen sites. For the synoptic cases, wind vector magnitudes and directions were averaged for each site before and after frontal passages that impacted the CBD. For all cases, wind speed and direction comparisons were made between the individual sites within the CBD. As a result, distinct wind flow patterns within the city were deduced. Possible reasons for these wind flows resulted from the analysis of building structures, site location, and street orientation. It also was found that while airflow through Oklahoma City is extremely complex, small and large scale wind flow patterns were identifiable. As a result, this study emphasizes the need for the further analysis of wind flows through cities during typical, but complex scenarios to better understand how pollutants and chemical/biological agents might flow through a city under a wide variety of weather conditions.

SCIENCE AND MATH TEACHING

MICHAEL J. SANGER, CHAIR

A HISTORY AND OVERVIEW OF TENNESSEE SCIENCE OLYMPIAD. ***David A. Stanislawski and Patricia Patterson,*** *Chattanooga State Technical Community College, Chattanooga, Tennessee and Middle Tennessee State University, Murfreesboro, Tennessee.* Science Olympiad is a national organization that fosters an interest in science and technology among middle school and high school students. At regional, state, and national tournaments, teams of students have an opportunity to represent their school by competing in a variety of science and technology events that test their scientific knowledge and problem solving skills. Science Olympiad is currently celebrating its 20th anniversary. We will present a history of Science Olympiad in Tennessee. We also will highlight some of the goals of the Tennessee Science Olympiad Board of Directors for the next five years. Information and registration forms for joining the Science Olympiad family will be available at the presentation.

COLLABORATION IN THE SCIENCE CLASSROOM. ***Sarah F. Barlow,*** *Middle Tennessee State University, Murfreesboro, Tennessee.* In this era of collaborative learning, creating a classroom environment conducive to student interaction is imperative. Through collaboration students gain confidence and expertise in logical thinking, in working with others, and in communicating ideas. These skills are highly valued in today's competitive employment marketplace as well as in academia. For the first day of class in a nonmajors biology course, strategies that promote student involvement and set the stage for collaborative work can be coupled with a view of the characteristics of science. This presentation demonstrates activities that engage students in thinking about science and initiate student interaction. General student interaction throughout the course is enhanced by implementing this cooperative experience early in the course. In combining a collaborative experience with a simple task, the students are likely to be successful and have a positive attitude toward working together in general. Students become engaged with science and involved in working with classmates.

INTEGRATION OF INQUIRY-BASED FIELD INVESTIGATIONS USING STUDENT GROUPS IN COLLEGE-LEVEL SCIENCE LABORATORIES: IS IT EFFECTIVE? ***Dawn M. Ford, Karen Adsit, and Sean Richards,*** *University of Tennessee, Chattanooga, Chattanooga, Tennessee.* The National Science Foundation (NSF) funded a two-year project at the University of Tennessee, Chattanooga to develop, implement, and assess student-driven, hypothesis testing laboratory modules for introductory and upper-level courses in the Environmental Sciences program. This project, started in 2002, provides students with field opportunities to conduct group scientific research projects using field instrumentation and classroom technology. The primary goal of the project is to provide students with active and cooperative learning techniques to improve their understanding of the hypothesis-testing nature of science. In the process, students will improve their ability to use scientific equipment, work in teams, make oral presentations, and write scientific papers. Introduction

to Environmental Problems I was the first course in which new modules were implemented. This course is the first of a two-semester sequence in introductory environmental science taken by both majors and nonmajors. For the NSF project, the laboratory portion of the course was changed to include a semester-long research project during which students work in groups to examine the water quality of local streams using the scientific method. Together, students make observations, pose questions, conduct literature reviews of water quality variables, generate hypotheses, design experiments, collect data using field equipment, statistically analyze data, make conclusions, make platform-type presentations to the class, and write individual scientific reports. Group projects can be difficult to evaluate. For this project, student grades consist of "paper, process, and presentation." The paper score is based on the quality of the individual report, while the process score is based on how well the student performs in his/her group, interacts with other group members, and shares group work. The process score is determined by both instructor observations and anonymous peer evaluations. The presentation score is based on both the quality of the group presentation and on the process score. A multiplier based on the student process score determines the individual scores for the presentation. The effectiveness of the project and the change in student problem-solving skills, knowledge of the scientific method, and attitudes about science and group work were assessed using pre- and post-project surveys. The Likert technique was used to measure attitudes. Multiple-choice, multiple-answer, and ordering questions were used to measure science knowledge and skills. Preliminary results indicate multiple significant differences between the pre- and post-survey responses.

CORRELATES OF SUCCESS/FAILURE IN HUMAN ANATOMY AND PHYSIOLOGY FOR PRE-HEALTH PROFESSIONS STUDENTS. ***Amy E. Jetton,*** *Middle Tennessee State University, Murfreesboro, Tennessee.* Human anatomy and physiology (A&P) for nursing and pre-health professions students is a demanding content-intensive course. Many nursing programs prefer that their students take this course without prerequisites, and those students who had strong chemistry and biology courses in high school can succeed in this class. However, for the average freshman or the student returning to school after 5+ years, this course is often a discouraging and disastrous beginning, and sometimes ends their college/university experience. Analysis reveals that college level courses in biology and chemistry, including non-majors classes, significantly improve overall rates of success (A/B/C) in A&P. By correlating A&P performance to transcript history (previous science courses, ACT/SAT scores), I hope to find strong predictors of success/failure that can be used to develop guidelines for advising students into appropriate courses to remedy deficiencies, improving their experience and success in A&P.

RAISING ECOLOGICAL AWARENESS IN PRESERVICE EDUCATORS AND ELEMENTARY STUDENTS THROUGH A CEDAR GLADE CURRICULUM STUDY. ***Kim Cleary Sadler and Cindi Smith-Walters,*** *Middle Tennessee State University, Murfreesboro, Tennessee.* The cedar glade curriculum model was designed to raise ecological awareness about a unique ecosystem through field study partnerships. Historically used as junkyards, cedar glades serve as habitat to over 350 plant species, with more than 20 species endemic to the limestone glades. To study the cedar glades, preservice educators work cooperatively with teams of four elementary students who each select an endemic plant to research. After gathering information about cedar glades from a variety of sources, field visits are conducted. Plants are located, mapped, and developmental plant processes are charted; predictions and inferences are made about plants relative to rock and soil parameters. Within this contextual framework, the cedar glade study was designed to teach basic processes of plant ecology in two tiers, by biology faculty teaching preservice educators and preservice educators in turn teaching elementary students through a cooperative partnership. Interdisciplinary in scope, the curriculum design integrates science, math, language, and visual arts. The instructional model uses basic skills to form concepts, and integrated skills to interpret data (identify relationships, make inferences), and apply principles (predict, explain, hypothesize, support, verify). The integration of these skills nurtures both the preservice and elementary student's ability to use and develop scientific ways of thinking and in turn enables them to apply what they know to their world beyond the classroom.

DEPTH VERSUS BREADTH: DO STUDENTS LEARN CHEMISTRY CONCEPTS AS WELL WITH INQUIRY-BASED METHODS AS TRADITIONAL LECTURE METHODS? ***Michael J. Sanger,*** *Middle Tennessee State University, Murfreesboro, Tennessee.* For years, science educators have advocated teaching science using inquiry-based teaching methods. However, college faculty in science departments resist these methods, relying on lecture formats they are more comfortable and confident with. This paper compares the responses of students learning chemistry using inquiry-based and traditional lecture methods on content-knowledge chemistry questions. Students' beliefs about the nature of science also will be compared.

CHEMISTRY MISCONCEPTIONS OF PRESERVICE CHEMISTRY TEACHERS: WHAT THEY THINK THEY KNOW JUST BEFORE THEY TEACH. ***Amy J. Phelps,*** *Middle Tennessee State University, Murfreesboro, Tennessee.* Chemistry teachers are responsible, at least in part, for the conceptions of their students so it would be interesting to know what preservice teachers think about various chemistry concepts. Over a nine year period, a chemistry concepts test has been given to a group of preservice high school chemistry teachers as part of their chemistry curriculum course. This paper will delineate the results of that test across the years in an effort to illuminate our understanding of preservice teachers' views of chemistry concepts. Additionally, the paper will include the students reflective comments about how they have come to know what they know or how they have failed to know what we want them to know. The chemistry preservice teachers can serve as a sample of what lessons from our chemistry instruction are being carried forward into the lives of chemistry majors.

INNOVATIVE INTRODUCTORY PHYSICS—A BLENDED SCIENCE COURSE FOR TEACHERS. ***Aimee L. Govett and John W. Farley,*** *East Tennessee State University Johnson City, Tennessee and University of Nevada, Las Vegas, Las Vegas, Nevada.* Traditional introductory science courses, taught in the College of Science, are removed from the relevant pedagogy, taught in the College of Education and not always the best preparation for K–12 teachers. We proposed a blended course, combining science content with pedagogy, to determine if such a course would significantly affect teachers' science content knowledge and their attitude toward teaching science. Physics for Teachers,

co-taught by faculty from education and physics, was offered for the first time to physics, chemistry and physical science teachers (summer 2001) with a feedback meeting during the following academic year. Participants were pre- and post-tested on a standard assessment tool in introductory physics, the Force Concept Inventory (FCI) test. Participants significantly improved their scores on the FCI as a result of the course with more dramatic results obtained on FCI questions covered in our course. They also showed significant improvement in their attitude toward teaching physics.

SOME CONSTRUCTION PROBLEMS TO CHALLENGE GEOMETRY STUDENTS. ***Max Y. Melnikov,*** *Middle Tennessee State University, Murfreesboro, Tennessee.* A compass and a straightedge represent standard construction tools in geometry. The first segment of the talk will focus on some construction problems that are supposed to be resolved with the aid of these tools, but we will discuss such challenge problems that have not traditionally been included in the curriculum of the College Geometry course. We plan, for example, to go through the procedure of building a triangle given its height, median, and angle bisector drawn from the same vertex. The most challenging segment of the talk deals with such unusual construction problems as when the student is limited to the use of only one of the two traditional tools. We will, for example, show how a compass only can help us to divide the circular arc onto four congruent segments, or how a perpendicular can be dropped onto a line segment with a straightedge only available.

BIOTECHNOLOGY RESOURCE GROUP: OPPORTUNITIES FOR RESEARCH AND TEACHING. ***Rebecca L. Seipelt,*** *Middle Tennessee State University, Murfreesboro, Tennessee.* The Biotechnology Resource Group (BRG) is an interdisciplinary group of scientists working together in the middle Tennessee area to develop new biotechnologies and to educate a workforce for the biotechnology industry. The BRG, with National Science Foundation funding, supports new technology development by providing support for students and teachers to engage in interdisciplinary research with BRG scientists. The BRG, with National Science Foundation funding, supports workforce development by providing biotechnology training for high school teachers in a 3-day summer workshop, being available for after-school training, and also by providing supplies and lending equipment for high school teachers to use in their classrooms. In addition, undergraduate and graduate students can explore biotechnology industrial careers and gain valuable work experience through internships. Past and present research efforts will be presented along with future teaching and research opportunities in physics, chemistry, and biology, as well as other disciplines.

GRADE SCHOOL TO GRADUATE SCHOOL: ATTRACTING AND RETAINING WOMEN IN SCIENCE, TECHNOLOGY, ENGINEERING AND MATHEMATICS. ***Judith Iriarte-Gross, Simone Stennis*, and Jill Roberson-Blatt****, Middle Tennessee State University, Murfreesboro, Tennessee.* Middle Tennessee State University hosts a variety of programs for women in the STEM (science, technology, engineering and mathematics) starting with grade school to graduate school. We have been presenting Expanding Your Horizons in Science and Mathematics (EYH) conference to middle school girls (grades 5–8) for seven years. We have expanded EYH due to the large demand, for women in high school (grades 9–12). This new program is called TWISTER, Tennessee Women in Science, Technology, Engineering, and Research. Undergraduate and graduate women in STEM have formed a WISE (Women in Science and Engineering) student organization this year and are proposing several new events to attract women to STEM majors. We will present and discuss our strategies to attract and retain women in STEM.

PRE- AND POST TESTING AS A MEASUREMENT OF EFFECTIVENESS IN A GENERAL EDUCATION PHYSICAL SCIENCE COURSE. ***Judith Iriarte-Gross and Terrence A. Lee,*** *Middle Tennessee State University, Murfreesboro, Tennessee.* Topics in Physical Science is a one-semester introductory general education lecture and laboratory course for non-science majors. This course focuses on fundamental topics in astronomy, chemistry, geology and physics and the interdisciplinary nature of these four areas. This course emphasizes a broad and integrated knowledge of physical science, which should prepare our non-science majors with sufficient knowledge to be scientifically literate. Between 700 and 800 students enroll in this course each semester with approximately 150 students taking it during the summer. A block of core topics has been defined by the faculty; however, there has not been an assessment of the course other than the in class exams and the laboratory grades. In order to assess the overall progress of our students, a pre and post exam that covers the core topics was designed by the faculty. The results of this exam for three semesters and a statistical analysis will be presented and discussed.

RESEARCH AND DEVELOPMENT OF PHYSICAL SCIENCE LABORATORIES WITH CONNECTIONS TO EVERYDAY ACTIVITIES. ***Linda Hendrickson* and Judith Iriarte-Gross,*** *Middle Tennessee State University, Murfreesboro, Tennessee.* The purpose of this research is to develop and test new laboratory activities that focus on real life experiences for physical science students. One of our goals is to make the labs interesting and applicable for the non-science majors who are required to take this course. We are introducing new technology in these labs such as the TI-83+ graphing calculators, computers, and Vernier Lab Pros and sensors. Exposing the students to this technology is just another step in helping provide them with the information they need to be successful in the rapidly growing technology-based work force. Some of the new labs we are developing include: "Go Solar," "Downhill All the Way," "$\alpha\beta\gamma$: The ABCs of Radiation," and "The Color of Chemistry." Our research with these labs, results, and comments from physical science students will be presented.

TENNESSEE SCIENCE OLYMPIAD—GETTING YOUR STUDENTS INVOLVED IN SCIENCE. ***David A. Stanislawski, Michael Daley, Patricia Patterson, and Robert Fabian,*** *Chattanooga State Technical Community College, Chattanooga, Tennessee, University of Memphis, Memphis, Tennessee, Middle Tennessee State University, Murfreesboro, Tennessee, and Bearden Middle School (retired), Knoxville, Tennessee.* This continuous poster session consists of a video tape of the 2003 National Science Olympiad Tournament at The Ohio State University. The video shows the fun and excitement at a Science Olympiad Tournament in which teams of students demonstrate their knowledge and problem solving skills in all areas of science and technology. Members of the Tennessee Science Olympiad Board of Directors will be available at break times to answer questions, distribute literature, and take names of interested teachers.

ZOOLOGY

JOSEPH R. SCHILLER, CHAIR

A CHAMPION OF PROGRESS: A BRIEF INTRODUCTION TO THE ENDANGERED NASHVILLE CRAYFISH (*ORCONECTES SHOUPI*) AND THE MILL CREEK WATERSHED. ***David I. Withers,*** *Tennessee Department of Environment and Conservation, Division of Natural Heritage, Nashville, Tennessee.* The Nashville crayfish, *Orconectes shoupi,* is an endemic decapod crustacean restricted to the Mill Creek watershed in Davidson and Williamson Counties, Tennessee. Because of its limited distribution, the species was listed by the United States Fish and Wildlife Service and the Tennessee Wildlife Resources Agency in 1986, and remains the only federally endangered crustacean in Tennessee. Once thought to be limited to the main stem of Mill Creek and its larger tributaries, in recent years the species also has been found in 1st and 2nd order tributaries of that drainage. Despite the additional regulatory attention received by certain permitted activities in the Mill Creek system, the crayfish remains largely unknown to the general public. The current presentation provides an overview of the species, its distribution and life history, and addresses some of the conservation needs of an endangered species occurring primarily in an urban area.

EFFECTS OF WATER TEMPERATURE ON THE GROWTH OF BARRENS TOPMINNOW AND WESTERN MOSQUITOFISH. ***Malabika Laha* and Hayden T. Mattingly,*** *Tennessee Technological University, Cookeville, Tennessee.* The Barrens topminnow, *Fundulus julisia,* is an inhabitant of the spring-fed headwaters of the Barrens plateau region of middle Tennessee. The species has experienced dramatic declines in recent years, apparently related to habitat degradation and invasive species such as the aggressive western mosquitofish, *Gambusia affinis.* The objective of this study was to document the specific growth rate (SGR) of the two species at four temperature levels (10°, 15°, 20° and 25° C), representing a range of temperatures that might be encountered in or near topminnow habitats. Eight topminnow replicates and three mosquitofish replicates were allowed to grow for 30 days at each temperature level. The SGR increased with increase in temperature for both species. Mean comparisons for topminnow SGR showed significant differences at each temperature level increase except 20° to 25° C. Mosquitofish had higher mean SGR at 20° and 25° C than at 10° and 15° C. Between-species comparisons of SGR showed significant difference only at 10° C (mosquitofish had a higher SGR). At 15° C, though the difference was not statistically significant ($P = 0.0604$), it may be biologically meaningful. Further studies with larger sample sizes may be required to investigate the species-wise differences.

USING SCANNING ELECTRON MICROSCOPY TO STUDY THE DEVELOPMENT OF TELEOST FISH. ***Judith D. Shardo,*** *Middle Tennessee State University, Murfreesboro, Tennessee.* Of roughly 25,000 species of teleost fishes, the morphological development of only a few species has been described in detail, far too few to permit strong comparative studies. Scanning electron microscopy is an excellent tool for studying the sequence of changes in early development of both external and internal structures. The teleost embryo first appears as a clump of cells along the thickened margin of the blastodisc. The embryonic axis forms with the appearance of the notochord and a solid neural keel that later cavitates. The brain and eyes develop followed by the tail and jaws. While most teleost species studied follow that general sequence, hatching time, the transition from embryo to yolk-sac larva, is one character that clearly varies among species. The yolk-sac larvae of some species hatch at an early developmental stage lacking pigmented eyes and functional jaws. These structures must complete development before all yolk is consumed.

DEMOGRAPHY OF HELLBENDERS IN MIDDLE TENNESSEE: CAUSE FOR CONCERN? ***Brian T. Miller and Joyce L. Miller,*** *Middle Tennessee State University, Murfreesboro, Tennessee.* Mark-recapture studies were conducted on the Collins and Buffalo Rivers from June 1990 to September 1993, and from July 2002 to August 2003. Seventeen visits to the Collins River during the early 1990s resulted in 82 captures (44 individuals). This site was dominated by large, sexually mature hellbenders (total length [TL] ranged from 408–545 mm). Only one individual was found during the three most recent visits (July 2002–May 2003). Seven visits to the Buffalo River during the early 1990s resulted in 39 captures (29 individuals). TL ranged from 111–608 mm; three hellbenders were < 200 mm and four between 201 and 300 mm. The capture of young suggests successful reproduction was occurring. Unfortunately, the study site has degraded considerably during the last decade; successful reproduction at the site is now doubtful. Streams in middle Tennessee appear to harbor small, declining, populations of hellbenders.

SEASONAL CHANGES IN THE ADRENOCORTICAL STRESS RESPONSE IN FREE-LIVING FENCE LIZARDS. ***Matthew Klukowski,*** *Middle Tennessee State University, Murfreesboro, Tennessee.* Species with limited lifetime reproductive opportunities cannot afford to have their mating season interrupted by stress, and thus should not exhibit a vigorous adrenocortical stress response during the breeding season. This hypothesis was tested in male fence lizards, *Sceloporus undulatus.* During the breeding and non-breeding season lizards were subjected to 0 (control), 10 min, or 4 h of confinement stress in the field. During the breeding season, there was not a significant adrenocortical stress response even after 4 hr of stress, and plasma testosterone concentrations were unaffected. However, during the non-breeding season the stress response was pronounced and plasma testosterone was significantly elevated in the 10 min group. The results support the hypothesis that the stress response will be weak during the reproductive season in species with limited mating opportunities. Furthermore, male fence lizards exhibit substantial seasonal variation in the adrenocortical stress response.

THE INFLUENCE OF HABITAT COMPLEXITY ON THE FORAGING SUCCESS OF THE EASTERN GARTERSNAKE (*THAMNOPHIS SIRTALIS SIRTALIS*). ***J. Jeffrey Green*, John S. Placyk Jr.*, and Gordon M. Burghardt,*** *University of Tennessee, Knoxville, Tennessee.* This study was the first to investigate the influence of habitat complexity on the foraging behavior of a generalist predator, the eastern gartersnake. Laboratory experiments in which snakes were offered earthworm prey in either the presence or absence of an environmental variable that may increase habitat complexity, indicated that overall foraging behavior of *Thamnophis sirtalis sirtalis* did not differ significantly between treatments; however, foraging success was significantly higher in a completely barren environment. Our results were similar to those found in studies involving *Elaphe obsoleta*

and *Nerodia clarkii compressicauda,* both specialist predators, which showed a decrease in foraging efficiency associated with an increase in habitat complexity. Results indicate that the influence of habitat complexity on the foraging behavior of reptilian predators may not vary greatly between species or from generalist to specialist; and that generalist predators may be no better at adapting to increases in habitat complexity than specialist predators.

PRELIMINARY INVESTIGATION OF TIMBER RATTLESNAKE THERMOREGULATION, IN MIDDLE TENNESSEE. ***Timothy Worrall* and Vincent A. Cobb,*** *Middle Tennessee State University, Murfreesboro, Tennessee.* The thermoregulatory behavior of free-ranging gravid and non-gravid timber rattlesnakes, *Crotalus horridus,* was studied during June and July of 2003. As a preliminary investigation, two snakes were monitored in the field using a surgically implanted transmitter and snake body temperatures were recorded every 30 min for 40 days using a miniature temperature logger. Data indicate that pregnancy does influence thermoregulatory behavior in timber rattlesnakes; the gravid individual maintained a warmer ($\bar{x}$ day T_b = 30.1°C, gravid; $\bar{x}$ day T_b = 27.6°C, non-gravid) and less variable body temperature during the day, but at night, body temperatures were more similar ($\bar{x}$ night T_b = 22.1°C, gravid; $\bar{x}$ night T_b = 20.8°C, non-gravid). Data also indicate that the gravid snake warmed up earlier during the day and maintained a warm temperature longer than the non-gravid individual. A weather station was erected nearby for the monitoring of environmental temperatures and determining what temperatures were available for the snakes. Variation in climatic conditions and environmental temperature appear to have noticeable effects on snake body temperature selection.

PROXIMITY TO EDGE AND PREDATION RISK ON ARTIFICIAL NESTS OF NORTHERN BOBWHITES. ***Jason B. Jennings*, Michael L. Kennedy, and Allan E. Houston,*** *The University of Memphis, Memphis, Tennessee (JBJ, MLK) and Ames Plantation, Grand Junction, Tennessee (AEH).* Predation on the nests of northern bobwhites (*Colinus virginianus*) by Virginia opossums (*Didelphis virginiana*), raccoons (*Procyon lotor*), and striped skunks (*Mephitis mephitis*) was assessed in relation to proximity to forest edge. The study was conducted at the Ames Plantation in Fayette and Hardeman counties, Tennessee, during 2002 and 2003. Artificial nests, baited with eggs of northern bobwhites, were placed in raccoon-size live traps at six distance categories (0–10 m, 11–20 m, 21–30 m, 31–40 m, 41–50 m, and > 50 m) from forest edge. Association between nest predation and distance to forest edge was assessed using a chi-square analysis. Results reflected predation on nests, but there was no statistically significant ($P > 0.05$) relationship between nest predation and distance to forest edge at the intervals tested.

ESTIMATING POPULATION DENSITY OF WHITE-TAILED DEER ON MILAN ARMY AMMUNITION PLANT. ***Philip L Johnson*, Michael L. Kennedy, and Steve W. Stephenson,*** *The University of Memphis, Memphis, Tennessee (PLJ, MLK) and Milan Army Ammunition Plant, Milan, Tennessee (SWS).* Infrared-triggered cameras were used to estimate population density of white-tailed deer (*Odocoileus virginianus*) at the Milan Army Ammunition Plant in Carroll and Gibson counties, Tennessee, during fall 2002 and winter 2003. Density estimates were derived from photographs taken at 20 sites during 21 days of sampling. Each site was baited with shelled corn, and cameras were set to record photographs at 10 minute intervals. Based on photographs of male, female, and juvenile animals, density was estimated as one per 5.1 ha during fall and one per 3.7 ha during winter. Based on reports in previous studies, estimates derived in the present investigation reflected high densities of white-tailed deer at the study site.

AN ISOTOPIC EXAMINATION OF CAVE AND EPIGEAN AQUATIC SYSTEMS IN MAMMOTH CAVE. ***Zacchaeus G. Compson* and Philip W. Lienesch,*** *Western Kentucky University, Bowling Green, Kentucky.* High-water events in the Green River result in flow-reversals, which flush native and introduced fishes into Mammoth Cave, posing natural threats to the underground cave fauna. However, little is understood about how natural flood events affect the trophic structures of cave fauna. Of specific interest are natural springs that serve as gateways connecting the cave and epigean ecosystems. The purpose of this study was to utilize isotopic ratios of carbon and nitrogen in order to: 1) describe the trophic structure of epigean, spring and cave aquatic systems within Mammoth Cave National Park, and 2) elucidate differences in trophic structures both seasonally and spatially between these systems. Fourteen sites were sampled from fall 2002 to fall 2003. Samples were dried, pulverized, weighed and sent to the Colorado Plateau Stable Isotope Laboratory at Northern Arizona University for isotope analyses. Two a priori hypotheses were tested and discussed: 1) the trophic structures of cave and spring sites will be more general than those of epigean sites, and 2) fish living in spring heads will assimilate δ values intermediate to those of organisms in cave and epigean aquatic systems. Answers to these questions give scientists a clearer understanding of the interaction between epigean and cave ecosystems and provide valuable insight into the regulation of introduced game predators, such as muskellunge (*Esox masquinongy*) and trout (*Oncorhynchus mykiss*), that are so valuable to the culture and economy of southern Kentucky.

MEASURES OF BIODIVERSITY OF SMALL MAMMALS IN THREE HABITAT TYPES USING SHERMAN LIVE TRAPS. ***Heidi L. LaMountain* and Michael L. Kennedy,*** *The University of Memphis, Memphis, Tennessee.* During fall 2001 and 2002, winter 2003, and spring 2002 and 2003, biodiversity of small mammals in three habitat types (forest, field, forest/field edge) was assessed at Milan Army Ammunition Plant in Carroll and Gibson counties in western Tennessee. Animals were sampled using Sherman live traps baited with rolled oats. Thirty transects of 10 traps each for fall 2001 and 2002, winter 2003, spring 2003, and 30 transects of 15 traps each for spring 2002 were employed to capture small mammals in each habitat type. Estimates of biodiversity were based on catch per unit effort. Species richness was greatest in edge and field habitats for all seasons except winter 2003. The white-footed mouse (*Peromyscus leucopus*) and cotton rat (*Sigmodon hispidus*) had greatest species abundance depending on habitat and season. Catch per unit effort, species evenness, and overall biodiversity varied among habitats and seasons.

MOVEMENT PATTERNS IN THE RACCOON, *PROCYON LOTOR*, IN SOUTHWESTERN TENNESSEE. ***John R. Hisey*, Michael L. Kennedy, Troy A. Ladine, Shannon A. Maris-Danley, and Lacey D. Loudermilk,*** *The University of Memphis, Memphis, Tennessee (JRH, MLK, TAL, SAM-D) and Lee University,*

Cleveland, Tennessee (LDL). Movements of organisms influence gene flow and colonization rate but are poorly documented among some solitary mammalian mesopredators, which may become superabundant and threaten populations of their prey. To address hypotheses on patterns of movement relative to sex and age in one such species, we captured raccoons during winter sessions over 12 years on one live-trap grid and both winter and summer sessions for three years on three grids near Memphis, Tennessee. Annual disappearance (turn-over) rates were similar to seasonal disappearance rates so that seasonal migratory patterns did not predominate. Appearance rate of reproductive-age males was only slightly correlated to numbers of females or sex ratios on the site. However, rate of establishment by these males of residency on home ranges was significantly correlated to female numbers and sex ratios. Such movement rates may affect evolutionary processes and should shape management planning for solitary carnivores and prey species they impact.

AN ASSESSMENT OF SPECIES RICHNESS IN MAMMALS USING SCENT-STATION PROCEDURES IN THREE HABITATS. ***James B. Akins*, Brian D. Carver, and Michael L. Kennedy,*** *The University of Memphis, Memphis, Tennessee (JBA, MLK) and Freed-Hardeman University, Henderson, Tennessee (BDC).* Species richness for mammals was assessed in relation to three habitats (wet, dry, moist) at Milan Army Ammunition Plant located in Gibson and Carroll counties in western Tennessee between late June to early July 2001 thru 2003. Assessments were made using standard scent-station procedures. Survey lines consisted of 10 scent stations placed at 0.32 km intervals along a continuous route. Each station consisted of a circle of sifted sand one m in diameter. A cotton ball saturated with bobcat urine was attached to a wooden applicator stick placed in the center of the circle. Stations were operated for one night. The presence of one or more tracks of a species at a station verified the presence of that species occurring in the represented habitat type. Greatest visitation was seen for wet habitat, but species richness did not differ among habitats (ANOVA; $P > 0.021$).

AN ASSESSMENT OF MAMMALIAN BIODIVERSITY IN THREE HABITAT TYPES USING PITFALL TRAPS. ***Melita E. Smith*, Michael L. Kennedy, and James A. Huggins,*** *The University of Memphis, Memphis, Tennessee (MES, MLK) and Union University, Jackson, Tennessee (JAH).* Habitat use was assessed for three species of shrews (southeastern shrew, *Sorex longirostris;* southern short-tailed shrew, *Blarina carolinensis*; least shrew, *Cryptotis parva*) at the Milan Army Ammunition Plant in Carroll and Gibson counties in western Tennessee. Animals were captured using pitfall traps, and data were analyzed by species and habitat type (forest, field, forest/field edge, kudzu). *Blarina carolinensis* was the species taken in greatest abundance and displayed the greatest breadth in habitat tolerance, while *C. parva* was taken in least abundance and showed the least breadth in habitat tolerance. Differences in habitat utilization were found for each species. Kudzu was utilized by all species at a level comparable to other habitats.

TESTING THE HYPOTHESIS THAT AMBIENT TEMPERATURES DURING EGG-LAYING EXPLAIN WITHIN SEASON CLUTCH-SIZE DECLINE IN BIRDS. ***T. David Pitts,*** *University of Tennessee, Martin, Martin, Tennessee.* Many birds lay large clutches early in the year and smaller clutches later in the year. Ornithologists have fervently debated the causes of this decline. A recently published hypothesis suggests that small clutches during warm weather are adaptive because high ambient temperatures during the egg-laying period may cause abnormal embryonic development, especially in large clutches. One way to minimize the exposure of eggs to suboptimal temperatures prior to the onset of incubation is to decrease clutch size. I used data from three nesting seasons of Eastern Bluebirds (*Sialia sialis*) to test two predictions that are generated by this hypothesis: 1) the first egg in each clutch is least likely to hatch because it is exposed longer to ambient temperatures before incubation begins, and 2) more nests will have eggs that fail to hatch during the warmer part of the nesting season. My results do not support either of these predictions.

BIOASSESSMENT OF TRACE CREEK WATER QUALITY ABOVE AND BELOW DISCHARGE OF WAVERLY SEWAGE TREATMENT PLANT, HUMPHREYS COUNTY, TENNESSEE. ***Timothy D. Brown*, James O. Harmon* Jr., Laura D. Mills*, Rhonda Johnson*, and Steven W. Hamilton,*** *Austin Peay State University, Clarksville, Tennessee.* This study employed an aquatic macroinvertebrate survey to assess water quality of Trace Creek in Humphreys County, Tennessee, which receives effluent from the Waverly Sewage Treatment Plant. A riffle about 100 m upstream and another about 300 m downstream of the outfall were sampled. Dissolved oxygen, pH, temperature, specific conductance, total dissolved solids, and turbidity were measured at each site. A modification of the Tennessee Department of Environment and Conservation's (TDEC) stream survey protocols was used in the assessments. Each of the four team members collected three macroinvertebrate samples per riffle using a rectangular aquatic net. These three samples were combined and 300 macroinvertebrates were randomly subsampled from the composite sample using a gridded pan. Most macroinvertebrates were identified to genus. The metrics taxa richness, EPT taxa richness, % EPT, % clingers, NC Biotic Index, % Oligochaetes + Chironomids, and % dominant (recommended by TDEC for macroinvertebrate biomonitoring), were used to calculate a multimetric index score for each team member's upstream and downstream sample that were compared to target values established for the bioregion (71f, Western Highland Rim). Although individual team member's scores varied, the mean team score indicated Trace Creek was "Supporting" its TDEC designated use. Previous TDEC reports indicated Trace Creek had excessive phosphorus and nitrogen, but our data indicates the stream is meeting its use criteria.

A SURVEY OF THE HERPETOFAUNA OF THE DUCK RIVER WATERSHED WITHIN COFFEE COUNTY, TENNESSEE. ***Matthew L. Niemiller****, Middle Tennessee State University, Murfreesboro, Tennessee.* The Duck River and its adjacent watershed in middle Tennessee is one of the most biologically diverse river drainages in the United States. Over 500 species of aquatic plants, vertebrates, and invertebrates have been documented, many of which are endemic. Several inventories on the mussel and fish fauna of the watershed have been conducted, but little attention has been directed towards herpetofauna. A herpetological inventory was conducted from May 2002 to October 2003 using visual encounter surveys, drift-fence/pitfall traps and road cruising. The inventory documented 45 species, 24 amphibian and 21 reptile, within the watershed. Of the 24 amphibians, 12 frog and 12 salamander species were documented. Of the 21 reptiles, 3 turtle, 4 lizard and 14 snake species were documented.

The first distribution record for *Gyrinophilus porphyriticus* in Coffee County was reported.

AN ASSESSMENT OF SEX-BIASED RESPONSE OF RACCOONS *(PROCYON LOTOR)* TO LIVE TRAPS IN WESTERN TENNESSEE. ***Erica Hessen*, Brian D. Carver, John R. Hisey, and Michael L. Kennedy,*** *The University of Memphis, Memphis, Tennessee (EH, JRH, MLK), and Freed-Hardeman University, Henderson, Tennessee (BDC).* Sex-biased response of raccoons (*Procyon lotor)* to live traps was assessed using mark-recapture procedures at the Meeman Biological Station in Shelby County, Tennessee, during winters of 2001–2003. Sampling was conducted on a 50-trap grid consisting of 5 lines of 10 traps each spaced about 200 meters apart. Individuals were captured using live traps (raccoon size) baited with canned cat food, sedated, tagged in both ears, and released. The work was conducted during early January through late March and involved approximately 2000 trap nights (1 trap night = 1 trap set for 1 night) per year. The number of males and females captured and rates of recapture by sex were determined. Results are discussed in light of previous reports.

PREDATION ON INTERNAL ORGANS OF FIELD-DRESSED DEER. ***Joshua K. Bright*, Philip L. Johnson*, Allan E. Houston, and Michael L. Kennedy,*** *The University of Memphis, Memphis, Tennessee (JKB, PLJ, MLK) and Ames Plantation, Grand Junction, Tennessee (AEH).* To determine predators involved in predation on remains of field-dressed white-tailed deer (*Odocoileus virginianus*) following harvest, internal organs and associated materials (internal organs) were collected and later placed at selected sites in forested habitat. Predators utilizing internal organs were recorded to species using infrared cameras. The study was conducted at the Ames Plantation in Fayette and Hardeman counties, Tennessee, during December 2002 and January 2003. During each period, 20 cameras were placed over internal organs at 20 widely separated sites. Internal organs were positioned on the ground, and cameras located about 3 meters away. Results indicated predators to include turkey vulture (*Cathartes aura),* black vulture (*Coragyps atratus*), crow (*Corvus brachyrhynchos),* red-tailed hawk (*Butco jamaicensis),* red fox (*Vulpes vulpes*), raccoon (*Procyon lotor*), dogs (*Canis familiaris*), and coyote (*Canis latrans*).

Reelfoot Lake Symposium

WINTFRED L. SMITH, CHAIR

GEOGRAPHY OF REELFOOT LAKE REGION. ***Robert M. Simpson,*** *University of Tennessee, Martin, Martin, Tennessee.* The geography of Reelfoot Lake is presented. It is located in the rural, mostly agrarian area of northwest Tennessee. It straddles the border between Lake and Obion counties, and though the lake itself is not in Kentucky, its watershed extends into Hickman County and Fulton Counties in Kentucky. Annual precipitation in the region averages nearly 50 inches. The region enjoys hot, humid summers and mild winters. Economic development is somewhat limited to agriculture—especially to the growing of soybeans, corn, and cotton; to light manufacturing (generally) and tourism related to the lake. Populations of the counties in the region average around 30,000 each. Growth and development of the area may increase as a result of the construction of Interstate 69 that is slated to pass within 30 miles of the area.

GEOLOGIC HISTORY OF THE REELFOOT REGION. ***Michael Gibson,*** *University of Tennessee, Martin, Martin, Tennessee.* The modern Reelfoot Lake region is a composite of a long geologic history beginning with Neoproterozoic tectonic rifting forming the still active dominant structural control. During Paleozoic and Mesozoic, infilling of the rift and Mississippi Embayment dominated as marine and terrestrial environments developed in response to sea level changes and tectonic events. The geologic recent (past 2 million years) has been dominated by more infilling and other surface processes, namely the establishment of the Mississippi River drainage route and glacial-derived upland sediments. Today the Reelfoot region can be subdivided into regions and associated processes: Mississippi River, accounting for the shape of Reelfoot Lake and the surrounding lowlands and flood hazards; the Bluff Region consisting of more ancient loess hills, providing sediment for lake infill and agriculture recording paleoclimate, and underlying consolidated sedimentary units; Reelfoot Lake Basin itself, dominated by limnological and some fluvial processes; Fault-related processes and structures, such as earthquakes and mass wasting.

PALEOSEISMOLOGY OF THE NEW MADRID SEISMIC ZONE FROM TREE RINGS. ***Malcolm K. Cleaveland and David W. Stahle,*** *University of Arkansas, Fayetteville, Arkansas.* Tree rings in long-lived baldcypress (*Taxodium distichum*) trees can be used to make inferences about seismic activity in the great 1811–1812 New Madrid Seismic Zone earthquakes. Many of the baldcypress at Reelfoot Lake responded with an incredible growth spurt to the flooding that drowned bottomland hardwoods. In 1814 growth reached > 8 standard deviations above average. This spurt, along with the development of "hanging buttresses" at the new water level reveals interesting elements of baldcypress physiology. A comparison of damage and growth response at different sites in the region may answer some of the questions that surround the 1811–1812 seismicity. Baldcypress at the St. Francis Sunklands site (near Marked Tree, Arkansas) show extreme damage and at least 50 years of growth suppression, indicating that the site must have been quite close to the epicenter of one of the great earthquakes. However, Allred Lake, Missouri baldcypress, about 100 km away, show no obvious damage. The Reelfoot Lake trees show intermediate levels of damage. Development of additional chronologies in the region might improve our knowledge of the events.

ARCHAEOLGICAL RESEARCH AT REELFOOT: THE LAST 20 YEARS. ***W. Lawrence,*** *Natural and Cultural Resource Management Section, TEDC, Nashville, Tennessee.*
Abstract not available.

APPLICATION OF SATELLITE IMAGES ON ASSESSING WATER QUALITY OF REELFOOT LAKE, TENNESSEE. ***Fugui Wang*, Luoheng Han, and Hsiang-te Kung,*** *The University of Memphis, Memphis, Tennessee (FW, HK) and The University of Alabama, Tuscaloosa, Alabama (LH).* Reelfoot Lake has been an important economic, ecological, and recreational asset for the state of Tennessee for many years. Unfortunately, the water quality of Reelfoot Lake is becoming eutrophic. The goal of this research is to evaluate and map water quality of Reelfoot Lake by analyzing trophic state index, and using the models construct-

ed between "ground truth" data of water quality parameters and spectral reflectance recorded simultaneously by Landsat TM. In August, 2003, Secchi disk depth was measured and water samples were collected at 19 sampling sites. Turbidity, chlorophyll concentration, total solids, and total suspended solids were measured from the water samples in labs. The results indicated that water quality was very poor and hypereutrophic. The major factor affecting water quality was outgrowth of algae. Based on the models established, water quality maps for Reelfoot Lake were created. Finally, spatial patterns and factors influencing these patterns were analyzed and discussed.

SEVENTY-FIVE YEARS OF PLANT COMMUNITY CHANGES AT REELFOOT LAKE. ***Nicholas A. Winstead* and Sammy L. King,*** *University of Tennessee, Knoxville, Knoxville, Tennessee and Louisiana State University Cooperative Fish and Wildlife Research Unit, Baton Rouge, Louisiana.* Reelfoot Lake marshes have succeeded during the past 75 years from *Zizaniopsis miliacea*-dominated marshes to *Decodon verticillatus*-dominated marshes. Reasons for these changes have been attributed to water-level stabilization, but have not been discussed in detail in the literature. Fifteen years have passed since the last plant community studies, and current extent and composition of plant communities is unknown. The United States Fish and Wildlife Service and United States Army Corps of Engineers have proposed water-level management changes incorporating major periodic drawdowns, but impacts to marshes have not been adequately addressed. The lead management agencies for Reelfoot are charged with providing wildlife habitat; but without knowing how drawdowns may affect plant communities, they cannot predict how wildlife populations may respond. We attempt to explain why plant communities have changed over the past 75 years, and to understand how drawdowns may affect the current extent and composition of marshes at Reelfoot Lake.

FIRST RECORD OF *CORDYLOPHORA LACUSTRIS* (CNIDARIA) FROM REELFOOT LAKE IN NORTHWEST TENNESSEE. ***Wintfred L. Smith and Jamie Hamilton,*** *University of Tennessee, Martin, Martin, Tennessee and Troy, Tennessee.* The periphyton of Reelfoot Lake has not been previously studied. A qualitative survey was undertaken in 1995 to evaluate its composition. The nonindigenous hydroid *Cordylophora lacustris* was collected from Buck Basin during June and July 1995 through 1998, at water temperatures of 26–30°C and Secchi disk transparency less than 0.5 meter. Specific conductance during the course of a year in this basin was within the range of 100–200 μmho cm^{-1}. Specimens were attached to the upper portion of plants and sticks in water of one to two meters depth. They were interspersed with massive growths of *Epistylis* sp., *Carchesium* sp., *Vorticella* sp., *Stentor* sp., *Sinantherina socialis, Urnatella gracilis,* and encrusting bryozoans. The polyps themselves were often overgrown with protozoans and rotifers. No annulations on the perisarc were seen and no gonophores were observed. Colony height did not exceed three millimeters and the hydrorhiza was well developed.

HISTORY OF ORNITHOLOGY AT REELFOOT LAKE. ***T. David Pitts,*** *University of Tennessee, Martin, Martin, Tennessee.* The birds of Reelfoot Lake have been not been intensively studied, in spite of their historical importance as a source of food, income, and recreation. Most of the publications about Reelfoot birds document the presence of species or describe population sizes and changes. The first comprehensive list of species was published in 1889, with additional inventories in 1933, 1937, 1965, and 1985. The Tennessee Breeding Bird Atlas is currently the best source of information about the nesting birds at Reelfoot. Christmas Bird Counts have been conducted at Reelfoot since 1935, but no summary of winter data is available. Few papers give detailed accounts of either breeding biology or wintering ecology; two exceptions include Walkinshaw's research on Prothonotary Warblers and Rawls' report on wintering waterfowl. A notable aspect of ornithological research at Reelfoot is the lack of information about factors, such as secondary succession, that influence bird populations in the area.

SEASONAL CHANGES IN FISH ASSEMBLAGE IN FLOODED FORESTS SURROUNDING REELFOOT LAKE, TENNESSEE. ***Tom A. Blanchard,*** *University of Tennessee, Martin, Martin, Tennessee.* The purpose of this ongoing study is to identify fish species that utilize periodically flooded habitats within the Reelfoot Lake flood plain and to assess seasonal changes in abundance, species diversity, and species composition of fishes occupying these habitats. A four foot seine (1/8 inch mesh) was used to collect fishes along two 100 m transects within the Grassy Island unit of the Reelfoot Lake National Wildlife Refuge in Obion County, Tennessee from 22 April–5 October of 2003. From the 12 collections made to date, a total of 550 individuals have been collected, including 14 species representing 10 families. Although the total abundance of fish from each collecting period ranged from 237 in April to 43 in October, the species diversity remained relatively constant (range = 1.178–1.732). Species composition between the two sites was similar throughout the study. Two species were unique to site one and three species were unique to site two.

GREETINGS FROM REELFOOT LAKE: POSTCARDS AND THE EVOLUTION OF A FISHERMAN'S PARADISE. ***Jefferson S. Rogers,*** *University of Tennessee, Martin, Martin, Tennessee.* Reelfoot Lake is a place that has taken on a number of identities since its formation in the early nineteenth century. It has been known, for example, as a unique natural phenomenon, tourist destination, land-management project, wildlife refuge, and divider of socio-economic communities. These aspects have been documented and promoted by commercial postcards over the past eight decades. This presentation first outlines the utility and limitations of postcards as informative sources of longitudinal environmental and cultural data; it then reviews the evolution of Reelfoot Lake's multiple identities as depicted on postcards printed between the late 1920s to the present. Analysis of Reelfoot postcard identities not only demonstrates that the history of infrastructural development along the shores of the lake is well-documented but also reveals that an increasing awareness of the lake's subtle complexities has gradually emerged.

NUTRIENT AND METAL CONCENTRATIONS IN REELFOOT LAKE SEDIMENTS. ***Paula M. Gale,*** *University of Tennessee, Martin, Martin, Tennessee.* Reelfoot Lake, located in North Western Tennessee is considered one of the premier natural resources in West Tennessee and is Tennessee's largest natural lake. Agricultural and residential runoff in the watershed has added excess nutrients and metals into the lake and subsequently have contributed to cultural eutrophication of this aquatic system. Lake drawdown is being considered as a means of consolidating the sediments and controlling the growth of aquatic weeds. The

current study was initiated to investigate the reactivity of Reelfoot Lake sediments when exposed to altered redox conditions, as would happen to shallow sediments during a drawdown. Sediment samples collected from shallow areas around the lake were dried and rewetted to simulate a drawdown. Nutrient release rates were measured for each of the sediment samples. Samples also were analyzed for a suite of nutrients and metals. The lake sediments ranged in texture from sandy materials low in organic matter to clayey materials high in organic matter. Reactivity of the sediments also varied with high organic matter samples showing higher nutrient release rates and metal concentrations. Nitrogen release rates ranged from 4.3–16.5 mg N kg^{-1} day^{-1}, while phosphorus release ranged from 0.12–0.71 mg P kg^{-1} day^{-1}. These results suggest that lake management techniques that alter the oxidation-reduction status of the sediments may result in the release of nutrients and reactive metals to the water column.