

ABSTRACTS OF PAPERS PRESENTED AT THE 112TH MEETING

BOTANY SECTION

JEFFREY L. WALCK, CHAIR

TWO NOVEL TRANSPOSABLE ELEMENTS IDENTIFIED IN A COMPUTERIZED SURVEY OF THE RICE (*ORYZA SATIVA* L.) GENOME. **Leah Lavoie*** and **Todd C. Wood**, *Bryan College, Dayton, Tennessee*. Miniature Inverted-repeat Transposable Elements (MITEs) are a class of transposable elements characterized by their small size, short Terminal Inverted Repeats (TIRs), direct repeats at insertion sites, and propensity to form secondary structure. We surveyed the rice genome to identify novel MITE insertional polymorphisms by comparing the rough draft genome sequence of the *indica* subspecies to the publicly-available genomic sequence of the *japonica* subspecies. Our results revealed two novel MITEs, which we name *Drifter* and *Runabout*. Both MITEs display the canonical MITE characteristics except that neither is particularly AT-rich. *Drifter* consists of 232 nucleotides (nt), with a TIR of 19 nt and a direct repeat of 5 nt. *Runabout* consists of 222 nt, with a TIR of 12 nt and a direct repeat of 3 nt. Whereas the AT content of previously-identified rice MITEs ranges from 56.6–77.3%, the AT content of *Drifter* (52.0%) and *Runabout* (46.1%) is much lower.

CLARIFICATION OF *CAREX* SECTION *PHAESTOGLOCHIN* IN TENNESSEE, WITH PARTICULAR REFERENCE TO *CAREX RADIATA*. **L. Dwayne Estes** and **Jeffrey L. Walck**, *Middle Tennessee State University, Murfreesboro, Tennessee*. *Carex* is a large and taxonomically complex genus with 121 taxa known from Tennessee. Voucher collections of *C. radiata* (Wahlenb.) Small, a member of the section *Phaestoglochin*, were made from populations growing in upland forests in Cannon and Maury counties, Tennessee during 2001. This species ranges from Nova Scotia to Manitoba, south to North Carolina, Alabama, and Missouri. However, *C. radiata* was not listed in the Atlas of Tennessee Vascular Plants by Chester et al. (1993). The species was listed in Underwood's (1945) publication on the *Carex* in Tennessee (Amer. Midl. Nat. 33:613–643) from Blount, Cumberland, Franklin, Knox, Morgan, Sevier, Sumner, and Wilson counties. The taxon *radiata* has long been treated under the name *C. rosea*, which is a different species and is listed by Chester et al. (1993). Therefore, *C. rosea*, *C. convoluta*, and *C. radiata* mentioned in Underwood (1945) are actually *C. radiata*, *C. rosea*, and *C. appalachica*, respectively. These three taxa are closely allied, and a review of them and of the other species in *Phaestoglochin* will be presented. Thus, *C. radiata* should formally be considered a component of the Tennessee flora.

STATUS OF *CASTANEA DENTATA* ON THE NORTHERN

HIGHLAND RIM OF KENTUCKY AND TENNESSEE IN 2002. **Louis J. Schibig**, **Robert R. Barber**, **Jack C. Torkelson***, **Michael J. Hill***, and **Jeannie L. Katzenmiller**, *Volunteer State Community College, Gallatin, Tennessee*. The objectives were to obtain Global Positioning System coordinates for the *Castanea dentata* specimens on the northern Highland Rim and to record for each the diameter (dbh), height, health, topographic aspect, elevation, soil conditions, and associated tree species. Live ($n = 195$) chestnut trees were recorded in 11 counties. Twelve live trees with a dbh ≥ 10.2 cm were found and nine were fruiting. Most chestnuts were growing on dry, cherty, acidic soil on the Fort Payne formation. Of the 58 dead chestnut stems (six years or older), three died at 30 years of age, while 40 died at 6 to 15 years of age. Overall average growth rate was 0.6 cm/year; the average for mesic sites was 0.8 cm/year, and 0.5 cm/year for dry sites. On mesic sites, dominant associates included *Liriodendron tulipifera*, *Acer rubrum*, *Fagus grandifolia*, *Oxydendrum arboreum* and *Quercus rubra*; on dry sites, associates included *Quercus prinus*, *Q. velutina*, *Oxydendrum arboreum*, *Carya* spp., and *Nyssa sylvatica*.

NITROGEN, PHOSPHOROUS, AND CARBON USE IN THREE TAXA OF LEMNACEAE. **G. Shinde**, **T. J. Durham**, and **S. K. Ballal**, *Tennessee Technological University, Cookeville, Tennessee*. Duckweeds are members of the family Lemnaceae. They are small, green, fast-growing aquatic plants with relatively simple morphology. Duckweeds are used to feed fish, poultry, waterfowl, and cattle because they are a rich source of proteins and are easy to harvest. They are used as vegetables in many cultures around the world, as organic fertilizers, and to treat wastewater. Duckweeds are employed as experimental organisms for a variety of developmental studies in the laboratory. We investigated the role of duckweeds on removal of total nitrogen, phosphorus, and dissolved organic carbon from pond water containing different taxa. Samples were collected from five study sites on the Cumberland Plateau every week in the summer of 2002. The samples were analyzed for total nitrogen, Cl^- , NO , PO_4 , SO_4 , total phosphorus, dissolved organic carbon, pH, and total biomass. The results indicate that duckweeds use significant amounts of pond water nitrogen, phosphorus, and dissolved organic carbon to increase their biomass. These results indicate the need for future research to study the water chemistry periodically of the ponds containing different Lemnaceae taxa. Because the existence of a particular species in a pond correlated with the water chemistry of the pond, we can estimate which taxon will be more effective in removing nitrogen, phosphorus, and dissolved organic carbon from pond water. Future studies will assess the presence of particular pesticides and herbicides in water samples and correlate their effect on duckweed production in a particular pond.

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CELL AND MOLECULAR BIOLOGY SECTION

MATT ELROD ERICKSON, CHAIR

THE *BST1* GENE PRODUCT IS A NEGATIVE REGULATOR OF VESICLE BUDDING AND MAY CONTAIN A LIPASE DOMAIN. **Todd L. Edwards*** and **Matthew J. Elrod-Erickson**, *Middle Tennessee State University, Murfreesboro, Tennessee*. Proteins move through the organelles of the secretory pathway in vesicles that bud from one organelle and then fuse to the next. A key question is how cargo molecules in transit are sorted into these vesicles while the resident proteins of a given organelle are kept out of the vesicles. We are currently testing the hypothesis that the *BST1* gene of *Saccharomyces cerevisiae* influences both vesicle formation and the sorting of proteins into vesicles at the endoplasmic reticulum (ER) by modifying the lipid environment near budding vesicles. The *BST1* protein contains residues characteristic of a lipase motif, as do homologs in several other species. We targeted these residues for site-directed mutagenesis to determine if they are essential for *BST1* function, as would be expected if Bst1p has lipase activity. Mutants will be examined for retention of resident ER proteins in a simple colony assay.

DNA SYNTHESIS AFTER EXPOSURE TO HEAVY METALS IN THE TESTIS OF THE SPINY DOGFISH (*SQUALUS ACANTHIAS*). **J. Michael Redding**, *Tennessee Technological University, Cookeville, Tennessee*. Contamination of aquatic environments with metal compounds poses a serious risk to the health of aquatic species and terrestrial species that rely on food from aquatic environments. The known toxic effects of metals are diverse and have been characterized extensively for mammalian systems, but much less is known about non-mammalian vertebrates, especially in males. In the dogfish testis, distinct developmental stages of spermatocysts (germ cell:Sertoli cell units) can be isolated and cultured in vitro for at least two weeks. Moreover, mitotic activity, as indicated by DNA synthesis, is maintained quantitatively during this period and is responsive to stimulatory and inhibitory factors. Thus, this model system would seem suitable for toxicological studies of vertebrate spermatogenesis. DNA synthesis rate in the *Squalus* testis is sensitive to metal intoxication in both a metal-specific and concentration-dependent manner.

THE REGULATION AND ACTIVATION OF STATs BY CILIARY NEUROTROPHIC FACTOR IN ADIPOCYTES. **William C. Stewart**, **Sanjin Zvonic**, and **Jacqueline M. Stephens**, *Middle Tennessee State University, Murfreesboro, Tennessee (WCS) and Louisiana State University, Baton Rouge, Louisiana (SZ, JMS)*. Ciliary Neurotrophic Factor (CNTF) is primarily known as a glial factor that prevents neuronal degeneration following a nerve lesion. However, CNTF also causes weight loss in humans and a variety of rodent models of obesity/type II diabetes. CNTF administration can correct or improve hyperinsulinemia, hyperphagia, and hyperlipidemia associated with these models of obesity. To investigate the effects of CNTF on fat cells, we examined CNTF effects on STAT, Akt, and MAPK expression and activation. We also examined the ability of CNTF to regulate the expression of adipocyte transcription factors and other adipogenic proteins. Our studies demonstrate that preadipocytes are more sensitive to CNTF treatment than adipocytes, as judged by both STAT 3 and Akt activation. Despite decreased levels of CNTF receptor expression in fully differentiated 3T3-L1 adipocytes,

CNTF treatment resulted in a time dependent STAT 3 activation. Chronic treatment of adipocytes resulted in a substantial decrease in FAS and a notable decline in SREBP-1 levels, but had no effect on the expression of STAT proteins, PPAR γ , or C/EBP α . However, CNTF resulted in an increase in GLUT 4 levels and a significant induction in IRS-1 expression. We also demonstrated that CNTF activates STAT γ 3 in rodent adipose tissue and skeletal muscle in vivo.

CHEMISTRY SECTION

ISMAIL KADY, CHAIR

USE OF SIGNATURE MOLECULAR DESCRIPTOR FOR COMPOUND DESIGN AND LIBRARY SCREENING. **Donald P. Visco Jr. and Archana Kotu***, *Tennessee Technological University, Cookeville, Tennessee*. Two different areas where Signature may be a useful molecular descriptor are examined. First, Signature, owing to its minimal degeneracy, is the ideal candidate for the solution of the inverse problem. In the inverse problem, QSAR models and physicality constraint equations are developed from the signatures of the training set compounds. Using the physicality constraint equations new sets of atomic signatures (in terms of their occurrences) are generated. New compounds are developed from these sets of atomic signatures and their property values are predicted using the QSAR models. We explore Signature in this area using a set of 22 common energetic materials for the high performance liquid chromatography (HPLC) characteristic capacity factors, k' as our training set. In the second area, we explore the ability of Signature to examine molecular similarity and diversity in screening databases that aid in, for example, the isolation of lead compounds in drug design. We compare our work with that from other screening-tools, such as Stigmata algorithm using Daylight's Fingerprints. An example for 121 HIV protease inhibitors is provided using similarity/diversity measures developed from Signature descriptors.

WEAKLY COORDINATING ANIONS: NUCLEAR QUADRU-
PLE RESONANCE STUDIES OF OXYGEN-METAL BOND-
ING IN METAL CHLOROACETATES AND TRICHLORO-
METHANESULFONATES ("TRICHLATES"). **Gary P. Wulfs-
berg**, **Michael Cochran***, **Jamie Wilcox***, and **Debra Jones
Jackson***, *National Center for Applications of NQR Spectroscopy in Inorganic Chemistry, Middle Tennessee State University, Murfreesboro, Tennessee*. Weakly coordinating anions are important components of catalyst systems in which the active catalyst is a cation. For example, the zirconocene cation catalysts improve polymerization of ethylene, propylene, and styrene. Salts and esters of the weakly coordinating $\text{Cl}_3\text{CSO}_3^-$ (trichloromethanesulfonate or "trichlate" ion) and of the more coordinating chloroacetate ions $\text{Cl}_x\text{CH}_3\text{CO}_2^-$ ($x = 1-3$) have been studied by the very sensitive method of ^{35}Cl nuclear quadrupole resonance (NQR) spectroscopy. The NQR frequencies with a given cation or element are generally highest for trichlates and lowest for monochloroacetates. The NQR frequencies of a given anion are very sensitive to the nature of the metal-oxygen bonding: in covalent derivatives they are lower with more electron-donating elements; in ionic salts, they fall rapidly as the radius of the cation increases. Its NQR spectrum suggests that hydrated HCl_3CSO_3 is a strong acid, fully ionized in the solid state.

NICKEL DEPLETES GLUTATHIONE LEVELS IN HUMAN MONOCYTIC PROGENITOR CELLS (U937 CELLS). **William Y. Boadi, Justin B. Anderson*, Peter A. Iyere, Lonnie Sharpe, and Samuel E. Adunyah, Tennessee State University, Nashville, Tennessee and Meharry Medical College, Nashville, Tennessee.** Nickel (Ni^{2+}) has been classified as a human carcinogen by the International Agency for Research on Cancer. The lesions inflicted on nuclear chromatin by Ni^{2+} as well as by other carcinogenic metals have been attributed to the generation of oxygen radicals and/or other free radical species. One of the ways the cells can reduce their intracellular oxidative damage is through glutathione (GSH; a natural antioxidant) and its antioxidative enzyme through the GSH-Redox system. Thus, intracellular GSH levels are critical in metabolic pathways, as well as in the antioxidant system of most aerobic cells. The purpose of the present study was to study the effects of low doses of Ni^{2+} induced oxidation on GSH in human leukemia U937 cells. Cells were treated with Ni^{2+} (10, 20, and 40 μM), 20 μM H_2O_2 and maintained at 37°C under 5% CO_2 tension in RPMI 1640 medium containing 10% FBS and 50 units/ml each of penicillin and streptomycin. Untreated and control cells were cultured side by side with Ni^{2+} treated cells. Untreated cells did not contain any metal or the reagents used in the oxidation process. Control cells contained all reagents except the different Ni^{2+} doses. Following incubation of the cells for 24 h at 37°C, the cells were pelleted by low speed centrifugation, resuspended in 5% metaphosphoric acid (MPA), and centrifuged at $3,000 \times g$ for 10 min at 4°C. The supernatant GSH levels were measured as described in a GSH assay kit (Pierce; Cat. No. 354102). GSH levels were expressed as μmol per milligram protein. GSH levels were higher in the untreated cells compared to control and treated cells. There was a dose-dependent decrease in GSH levels for the levels of Ni^{2+} employed in the study. Our data demonstrate that U937 cell exposure to low Ni^{2+} levels significantly ($P < 0.0001$) decreases intracellular GSH levels. The observed effects of Ni^{2+} suggest a higher oxidative stress due to the loss of GSH.

EFFECT OF COPPER ON GLUTATHIONE LEVELS IN LEUKEMIA U937 CELLS. **William Y. Boadi, Brooke Henderson*, Peter A. Iyere, Lonnie Sharpe, and Samuel E. Adunyah, Tennessee State University, Nashville, Tennessee, and Meharry Medical College, Nashville, Tennessee.** We have previously shown that copper (Cu^+) ions can cause lipid peroxidation in U937 cells through the Fenton's reaction. This presupposes that intracellular levels of glutathione (GSH; a natural antioxidant) are being used. One way the cells can reduce intracellular oxidative damage is through GSH and its antioxidative enzyme through the GSH-Redox system. Thus, intracellular GSH levels are critical to metabolic pathways and the antioxidant system of most aerobic cells. We assessed the effects of low doses of Cu^+ on GSH in U937 cells. Cells were treated with Cu^+ (5, 10, 20, or 40 μM), 20 μM H_2O_2 and maintained at 37°C under 5% CO_2 tension in RPMI 1640 medium containing 10% FBS and 50 units/ml each of penicillin and streptomycin. Untreated and control cells were cultured side by side with cells treated with Cu^+ . Untreated cells did not contain any metal or the reagents used in the oxidation process. Control cells contained all reagents except the different Cu^+ doses. Following incubation for 24 h at 37°C, the cells were pelleted by low speed centrifugation, resuspended in 5% metaphosphoric acid (MPA), and centrifuged at $3,000 \times g$ for 10 min at 4°C. The supernatant GSH levels were measured as described in a GSH assay kit (Pierce; Cat. No. 354102). GSH levels were

expressed as μmol per milligram protein. GSH levels were the same for the untreated, control, and treated cells for the 5 and 10 μM levels. Thereafter GSH levels decreased significantly ($P < 0.01$) for the 20 and 40 μM levels compared to the untreated and control samples. The results indicate that exposure to high levels of Cu^+ can affect cellular antioxidative status.

TO BUY OR NOT TO BUY: PREPARATION OF COLLOIDAL SILICA SPHERES. **Cynthia R. Allison*, Cameron K. Gren*, Michael W. Hobkirk*, David E. Noga*, Marion R. Wells, and Andrienne C. Friedli, Middle Tennessee State University, Murfreesboro, Tennessee.** Applications of spherical colloidal silica include optical lenses, biosensors, photonic bandgap materials, and catalysts. Our intended application as organosiloxane-derivatized spherical building blocks requires that the nanoparticles have uniform size and shape. According to literature reports, controlled preparation of colloids is rapid and simple using ethanol, tetraethyl orthosilicate, ammonia hydroxide, and water combined using the Stöber or seeded methods. The size and quality of the spheres is dependent upon temperature, concentration of reactants, and reaction time. Transmission Electron Microscopy, Scanning Electron Microscopy, Thermal Gravimetric Analysis, and Atomic Force Microscopy were used to analyze and characterize the spheres. Synthesized spheres were found to be uniform, but larger and more prone to clustering than commercial 200 nm diameter particles.

SYNTHESIS OF AMINO- AND CARBOXYLIC ACID-TERMINATED ORGANOSILANES. **David E. Noga*, Cynthia R. Allison*, Adam F. Farmer*, and Andrienne C. Friedli, Middle Tennessee State University, Murfreesboro, Tennessee.** Organosilanes have been used as precursors for coatings that change surface properties and chemistry. We modify planar and spherical surfaces with end-functionalized organosilanes for applications in biosensors or patterned surfaces. Here we report the synthesis of 10-amino-1-trimethoxysilyldecane (**1**), *t*-butyl 10-trimethoxysilyldecanoate (**2**), and derivatives. Ester **2** was synthesized in three steps from commercial 10-undecenoyl chloride. The synthesis of **1** was carried out in four steps via a modified Curtius reaction involving the conversion of 10-undecenoyl chloride to the trifluoroacetamide, alkaline hydrolysis to the amine, and hydrosilylation to **1**. Use of carbamate protecting groups for the amine, and the identity of observed side products were investigated.

CONTROLLED COATING OF COLLOIDS: ORGANOSILOXANE FILMS ON SILICA NANOPARTICLES. **Michael W. Hobkirk*, Cynthia R. Allison*, Cameron K. Gren*, and Andrienne C. Friedli, Middle Tennessee State University, Murfreesboro, Tennessee.** Colloidal silica spheres have many possible applications, including chromatographic supports, photonic bandgap materials, catalysts, and biosensors. Some applications require reproducible derivatization with organosilane precursors to form monolayers on the particle surfaces. Methods were developed to control internal and external water content of the particles by changing the conditions for sphere isolation. Temperature, time, and solvent system were varied to study the effect on surface derivatization. A variety of derivatives were explored using trichloro- and trimethoxy silanes with different end functional groups. General sphere morphology was determined by Transmission Electron Microscopy, extents of derivatization up to a monolayer were determined with Thermal Gravimetric Analysis

(TGA), and water content was analyzed using Infrared spectroscopy and TGA.

PRODUCING PUSH-PULL POLYENE PIGMENTS. *Robert W. Tilford* and Andrienne C. Friedli, Middle Tennessee State University, Murfreesboro, Tennessee.* We are investigating the effect of donor geometry and structure on properties in a series of donor-acceptor polyene dyes. 2,4-Pentadien-1-als with alkylated 5-(5-indoliny) or 5-(4-piperidinylphenyl) donors were synthesized via a key reaction between the corresponding aryllithiums and 5-N,N-diethylamino-2,4-pentadienal. The aldehydes and their Knoevenagel condensation derivatives with malononitrile were characterized with NMR and UV spectroscopy. These compounds are expected to have second-order nonlinear optical (NLO) properties and some may exhibit liquid crystalline phases. Geometry and UV spectra of the synthesized dyes were calculated using AM1 and compared to known values in related compounds with NLO properties.

ENGINEERING AND ENGINEERING TECHNOLOGY SECTIONS CHIN-ZUE CHEN, CHAIR

SELECTION OF OPTIMUM MACHINING PARAMETERS IN COMPUTER NUMERICAL CONTROL MILLING AND TURNING PROCESSES. *Ismail Fidan, Tennessee Technological University, Cookeville, Tennessee.* It is very important to practice the correct value of Computer Numerical Control (CNC) machining parameters. For example: Too fast a speed or feedrate will result in early tool failure or poor surface finish. Too slow a speed or feedrate will lead to increased machining time and, possibly, greater part cost. In CNC, there are many sources and look-up tables available for selecting these correct parameters. Spreadsheet-based, modular design tools are popularly used in machining technology. The user directly enters most of the process level data into these programs created by a macro language. The main objective in these developments is to reduce the number of the look-ups and data readings from the manuals and handbooks and support the CNC programmer with the estimated machining parameters. In this presentation, such a developed tool and its implementations will be reported.

TEACHING PERFORMANCE EVALUATION OF TRANSMISSION LINES THROUGH AN ELECTRONICS ENGINEERING TECHNOLOGY STUDENTS' PROJECT. *Adel Salama and Ashraf Saad, Austin Peay State University and Georgia Institute of Technology.*
Abstract not available

USING CONCEPT MAPS FOR TEACHING AND LEARNING ELECTRONICS ENGINEERING TECHNOLOGY. *Adel Salama and Ashraf Saad, Austin Peay State University and Georgia Institute of Technology, Atlanta, Georgia.*
Abstract not available

COMPARISON OF SECOND AND THIRD ORDER MODELS OF INTRACRANIAL PRESSURE DYNAMICS. *Michael L. Daley, S. Surapaneni, K. Madala, and Charles W. Leffler, The University of Memphis, Memphis, Tennessee (MLD, SS, KM) and*

The University of Tennessee Health Science Center, Memphis, Tennessee (CWL). Quantitative physiologic models of the cerebral hemodynamics and hydrodynamics have been proposed. The purpose of this study was to examine the validity of previously proposed second and third order physiologic models using asphyxic responses obtained from a piglet preparation equipped with a cranial window. The asphyxic response is characterized by a dramatic transient increase of arterial blood pressure (ABP) and intracranial pressure (ICP) which is followed by a significant steady decrease in ABP. Serial experimental measures of the bandwidth (BW) of the transmission characteristic of ABP to ICP during the induction of asphyxia were determined by autoregressive analysis for both second and third order model structures. These structures were selected to correspond to previously proposed physiological parameter based models. Preliminary results derived from experimental pressure recordings demonstrate the occurrence of resonance which is a possible feature of the third order physiologic model but not of the second order model.

DYNAMIC REGULATION OF CEREBRAL BLOOD FLOW IN RESPONSE TO DILATORY AND CONSTRICTIVE VASCULAR CHALLENGES. *Michael L. Daley, V. Srinivasan*, P. Balasubramanian*, and Charles W. Leffler, The University of Memphis, Memphis, Tennessee (MLD, VS, PB) and The University of Tennessee Health Science Center, Memphis, Tennessee (CWL).* Knowledge of whether the cerebral vasculature is actively regulating cerebral blood flow (CBF) or passively following changes in arterial blood pressure (ABP) would be of value to the intensive care management of patients with severe head-injury. To explore the development of a method to continuously monitor the reactivity of the cerebral vasculature, a study was designed to characterize the dynamic relationship between regional cerebral blood flow, cerebral perfusion pressure (CPP), ABP, and pial arteriolar diameter during dilatory and constrictive challenges in six piglets each equipped with a cranial window. Dilatory responses induced by topical application of isoproterenol produced a transient decrease in CPP, and a corresponding transient increase of CBF. In contrast, constrictive challenge induced by infusion of noradrenalin produced a transient increase of ABP, CPP, and CBF with no significant changes in mean arteriolar diameter. These results indicate that dilatory challenge is a more effective method for evaluating cerebral reactivity.

MICRONIZING FIELD FLOW FRACTIONATION. *N. Vyas, J. J. Biernacki, G. Cunningham, M. J. M. Wells, and S. Mahajan, Tennessee Technological University, Cookeville, Tennessee.*
Abstract not available

MODELING THE SOLUBILITY OF FOAM BLOWING AGENTS IN POLYOLS. *Donald P. Visco and Ranganathan Parthasarathy*, Tennessee Technological University, Cookeville, Tennessee.* The solubility of a blowing agent in a polyol plays a crucial role in the formation of a durable polyurethane (PUR) foam since too little dissolved blowing agent could form foam with imperfections. The proper blowing agent/polyol combinations used in the manufacture of PUR foams has not been optimized for particular applications and experience is normally used as the main guide. Accordingly, a more detailed, systematic approach to this problem of polyol-blowing agent selection is desired. This work focuses on exploring the various combinations of polyols and blowing agents in order to predict the suitable combinations (absorption levels) from a thermodynamic model.

The model used to perform the task is the Sanchez-Lacombe equation of state. The model has been chosen because, in the past, it has been useful in modeling the solubility of small molecules in polymers. The results from this study are reported on various hydrofluorocarbon (HFC) blowing agents: R 134a, R 245fa, R 365mfc, R 245ca, R 32, R 152a, R 143a, R 125 and on various polyols: Pluracol 355, Terol 352, Pluracol 975, and Stepanpol PS 3152. It was found that the third generation blowing agents like R 245fa, R 245ca, and R 365mfc demonstrated more absorption in the polyols tested even at very low pressures and temperatures. Hence, durable PUR foams can be prepared using these combinations for suitable applications.

MODELING OF REFRIGERANT MIXTURES USING SAFT-VR EQUATION OF STATE. *Donald P. Visco and Saravanan Swaminathan**, Tennessee Technological University Cookeville, Tennessee. The Statistical Associating Fluid Theory (SAFT) with attractive potentials of variable range (SAFT-VR) is used to model the phase equilibria of hydrofluorocarbon (HFC) mixtures. Pure components from methane, ethane, propane, fluorinated ether series (new generation refrigerants) etc. were modeled for SAFT-VR. Using the experimental data for the saturated vapor and liquid volumes and vapor pressures of the pure components, optimized parameters were obtained for SAFT. The obtained pure component parameter values were used to predict the phase equilibria of the mixtures by parameterising the binary interaction parameter (BIP). Along with vapor-liquid equilibria, we present regions of liquid-liquid immiscibility for some systems. The predictions from SAFT-VR showed good compliance with experimental data for mixtures.

KINETICS AND MICROSCOPIC STUDY OF THE REACTION BETWEEN BLAST FURNACE SLAG AND CALCIUM HYDROXIDE. *K. Meenakshisundaram* and J. J. Biernacki*, Tennessee Technological University, Cookeville, Tennessee. Abstract not available

CATALYTIC CARBON MONOXIDE MEMS SENSOR. *Himabindu V. Gopiseti*, Raghavendra R. Watanda*, and Joseph J. Biernacki*, Tennessee Technological University, Cookeville, Tennessee. Abstract not available

MECHATRONICS—AN ENGINEERING TECHNOLOGY PERSPECTIVE. *Chin-Zue Chen and John W. Blake*, Austin Peay State University, Clarksville, Tennessee. The term Mechatronics was first coined in the late 1960s in symbolizing the computer control of electric motors. Since then, the scope of mechatronics has expanded along with the advances of technology. Today, mechatronics is defined as the synergistic integration of mechanical engineering with electronics and intelligent computer control in design of products and processes. It is clear that mechatronics is multidisciplinary and a single classical engineering curriculum will not be able to meet its needs. Many universities around the world have revised their engineering curricula to include mechatronics education in order to meet the demand from industries. The function of Engineering Technology program in higher education is to prepare technologists who bridge the gap between engineers and technicians. Therefore, Engineering Technology programs should reflect the changes in the Engineering programs in order for their graduates to be able to fulfill the market needs. The presentation will provide the philosophy be-

hind mechatronics, describe how the mechatronics courses are included in engineering schools, and then suggest what and how mechatronics courses can be integrated into the Engineering Technology program.

MOLECULAR MODELING OF HFC-245FA. *Anand Narayana and Donald P. Visco*, Tennessee Technological University, Cookeville, Tennessee. Blowing agents play an important role in controlling product quality of polyurethane foams. HFC-245fa is widely used as a blowing agent due to its very low Ozone Depletion Potential. Knowledge of the thermodynamic properties of HFC-245fa at various states is important for its utilization in the manufacture of polyurethane foams. The thermodynamic properties of the system at various important states can be extracted through simulations using a molecular model without performing an actual experiment. Molecular modeling is an efficient, economical, and non-hazardous way of predicting the properties of the system. A molecular model is obtained by parameterizing the AMBER force field in the TOWHEE package (version 3.6.x). The charges on the atoms are derived using the RESP technique of fitting charges against the electrostatic potential calculated using ab initio calculations of type UHF/6-31G* with a MP2 correlation. The simulation results are compared with the experimental liquid density and vapor pressure over a wide range of temperature.

ETHICS IN SCIENCE AND TECHNOLOGY SECTION RUBYE PRIGMORE-TORREY, CHAIR

RESEARCH INTEGRITY: WHAT DOES IT MEAN? *Rubye Prigmore Torrey*, Tennessee Technological University, Cookeville, Tennessee. Research is thought of as the process of discovery—revealing new knowledge. This type of discovery must be reported in its purest form. Integrity has been defined as the adherence, uncompromisingly, to sound moral and ethical principles. Hence, this is the manner in which research must be performed and reported. The act of carrying out research in this manner must emanate from the researcher. One can be taught the importance of research integrity, but the act of doing it must come from the individual actually performing the research. This presentation deals with the importance of being an ethically responsible researcher with integrity versus the damaging effect of not having research integrity.

RESEARCH INTEGRITY: PLAGIARISM IN THE CLASSROOM. *Donald B. Sanderson*, East Tennessee State University, Johnson City, Tennessee. Abstract not available

RESEARCH INTEGRITY: HOW SHALL WE TEACH IT? *Jeff G. Wardeska*, East Tennessee State University, Johnson City, Tennessee. The strength of scientific investigation lies in its openness and integrity. We focus on the facts and theories of science in our courses, with little attention as to how science is actually done in the lab. We teach the Scientific Method showing science as a formal, linear, objective process which produces "truth". Yet, the Scientific Method is increasingly seen as an ideal, approximating the workings of science as a corporate entity, but only rarely practiced by individual scientists. Textbooks often present science in a cut and dried format and students are too

frequently taught to get the "right answer". This situation is vastly different from scientific research where the right answer is subservient to the integrity of the results. To teach research integrity we must shift our student's thinking away from the quest for "truth" to the importance of honest results. An area in which all these issues converge is the undergraduate (or graduate) research project. In our department we use research as well as our integrated laboratories to illustrate accepted scientific practices.

INCREASING POTENTIAL FOR CONFLICT OF INTEREST: ANOTHER APPLICATION OF THE LAW OF UNINTENDED CONSEQUENCES. *Michael L. Woodruff, East Tennessee State University, Johnson City, Tennessee.* Conflict of interest (COI) may occur in a variety of ways. Some of types of potential COI are essentially restricted to the individual faculty member and may or may not involve monetary reimbursement. Refereeing papers is an example of the former. Compensated consulting for a company is an example of the latter. Both have the potential for COI and most universities have a policy that covers these situations. However, more and more universities themselves may be expanding the domain of COI and are even encouraging faculty to enter into situations where COI is inevitable for the faculty member and perhaps even the university. This is happening because activities such as contract work for the private sector and participation in start-up companies by university faculty both generate revenue that supports the research mission of the university and assists the university in achieving goals related to service to the community in the form of economic development. This presentation discusses COI that emerges when universities enter into contracts with the private sector and when faculty are principals in start-up companies that may even be housed in a university-related incubator.

GEOLOGY AND GEOGRAPHY SECTION

HABTE G. CHURNET, CHAIR

HARPEATH RIVER WATERSHED SEDIMENT STUDY: FINAL REPORT. *David J. Wilson, Brown and Caldwell, Nashville, Tennessee.* Volunteers with the Harpeth River Watershed Association and the Cumberland River Compact carried out a study of sediment in the Harpeth River watershed during the period September 2000–August 2001. 1053 data sets were collected. Mean turbidities were calculated for 43 stations; the range 0.87–17.64 m^{-1} , and the median was 5.26 m^{-1} . Twelve stations showed mean turbidities less than 3.0 m^{-1} , thirteen were in the range 3.0–6.0, and eighteen exceeded 6.0 m^{-1} . The mean turbidity for five near-pristine streams was 1.40 m^{-1} . The data should provide a baseline for future comparisons as best management practices are put in place. Linear and log-log plots of turbidity versus total suspended solids generally gave good correlations, but the correlations varied substantially from station to station. The sediment loss from the upper half of the watershed was estimated to be 53,000 tons/year, or about 406 lb/acre year.

COMPARATIVE TAPHONOMY OF SCYPHOCRINITES LOBOLITHS FROM TWO WEST-CENTRAL TENNESSEE LOCALITIES. *Ryan Beasley*, Adam Hames*, Michael Latham*, Mark McKee*, Elizabeth Rhenberg*, Chris Seifert*, Yuko Takashita*, Mary M. Ulderich*, Jane Whitnel*, and Michael Gibson, The University of Tennessee, Martin, Martin, Tennessee.*

The crinoid *Scyphocrinites* has a bulbous, chambered holdfast ("lobolith", originally called *Camerocrinus*) and has been interpreted as benthic and pelagic based upon lobolith form and infill (sediment and crystals). Taphonomic characteristics were compared for loboliths from Silurian Decatur Limestone (Camden) and Devonian Ross Formation (Horse Creek). Camden loboliths are uniform in size, 95% uncrushed, with predominantly crystalline chamber infill composed entirely of calcite and some micrite, and no chert formation. The Horse Creek loboliths have a larger size range and are more variable taphonomically with 35% crushed to varying degrees (related to lithology and bed thickness) or heavily corroded externally, predominantly micrite to packstone infill, but with both calcite and quartz crystals. Chert occurs in 83% as nodules and threads or sepiarian-reticulate patterns, growth directions towards the center and outsides from the inner walls of the chambers. Epibionts occur on both populations with decreasing rank abundance of ectoprocts, pelmatozoans, and brachiopods respectively.

A NEW PLANT FOSSIL SPECIES OF DENDROPANAX FROM THE CLAIBORNE FORMATION WESTERN TENNESSEE. *B. Roger Moore, University of Florida, Gainesville, Florida.* A new collection of fossil leaves was made near Huntingdon, Tennessee as part of an ongoing reinvestigation of Tertiary floras from Southeastern North America. A leaf form similar to an abundantly collected form placed in the genus *Dendropanax* has been identified using gross morphology and venation suggesting a new species. As far as we know this is the first reporting of this leaf material in the fossil record.

DEATH VALLEY AND THE DEPOSITIONAL SETTING OF THE TENNESSEE OCOEE SERIES. *Ryan Faerber* and Habte G. Churnet, The University of Tennessee, Chattanooga, Chattanooga, Tennessee.* The turbidite sequences of the Ocoee Series contain lithic fragments of continental shelf carbonate and siliciclastics, and gneissose terrestrial materials. The Snowbird and the Great Smoky groups of the series directly overlie Grenvillian basement rock. The age of the Ocoee Series is currently controversial. However, irrespective of the age of the Ocoee Series, their depositional setting was such that they were at least on one side bounded by ancient basement rock. It is likely that a continental shelf foundered and the Ocoee Series formed as submarine fan deposits in extensional basins. The depositional setting may be better appreciated by examining Death Valley of the desert southwest, which is bounded by Precambrian rocks. Here, the Panamint Range peels away from the Black Mountains by sliding over a listric fault. More extensive alluvial fans coalesce on the Panamint side of Death Valley, whereas smaller alluvial fans are formed at the foot of the fault scarp of the Black Mountains. Death Valley sediments are recent but contain fragments of Precambrian rocks, which are derived from bounding mountains that are exposed by denudational faulting.

IS THE CHILHOWEE MOUNTAIN OF THE TENNESSEE WESTERN BLUE RIDGE A KLIPPE? *Habte G. Churnet, The University of Tennessee, Chattanooga, Chattanooga, Tennessee.* The geology of Western Blue Ridge is currently mired in controversies. By finding Silurian or younger age fossils in the Walden Creek Group, Unrag and others (1993), have placed into question the widely held view that this group is Precambrian in age. The spatially close and repeated association of the Walden Creek Group with subjacent Great Smokey Group and Snowbird

Group, and the conformable contacts among them, would indicate that the entire Ocoee Series is likely Silurian or younger. Moreover, Unrag and others (1990), have placed the Sandsuck Formation as lowermost Cambrian, implying that the Sandsuck Formation is separated from the rest of the Walden Creek group by a fault contact everywhere. Accordingly, the Chilhowee Mountains must be a klippe if the newly ascribed age of the Ocoee Series is correct. This is a preliminary report on the sense of shear associated with faults on the eastside of the Chilhowee Mountains.

HISTORY OF SCIENCE SECTION

GEORGE WEBB, CHAIR

A HIDDEN CHAPTER IN BIOLOGICAL WARFARE DURING WORLD WAR ONE. *Frederick H. Kasten, East Tennessee State University, Johnson City, Tennessee.* The ability of nations and terrorists to conduct biological warfare using anthrax and other bio-weapons is a matter today of great concern. Not well known is the fact that the threat was actually carried out by German espionage agents in neutral America in World War One. Evidence from records of the postwar Mixed Claims Commission prove that this and other sabotage programs were directed by Department IIIB of the General Staff of the German Army. Horses and mules for use as cavalry and draft animals and earmarked for shipment to the Allies in Western Europe were to be infected with anthrax and glanders bacilli. Dr. Anton Dilger, a German-American physician, was recruited as an agent in early 1915 and established a "germ factory" in Chevy Chase, Maryland. Deadly products were delivered in glass vials to stevedores who infected many animals along the East Coast. No attempts were made to infect humans nor were there any reports of accidental human infections.

"WE HAVE NO 'ERRING BRETHERN' TO WELCOME BACK IN OUR MIDST": THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE MEETING IN NASHVILLE, 1877. *George E. Webb, Tennessee Technological University, Cookeville, Tennessee.* When Nashville hosted the 26th meeting of the American Association for the Advancement of Science during the late summer of 1877, it became the first southern host city since Charleston in 1850 and the last until New Orleans in 1905. Among the noted scientists in attendance were astronomer Simon Newcomb and paleontologist Othniel C. Marsh, both of whom delivered major addresses. Despite the oppressive heat and concerns about the healthfulness of the city's environment, registrants totaled 173, a respectable attendance for the post-war decades. During the week-long meeting, scientists and local participants learned of the recent discovery of the Martian moons, the growing evidence supporting the concept of organic evolution, and numerous other discoveries and explanations in various scientific fields. A discussion of this meeting provides an intriguing glimpse into the status of the South within the scientific community during the late 19th century.

AN ENDOPARASITIC SNAKE? RUTHERFORD COUNTY MEDICINE MEETS THE X-FILES IN THE 1870S. *C. Steven Murphree, Belmont University, Nashville, Tennessee.* On the evening of June 26, 1874, Dr. J. M. Burger, a Murfreesboro physician, extracted a 23 inch water snake by hand from the upper

gastrointestinal tract of a young woman residing in Christiana named Thankful Taylor. The snake had apparently survived in Miss Taylor's stomach and intestine for nearly five years after it was unknowingly ingested in spring water. Movement of the snake produced convulsions that kept her bedridden much of the time. Fortunately, the snake was preserved in ethanol by Dr. Burger and remains today in the possession of his descendants. In addition, he prepared a detailed report of this most unusual case and citizens who had observed the extraction signed affidavits to that effect. Subsequent investigations by the Rutherford County Medical Association and the Tennessee Medical Association ultimately supported Dr. Burger's report.

WORLD WAR ONE AND THE ORIGIN OF THE AMERICAN DYE INDUSTRY. *Frederick H. Kasten, East Tennessee State University, Johnson City, Tennessee.* The purpose of this study was to examine the factors leading to the emergence of the American dye industry in World War One. Crucial events occurred during the war that would affect the American textile industry, leading to the appearance of America's own organic chemical and dye industry. The events included the successful British blockade of German shipping and subsequent "dye starvation" in America, surprise arrival in neutral America of the world's blockade-runner merchant submarine (*Deutschland*) carrying more than a million pounds of valuable dyes, renewal of unrestricted U-boat warfare in early 1917, entry of the United States into the war, takeover of German subsidiary dye factories and patents in America, government encouragement of the infant chemical industry to build chemical plants, and new tariff policies to reduce postwar dependency on German dye imports.

THROUGH THE SIDE DOOR: HISTORY OF SCIENCE AS SCIENCE IN THE UNDERGRADUATE CURRICULUM. *Thomas A. Furttsch and George E. Webb, Tennessee Technological University, Cookeville, Tennessee.* One justification for including history of science courses in the undergraduate curriculum is their value in introducing scientific concepts to students in non-science disciplines. A two-semester sophomore-level course, "History of Scientific Thought," has been taught at Tennessee Technological University for over twenty-five years. Although science and engineering students often take this course to fulfill social science requirements, most students enroll to satisfy part of their science requirement. Ensuring that humanities and social science majors gain a sound understanding of scientific concepts and develop an appreciation of how science proceeds has required careful lecture design and innovative assessment strategies. This paper presents a description of the course, an analysis of the more successful alterations to the course, and suggestions for the adoption of similar courses at other institutions.

MATHEMATICS AND COMPUTER SCIENCE SECTION

JEFF KNISLEY, CHAIR

INCORPORATING ORACLE IN UNDERGRADUATE DATABASE COURSES: LESSONS LEARNED. *Donald B. Sanderson and Lorie I. Moffitt, East Tennessee State University, Johnson City, Tennessee.* When incorporating Oracle in undergraduate da-

tabase courses one may encounter several unique situations. This is especially true in small departments where resources are limited. The Oracle system requires more time and planning than some of the less powerful Database Management Systems. This presentation will address these issues and methods for dealing with them. Specifically we will discuss: Acquiring Oracle; Oracle licensing and costs and the Oracle Academic Initiative (OAI), Installing Oracle; Hardware requirements, installation procedures and a timeline Student access, and weighing the benefits of local and remote access. Integrating Oracle into the curriculum: The differences between a CS and an IT approach. We will conclude with an analysis of the benefits vs. the costs of this activity. A set of metrics to help make the decision of whether or not to add Oracle to your curriculum will be presented.

SECURING A REGIONAL COLLEGE CAMPUS COMPUTER NETWORK: A CASE STUDY. *Rick Simons* and Phil Pfeiffer, East Tennessee State University, Johnson City, Tennessee.*
Abstract not available

LESSONS LEARNED; ONLINE AND AUGMENTED ONLINE TEACHING OF A SOFTWARE ANALYSIS AND DESIGN CLASS. *Srini Ramaswamy, Tennessee Technological University, Cookeville, Tennessee.*
Abstract not available

RELATIVITY AND ROCKET POWERED FLIGHT. *Yousuf S. Mohammad* and Jeff Knisley, East Tennessee State University, Johnson City, Tennessee.* Rocket powered space flight undergoes certain levels of perturbations from gravity and other aspects of special and general relativity. This paper goes through parts of general relativity and proves that, even when accounting for the effects of general relativity, the motion of a rocket whose exhaust gas is expended 180 degrees from the nose of the rocket always remains in a single plane.

GREEN'S FUNCTION FOR AN EQUIVALENT CABLE MODEL. *Scott La Voie* and Jeff Knisley, East Tennessee State University, Johnson City, Tennessee.* Ionic channels are common in dendritic electrotonic models. In this presentation, we derive the Green's function for an electronic model with no ionic channels, and then we use the Green's function to construct a perturbation approximation of the solution for a model with ionic channels.

AUGMENTING MICROSOFT VISIO TO GENERATE SQL FROM ER DIAGRAMS: THE METS PROJECT. *Justin L. Starnes* and Donald B. Sanderson, East Tennessee State University, Johnson City, Tennessee.* The METS project is designed to generate the SQL statements needed to create a database from a Microsoft Visio ER or EER diagram. There are five different approaches that can be taken in Visio automation to develop the necessary SQL. These approaches include a stand-alone executable (EXE), a Visio library (VSL), a VBA macro, a COM add-in, and a hybrid technique. The EXE is the only approach that executes in a different process from the Visio instance. Therefore, it is slower than the other approaches but also is more robust, since a program crash will not crash the instance of Visio as well. This robustness accompanied by its ease of development and maintenance led to its use in the METS project.

DEVELOPMENT OF A DATA WAREHOUSE OF ACADEMIC

OUTCOME ASSESSMENT DATA. *Margaret C. Lester* and Donald B. Sanderson, East Tennessee State University, Johnson City, Tennessee.* Data warehouses are often constructed by analyzing current query behavior and designing data models that will support those queries. However, this method presumes that current queries are producing accurate reports, and that end users are currently capable of producing all of the reports they need. If the source database is not in a relational database format, this may not be the case. An alternative method is to construct the data warehouse models by first analyzing the data sources to identify the existing entities and relationships, and then designing the multidimensional data warehouse models. Although this is a more time-consuming method, this research proposes that the quality of the end product justifies the additional effort in cases where the source data is in a non-relational format.

A JAVA INTERFACE AND EVENT EDITOR. *Raymond C. Overton* and Martin L. Barrett, East Tennessee State University, Johnson City, Tennessee.* For beginning Java programmers, creating a usable interactive interface is difficult for two reasons. First, the layout of the interface is difficult to realize using a layout manager. Second, the Java event model requires that interface components signal the receipt of an event to a listener class, which, being not inherently visual, is a difficult programming concept to master. JAMVIE software attacks these problems with a visual, interactive, two-way (interface to code and code to interface) methodology for developing event-driven interactive programs. Beginner programmers can use JAMVIE both as a prototyping tool and as a model checker for existing programs.

NON-FUNCTIONAL REQUIREMENTS MODELING. *James Moody* and Martin L. Barrett, East Tennessee State University, Johnson City, Tennessee.* A non-functional requirement is, by definition, a software requirement without an observable response to an external stimulus. This makes such requirements difficult to specify and test. To better specify them, a hierarchical classification system of non-functional requirements was created. The hierarchy allows a software developer to categorize system performance, cost, security, and other requirements and write precise, outcome-based acceptance tests for them. In addition, a teaching module for undergraduate software engineering students was developed. Students learn how to write non-functional requirements using a method that parallels the well-know Use Case modeling technique for functional requirements.

MATHEMATICS AND SCIENCE TEACHERS SECTION

JUDITH BONICAMP, CHAIR

BASIC ELECTRIC AND MAGNETIC CONCEPTS: ARE THEY FORGOTTEN OR NEVER LEARNED? *Roy W. Clark, Middle Tennessee State University, Murfreesboro, Tennessee.* A survey was given students in the Fall, 2001 classes in General College Chemistry at Middle Tennessee State University. This survey tested very basic knowledge of electrical and magnetic ideas and conventions. The survey also was given to classes of future K-8 and High School teachers. The results were shocking, to say the least, but they do know that AC/DC is a rock band.

HOW A TEAM OF UNDERGRADUATE TEACHING INTERNS REJUVENATED AN AMERICAN CHEMICAL SOCIETY CHEMISTRY PROGRAM. **Judith M. Bonicamp**, *Middle Tennessee State University, Murfreesboro, Tennessee*. Improvements resulted at all levels in an American Chemical Society certified chemistry program when a team of undergraduate teaching interns began consulting in the laboratories. The author describes the problems and teaching philosophies that led to the institution of the Chemistry Instruction Internship Program, the goals of the program with some preliminary assessments, some funding options, and how to recruit outstanding undergraduate teaching interns.

FREE MATH AND SCIENCE EDUCATION RESOURCES ON THE INTERNET. **Judith H. Hector**, *Walters State Community College, Morristown, Tennessee*. The Eisenhower National Clearinghouse for Mathematics and Science Education identifies effective curriculum resources, creates high-quality professional development materials, and disseminates useful information and products to improve K-12 mathematics and science teaching and learning. The presentation will highlight the materials available free on the www.enc.org web site and in the free print magazine, *enc Focus*. The web materials include the Digital Dozen, twelve exemplary educational web sites selected monthly, and a system of indexing based on mathematics or science topics. Some of the resources are appropriate for math and science undergraduates, and many more are helpful in courses for preservice teachers.

DETERMINING RATE LAWS OF EVERYDAY PROCESSES. **Amy J. Phelps and Michael J. Sanger**, *Middle Tennessee State University, Murfreesboro, Tennessee*. This hands-on presentation will describe the use of two everyday processes (flipping pennies and burning a small birthday candle) to introduce students to the concepts of chemical kinetics. The purpose of this experiment is to determine whether burning a candle and flipping pennies are consistent with zero-, first-, or second-order rate laws. To do this, students collect time-dependent data of the candle's mass or the number of pennies remaining (Amount) and plot curves of (Amount) versus time, $\ln(\text{Amount})$ versus time, and $(\text{Amount})^{-1}$ versus time. Numerical values for the rate constants also can be determined from the slopes of the linear plots.

DEMONSTRATION OF A YEAR-LONG GENERAL CHEMISTRY COURSE ON THE INTERNET USING COURSEINFO. **Earl F. Pearson**, *Middle Tennessee State University, Murfreesboro, Tennessee*. Current students often are working, have family obligations or other factors that impede their regular, punctual class attendance. The traditional lecture delivery system is designed for students that attend every meeting and spend large amounts of time outside of class studying and working problems. I also require students to attend every class or make up the work they missed. This talk will describe the use of CourseInfo (or other web delivery systems) to deliver every aspect of a year-long freshman chemistry class. The course materials provided include: the syllabus, make-up work, homework assignments, text outlines for each chapter with emphasis points bulleted, practice exams and quizzes, PowerPoint lectures, student grades, and a grade prediction program. CourseInfo also provides for announcements to the class, email between students and instructor, group discussions and forums and even home pages for the students if they wish to set one up.

USING COMPUTER ANIMATIONS TO TEACH CHEMISTRY AT THE MOLECULAR LEVEL. **Michael J. Sanger**, *Middle Tennessee State University, Murfreesboro, Tennessee*. Chemists use three representations (microscopic, macroscopic, and symbolic) to describe chemical reactions. Traditional chemistry lectures focus on symbolic representations and traditional chemistry labs focus on the symbolic and macroscopic representations. These courses rarely focus on the microscopic representation, primarily because it is impossible to directly show students the interactions of atoms, molecules, and ions. Computer animations of chemical processes at the microscopic level are useful because they allow students to "see" how atoms, molecules, and ions interact. This presentation will show examples of computer animations created by the author and describe how they are used in the chemistry classroom.

TECHNICAL ERRORS IN MIDDLE AND HIGH SCHOOL SCIENCE TEXTS. **David J. Wilson**, *Brown and Caldwell, Nashville, Tennessee*. Recently Larry Gregory, of the Tennessee Department of Education, requested the Tennessee Academy of Science to review materials being considered for teaching science in Tennessee schools. The reviews focused only on scientific accuracy. The author reviewed three modules and two texts for middle school science and three high school chemistry texts. A summary of the findings includes the number of errors in each of the books, types of errors found, and representative examples of errors. This limited study observed that quality control with regard to technical accuracy is quite poor, a point made by other studies as well. Speculations will be made as to the causes for this problem and how it might be corrected. Sets of errata for each of the books will be available.

THE POWER OF PRACTICE: WHAT STUDENTS LEARN FROM HOW WE TEACH. **Amy J. Phelps**, *Middle Tennessee State University, Murfreesboro, Tennessee*. If change in science education is to take place in this country, it cannot be merely a K-12 issue. This paper offers the reader the opportunity to hear from students the beliefs they have based in large part on their experiences in science classrooms at the college level. Constructivism makes clear the key role prior conceptions play in the process of learning. As instructors of methods courses, the authors were interested in the conceptions about teaching and learning of science majors that wished to become high school teachers. These conceptions have much to do with efforts nation wide to improve the science education of Americans. The data were collected from 1990-2000 and the results are reported in the form of assertions that describe the four major categories of beliefs. In general, these students value content over pedagogy, believe that good teachers are entertaining, that laboratories are important in science teaching although they are not sure why, and that methods courses are a waste of time for a variety of reasons. The results of this study indicate that college science instructors can have a profound impact on reforming K-12 science education practice, but they must first take some bold steps to change their practice in the classroom.

THE EFFECTIVENESS OF COOPERATIVE LEARNING AS AN INSTRUCTIONAL STRATEGY IN LARGE, NON-MAJORS COLLEGE BIOLOGY CLASSES. **Kim Cleary Sadler**, *Middle Tennessee State University, Murfreesboro, Tennessee*. My goal for my non-majors biology course is to cultivate biological literacy in students not in science programs. More than

the recall of facts, biological literacy includes the process of science, in addition to attitudes and values that extend from the nature of science itself. Cooperative learning may be defined as an active learning strategy in which students work together to create their knowledge interdependently to maximize their own and each other's learning. To determine the effectiveness of cooperative learning groups in my large lecture class (> 75 students), data were collected to ascertain biological literacy using the Biology Self-Efficacy Scale and a high school Biology End-of-Course Exam. Data on student achievement was determined by final course grade. Although my cooperative lecture class reported a significant difference in applying biology to other areas in their life and overall knowledge on the high school exam, there was no significant difference in analyzing and generalizing biological concepts or academic achievement.

THE TENNESSEE JUNIOR ACADEMY OF SCIENCE: SIXTY YEARS OF SERVICE TO SECONDARY SCIENCE STUDENTS. *Jack Rhoton, East Tennessee State University, Johnson City, Tennessee.* The Tennessee Junior Academy of Science (TJAS) has been serving secondary science students in Tennessee for sixty years. Begun in 1942 at the George Peabody College in Nashville, the Junior Academy is designed to promote the growth and development of young scientists in Tennessee High Schools by providing an annual program of scientific atmosphere and stimulation for capable young students. The overarching objectives of TJAS are to promote and encourage an improved science instructional program in the state, and to encourage more original scientific research by secondary students. This session will highlight the activities of the Junior Academy and provide information about how students can benefit by their participation in the program.

A HARDWARE MODEL FOR THE CONCEPTS OF THE MOLE, LIMITING REACTANT, AND THEORETICAL YIELD. *Tammy J. Melton and Larry A. Scheich, Middle Tennessee State University, Murfreesboro, Tennessee and St. Norbert College, De Pere, Wisconsin.* Teaching about matter and fundamental chemical relationships is hampered by the physical reality of the submicroscopic size of atoms and molecules. The problem of teaching this and related concepts to the introductory chemistry student is a perennial one. Concrete physical models are useful for displaying shapes and molar relationships, but published examples do not require students to relate the number of items with their masses. We have developed a learning exercise that takes the modeling a step further by having students weigh pieces of hardware—nuts, bolts, screws, and washers—representing individual atoms, and compare their masses to a theoretical calculation. Using a dozen for the concept of the mole, students first complete a "periodic table" and then assemble the pieces to answer various stoichiometric questions. The students' calculations are then tested against the actual masses of the assembled pieces to teach limiting reactant and theoretical yield.

MEDICAL SCIENCE SECTION

FRED HOSSLER, CHAIR

NICOTINE ALLEVIATION OF COGNITIVE AND MOTOR DEFICITS IN A RODENT MODEL OF SCHIZOPHRENIA: UNDERLYING MECHANISMS. *Russell W. Brown, Kimberly*

Thompson, Kenyatta D. Thompson, Jeffrey J Ward, Stephanie K. Thacker, Michael T. Williams, and Richard M. Kostrzewa, East Tennessee State University, Johnson City, Tennessee (RWB, KT, KDT, JJW, SKT, RMK) and University of Cincinnati, Cincinnati, Ohio (MTW).

Abstract not available

REOVIRUS ANTIGEN EXPRESSION LEVELS IN TRANSFORMED AND NON-TRANSFORMED HUMAN CELLS. *Jason K. Alexander* and Anthony L. Farone, Middle Tennessee State University, Murfreesboro, Tennessee.* Reovirus serotype 3 Dearing (T3D) has been shown to induce apoptosis and viral lysis in cells. It has also been shown that reovirus kills transformed cells at higher levels than non-transformed cells. This study utilized a human fibroblast WI-38 cell line and the transformed counterpart, WI-382RA, to evaluate reovirus antigen expression levels at 12-h post-infection. Viral infection was performed at a MOI of 100 and cell enumeration by direct count microscopy at 600× and 200× magnification for the WI-382RA and WI-38 cell lines, respectively. Viral antigen was detected with anti-reovirus T3D polyclonal rabbit antibody, followed by a fluorescently labeled anti-rabbit goat antibody. Results showed that 24.7% of the WI-382RA cells and 4.5% of the WI-38 cells were positive for reovirus antigen. Positive cells were further classified for viral inclusions indicating viral replication. WI-382RA cells possessed viral inclusions at a rate of 76.9% and the WI-38 cells at a rate of 41.9%. These results support previous studies that demonstrated higher levels of infection in transformed cells than in non-transformed cells.

ADULT STEM CELL TRANSPLANTATION INTO ISCHEMIC MYOCARDIUM. *Jeffrey E. Carter*, Fred E. Hossler, Brian P. Rowe, Chaunfu Li, Janet W. Davis, Esha D. Ibrahim, and Race L. Kao, Quillen College of Medicine, East Tennessee State University, Johnson City, Tennessee.* Ischemia due to myocardial infarction frequently develops into a scar in the ventricular wall yielding reduced elastance and a decrease in myocardial function. Adult stem cells (satellite cells) are myogenic cells found in skeletal muscle. The goal of this study was to implant satellite cells to reconstruct and restore damaged myocardium. Ischemia was produced by ligation of the left anterior descending artery to be followed in two weeks with cell implantation. Cells were obtained from the tibialis and quadratus muscle groups and cultured to yield 100 million cells with a portion of the cells being transfected with angiogenic factors VEGF-165 and ANG-1 to augment perfusion to ischemic regions. Four weeks after implantation, cardiac function was analyzed using Emax and Tau in all groups. Hearts were then harvested and injected with Mercor plastic resin for corrosion casting or perfused with silver nitrate for vascular analysis.

ENOXAPARIN-INDUCED SKIN NECROSIS IN A PATIENT WITH FACTOR XII DEFICIENCY: A CASE REPORT. *Omar S. Aljilawi, Wael S. Abu-Auda, and Anand Karnad, East Tennessee State University, Johnson City, Tennessee.* Heparin-induced skin necrosis is a serious complication that may herald a potentially life threatening heparin sensitivity with systemic arterial and venous thrombosis followed by secondary complications like pulmonary embolism. We report a case of skin necrosis induced by Enoxaparin, a low molecular weight heparin (LMWH). A 77-year-old white male who presented with unstable angina and elevated Blood Pressure (BP) for 2 days duration, has

a significant history of non-insulin dependent diabetes mellitus, hypertension, hyperlipidemia, and peripheral vascular disease. Initial evaluation revealed a BP of 147/102; otherwise an unremarkable examination. Laboratory evaluation revealed PT: 11.1, PTT: 157.8, and INR: 0.95. Total CPK was 88, CK-MB was 15.1, and Index of 17.2. The diagnosis of non-Q wave MI was entertained and heparinization was considered. Elevated PTT made further monitoring of anticoagulation not possible, and patient was placed on subcutaneous Enoxaparin at a dose of 2 mg/kg BID. Mixing test revealed marked correction of PTT (Mixing ratio and PTT: 9/10 PTT 40.8, 1/2 PTT 31.8, 1/10 PTT 28.9). Factor XII assay revealed less than 2% of normal activity, diagnosing Hageman factor deficiency. Twenty-four hours after starting Enoxaparin, necrotic skin lesions were noted in the arms and abdomen. Enoxaparin was then discontinued and a skin biopsy revealed dermal necrosis and hemorrhage consistent with heparin-induced skin necrosis. Laboratory follow-up did not reveal subsequent thrombocytopenia. To our knowledge, this is the first reported case of heparin related skin necrosis in a patient with Factor XII deficiency. Factor XII deficiency was first described by Ratnoff and Colopy in 1955. It leads to a problem in using heparin in not being able to monitor PTT and anticoagulation. There is sufficient evidence in the literature to support a role of factor XII deficiency in thrombotic disorders including venous thrombosis and coronary arteriosclerosis. The thrombotic diathesis in Factor XII deficiency is probably due to impaired plasma fibrinolytic activity. Our patient experienced a rapid onset of skin lesions within 24 h of Enoxaparin injection, while most cases developed skin lesions 6–12 days after heparin injection. Furthermore, our patient did not experience thrombocytopenia following Enoxaparin therapy. Factor XII deficiency may have contributed in the pathogenesis of heparin-induced skin lesions, in view of the rapid onset of skin lesions and the absence of thrombocytopenia. A probable alternative mechanism of heparin-induced skin necrosis involving the contact system needs further investigation.

PHARMACOKINETICS OF INTRAVENOUS (1-3)- β -D-GLUCANS IN RATS. *Luke Barker, Brent Lockhart, Liz Adams, David L. Williams and Peter J. Rice, James H. Quillen College of Medicine, East Tennessee State University, Johnson City, Tennessee.* Glucans are a family of carbohydrates found in the cell walls of fungi and certain bacteria. Recent evidence indicates that the innate immune system is modulated when these carbohydrates are recognized by specific receptors that potentially signal a microbial infection. It is not known whether physical differences such as molecular size, branching frequency or solution conformation may affect the pharmacokinetics of carbohydrates. Three carbohydrates (glucan phosphate, laminarin and scleroglucan), with varying molecular sizes, branching frequency and solution conformation, were fluorescently labeled and studied in adult Sprague Dawley rats. We administered single 1–3 mg/kg doses intravenously and examined the pharmacokinetics over a 24-h period. Plasma carbohydrate concentrations over time were fit to compartmental models of elimination and distribution with an absorption phase. Absorption upon administration through the penile vein was variable and affected the ability to quantify the distribution phase. Elimination ($t_{1/2}$) half live values were similar for laminarin (2.6 ± 0.2 h), glucan phosphate (3.8 ± 0.9 h), and scleroglucan (3.1 ± 0.6 h). $V_{D\beta}$ values were also similar for laminarin (540 ± 146 ml/kg), glucan phosphate (350 ± 88 ml/kg), and scleroglucan (612 ± 154 ml/kg). Distribution compartment

$t_{1/2}$ values were similar for laminarin (3.7 ± 1.3 min), glucan phosphate (4.3 ± 0.8 min), and scleroglucan (2.1 ± 0.5 min), V_D values at C_p0 were lowest for glucan phosphate (100 ± 19 ml/kg), with similar values found for laminarin (252 ± 99 ml/kg), and scleroglucan (261 ± 130 mg/kg). Intravenously administered glucans appear to have similar pharmacokinetics. Our results suggest that fluorescent labeling will permit pharmacokinetics to be established for a number of other carbohydrates.

MICROVASCULATURE OF THE DOG URINARY BLADDER REVEALED WITH VASCULAR CORROSION CASTING AND SCANNING ELECTRON MICROSCOPY. *Fred E. Hosler, Courtney W. Ridner, and Race L. Kao, James H. Quillen College of Medicine, East Tennessee State University, Johnson City, Tennessee.* The urinary bladder stores and releases urine, and despite frequent changes in volume which are known to compromise vessel patency, a rich blood supply is needed to support its functions. Here we describe the microvasculature of the dog bladder using vascular corrosion casts (VC) and scanning electron microscopy (SEM). Vascular corrosion casts were prepared by infusing low viscosity methacrylate resins, removing tissue with KOH, and lyophilizing and coating the resulting VC with gold for routine SEM. The bladder is supplied by left and right cranial and caudal vesicular branches of the internal iliac and urogenital arteries, respectively. Highly coiled serosal vessels freely anastomose with each other. Mucosal vasculature consists of a dense, freely anastomosing capillary bed, just deep to the urothelium, which is supplied by a rich plexus in the lamina propria. Submucosal vessels arranged perpendicular to the surface supply the mucosa. The value of vessel coiling and arrangement, valves, and anastomoses to blood flow will be described.

SPONTANEOUS VERTEBRAL ARTERY DISSECTION AN UNUSUAL CAUSE OF RESPIRATORY FAILURE IN ELDERLY. *Halim S. Abou Faycal, Mehran Tavakoli, Said B. Iskandar, Ryland P. Byrd Jr., and Thomas M. Roy, East Tennessee State University, Johnson City, Tennessee.* An 86 year-old white male with a history of atherosclerotic cardiovascular disease and hypertension, complained of a severe occipital headache that radiated into his neck. He had suffered no recent head trauma. The headache was associated with nausea, vomiting, and a near syncope episode. While being evaluated in the emergency department he suffered a respiratory arrest necessitating endotracheal intubation and support with positive pressure mechanical ventilation. His blood pressure was 159/78 mmHg, heart rate 78 beats per min, and temperature 97°F. Physical examination revealed a holo-systolic murmur (2/6) heard best at the apex with radiation to the axilla. His Babinski was up going on the left side. Serum electrolytes, cardiac isoenzymes, and an EKG were unrewarding. Computerized tomography of the patient's head demonstrated no evidence of an acute ischemic event or bleed. Analysis of his cerebral spinal fluid was normal. Magnetic resonance imaging/angiogram (MRI/A) documented dissection of the right vertebral artery. The patient was treated with aspirin and was subsequently successfully extubated. He was discharged home on aspirin and blood pressure control. This report serves as a reminder to the clinician that while unusual, vertebral artery dissection can occur in the elderly, and should alert physicians to consider this diagnosis in patients who present with headaches and respiratory failure.

NONINVASIVE DETECTION OF BASIC ELECTRICAL

RHYTHM FREQUENCY OF GASTROINTESTINAL SMOOTH MUSCLE IN PRELIMINARY COLECTOMY STUDIES WITH THE SQUID MAGNETOMETER. *Brenda J. Christopher*, Andrew G. Myers, Jared Sims, James G. McDowell, Bill Richards, and Alan Bradshaw, Vanderbilt University School of Medicine, Nashville, Tennessee (BJC, AGM, JS, JGM, BR) and Living State Physics Group, Nashville, Tennessee (AB).* High morbidity and mortality rates are associated with acute mesenteric arterial occlusion. Current diagnosis is based on the presence of irreversible pathologic damage and only a few invasive options are available. The omnipresent slow electrical activity of the gastrointestinal (GI) tract is the basic electrical rhythm (BER). Studies have shown that the BER decreases with ischemia well before the irreversible changes. The Superconducting Quantum Interference Device magnetometer (SQUID) can noninvasively detect the magnetic field created by the electrical current of the GI tract. This study revealed that the SQUID could differentiate between pre-colectomy and post-colectomy readings in pigs, indicating the presence of a colonic frequency. The SQUID seems to be efficient at detecting changes in biochemical activity that reflect the metabolic state of smooth muscle, suggesting it may provide an earlier noninvasive diagnosis of mesenteric ischemia. This diagnosis can lead to earlier intervention which could substantially increase patient survival rates.

UNCOMMON CAUSE OF CHEST PAIN AND ABNORMAL ECG IN A YOUNG MAN. *Said B. Iskandar, Daniel Merrick, and Kim Dittus, The Veterans Affairs Medical Center, Mountain Home, Tennessee (SBI, KD) and James H. Quillen College of Medicine, East Tennessee State University, Johnson City, Tennessee (DM).* Myocardial infarction is a common life threatening condition. Annually around one million Americans suffer from this disease. Multiple agents can be used to treat acute coronary syndrome. These therapies, while potentially life saving for patients with symptomatic coronary artery disease, could be life threatening in other conditions. Hypertrophic cardiomyopathy (HCM) is considered the most common inherited cardiac disorder, with an incidence of 1 in 500 individuals. The most common form of HCM presents with asymmetric septal hypertrophy. In the Japanese population as many as 25% of patients with HCM have involvement primarily of the left ventricular apex (AHC). This however occurs in only 1 to 2 percent of the non-Japanese population. The United States based physician caring for patients presenting with chest pain needs to be aware of this disorder and the fact that it is not limited to the Japanese patient. We will present a patient with ECG changes of ST segment elevation suggestive of acute coronary syndrome. Patient was found to have AHC. Thrombolytics, indicated in STEMI, could be harmful in this case.

EFFECTS OF VITAMIN E ON IMMUNE STRESS RESPONSES. *David S. Chi, Joseph K. Neumann, Guha Krishnaswamy, Daniel R. Merrick, and William L. Stone, East Tennessee State University, Johnson City, Tennessee.* Since stress causes coronary artery disease and vitamin E is thought to protect against it, twenty-six subjects were randomly assigned to receive either 400 IU alpha-tocopherol or placebo daily for two weeks, and subjected to the stressor, a 5-min mirror tracing task with noise. Pre- and post-stress blood samples were collected and assayed for white blood cells (WBC), lymphocyte phenotypes, and serum levels of TNF-alpha and cortisol. The stressor increased the cortisol level in the placebo group (9.3 ± 3.1 to 11.4 ± 3.5 ug/ml),

but not in the vitamin E group (19.6 ± 4.1 to 16.9 ± 5.3 ug/ml). However, there were no differences in WBC, lymphocyte phenotypes, and serum levels of TNF-alpha between the two groups and between the pre- and post-stress samples. This suggests that vitamin E had no effect on these parameters. (Supported by Ruth R. Harris Endowment and RDC, ETSU)

5-AZA-2'-DEOXYCYTIDINE FOR MYOCARDIAL INFARCTIONS. *Esha D. Ibrahim*, Janet W. Davis, Thomas K. Chin, and Race L. Kao, James H. Quillen College of Medicine, East Tennessee State University, Johnson City, Tennessee.* Ventricular myocytes of adult mammals are considered terminally differentiated cells that have lost their ability to multiply by cell division. The myocardium does not contain myogenic stem cells like those seen in skeletal muscle; an injured heart is repaired by scar formation. Pharmacologic myocardial regeneration is a novel idea, and uses 5-Aza-2'-deoxycytidine (AC) to transdifferentiate cardiac fibroblasts into myocytes. Mongrel dogs (12) were used to test the hypothesis of scar reduction and functional improvement with neomyocardial formation after myocardial infarction by AC treatment (7 dogs) versus controls (5 dogs). Echo cardiography, digital sonomicrometry, and Millar microtip pressure transducers were used to determine regional contractility, left ventricular pressure, pressure volume loops, and pressure-length loops. The hemodynamic functions were determined at baseline (set at 100%), during ischemia (occlusion of coronary vessel), and at 6 weeks after ligation. A dramatic improvement was noted in segment shortening in the drug-injected dogs [baseline = 100%, ischemia = -13.3%, drug (6 weeks) = 106.7%, control (6 weeks) = 62.2%]. During post-mortem heart sectioning, it was clearly noted that drug-treated hearts had considerably less scar tissue than the control hearts.

ADOLESCENT NICOTINE TREATMENT ALLEVIATES COGNITIVE DEFICITS IN A RODENT MODEL OF SCHIZOPHRENIA. *Kimberly N. Thompson, Timothy J. Flanigan, Stephanie K. Thacker, and Russel Brown, East Tennessee State University, Johnson City, Tennessee.* Quinpirole treatment during the first three weeks of life in a rat produces long-term increased sensitization of the D₂ receptor. Based on the fact that a primary underlying mechanism of schizophrenia is long-term increases in D₂ receptor function, this may be a novel and effective rodent model for schizophrenia. Five litters of male and female Sprague-Dawley rats were utilized in this study. Beginning on PD 1, rats were administered quinpirole (1 mg/kg) or saline once daily from PD 1-21. Beginning on PD 30, rats were given nicotine (0.3 mg/kg free base) or saline twice daily for 14 consecutive days (30-43). Thus, there were four treatment groups: Quinpirole-Saline, Quinpirole-Nicotine, Saline-Saline, Saline-Nicotine. One day after drug treatment, rats began behavioral testing on the MWT. The MWT is a spatial memory task in which an animal is trained to locate a platform placed in a pool of water. Ontogenetic quinpirole treatment did not produce any significant impairment on acquisition, but did produce an impairment on the probe trial. Nicotine alleviated this impairment. There were no significant group differences on the matching-to-place task, and no sex differences on any behavioral measure. Neurochemical assays will be analyzed in the coming weeks.

NICOTINE IMPROVES SPATIAL PERFORMANCE IN MEDIAL FRONTAL CORTEX LESIONED RATS, BUT IMPROVEMENT DEPENDS ON PREVIOUS EXPERIENCE. *Ra-*

chel L. Norris, Stephanie K. Thacker, Ivy R. Click, and Russell W. Brown, East Tennessee State University, Johnson City, Tennessee.

Abstract not available

MICROBIOLOGY SECTION

JEFF LEBLOND, CHAIR

DETECTION OF A TICK-BORNE ENTEROVIRUS IN PATIENT CEREBROSPINAL FLUID. *Eric C. Freundt* and Stephen M. Wright, Middle Tennessee State University, Murfreesboro, Tennessee.* Human enteroviruses are important pathogens associated with a range of diseases, including aseptic meningitis. Transmission primarily occurs through fecal-oral means. Natural transmission of enteroviruses by blood-feeding arthropods has not been documented. This investigation was initiated after a study reported detection of novel enteroviral genetic sequences in *Amblyomma americanum* and described a possible link with aseptic meningitis. Cerebrospinal fluid (CSF) samples were obtained from two patients with aseptic meningitis and a recent history of tick attachment. These CSF samples were examined for enteroviral sequences using RT-PCR to amplify a region conserved among enteroviruses. A 249 base pair fragment was sequenced and demonstrates 100% homology with the enterovirus sequence isolated from *A. americanum*, suggesting that the same virus is capable of infecting humans and can be maintained in ticks. These results imply that a distinct tick-borne enterovirus may cause aseptic meningitis and that tick transmission plays a role in enteroviral disease epidemiology.

ISOLATION AND IDENTIFICATION OF LIPASE-PRODUCING MICROORGANISMS. *Kimber Logan-Dunn* and John M. Zamora, Middle Tennessee State University, Murfreesboro, Tennessee.* Microbial enzymes are used in the baking, brewing, distilling, and textile industries. Lipases are the enzymes that break down lipids. The purpose of this study was to isolate and identify lipase-producing organisms. Several laboratory strains of organisms were plated onto spirit blue agar and minimal salts agar containing peanut oil to determine if these organisms produced lipase. Most organisms grew on spirit blue agar and the determination of lipase production was based on changes in the media. Only organisms capable of degrading peanut oil could grow on the minimal salts agar containing peanut oil. Soil samples were inoculated onto minimal salts agar containing peanut oil. Bacteria capable of breaking down the peanut oil were isolated and identified to species. The organisms were grown in liquid culture and lipid breakdown was determined using a titrimetric assay. Results were obtained and bacterial lipase units were calculated for each organism. Statistical analysis was used to determine the best lipid degraders. These environmental isolates may be useful in the production of lipase.

ALLELOPATHIC AND ANTIMICROBIAL PROPERTIES OF *LIGUSTICUM PORTERI*. *Jesse M. Carter* and John M. Zamora, Middle Tennessee State University, Murfreesboro, Tennessee.* *Ligusticum porteri* is a plant that grows in the higher altitudes (6,000–10,000 feet above sea level) of the southwestern and rocky mountain states. The root of this plant has been used for centuries to treat a variety of ailments. The common name for this plant is osha. 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, antifungal, or antiprotozoan activity. These extracts were inhibitory to many bacteria including *Mycobacterium* sp. and *Bacillus* sp. There was some antifungal and antiprotozoan activity detected. The hot water extract of *Ligusticum porteri* 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 *Ligusticum porteri*. Hot water extracts also were tested for antiviral activity against T4 phage. The extracts did not lower the number of plaque forming units.

DRINK OR SWIM: BACTERIOLOGICAL WATER QUALITY OF AREAS ON THE STONES RIVER AND J. PERCY PREIST LAKE. *Jamie L. Rogers* and John M. Zamora, Middle Tennessee State University, Murfreesboro, Tennessee.* The use of water for recreation, such as swimming, boating, and fishing, is increasing. People who use these waters take it for granted that they are safe to use. A safe and abundant supply of drinking water is also taken for granted. Water supply is a matter of both quality and quantity. The demand for water is so great that often water reuse has to be practiced. The purpose of this study was to test several areas of the Stones River and J. Percy Priest Lake for the presence of coliform bacteria as well as total bacteria using two methods. The first method was a standard aerobic plate count where water samples were collected, diluted, and plated onto tryptic soy agar as well as MacConkey agar. Tryptic soy agar was used for the enumeration of bacteria. MacConkey agar was used for the enumeration of coliforms. The second method was a agar dip slide method that allows for estimation of total bacteria as well as enteric bacteria. This second method is much simpler and allows for routine monitoring of sewage, rivers, and lakes. Both methods showed elevated numbers of bacteria as well as an abundance of coliforms in the sites tested.

SUPERINFECTION WITH HERPES SIMPLEX VIRUS TYPE 2 INDUCES A PERSISTENT MORPHOLOGY IN *CHLAMYDIA TRACHOMATIS*. *Srilekha Deka, Sophie Dessus-Babus, Judy Whittimore, Priscilla B. Wyrick, and Robert V. Schoborg, East Tennessee State University, Johnson City, Tennessee.*
Abstract not available

CONSTRUCTION OF AN EXPRESSION VECTOR FOR THE IDENTIFICATION OF GENES REQUIRED FOR THE PRODUCTION OF HETEROBACTIN IN *RHODOCOCCUS ERYTHROPOLIS*. *Samuel E. Moretz* and Bert C. Lamson, East Tennessee State University, Johnson City, Tennessee.* Iron is an often scarce but essential metabolite required by most organisms for growth. Many bacteria and fungi have evolved mechanisms to scavenge iron by producing siderophores. Siderophores, produced only when the organism is in a low iron environment, are small, soluble molecules that bind iron with high affinity. *Rhodococcus erythropolis*, a bacterium important to the chemical and biotechnology industries, produces a class of siderophore called heterobactins. A recently isolated mutant strain of *R. erythropolis* strain IGTS8, designated N5-59, is deficient in heterobactin production. An expression vector, pSMZ7, was engineered to contain both *Rhodococcus* and *Escherichia coli* origins of replication, a *Rhodococcus* strong constitutive promoter, and erythro-

mycin and ampicillin resistance markers. pSMZ7 was used to construct a gene expression library of the wild type genome, IGTS8. The plasmid expression library was then screened in the mutant strain, N5-59, to identify a clone that can restore siderophore production in N5-59.

NOVEL PENICILLIN RESISTANCE IN *MORAXELLA CATARRHALIS*. *James Fairman**, *Foster Levy*, and *Elaine S. Walker*, *East Tennessee State University, Johnson City, Tennessee*. β -lactamases are a class of bacterial enzymes that confer resistance to antibiotics which contain a β -lactam ring. Phenotypic expression can be assayed for by a nitrocefin disc test for enzymatic degradation of a nitrocefin substrate. During experiments to determine minimum inhibitory concentrations of penicillin (a β -lactam antibiotic) on *Moraxella catarrhalis*, a sample of isolates was found to be resistant to β -lactams. These isolates were very unusual because they shared both a negative response to the nitrocefin disc test and their DNAs failed to generate a PCR product using primers corresponding to the 5' region of the β -lactamase gene. A genomic test is underway to test for the presence of a β -lactamase gene at the *bla* locus. These observations suggest *M. catarrhalis* has evolved a new allele that has no substrate specificity for nitrocefin and whose 5' DNA sequence is variant, or *M. catarrhalis* has evolved a novel resistance mechanism to β -lactam antibiotics.

PHYSICS AND ASTRONOMY SECTION

ROBERT MARLOWE, CHAIR

TIME DEPENDENT MESOPHASE STRUCTURE OF COLUMNAR THERMOTROPIC LIQUID CRYSTALS. *M. Sarkar*, *Tennessee State University, Nashville, Tennessee*. Two samples of liquid crystals, hexa-alkanoyloxy-tribenzo-cyclononene (II-9) and, hexakis-alkylsulphono-benzene (HASB14) are investigated for any structural change in 11 years by using X-ray optics, specially, transmission diffractometry. In the case of HASB14, indeed, the overall spatial crystallographic hexagonal symmetry is preserved but the axial parameters are changed. For II-9, lattice parameters are changed as a function of temperature, but its overall oblique symmetry remains unchanged. This might be due to the change in the sample composition (decomposed or oxidized). To ascertain this assumption, chemical analysis is needed.

THE MONITORING OF SELECT MIRA-TYPE STARS FOR MICROVARIABILITY. *Gary D. Henson and Jennifer A. Reiff**, *East Tennessee State University, Johnson City, Tennessee and Otterbein College, Westerville, Ohio*. The possible occurrence of microvariability in Mira-type stars is addressed in this paper. Broadband photometry using the B, V, I, and R filters was performed on four stars suspected of exhibiting microvariability. Light curves for these four stars (RR Boo, RX Mon, SV And, and X Crb) are provided for all observing nights between September 2001 and June 2002. The nature of any detected variations and their relation to the phase of the stars' pulsation light curve is discussed as well as possible mechanisms for the cause of microvariability in Mira stars.

A COMPUTER-SIMULATED NEURAL NETWORK TO DETECT THE SPORE OF *BACILLUS ANTHRACIS* IN AEROSOL FROM LIGHT SCATTERING MEASUREMENTS. *Patricia G.*

Hull, and Thomas Mason, Tennessee Technological University, Cookeville, Tennessee. An artificial neural network was trained to detect the presence of *Bacillus anthracis* (anthrax) spore in an aerosol. The Fourier coefficients of two elements of the Mueller scattering matrix, S_{12} and S_{34} as functions of scattering angle were used as input data for training the network. A few of the data sets were based on experimental measurements of the scattering from aerosols containing soot particles or water droplets, most were generated from analytical models. Experimental measurements of scattering from *Bacillus subtilis* spore played the role of anthrax for the neural network training. The spore of *Bacillus subtilis* is very similar in appearance and scattering properties to that of *Bacillus anthracis* but is safe to use. The training resulted in successful identification of the spore in 70–80% of the test data sets.

ZOOLOGY SECTION

GEORGE MURPHY, CHAIR

PREDATION ON NESTS OF NORTHERN BOBWHITES (*COLINUS VIRGINIANUS*): OBSERVATIONAL EVIDENCE FOR VERTEBRATES. *Jason B. Jennings**, *Michael L. Kennedy*, and *Alan E. Houston*, *The University of Memphis, Memphis, Tennessee (JBJ, MLK) and The Ames Plantation, Grand Junction, Tennessee (AEH)*. Incidence of predation on artificial northern bobwhite quail (*Colinus virginianus*) nests by raccoons (*Procyon lotor*), Virginia opossums (*Didelphis virginiana*) and striped skunks (*Mephitis mephitis*) was assessed at the Ames Plantation, Fayette and Hardemann Counties, Tennessee. This study was conducted from 1 June–15 September of 2001 and 2002. Our objectives were to determine: 1) if incidence of predation was evenly distributed among the three mesopredator species, and 2) what percentage of a known population of mesopredator species is involved in predation on northern bobwhites. There was no significant difference ($P = 0.439$) between the numbers of raccoons ($n = 27$) and striped skunks ($n = 33$) caught on an artificial nest. There were significantly fewer opossums ($P < 0.000$; $n = 6$) captured. There was only a very small percentage of a known population of raccoons and skunks involved in predation and no known opossums were involved. This indicates predation is not widespread within the populations of these three species.

AN ASSESSMENT OF BIODIVERSITY OF SMALL MAMMALS IN THREE HABITAT TYPES IN WESTERN TENNESSEE. *Heidi L. LaMountain** and *Michael L. Kennedy*, *The University of Memphis, Memphis, Tennessee*. 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 during the fall of 2001 and spring 2002. Animals were sampled using Sherman live traps baited with rolled oats. Thirty transects of 10 traps each were employed to capture small mammals in each habitat type. The white-footed mouse (*Peromyscus leucopus*) had the greatest species abundance distribution in each habitat. Species richness was greatest in edge and field habitats.

AN ASSESSMENT OF SPATIAL PARTITIONING OF HABITAT AMONG MAMMALIAN MESOPREDATORS. *Brian D. Carver** and *Michael L. Kennedy*, *The University of Memphis*,

Memphis, Tennessee. We used mark-recapture procedures to assess spatial partitioning of habitat among three co-occurring mammalian mesopredators (Virginia opossum, *Didelphis virginiana*; raccoon, *Procyon lotor*; and striped skunk, *Mephitis mephitis*) in western Tennessee. The study was conducted on 6 trapping grids located at sites trapped during the fall and winter seasons. Habitat and population density varied among grids. Capture data were examined using chi-square analysis. Results indicated that rates of capture were not significantly different from expected rates. We interpreted these results to suggest that the spatial occurrences of the species examined were independent of one another and reflected a neutral association not indicative of habitat partitioning.

HABITAT USE BY THREE SPECIES OF SHREW IN WESTERN TENNESSEE. *Melita E. Smith, Michael L. Kennedy, and James A. Huggins, The University of Memphis, Memphis, Tennessee (MES, MLK) and Union University, Jackson, Tennessee (JAH).*

Abstract not available.

THE USE OF PASSIVE INTEGRATED TRANSPONDERS IN STUDIES OF THE LIFE HISTORY AND ECOLOGY OF *EUMECES FASCIATUS* AND *EUMECES LATICEPS*. *Joseph R. Schiller, Amy N. Evjen*, and Amelia C. Lewis*, Austin Peay State University, Clarksville, Tennessee.* The purpose of this study was to evaluate the use of passive integrated transponders (PITs) for identifying previously captured skinks, *Eumeces fasciatus* and *E. laticeps*, in field conditions. The objective was to permanently mark a significant number of skinks for a continuing long-term population study of *E. fasciatus* and *E. laticeps* in southern Montgomery County, Tennessee; and to compare the efficacy of PIT tagging to traditional toe clipping. Skinks were captured using pitfall, funnel, and rodent glue traps; by hand; and by angling. Seventy two captured skinks were toe clipped and thirty two skinks were implanted with PITs. No mortality occurred within 24 h of PIT implantation or toe clipping. PIT tagged skinks were identified more reliably than toe clipped skinks.

MULTI-SCALE BREEDING BIRD AND LAND-COVER ASSOCIATIONS WITH SURFACE MODELING OF URBAN IMPACTS. *J. Russell Butler, University of Michigan, Ann Arbor, Michigan.* The association patterns between breeding bird diversity and amount of different land cover types at five spatial scales were analyzed as well as was the spatial impact urban areas have on bird diversity. I conducted breeding bird surveys from 2,021 randomly selected roadside locations in a 500,000 ha area of north-central Tennessee. Study area land cover was derived from satellite imagery. Breeding bird species were divided into migration guilds and land cover into natural and artificial types. Bird/land cover association patterns were assessed through canonical and bivariate correlation analyses; the urban spatial impact through surface modeling, spatial regression, and image overlay procedures. Resident species showed no relationship with land cover. In contrast, Neotropical migrant breeding bird species were affected by the amount of different land covers. Furthermore, an area over 60 times larger than downtown Nashville exhibited exceptionally low numbers of Neotropical migrants. This suggests that local as well as regional scale areas need to be assessed in order to more effectively design management and conservation strategies.

ASSOCIATION OF SELECTED HABITAT VARIABLES TO CAPTURE SUCCESS OF MESOPREDATORS. *Roger A. Baldwin*, Allan E. Houston, and Michael L. Kennedy, The University of Memphis, Memphis, Tennessee (RAB, MLK) and Ames Plantation, The University of Tennessee, Grand Junction, Tennessee (AEH).* During the winter and summer seasons of 2000–2002, raccoons (*Procyon lotor*), Virginia opossums (*Didelphis virginiana*), and striped skunks (*Mephitis mephitis*) were live-trapped on five replicated 8 by 8 grids (traps spaced at 230 m intervals) at the Ames Plantation in Fayette and Hardeman counties in western Tennessee. The purpose of the study was to determine the association of selected habitat variables to capture success. At each trap site, 24 habitat variables were measured. Univariate and multivariate statistical techniques were used to determine the association of variables with captures. No single variable appeared to clearly reflect an association between capture and habitat for all species. However, a small number of variables, used collectively, could be utilized to predict the occurrence of each species.

LONG-TERM DYNAMICS IN A POPULATION OF RACCOONS, *PROCYON LOTOR*, IN SOUTHWESTERN TENNESSEE. *John R. Hisey*, M. L. Kennedy, Troy A. Ladine, and Shannon A. Maris-Danley, Lee University, Cleveland, Tennessee (JRH) and The University of Memphis, Memphis, Tennessee (MLK, TAL, SM-D).* To test hypotheses addressing population structure and movements in a solitary carnivore species, we captured 277 raccoons during the winters of 1991–2002 in live traps 150 m apart in a 5 by 10 grid near Memphis, Tennessee. The age structure was stable until numbers began dropping rapidly at about five years of age. Annual turn-over (disappearance) rates averaged 79%, ranged between 50 and 100%, and were high in every age, sex, and year, though animal numbers captured varied annually. Movements between sites occurred in 100% of male and 65% of female juveniles, and 57–86% of males and 42–71% of females annually for other age classes. Trends were consistent with predictions of juvenile male dispersal, female philopatry, a mixed strategy of roaming and residency for mid-aged males, and loss due to mortality in older age classes. Dispersers may control composition of individuals and genetics in such populations more than do residents.

A STUDY OF THE EFFICACY OF PASSIVE INTEGRATED TRANSPONDERS FOR PERMANENT IDENTIFICATION OF *EUMECES FASCIATUS* AND *EUMECES LATICEPS*. *Amelia C. Lewis*, Joseph R. Schiller, and Amy N. Evjen*, Austin Peay State University, Clarksville, Tennessee.* Past mark-recapture studies often have used toe clipping to permanently mark and track scincid lizards. This study evaluated the relative effectiveness of Passive Integrated Transponder (PIT) tags compared to toe clipping techniques for marking *Eumeces fasciatus* and *E. laticeps*. The skinks were captured in a forest area that had been partially logged 5 years before and is also grazed. The trapping and marking of animals began on April 11, 2002 and was discontinued on September 1, 2002. The first PIT tagged animals were released into the field on June 29, 2002. Thirty-one animals were toe clipped and 41 animals were toe clipped and injected with PIT tags. The number of field identifications by PIT tags was compared to the number of field identifications by toe clips. PIT tags proved to be easier to read and more accurate than toe clips for identifying previously captured animals in the field.

A STUDY OF THE EFFECT OF TAIL AUTOTOMY ON SOCIAL DOMINANCE AMONG MALE FIVE-LINED SKINK, *EUMECES FASCIATUS* IN CONTESTS OVER MATING ACCESS TO REPRODUCTIVE FEMALES. *Amy N. Evjen*,* *Joseph R. Schiller*, and *Amelia C. Lewis**, *Austin Peay State University, Clarksville, Tennessee*. Social dominance of many lizard species, including *Eumeces laticeps*, has been shown dependent on body size. This study investigated change in social dominance among *E. fasciatus* due to a change in body size caused by tail autotomy. The skinks were obtained from an area of grazed forest that had been selectively logged 5 years earlier south of Clarksville, Tennessee. Contests over breeding access to females were conducted between pairs of adult male *E. fasciatus* in order to establish social dominance rankings. Tongue flicks, orientations, bites, grapples and tail wags were observed and quantified in the contests. The male that forced its opponent to retreat was considered dominant. Contests were repeated after the tail of the dominant male was autotomized. These contests resulted in no change in the previously established social dominance among male pairings.

CORBICULA FLUMINEA (BIVALVIA: MOLLUSCA) GLYCOGEN CONCENTRATION AND CONDITION INDICES AS INDICATORS OF HABITAT QUALITY IN THE UPPER WOLF RIVER, TENNESSEE AND MISSISSIPPI. *David H.*

Kesler, Rhodes College, Memphis, Tennessee. The objective of this study was to identify different qualities of bivalve habitat within the upper Wolf River in western Tennessee and Mississippi using differences in *Corbicula fluminea* glycogen concentration and condition indices. The specific hypothesis that will be tested eventually is that filter-feeding bivalves have higher glycogen concentrations and condition indices downstream from swamp or lentic habitats. I sampled monthly at Highway 72, LaGrange, Michigan City, Batemen Bridge, and Moscow from April to August, 2002. Glycogen concentrations of foot tissue, while varying seasonally, were not useful in differentiating locations. The condition index of tissue dry mass/internal shell volume differed among sites ($F = 30.3$; $d.f. = 3,36$; $P < 0.001$) and were higher at Batemen Bridge ($P < 0.5$). The same was true for ash-free-dry-mass/internal shell volume ratios ($F = 29 = 0.1$; $d.f. = 3,35$; $P < 0.001$), which were also significantly higher at Batemen Bridge ($P < 0.05$). Glycogen concentration was positively correlated ($P < 0.05$) with the condition indices of tissue dry mass and ash-free-dry-mass/shell weight, and dry mass and ash-free-dry-mass/internal shell volume. Glycogen concentration was negatively correlated ($P < 0.05$) with tissue water content. The shell volume/weight ratios were lower ($P < 0.05$) at Batemen Bridge than other locations. These data indicate that the habitat of Batemen Bridge, immediately downstream from a lentic habitat, is conducive to filter-feeding bivalves.