

ABSTRACTS PRESENTED AT THE ANNUAL MEETING
BOTANY SECTION

HAL DE SELM, *Chairman*

Foliose and Fruticose Lichens of Cedar Glade Communities in Rutherford County, Tennessee. WILLIAM P. MAHR and PHILIP M. MATHIS, Middle Tennessee State University.

The foliose and fruticose lichen flora of cedar glade communities in the Stones River National Battlefield Park were systematically inventoried during the spring and summer of 1979.

Twenty-four foliose species and 12 fruticose species were identified. Taxonomically, 18 genera and 7 families were represented with the best represented families being Cladoniaceae, Parmeliaceae and Physciaceae. All species identified have been previously reported from Tennessee, but not from Rutherford County.

On *Ranunculus trichophyllus* Chaix in Tennessee. EDWARD W. CHESTER, Austin Peay State University.

This northern and western-ranging aquatic species was first reported from Tennessee in 1960, has not been collected since, and appears on both State and Federal lists of rare, threatened, and endangered species as a possibly extirpated member of the Tennessee flora. The record is based on a Montgomery County specimen collected by Alfred Clebsch in 1949 (APSU, TENN.). Based on a subsequent evaluation of the material by Clebsch, the author, and Dr. Carl Keener, as well as new, more complete collections from the intact, original collection site, the material is more appropriately placed with *R. longirostris* Godr. Thus, *Ranunculus trichophyllus* Chaix should be deleted from lists pertaining to the Tennessee flora.

Appalachian Ranges National Landmarks. H. R. DE SELM and BRADEN CONDLEY, University of Tennessee, Knoxville.

The Appalachian Ranges Region is comprised mainly of the Ridge and Valley and Blue Ridge Provinces. All of the former and all but the southern portion of the latter are being explored for unique and special natural (ecological and geological) areas. Currently more than 200 sites have been recommended and some of them have been examined.

The White Pine—Hardwood Vegetation Types of the Great Smoky Mountains National Park. H. R. DE YOUNG and H. R. DE SELM, University of Tennessee, Knoxville.

The White Pine—Hardwood type was described by Miller in 1938; however, subsequent researchers of Park vegetation have not described this type. In the summer of 1977 a vegetation analysis was conducted utilizing Miller's type map.

The majority of White Pine—Hardwood vegetation is located in the western end of the Park on the Tennessee side at low to mid-elevations generally centering around Cades Cove and extending down Abram's Creek to Chilhowee Lake. Slope position is highly variable with white pine occurring on dry ridges, mid-slope positions and along flood plains.

Seven types were derived from 144 sample plots grouped by leading dominants using the Orloci (1967) cluster analysis. From the canonical analysis the types can be inferred to occur along a complex scale utilizing slope position and protection which influences moisture availability.

Floristic Trends on Sandstone Outcrops of the Cumberland Plateau in Tennessee and Northern Alabama. BRETTE E. PERKINS and H. R. DE SELM, University of Tennessee, Knoxville.

The vegetation of six sandstone outcrop sites on the Cumberland Plateau from northern Alabama to northern Tennessee were sampled using quadrats. At each site, number and percent of total number of species in each life-form category were calculated. North-south trends were examined.

Environmental Pollution and Variation in Kudzu (Pueraria lobata). G. K. SHARMA and CAROL CHANDLER, University of Tennessee at Martin.

Kudzu is a perennial leguminous vine introduced into the United States from Japan for forage and erosion control. However, the plant presents some problems in cultivated fields and woodlands because of its extremely aggressive growth-making it a dreaded vine of the southeastern United States.

Four populations of kudzu (*Pueraria lobata* Willd.) were studied in rural, relatively unpolluted areas and in habitats characterized by heavy industrial pollution in northwest Tennessee. Leaf length, leaf width, petiole length, flower size and pod size showed a decrease in growth in heavily polluted areas. Trichome frequency and length on the leaf surfaces increased with an increase in environmental pollution, while the stomatal frequency values showed a slight decrease in polluted habitats. The length of the largest and the smallest stomata and the number of undulations in the epidermal cells in kudzu plant populations were not affected by environmental pollution. Subsidiary cell complex also remained constant in all the plant populations sampled in polluted and relatively unpolluted habitats.

A Water Soluble Inhibitor in Rhus. HAROLD A. SIMMONS and STEVE HAYS, Union University.

Fruits and leaves of *Rhus typhina* were subjected to boiling water. The resulting solution set for 48 hours, was filtered, and then used as a test solution. The percentage of seeds germinating and radicle length of *Phaseolus* were monitored for nine days. Data gathered during the fall and spring seasons revealed that a water soluble inhibitor was present which delayed germination.

However, the most pronounced effect was on radicle length:

Experimental set	Day	Radicle length
Fall (a) Leaf extract	5	11.5
	9	20.0
(b) Fruit	5	20.9
	9	28.0
Spring (c) Leaf extract	5	12.8
	9	23.0
(d) Fruit	5	25.2
	9	26.2

Elongation of radicles for control seeds was twice the means for experimental sets. Almost no differences exist in results from spring and fall sets, indicating that the winter season has minimum effect on the inhibiting substance.

Effects of Cytokinins on Auxin-induced Phloem Regeneration in Coleus Internodes. DUANE F. HOUCK, Southern Missionary College.

Excised number five internodes of *Coleus blumei* with wounded xylemless phloem bundles were treated apically with 1.0% indole-3-acetic acid (IAA) in lanolin and were placed in vials containing 10^{-6} M cytokinin or water. After one week the internodes were fixed, and slides were prepared of the stained phloem sections to show regenerated sieve tubes circumventing the wound areas. Intact plants were similarly wounded for standards. The amount of phloem regeneration around each wound was evaluated by a counting convention, and means for each treatment were obtained.

The mean phloem regeneration count around wounds of intact plants was 9.3 ± 1.8 , but in excised IAA-treated internodes in water only 0.8 ± 0.3 . When IAA-treated internodes were supplied basally with various cytokinins, some markedly increased the phloem regeneration, however, others did not. Listed in order of their effectiveness they are: zeatin, trans isomer (4.2 ± 1.2), 6-n-hexylaminopurine (4.0 ± 0.9), zeatin, mixed isomers (3.3 ± 1.9), 6-pentyl (5 OH) aminopurine (2.6 ± 1.0), 6-(Gamma-dimethylallylamino) purine (2.2 ± 0.7), 6-benzylaminopurine (1.2 ± 0.6), and o-hydroxybenzyladenine (0.2 ± 0.1). The relationships of cytokinin activity to molecular structure are discussed.

A Transformation-induced Alteration of Cellular Membranes in Crown Gall Tumor Cells. L. E. COCKERHAM, Lee College.

Phospholipids were utilized as a membrane marker to test for transformation-induced alteration of cellular membranes of cultured crown gall cells of *Vinca rosea* L. Fully-transformed cells contained less than half the amount of phospholipids (7.8 ug lipid P per g fresh weight) as normal *V. rosea* cells (21.4 ug

lipid P per g fresh weight). The normal *V. rosea* callus cells were not significantly different ($p>0.05$) in phospholipid content from partially transformed crown gall cells (20.7 ug lipid P per g fresh weight). Stimulation to rapid growth of the partially-transformed cells did not significantly alter its phospholipid content (23.1 ug lipid P per gram fresh weight). These findings suggest that the transformation process is directly responsible for an alteration of the cellular membranes and cannot be attributed to secondary effects associated with the rapid growth of these neoplastic cells.

Preliminary Tissue Culture Propagation Studies on Several Members of the Fern Genus *Nephrolepis*. JAMES D. CAPONETTI and MICHAEL J. BECK, The University of Tennessee, Knoxville. Preliminary investigations have been conducted on Boston Fern, Golden Boston Fern, Fishtail Fern, Fluffy Ruffles Fern, and Tuberosus Sword Fern for the determination of rapid propagation methods in sterile culture. Cultures were established from stolon (runner) tips and lateral buds. Several liquid and agar-solidified media were tested with and without plant hormones. Some cultures were kept in a vertical position and some in a horizontal position. Overall growth and development of stolon tips and lateral buds was similar on all media without plant hormones, in liquid vs solid media, or in vertical vs horizontal position of the explants. Each bud produced a single shoot. Cultures on media supplemented with plant hormones produced multiple shoots. Current research is aimed at refining the culture conditions necessary for rapid shoot multiplication in *Nephrolepis* ferns.

Growth responses of *Zea mays saccharata* B. and *Phaseolus vulgaris* L. to applications of gibberellic acid. THOMAS E. HEMMERLY and STANLEY O. ABELL, Middle Tennessee State University.

Young seedlings of sweet corn, *Zea mays saccharata*, and "Little Marvel" beans, *Phaseolus vulgaris*, responded differently to varying concentrations of gibberellic acid. Significant growth stimulation occurred in *Z. mays* when gibberellic acid was used in conjunction with fertilizer. This was not the case when either fertilizer or gibberellic acid was used alone.

In *P. vulgaris*, the dwarf condition was reversed and flower induction was accelerated in all seedlings treated with both gibberellic acid and fertilizer.

Data suggested that gibberellic acid, whether acting alone or with fertilizer, stimulated rapid growth and high dry matter accumulation in *Z. mays* and early flower induction in *P. vulgaris*.

Effects of Co gamma irradiation on Morphogenetic Characteristics of *Haworthia* Callus Tissues. K. N. PANDEY and P. S. KALON, Tennessee State University and P. S. SABUAKWAL and J. CALKINS, University of Kentucky.

Callus tissue was derived from the segments of inflorescence axes on modified Murashige and Skoog's medium supplemented with 0.2 mg/l naphthaleneacetic acid (NAA) and 0.2 mg/l kinetin (6-furfurylaminopurine). Stock cultures were maintained on the same medium supplemented with 1.5 mg/l NAA and 1.5 mg/l kinetin. One week after inoculation calli were exposed

to Co gamma 60 gamma rays at approximately 188 rad/minute. Radiation dosages ranged from 100 to 5,000 rad.

Increasing dosages of gamma-irradiation inhibited both vegetative bud and root differentiation. Dosages from 1,000 to 2,000 permitted only little or no organogenesis. However, tissues irradiated to higher dosages of gamma-rays showed continuous cell growth and division and remained as callus. The results indicate that growth and morphogenesis of callus tissues are affected differently by gamma-irradiation. Dosages of 3,000 rad and above were lethal.

CHEMISTRY SECTION

EUGENE H. KLINE, *Chairman*

The Quality of Morristown's Water. MARY C. LU, Walters State Community College, Morristown.

Among other environmental problems, water pollution has become a great concern by the general public. In order to know the quality of Morristown's water, a study was made through the cooperation of Morristown Water System and a chemist at Walters State Community College.

Due to technological unfeasibility, the study was conducted by means of analyzing the existing data rather than doing all laboratory tests over again. The laboratory works were done by the Morristown Water Plant, the Division of Water Quality Control of the Tennessee Department of Public Health and the Stewart Laboratories in Knoxville.

From the review and analysis of the laboratory data, including the consumption of chemicals, coliform count, composite analysis and various testings on contamination, odor, taste and hardness, it was found that the water quality in Morristown does meet the state and federal requirements. However, recommendations were offered for further improvement and to prevent health problems.

Conductive Polyimides Containing Selected Metal Salts. T. A. FURTSCH, Tennessee Technological University, and L. T. TAYLOR, V. C. CARTER, T. WOLFORD and J. SCHIAFF, Virginia Polytechnic Institute and State University.

Palladium-containing polyimide films with surface and volume resistivities approximately ten orders of magnitude lower than that measured for the polymer alone have been synthesized. Best results were observed when Li_2PdCl_4 and $\text{Pd}(\text{S}(\text{CH}_3)_2)_2\text{Cl}_2$ served as the source of palladium. X-ray photoelectron spectroscopic investigation of these films indicated palladium (II) was reduced to palladium metal during the thermal imidization (i.e. curing) process.

High Temperature and Pressure Reactions of Some Lignite Coal Liquefaction Model Compounds. EUGENE A. KLINE, Tennessee Technological University, Cookeville, and CURT L. KNUSSON and BRUCE W. FARNAM, Grand Forks Energy Technical Center, Grand Forks, N.D.

Model compounds of lignite coal were subjected to similar temperatures and pressures currently being used for liquefaction in a one liter batch autoclave. The temperature was increased 10°C each hour from 460°C to 500°C with small samples removed at regular intervals. The rate of loss of starting material and the rate of formation of products were often first order, although good mass balance was not maintained. Transmethylation and dimerization were important reactions which could be lessened but not extinguished with both donor solvent (tetralin) and syn gas ($\text{H}_2 - \text{CO}$). Syntheses of some possible products aided in identifying products.

The Crystal and Molecular Structures of [cis-(OC)₂Re(CH₂-CO)₂]₂Cu and [η⁵-C₅H₄(OC)Fe(CH₂CO)(C₆H₅CO)]BF₄: Metalla-β-Diketonate Complexes of Cu(II) and Boron. P. GALEN LEBERT, C. M. LUKEHART and L. T. WARFIELD, Vanderbilt University, Nashville.

The crystal and molecular structures of two recently synthesized metalla-β-diketonate complexes of Co(II) and boron was presented. The copper complex (A), [P₂/c, a=11.2231(9)Å, b=7.3648(5)Å, c=13.9179(10)Å, β=90.791(6)°, 2315 reflections, R=2.3%, R_w=2.6%], assumes a "chaise longue-chair" conformation in which an axial carbonyl ligand of each Re moiety appears to occupy a potential coordination site of the copper atom affording a severely tetragonally distorted octahedral complex. The boron complex (B), [P₂/c, a=8.0972(11)Å, b=11.5484(15)Å, c=15.8932(25)Å, β=111.769(13)°, 3891 reflections, R=4.8%, R_w=3.3%], adopts a boat conformation rather than having a planar ligand-ring backbone. The unusual molecular structures of (A) and (B) will be discussed with reference to related structures.

Lipid Synthesis in Cultured Rabbit Lenses. BARBARA ALBERS-JACKSON and CATHY HIX BAKER.

Lenses from New Zealand albino rabbits were incubated with 50 microcuries ¹⁴C acetate in medium 199 for 20 hours at 33°C under an atmosphere of nitrogen-oxygen-carbon dioxide (88:7:5). Individual lipids were analyzed and radioactivity determined incorporation occurred in phosphatidyl choline, cholesterol and phosphatidyl ethanolamine. The fatty acids which incorporated the greatest radioactivity were palmitic, myristic and oleic acids.

The Computer As a Tool for Teaching Chemistry. D. T. FARRAR, Tennessee Technological University.

Remote computer terminals have become increasingly available for educational use during the past several years. The terminals are often placed in the Chemistry building itself, thus providing easy access to the computer for both students and faculty. Rapid debugging and turn-around time, and the inter-

active features of remote terminals enhance their importance as instructional devices in Chemistry.

This discussion will cover some of the ways we are using Tennessee Tech's Chemistry terminal. Programs will be described that involve laboratory simulations, game-playing, construction of examinations and individualized problem sets, and the routines used for least squares fitting, integration, and plotting.

GEOLOGY SECTION

ERNEST W. BLYTHE, JR., *Chairman*

An Analysis of Doline Collapse Frequency. PHILLIP R. KEMMERLY, Austin Peay State University, Clarksville.

A temporal analysis of doline collapse on the Western Highland Rim indicated one approach to estimating collapse probabilities in areas where the geologic and hydrologic criteria associated with collapse have been identified. The collapse distribution was examined for trend, autocorrelation, and goodness-of-fit.

The collapse distribution, during one twelve-month period, conformed to a Poisson distribution with a mean occurrence rate, $\lambda = 0.346$ collapses/wk. Collapse inter-occurrence times were exponentially distributed (0.01 level).

Although the proposed model is spatially and temporally restricted, it may provide an initial framework for estimating collapse probabilities in other karst terrains with similar geologic and hydrologic settings.

Concretions from Eocene Rocks in Western Tennessee and Western Kentucky. ARMIN L. CLARK, Murray State University, Kentucky.

Hematitic and limonitic concretions from the northeastern part of the Mississippi embayment in the Eocene formations of western Tennessee in Henry, Weakley, and Carroll counties and western Kentucky in Calloway, Graves, and Marshall counties are products of localized cementation of quartz sands with iron oxide. These chemical structures are remarkably diversified in form and are either simple, or compound, or complex. Some are spherical or ellipsoidal, others are cylindrical, and still others present extraordinarily odd and fantastic shapes. The spherical concretions usually average 1/4 to 3 inches in diameter while the non-spherical ones are usually 3 to 6 inches in length; some elongate ones exceed 12 inches in length. Stratigraphically, the concretions show no preference for any particular horizon within the formations.

Abram Litton, Field Man. JAMES X. COGGAN, Austin Peay State University, Clarksville.

Abram Litton (1814-1901) studied under Gerard Troost at the University of Nashville, receiving an A.B. in 1831. In 1835 he joined the University faculty as professor of mathematics and natural philosophy. Litton left for study in Europe in 1838 and returned to Nashville by early 1843. From the mid-1830's through the mid-1840's he occasionally worked as a field geologist assisting Gerard Troost. Most notably, Litton aided Troost in mapping the Central Basin of Tennessee. In 1847 Litton moved to Indiana and joined D. D. Owen in a geological survey of the Chippewa lands in Wisconsin. He also worked with Owen in Minnesota and elsewhere. Many of Litton's colleagues became famous. Litton is unknown because he never wrote a geological report or signed a map. He was a seasoned field man at a time when field skills were rare. Apparently he was quite productive.

Relative Age of Chertification and Dolomitization in the St. Louis Limestone (Mississippian) of South Central Tennessee. DAVID N. LUMSDEN and JOSEPH L. COOPER, Memphis State University, Memphis.

The St. Louis Limestone contains abundant quantities of chert as nodules ("cannonballs"), stringers, lenses, and silicified (carbonate beds with 50% or more chert). Field and petrographic evaluation indicates that the chert is secondary (replacement of fossils, chert mudcracks, continuity of bedding planes through chert bodies, etc.). There is no apparent relationship between chert occurrences and stratigraphic or geographic location. Microscopically, the chert is variable from very fine (less than 0.01 mm) to relatively coarse (0.10 mm) with some chalcocite. Dolomite rhombs occur isolated in chert masses and chert pseudomorphs after dolomite were observed in insoluble residues. We suggest that chertification in St. Louis was at least partially contemporaneous with dolomitization.

Gravity Survey of a Part of the East Boundary of the Reelfoot Drift, Dyer and Lauderdale Counties, Tennessee. By RICHARD G. STEARNS, V. LEE HAGEE, SUSAN J. NAVA and SHARON L. WILSON, Vanderbilt University, Nashville.

Fourteen quadrants were surveyed in Western Tennessee and in portions of Arkansas and Missouri. The survey of Summer, 1979 spans the region south of which earthquakes become less frequent, and extends to the east edge of the Reelfoot rift zone. About 800 stations were surveyed in an area of about 900 square miles with an accuracy of ± 0.2 mgals. Accuracy is enhanced by use of a computer reduction program to remove both drift and total effects.

The main features of this region are the north edge of the Covington anomaly (plum), large gradients on the apparent edge of the rift and straight trending gradients parallel to a straight reach of the Mississippi River near Caruthersville, Missouri. Lesser anomalies include linear elongated features and smaller local features. Some of these linear features parallel local river systems. It is likely that the smaller local features are plutons. These plutons because of their smaller diameter are assumed to be at depths of less than one mile.

One continuous series of features marks the southern limit of the zone of most abundant earthquakes. From the straight gradient at Caruthersville, Missouri, the series includes the area of apparent small plutons and ends at the edge of the rift in a negative anomaly.

MATHEMATICS SECTION

ALVIN TIRMAN, *Chairman*

Sampling Proportional to Random Size (Resources with Diverse Distributions). V. R. R. UPPULURI, Union Carbide Corporation, Oak Ridge and S. A. PATIL, Tennessee Technological University, Cookeville.

Let X_1, X_2, \dots, X_N be a set of N independent identically X_n with probability $Nq(X_1 + X_2 + \dots + X_N)$, for $q = 1, 2, \dots$ and set of $N - 1$ variates, let $Y_i = X_i$ with probability $X_i/(X_1 + X_2 + \dots + X_N - Y_i)$. Continue this process. This type of sampling is referred to as sampling proportional to random size. In this paper we consider the cases when the variates X_n have truncated Poisson and truncated Negative Binomial distributions. We obtain the distributional properties of Y_1, Y_2, \dots, Y_N . We also consider the limits as N tends to infinity in each of these cases.

A One-Sided Characterization of Dedekind Semiprime Rings. JOHN KINLOCH, East Tennessee State University, Johnson City.

A ring with 1 is a Dedekind semiprime ring if R is a hereditary, noetherian, semiprime ring which is a maximal order in its quotient ring. These rings were originally studied by J. C. ROBSON (J. Algebra 9(1968), 247-265). In the following we characterize the two-sided nature of these rings by means of one-sided conditions only. A ring with 1 satisfies (LTF) if each finitely generated torsion-free left module is a submodule of a free module. **Theorem 1.** A ring R is a hereditary, noetherian, semiprime ring if R satisfies: (1) R is a left Ore ring, (2) R is left hereditary, (3) R satisfies (LTF), and (4) R satisfies the DCC on finitely generated integral left ideals containing a fixed integral left ideal. **Theorem 2.** A ring R is a Dedekind semiprime ring if R satisfies (1) - (4) of Theorem 1 and in addition (5) R is a maximal left order in its quotient ring.

Stieltjes Integrals In Certain Second Order Differential Equations. V. M. SAKHARE, East Tennessee State University, Johnson City.

The paper deals with the question of representing certain second order ordinary and delay differential equations by using Stieltjes integrals.

A Pre-Pythagorean Proof of a 3-4-5 Right Triangle. ALVIN TIRMAN, East Tennessee State University, Johnson City.

A proof is furnished which demonstrates on a checker board and without appeal to the Pythagorean Theorem that for a right triangle with legs of lengths 3 and 4, the hypotenuse has a length of 5.

Reflections as Departmental Chairman, Tennessee Technological University (1959-1979). RALPH C. BOWLES, Tennessee Technological University, Cookeville.

The Department of Mathematics and Computer Science at Tennessee Technological University grew from a faculty of eight

in 1959 to a faculty of twenty three in 1979 and a student enrollment from 800 to 2600.

The 1959 catalog listed twenty eight courses including five remedial courses. The 1978-80 catalog listed eighty nine undergraduate and thirty three graduate courses.

There existed a need for curriculum changes throughout the twenty year period. In the 60's the number of students entering Tech with four years of high school mathematics increased. The 70's, however, saw a reversal of this trend. This made it difficult to place students in the appropriate mathematics or computer science course in 1979 as it was in 1959.

Physics, chemistry, biology and engineering have all had their laboratories to attract students, and now mathematics has its computers and hand-held calculators. Mathematics teachers can and should maximize the use of these tools to attract, hold, and motivate students.

Use of Symbolic Operators in Variables. M. K. JAIN, The University of Tennessee at Martin, Martin.

The authors presented a general result and obtained several mathematical identities from it as particular cases.

MEDICAL SCIENCES SECTION

CHARLES W. HARLAN, *Chairman*

An Unusual Case of Brucellosis. RICHARD G. SOPER, BILLY RAY JENNINGS, DONNA WILLIAMS, University of Tennessee Center for Health Sciences, Memphis.

A case of Septic Arthritis of the right ankle caused by Brucella Abortus is presented. The infection may have been contracted while the patient was assisting with the birth of a still-born calf. A stain of the joint effusion revealed gram negative coccobacilli that on culture were identified as B. abortus, type undetermined. The acute phase agglutinins for brucella were 1:40. After multiple drainage procedures the patient was treated with tetracycline, for six weeks, and streptomycin for two weeks. At the time of this presentation, the patient was still on tetracycline therapy and asymptomatic. The clinical, laboratory, and pathogenic aspects of Brucella Arthritis are discussed.

Serum Complement Profiles in Chronic Sinusitis. B. R. JENNINGS, ROBERT FISHER, J. M. MASON, MARY BRADLEY and MARGARET C. MOFFATT, University of Tennessee Center for the Health Sciences, Memphis.

Serum complement profiles for total hemolytic complement CH_{50} components C3, C4, C5 and C3 proactivator were determined in 21 patients with chronic sinusitis.

The data were reduced to show three groups for each component: (1) those which were within 95% confidence intervals for normal, (2) those above normal, and (3) those below. Based on these results, the CH_{50} , C3 proactivator, and C5 revealed a pattern not significantly different from a normal distribution. There were significant increases ($p < 0.05$) of both C3 and C4, with 43% and 38% of sinusitis patients exhibiting elevations of C3 and C4 respectively.

Seven of the 21 patients had both elevated C4 and C3 values. Only 3 of the patients showed an increase in either C3 or C4 without a rise in the other component.

Chemotherapeutic Alteration of Lead Excretion and Tissue Distribution in Mice. E. B. SORENSON, E. S. MORETTI, and A. LINDENBAUM, Argonne National Laboratory.

To compare the efficacy of various chelating agents in removing lead from the body, mice were given a single intravenous injection of lead (30 mg Pb/kg), labeled with ^{210}Pb , followed by three intraperitoneal injections of 0.9% saline, ethylenediaminetetraacetate (EDTA), diethylenetriaminepentaacetate (DTPA), or the dibutyl ester of DTPA (Bu_2DTPA). ^{210}Pb levels were measured 2 days after the lead injection. Both Bu_2DTPA and DTPA treatment prevented further uptake of lead by the brain and Bu_2DTPA therapy was significantly better in removing lead from the liver and whole body than either DTPA or EDTA.

To determine the effect of prolonged Bu_2DTPA treatment, mice were administered ^{210}Pb -labeled lead (10 mg Pb/kg) intravenously, treated up to six times with either saline or Bu_2DTPA , and sacrificed at different times. ^{210}Pb was analyzed in tissues, the remaining carcass, and excreta. Therapy with Bu_2DTPA sig-

nificantly reduced brain and femur lead levels and caused some excess lead in both urine and feces.

Forensic Pathology as an Elective Rotation for Medical Students—University of Tennessee Center for the Health Sciences/Shelby County and Tennessee Medical Examiner Office Version. JAMES SPENCER BELL and CHARLES W. HARLAN, The University of Tennessee Center for the Health Sciences, Memphis.

A Forensic Pathology rotation has been offered as an elective to medical students at the UTCMS for several years. The program outline includes: making daily rounds with the Medical Examiners/Forensic Pathologists of Shelby County and the State of Tennessee Medical Examiner's Office, attending autopsies, attending court, attending and presenting assigned seminar topics, becoming familiar with forensic photographic equipment and needs, following toxicology samples from the deceased through the laboratory observing "chain of evidence" and testing procedures observing trace evidence at the scene and following it through laboratory testing procedures, becoming familiar with laboratory testing procedures and forensic serology application in both emergency and "routine" hospital functions, and reporting on selected reading assignments.

Prior students' current activities were presented. *Cafe Coronaries: A Review.* C. W. HARLAN and J. S. BELL, The University of Tennessee, and G. C. HARLAN, St. Joseph's Hospital, Memphis.

Sudden deaths which occur as a result of choking on food (usually a large piece of meat) have frequently been labeled death due to coronary thrombosis. Since many such deaths have occurred in restaurants, the term "cafe coronary" has been used. A number of such cases have been investigated by the Shelby County Medical Examiner's Office. The obstructing agents have included steak (twice), a Krystal hamburger, hamburger meat in spaghetti, plastic, a baked bean, and a whole peeled orange. Several techniques have been used to relieve the obstruction, including the Heimlich maneuver. Greater awareness of this emergency situation by both laymen and physicians and knowledge of applicable techniques may reduce the number of fatalities.

PHYSICS-ASTRONOMY SECTION

ROBERT R. MARCHINI, *Chairman*

A Calculation of the Density of the Universe Utilizing Ultraviolet. ROY W. CLARK and SOHEILA ABOUZANJANI, Middle Tennessee State University, Murfreesboro.

The theory that a non-doppler redshift explanation is possible based on the acceleration of light beyond C was first proposed by Clark, in November, 1972 at the Tennessee Academy meeting. There are several experimentally testable consequences of such a theory. Possible experiments are briefly discussed, and a calculation of density of the universe based on several assumptions in addition to the theory is shown to yield a value in agreement with current estimates.

Long-Range Interactions. RONALD E. MICKENS, Fisk University, Nashville.

Given a definition of the range of a potential and using certain theoretical ideas, we show that the only long-range interactions are those whose potential energy of interaction decrease inversely with the distance, i.e., $U(r) = \text{constant}/r$.

Physics Enrichment Program for High Schools. JAMES M. COOK, Middle Tennessee State University, Murfreesboro.

A program is described for enriching area high school physics courses. A team of three MTSU physics professors made a total of twenty-five (25) visits to various area high schools during the three year period, 1977-79. Most visits were to physics classes but a few were to merely science oriented groups. The major part of the presentations consisted of demonstrations illustrating assorted physical phenomenon. Use of liquid nitrogen allowed several unusual low temperature effects to be explored. Other popular demonstrations included radioactivity and a laser. A total of about 1700 high school students and many teachers were contacted. Classes were only visited after an invitation from the teacher. In addition to demonstrations, discussions of astronomy and general question and answer sessions were enjoyed by students. This project was supported by a grant from the MTSU public service committee.

Classroom Demonstrations With Liquid Nitrogen. FRANKLIN C. MASON, Middle Tennessee State University, Murfreesboro.

In conjunction with the MTSU Physics Enrichment Program for High Schools described in the preceding paper by Dr. James M. Cook of MTSU, a set of demonstration experiments at liquid nitrogen temperatures was devised by the author which can be performed with a minimal amount of equipment and supplies. These experiments currently serve as the subject of a presentation given by the author through the Visiting Scientist program of the Tennessee Academy of Science. The phenomena being demonstrated are: the liquefaction of the gas in an inflated balloon (with variations); the liquefaction of oxygen in the atmosphere; the quick freezing of mercury and other materials; the dramatic change in resistance of copper (with variations) and carbon; the dependence on the average rate of heat flow out of a body on the body's surface area; and the change in elastic properties of materials. As a final demonstration, a one-gallon ditto can is collapsed in the usual manner under the action of atmosphere pressure and is then brought back to its original shape (more or less) with a few milliliters of liquid nitrogen being poured into the collapsed can and loosely capped it off.

High School Physics: A Relevant Course Whose Time Has Come. WILLIAM R. CRANFORD, Jackson Central-Merry High School, Jackson.

The central theme of energy provides us with the excellent opportunity to make High School Physics THE MOST RELEVANT COURSE IN HIGH SCHOOL TODAY. By the use of current events and even new rock & roll songs these crucial issues of energy conservation, alternate energy sources, or even lifestyle changes can be effectively taught in the curriculum of the high school physics class.

The students can find that physics can be fun, interesting, and yet, challenging. They can learn to THINK PHYSICS in all of their everyday situations.

Demonstrating Physical Science by Videotape. WILLIAM LAMBERT, Carver High School and Memphis State University, Memphis.

Science students throughout the state are being taught by teachers who are unmotivated, uninspiring and undereducated. This is evidenced by a significant drop in enrollment in optional science courses, i.e., physics, chemistry, advanced biology. Science students are turned off in junior high school, where science is too often taught by teachers who have had little or no experience with the presentation of physical phenomena by demonstration and, in general, have even less in the way of laboratory facilities and equipment for use by their classes. The result is that a large segment of the junior high population encounters the "Read the chapter, answer the questions at the end" method of science teaching. In addition, many art teachers, home economics teachers and coaches are asked to teach "just one science class." Many teachers of science would like to do more for their students. This series of videotapes with the accompanying instruction booklet may offer a viable solution.

Energy Conservation Concepts in the High School Physics Curriculum. RON ROBERTSON, Dickson County High School, Dickson.

The activities of aluminum can recycling, an energy fair, science fair projects and a comprehensive energy audit of a high school building were used to demonstrate the relationship between physics and the practice of energy conservation. These activities increased student interest and understanding while demonstrating career opportunities.

The energy audit of the DCHS building involved the measurement of resistance to heat loss and gain through the R values of building materials, the relationship of V, I, and R in electrical power consumption of heating and cooling devices, an analysis of lighting with respect to energy consumption and illumination, and the role of occupancy in determining heating requirements. The 183,000 ft² building was found to have R values of 1.1, 4.2, and 3.0 in floor, ceiling and wall spaces, and is heated and cooled by hot and cold water heat exchanging units. The calculated utility cost was 11¢/ft² for natural gas and 23¢/ft² for electricity during a 12 month period in 1978-79. The average classroom was overilluminated while many vocation areas were underilluminated.

Numerical Analysis and the Electrical Behavior of Solids. D. R. FRANCISCHETTI, Memphis State University, Memphis.

The currently accepted mathematical model for charge transport in solids involves a nonlinear set of partial differential equations. This is the case for ionic, electronic, or mixed con-

duction processes. Although in many cases a useful description of a solid electrode/material system's electrical properties can be obtained with approximate analytical techniques, quite a number of interesting situations require numerical solution of the full nonlinear set of equations.

The numerical solution of nonlinear differential equations is an area of high current interest in applied mathematics and computer science. In the present discussion, illustrations are given of the application of numerical techniques to practical problems involving the electrical behavior of solid systems. The formulation of rate laws for electrode reaction as boundary conditions for the differential equations of charge transport is also discussed. Techniques for the analysis of experimental data in terms of the numerical solutions of the transport equation are briefly considered.

Proton Electrotransport in Pd. JOHN W. HANNEKEN, Memphis State University, Memphis.

A proton current was established in α -phase palladium wire ($[\text{H}/\text{Pd}] \approx 0.65$) by application of an electric field at room temperature. An electrochemical technique was developed to measure the discharge of protons from the Pd electrode into solution. The technique relies on maintaining a negligibly small residual electron current and by maintaining a constant voltage drop at the Pd-solution interface. Correlating the electronic current in the external circuitry with the change in pH of the discharge solution established the electronic current as an accurate measure of the proton current. A theory describing the discharge process in terms of a diffusion equation coupled with a boundary condition to account for surface impedance was also developed. In connection with this work, the possibility of proton superconductivity resulting from an attractive interaction between protons will be discussed.

SCIENCE-MATH TEACHERS SECTION

DAVID DRISKILL, *Chairman*

Perceived Needs of Upper Cumberland Science and Mathematics Teachers. RICHARD K. FLETCHER, JR., Tennessee Technological University, Cookeville.

A survey of teachers of science and mathematics who were in attendance at the group sessions of the 34th Annual Educational Conference revealed that lack of instructional materials and resources was their major concern. When asked to rate the degree to which university coursework in the several areas of science would be beneficial to them, science teachers indicated that work in environmental education would be most beneficial. Other areas of concern indicated by the science teachers were energy education and science teaching methodology. Mathematics teachers chose coursework in mathematics as the number one area of benefit. Forty seven percent of the mathematics teachers indicated work in teaching methodology would be highly beneficial. The mathematics teachers were not as interested in computer science coursework as one might expect with only 36.3 percent of the group indicating work in this area to be highly beneficial.

Guidelines for Science Teaching and Curriculum Development in the Middle School—A Review of Related Literature. RONALD B. CHILDRESS, West Virginia College of Graduate Studies, Charleston.

Since the late 1950's and early 1960's, widespread dissatisfaction with the traditional junior high school has resulted in a national movement toward a revised concept in the education of the early adolescent. Generally characterized as the middle school movement or middle childhood education, this revised concept of the transitional school has forced a rethinking of the operational parameters of the traditional junior high school. Inherent in this move toward a different concept of the transitional school has been a rethinking of the role and teaching of science for the early adolescent.

The purpose of this paper was to review available literature and research related to science teaching and curriculum development in the middle school. Related literature and research studies were analyzed and synthesized with the resultant produce being a series of guidelines for science instruction and curriculum development in the middle school. Hopefully, the synthesis and utilization of these guidelines will result in more meaningful instruction and curriculum development for the early adolescent.

Biofeedback: Anxieties of Test Taking. M. W. STRATTON, Tennessee State University, Nashville.

Simply speaking, biofeedback is the process of reflecting information back to a biological system which can be evaluated via electrical equipment that monitors internal activities (psychological and physiological). Every mental event that occurs is correlated to a muscle event; therefore, it is safe to say that practically all internal activities can be monitored, analyzed and interpreted with the results being used to illuminate any situation. In order to identify underlying factors that contribute to anxieties prior to test taking it was necessary to devise a log that could be completed by a subject 2-5 days before an exam (1 log/day). From this log it is possible to ascertain whether certain emotional or physiological situations existed, and with the aid of counseling, progressive relaxation, and/or special equipment minimize those things that cannot be controlled directly.

The Galapagos: A Laboratory for Evolution. GENE VREDEVELD, University of Tennessee, Chattanooga.

Most General Biology texts of the last few years refer to Darwin's Finches as an example of adaptive radiation and recite how central Darwin's knowledge of this group of birds was in the formulation of the Origin of Species concept. Some texts include pictures of other animals such as the turtles and iguanas with some explanation of them written in. In none of the books had the author visited the islands personally. I visited the Galapagos Island this last summer and came away impressed by two facts; 1) the fearlessness of the animals toward man, 2) the thinness or disharmonic character of the ecosystem. I think that stressing these two facts in high school or college General Biology would not only add to the interest but also lay a ground work to help the student identify with Darwin and be able to understand why Darwin could perceive the mechanism of evolution more clearly in the Galapagos than in continental ecosystems.

A Study of the Laboratory Approach and its Influence on Student Attitudes in Mathematics. E. RAY DOCKERY and PAMELA J. DOCKERY, West Virginia College of Graduate Studies, South Charleston.

The purpose of this study was to ascertain the effect that a laboratory approach has on children's attitudes toward mathematics. More specifically, this study attempted to control the method of instruction in order to determine the influence it has on the attitudes children hold toward mathematics.

While there was little evidence which supported the major premise of the study, several other important findings were revealed. Teacher age and experience were found to be important in attitudinal formations. A second finding of major significance was with the student's perception of the teacher's and parent's attitude toward mathematics. In both instances high statistical significance was found when comparing the students' attitude with his/her perception of the teacher or parent's attitude toward mathematics.

ENGINEERING SECTION

HALL C. ROLAND, *Chairman*

No abstracts submitted to Editor.

ZOOLOGY SECTION I

JAMES S. JACOB, *Chairman*

A Simplified Artificial Stream Channel Apparatus for Continuous Flow Macroinvertebrate Toxicological Assays. R. M. PUCKETT and E. L. MORGAN, Tennessee Technological University, Cookeville.

With the increasing demands placed upon toxicological assays for establishing water quality standards and effluent assessments, the development of an inexpensive, portable apparatus to better simulate the organism's natural habitat is needed. Our purpose in this study is to develop a new stream channel system which provides the advantages of simplicity in design and construction, and to maintain a constant flow of toxicant treatment solutions. The apparatus is alternative to the generally accepted systems employed in macroinvertebrate toxicity tests. Preliminary testing

with selected heavy metals tested at different concentrations in six parallel channels reveals a highly reliable system having reproducibility with ease of operation and maintenance.

Short Term Alleviation of Ammonia Toxicity by Environmental Sodium Chloride in Channel Catfish (*Ictalurus punctatus*). BARRY D. REEDER, J. R. TOMASSO and BILL A. SIMCO, Memphis State University, Memphis.

Plasma sodium depletion has been suggested as a contributing mechanism of ammonia toxicity in aquatic animals. The addition of sodium chloride to water has long been recognized as a method for preventing plasma electrolyte depletion in fish. This study was designed to determine the effect of environmental sodium chloride on ammonia toxicity to channel catfish (*Ictalurus punctatus*). The 6, 12 and 24 hour median lethal concentrations (LC50) of total ammonia nitrogen in fresh water (pH=6.9-7.1, total hardness=47 mg/liter, temperature=20-24°C) were significantly lower (305.5 ± 21.9 , 255.2 ± 10.3 , 269.9 ± 9.2 mg/liter \pm S.E., respectively) than in isotonic (8.3 g/liter NaCl) water (832.9 ± 16.5 , 367.7 ± 16.8 , 337.7 ± 13.2 mg/liter \pm S.E., respectively). However, the 48 hour LC50 values were not different (282.7 ± 5.9 versus 256.9 ± 3.4 mg/liter), indicating that environmental sodium chloride has only a short term protective effect. This effect is probably due to prevention of plasma sodium depletion. The absence of a long term protective effect by sodium chloride indicates the presence of other mechanisms of ammonia toxicity.

Plasma Corticosteroid and Electrolyte Dynamics of Hybrid Striped Bass (*Morone chrysops* x *Morone saxatilis* male) using changes in plasma corticosteroid levels as a general indicator of stress and changes in plasma chloride levels as an indicator of osmoregulatory dysfunction. Fish confined in a net for 10 minutes exhibited significantly elevated corticosteroid levels (24.2 ± 5.4 μ g/100 ml) and slight hyperchloremia (150.0 ± 2.7 meq/liter) when compared to baseline levels (0.8 ± 0.1 μ g/100 ml and 132.6 ± 1.5 meq/liter, respectively).

Hauling hybrid striped bass for 2 hours in fresh water significantly elevated corticosteroid levels (12.2 ± 1.2 μ g/100 ml) and reduced chloride levels (119.8 ± 1.4 meq/liter). Corticosteroid levels remained high and hypochloremia developed within 24 hours of both netting and hauling. Netting and hauling in 25 mg/liter MS-222 or 10 g/liter NaCl prevented chloride depletion during the stress, but hypochloremia developed within 72 hours of recovery in fresh water. Hauling in a combination of MS-222 and NaCl prevented hypochloremia for up to 72 hours after hauling; plasma corticosteroids, elevated during the haul, returned to near baseline levels within 24 hours. The development of hypochloremia several hours after handling indicates that, although hybrid bass survive the initial stress, survival may be reduced in the days following handling. A combination of 25 mg/liter MS-222 and 10 g/liter salt was the most successful handling medium tested.

Critical Surface Tension of Sodium Lauryl Sulfate for the Fat-head Minnow, *Pimephales promelas*. C. A. PITTINGER and D. S. TENNANT, Associated Water and Air Resources Engineers, Inc., Tennessee.

An investigation of the acute lethal toxicity of sodium lauryl sulfate to *Pimephales promelas* was conducted by means of static bioassay techniques. The critical surface tension below which fish mortality is not observed was determined and compared to previously reported values. Additional research assessed the effects of water hardness on surface tension levels and corresponding toxicity.

Scale Number Differences in *Camptostoma* (*Rafinesque*) Reared at Different Temperatures. GARY J. CARMICHAEL, Memphis State University, Memphis.

Breeding and rearing experiments were conducted to determine whether temperature differentials during development affected the lateral line scale number in the freshwater cyprinid *Camptostoma anomalum pullum*. The progeny of four parental crosses were reared at three different temperatures (19.9°C, 17.7°C, 24.3°C).

The lateral line scale number in the genus *Camptostoma* was found to be influenced by temperature. *Camptostoma* raised at a lower mean temperature ($13.9^\circ\text{C} \pm 1.5^\circ\text{C}$) had significantly

($P < .01$) more scales ($x = 47.59$) in the lateral line series than those of the same crosses raised at a higher mean temperature ($24.3^\circ\text{C} \pm 1.5^\circ\text{C}$) ($x = 44.71$).

Based on meristic characters (including scale number) several subspecies of *Camptostoma anomalum* have been recognized. One of these subspecies (*Camptostoma anomalum oligolepis*) has recently been elevated to species rank (*Camptostoma oligolepis*). In part this elevation in rank is based on lateral line scale number. Due to the effect of temperature on the lateral line scale number in *Camptostoma*, it would seem best to refer to specimens of the genus *Camptostoma* in the binomial, i.e., *Camptostoma anomalum* until the questions concerning meristic basis for taxonomic designation are answered.

Mammals of Special Interest in the Cumberland River Drainage Basin of Tennessee. GEORGE D. BAUMGARDNER, Memphis State University, and DAN EAGER, Tennessee Heritage Program, Memphis.

As part of a larger project to define unique and important natural areas in the Cumberland River Drainage Basin of Tennessee, sampling for mammals was conducted throughout this region. Species of primary interest were those considered endangered, threatened, or of special concern by the Tennessee Heritage Program. Approximately 54 sites were sampled during the summer and fall of 1979. Thirty-five sites were found to support mammals of interest. These sites consisted of a variety of habitats which included areas associated with mountains, gorges, swamps, streams, and ponds. Within this region many species were found to occur in boreal coniferous forests, deciduous forests, or some mixture of these forest types.

Status of the Coal Skink, *Eumeces anthracinus*, in Tennessee. J. STEPHEN SANDERS and JAMES S. JACOB, Memphis State University, Memphis.

The first record of the coal skink, *Eumeces anthracinus*, in Tennessee west of the Unaka Mountain Province was verified in the Spring of 1979. The specimen was collected in the Tennessee River Valley of West Tennessee. This represents a range extension of 105 km north of the nearest extant populations in northeastern Mississippi and northwestern Alabama, and 363 km west of the only other Tennessee locality for *E. anthracinus* near the Tennessee-North Carolina border. West Tennessee *E. anthracinus* apparently represent an intergrade between the northern coal skink, *E. anthracinus*, and the southern coal skink, *E. a. phivalis*. Coal skinks are generally found close to water and in West Tennessee may be confined to the Tennessee River Valley Drainage, as is much of the range of the western pygmy rattlesnake, *Sistrurus miliarius streckeri*, another reptile which is usually associated with riparian areas. This animal should be considered as an addition to the state list of endangered and threatened species since it is apparently the rarest lizard in Tennessee.

Status of the Southeastern Shrew, *Sorex longirostris*, in Tennessee. JANET K. BRAUN and MICHAEL L. KENNEDY, Memphis State University, Memphis.

The present status of the southeastern shrew, *Sorex longirostris*, was determined in Tennessee. The status is based on published literature records, examination of museum specimens, and the capture of several *S. longirostris* during a period between 1974 and 1979. *S. longirostris* was collected in varying numbers across the state, and a wide variety of habitat types were found to be used by this species. Management and preservation measures would be best aided by the determination of the preferred habitat and by the preservation and management of these habitat types.

Status of the Masked Shrew, *Sorex cinereus*, and the Smoky Shrew, *Sorex fumetus*, in Tennessee. JAMES A. HUGGINS and MICHAEL L. KENNEDY, Memphis State University, Memphis.

Although there are several published records of the masked shrew, *Sorex cinereus*, and the smoky shrew, *S. fumetus*, from Tennessee, the present status of these species in the state is not well understood. The purpose of this study was to bring together the available information concerning these species in Tennessee, and from this information, determine the current status of these species in the state. Records have been taken from published literature, from the examination of museum specimens housed in several collections over North America, and from specimens captured by field crews from Memphis State University during recent years. These species have been found to occupy a variety of habitats and to be sympatric throughout most of their ranges in Tennessee.

A Histological-Cytological Description of the Preputial Glands of Adult Laboratory Mice. R. D. IKENBERRY and S. K. CURTIS, East Tennessee State University, Johnson City.

Histological preparations of adult mice (ICR) preputial glands reveal that the glands of both sexes possess the general histological and cytological features of sebaceous glands. Each preputial gland is composed of multiple acini whose cells appear to discharge their products directly into large collecting ducts through a process of holocrine secretion. The basal cells of each acinus undergo considerable change with increasing differentiation. The acini of the glands are surrounded by connective tissue containing an abundance of fat, numerous myelinated nerves, small blood vessels, and occasional mast cells.

Tissue prepared for routine electron microscopy and examined with a Hitachi H-500 electron microscope indicate considerable cytoplasmic change. Nuclear shape becomes irregular, nucleoli disappear, and chromatin becomes noticeably condensed as differentiation proceeds. Mitochondria, Golgi apparatus, and smooth endoplasmic reticulum are abundant as well as lipid containing vacuoles. Desmosomes are very common intercellular junctions.

Identification of a Pheromone of the Preputial Gland of Laboratory Mice. R. D. IKENBERRY, FRANKLIN ELLIS, and CLEMENT WELSH, East Tennessee State University, Johnson City and Thomas Industries, and ORAU, Oak Ridge.

Preputial gland sebum of male house mouse (ICR strain) was analysed by gas chromatography-mass spectrometry. Three major fractions were separated by preparative gas chromatography and analysed by gas chromatography-mass spectrometry. These fractions were bioassayed by double blind treatment of female mice with known estrus cycles.

One fraction appeared to synchronize estrus cycles (Whitten effect) within grouped female mice. Further evaluation verified that estrus synchrony is strongly influenced by the fraction. The fraction is a methyl-substituted, unsaturated, 15 carbon alcohol: 3,7,11-trimethyl-2,6,10-dodecatrien-1-ol, commercially known as farnesol. The pheromone exists in the preputials as trans-trans and cis-trans stereoisomers. The trans-trans stereoisomer, responsible for the Whitten effect, was obtained as a pure fraction. The second fraction tested is a mixture of the trans-trans, cis-trans isomers and has no pronounced effect on estrus cycling. The third fraction analysed as hexadecanol has no influence on estrus.

Biological Assay for Determining the Effect of Male Preputial Gland Extracts on the Female Estrus Cycle in the Laboratory Mouse. JIM BURLESON and R. D. IKENBERRY, East Tennessee State University, Johnson City.

Sixty-two female mice were individually isolated to prevent the social environment from affecting the estrus cycle. Male mice preputial glands were extirpated for collection of the extracts. The extracts were fractionated by thermal conductivity gas chromatography and were swabbed on the nasal area of females. Vaginal smears were taken to determine the estrus cycles of individually caged females. It is concluded from these vaginal smear readings that one specific fraction induces females to go into a prolonged estrus stage lasting 2-3 days.

Periodicity in Release of a Pheromone Produced by the Preputial Glands of Laboratory Mice. CLEMENT WELSH and R. D. IKENBERRY, ORAU, Oak Ridge, and East Tennessee State University, Johnson City.

Previous investigations of the role of the preputial gland have indicated that secretion of pheromone containing sebum occurred at specific times. The purpose of this study was to determine if secretions did occur at specific times during the diurnal cycle.

Quantitation of the pheromone levels of male mice in different social environments was performed by gas chromatography. Release of the pheromone is regulated by the social environment and photo-period.

Correlation of Preputial Gland Activity and Urinary Marking Patterns in Determining Social Position of Male Laboratory Mice. DAVID COPPOLA, CLEMENT WELSH, and R. D. IKENBERRY, East Tennessee State University, Johnson City and ORAU, Oak Ridge.

Preliminary evidence has suggested good correlation between the activity of the preputial glands and the spatial distribution of urine of dominant male mice. An inverse relationship exists when subordinate males are analysed. Male mice (ICR strain) are paired in neutral cages and observed for specific aggressive-

aversive behavior. By round-robin elimination, order of dominance and sub-ordination are determined. The mice are then placed in open-bottomed cages over chromatography paper overnight. The paper is sprayed with ninhydrin and color is allowed to develop. Preputial pouch washings with saline are extracted in chloroform and gas chromatographed. Following several trials, the mice are killed; total body weight, preputial gland weight, condition of gland, bladder volume, and physical condition of the mice are recorded. The preputial sebium is chromatographed and analyzed for relative peak height of specific fractions.

Results to date indicate that there is a correlation between gland weight, condition and quantity of sebium and position within ordered groups ranging from most dominant to most subordinate. These activities and the spatial distribution of urine marks are related to the social position of the mice.

The Lipid Extract from Male Mouse Preputial Gland: Protein Assays. RICHARD EDWARDS and R. D. IKENBERRY, East Tennessee State University, Johnson City.

Recent literature indicates that the attraction factor in the male preputial glands could be extracted as a lipid. This study demonstrates that the attraction factor is a lipid. This study demonstrates that the lipid extract is rich in protein, and the amount seems to be directly proportional to the observed quantity of lipid isolated within the cytosol preparation at -5°C . Further investigation suggests that the pheromone may be assembled in the preputial gland as a hybrid lipoprotein molecule. The amount of this lipoprotein produced in the glands, is probably affected by the social environment.

ZOOLOGY SECTION II

FLOYD SCOTT, Chairman

A Correlated Thin Section-Freeze-Fracture Study on Membrane Specializations in Spermatozoa of the Chilopodan, *Lithobius Forficatus*. JAMES F. REGER and MALINDA E. C. FITZGERALD, University of Tennessee, Memphis.

The spermatozoa of *Lithobius forficatus* are characterized by a general filiform shape. The spermatozoon is about 2 mm long and is subdivided into; an anteriorly situated acrosome ($4\mu\text{m}$ long), a helical shaped nucleus ($300\text{--}300\mu\text{m}$ long), a connecting piece ($1\text{--}2\mu\text{m}$ long), and a principal piece (tail, approximately 1.5mm long). Except for the last 4-5 μm the entire principal piece contains a central $9 + 2$ axoneme. The tail is characterized by having several spirally oriented mitochondria surrounding it. Two sets of plasmalemma, E-face particles occur which are approximately 100 nm and 60 nm respectively. Both the inner and outer mitochondrial membranes contain specialized particulate arrays. The membranes of the nucleus and the acrosome do not contain specialized particle arrays but rather randomly distributed particles. These particle distributions will be discussed in terms of their possible function.

Stereological Analyses of Arsenic-Induced Histopathological Changes in Parenchymal Hepatocytes. E. M. B. SORENSEN, R. R. MITCHELL, A. PRADZYNSKI, T. BAUER, and L. L. GRAHAM, Memphis State University, Memphis and The University of Texas, Austin.

Green sunfish were collected from two lakes which had been contaminated with up to 1300 ppm arsenic, as reported by the Texas Water Development Board. Livers were examined for cellular changes by transmission electron microscopy and analyzed to determine arsenic concentration by neutron activation analysis. Livers from control fish collected from a pond containing no measurable level of arsenic were prepared and analyzed simultaneously.

Cellular changes were apparent in livers containing 6 to 65 ppm arsenic. These included the appearance of necrotic bodies and apparent increases in the number of fibrous bodies, autophagic vacuoles, necrotic areas, and rough endoplasmic reticulum (RER). Using stereological analyses to measure volume and surface densities of these changes, it was established that both the volume density of necrotic bodies and surface density of RER are correlated with the arsenic burden in the liver.

Effects of PCB (Aroclor 1254) on the Early Development and Mortality Rate in *Arbacia Eggs*. JAMES A. ADAMS, JOAN A. BAINIER, and MARILYN E. JAMES, Tennessee State University, Nashville.

Arbacia punctulata eggs are continuously exposed to various concentrations (5×10^3 ppb, 10^3 ppb, 5×10^2 ppb, and 10^2 ppb) of the PCB mixture, Aroclor 1254 in filtered sea water using reagent grade acetone as a carrier molecule. Control eggs are cultured in acetone and sea water.

The effects of the PCB on fertilization efficiency, pluteus development, and its acute toxicity to the eggs are studied. Differences between control and experimental results are tested using Chi-square and a 95% level of confidence. When the eggs are exposed to PCB at the time of fertilization there are no significant differences between the % fertilization, % plutei development, or % mortality when the controls are compared to the experimental. However, when the eggs are exposed to PCB one hour prior to fertilization there is a reduction in fertilization efficiency in all PCB concentrations. In all but the 5×10^2 ppb PCB concentration, the % mortality is higher and the % plutei development is lower.

Survival, Behavior and Reproduction in *Hydra viridis* Following Exposure to the Polychlorinated Biphenyl, Aroclor 1254. JAMES A. ADAMS and WARREN G. LAWSON, JR., Tennessee State University, Nashville.

This investigation studies the effects of the polychlorinated biphenyl mixture (PCB), Aroclor 1254, on the survival, behavior, and reproduction of *Hydra viridis*. The PCB is administered as a component of the culture medium (artificial pond water) in concentrations varying from 2.0 mg/l to 100.0 mg/l PCB. Reagent grade acetone is employed as a carrier for the PCB due to its low solubility in water. Control animals are cultured in 250 mg/l acetone in culture medium.

Our experiments indicate that Aroclor 1254 is lethally toxic to *H. viridis* with concentrations of 20.0 mg/l producing 100% mortality after a 24 hour exposure. Sublethal concentrations of PCBs cause lethargic behavior and decreased feeding in concentrations as low as 2.0 mg/l. Reproduction is suppressed in concentrations as low as 0.2 mg/l and morphological abnormalities occur at when the PCB level is 2.0 mg/l or greater.

Developmental Aspects of the Cell Cycle in *Hydra viridis*: The Effects of Hydroxyurea. JAMES A. ADAMS and BENNY WASHINGTON, Tennessee State University, Nashville.

This investigation is aimed at determining if the increased nerve cell population necessary for tentacle regeneration in *Hydra* requires that uncommitted interstitial cells enter the S period of their cell cycle, thus becoming "newly determined" for nerve cell differentiation; or if interstitial cells in late S or G₂ can be reprogrammed for nerve cell differentiation. *Hydra oligactis*, with their heads transected, are exposed to 0.1% hydroxyurea in artificial pond water (APW) at 0, 1, 2, 3, 4 and 5 hrs post-transection. Tentacle regeneration is observed at 24, 48 and 72 hrs. post-transection, and control date (-hydroxyurea) is compared to the experimental data using Chi-square.

Our results suggest that some reprogramming of cells can occur, but for regeneration of normal tentacle numbers cells must be allowed to synthesize DNA. However, by 3 hrs. post-transection a sufficient number of cells have entered the S period to allow for regeneration of normal tentacle numbers following hydroxyurea treatment.

Three New Species of Water Mites of the Genus *Arrenurus* from Tennessee. JAMES L. WILSON, Tennessee State University, Downtown Campus, Nashville.

Three new species of water mites of the genus *Arrenurus* from Tennessee (Acarina: Arrenuridae) are discussed. *Arrenurus (Megaluracarus) alticarpus* is discussed from specimens taken in Cumberland and Henderson Counties in Tennessee, and Buncombe and Anson Counties in North Carolina. *Arrenurus (Megaluracarus) friaufi* is discussed from specimens taken in Haywood County, Tennessee. *Arrenurus (Micruracarus) quadriseptemilunatus* is discussed from specimens taken in Cumberland County, Tennessee.

Helminth Fauna of Some East Tennessee Fishes. W. D. McGAVOCK and O. G. RHOTON, East Tennessee State University, Johnson City.

Three hundred eighty-eight fish were examined for helminth parasites. Fifteen per cent of the fish observed harbored one or more species of parasites. Seven species of cestodes, six species of trematodes and one acanthocephalan were studied.

The data was also analyzed in an attempt to: (1) determine whether the sex and age of the fish had any effect on the

incidence of parasitism; (2) learn what effects the parasites had upon the hosts; (3) establish whether there were certain streams which contained fish populations with endemic parasites and; (4) determine the rate of infection during certain months of the year. The results will be summarized.

Bone Growth Parameters in the Swallow (*Hirundo rustica erythrogastrer*). J. L. ROBERTSON and D. I. PAV, East Tennessee State University, Johnson City.

This report dealt with part of an ongoing research effort comparing precocial bird development to altricial bird development. Swallow eggs and chicks were collected at various times from the area around Kingsport, Tennessee. Because these birds are helpless at the time of hatching (altricial) they were easily collected and killed by drowning in the fixative of 10% buffered formalin. Six of their long bones were dissected out of the carcasses, measured for length in millimeters and placed back into fixative. They were then sectioned at mid-diaphysis and their outer diameters measured. Their marrow cavities were also measured in diameter. Bone length and diameter were plotted for each specimen. The leg bones (femur, tibiotarsus and tarsometatarsus) were observed to have a thinner wall with age. Conversely the wing bones (humerus, ulna and radius) either remained about the same or grew slightly thicker with age.

Cytomorphology of Bone Growth in Barn Swallow (*Hirundo rustica erythrogastrer*). D. I. PAV, J. L. ROBERTSON, F. J. ALSOP and J. M. CHEN, East Tennessee State University, Johnson City and Kingsport University Center, Kingsport.

The purpose of this research was to study in depth the cytomorphological changes in an altricial avian species, the barn swallow (*Hirundo rustica erythrogastrer*). A comparison was also made to the previous study on a precocial avian species reported by Pav et al. in 1979.

Eight age groups of swallows, ranging from embryonic to adult stages were collected and six long bones were removed bilaterally by microdissection. The length and width of each bone, and the lumen in the mid-diaphysis were measured. In each age group, the right side was prepared for routine histological examination, the left side for scanning electron microscopy. The epiphyseal plate was most active in the embryonic and early postembryonic stages. All epiphyses were closed by the fourteenth day post-hatching. Very little longitudinal growth occurred between fledging and adult stages. The only secondary ossification centers were seen in the distal epiphysis of the tibiotarsus and the proximal epiphysis of the tarsometatarsus.

Hoi Knives and Cold Bones: A Cutting Technique for Scanning Electron Microscopy. J. L. ROBERTSON and D. I. PAV, East Tennessee State University, Johnson City.

A technique for the slicing of bones of very young birds was devised after several fixation and sectioning methods were tried. The bones were dissected from young birds at several stages of development. They were then fixed, whole, by immersion in 10% buffered formalin for at least one week. The bones were then held in a copper wire loop while being cooled to -195.8°C degrees centigrade by immersion in liquid nitrogen. A teflon-coated, single edge razor blade was heated by immersion in boiling water for at least two minutes. The dried, hot blade was used to cut a longitudinal slice thru each frozen bone. After thawing, the bone halves were prepared for S.E.M. observation by standard techniques.

Epiphyseal Development of Long Bones in Red-winged Blackbird (*Agelaius phoeniceus*). J. M. CHEN, D. I. PAV, J. L. ROBERTSON, and F. J. ALSOP, East Tennessee State University, Johnson City and Kingsport University Center, Kingsport.

From a larger on-going research on several bird species, a bone development study in previously uninvestigated species, the altricial red-winged blackbird, is presented. The experimental series consisted of ten age groups ranging from embryonic through adult stages. In each specimen, seven appendicular bones, the humerus, ulna, radius, femur, fibula, tibiotarsus, and tarso-metatarsus were histologically examined and the cytomorphology described. Epiphyseal plates were active at hatching and longitudinal bone growth rapid from hatching to fledging. Endochondral bone was formed by ossification of cartilaginous cones projecting into diaphysis. Early postembryonically, numerous vascular canals proliferated the resting epiphyseal cartilage. Secondary ossification centers developed only in proximal tibiotarsus and distal tarsometatarsus. While at fledging all epiphyseal cartilages examined were active, in the juvenile stage all were completely replaced by well formed trabeculae.

COLLEGIATE DIVISION

RICHARD J. RARIDAN, Chairman

Isothermal Charge Storage in Electret Materials. KAM CHUEN LO, Middle Tennessee State University, Murfreesboro.

Dielectric materials have been studied for their electret behavior for many years. Most electrets studied by chemists are thermal electrets. These are usually disks of dielectric material heated, then cooled in the electric field.

In this study the phenomenon of charge storage in dielectric materials without the heat treatment was compared to thermal electret behavior. There is a significant isothermal electret effect in purified stearone and in other traditional electret materials. That the isothermal electret effect is not just a surface charge is shown by experiments in which the electret is shorted and the charge persists.

The Effect of Preputial Ectomy on Dominant Behavior in Male Mice. CHRISTINE NEWELL and R. D. IKENBERRY, East Tennessee State University, Johnson City.

Recent published accounts demonstrate that the preputial gland in male-mice grows in weight during attainment and/or maintenance of social dominance. The purpose of this study was to determine if removal of the preputial gland of a dominant male would result in a role reversal when he was paired with his former (subordinate) opponent. The complete removal of the gland did result in role reversal, yet when even a minute portion of the gland remained the preputial-ectomized male remained dominant. Further studies are being pursued to clarify the paradoxical nature of these results.

Sulphydryl Groups on Erythrocytes from Patients with Polycythemia Vera. JAMES M. LUETHKE and MARGARET W. HOUGLAND, East Tennessee State University, Johnson City.

Sulphydryl groups are essential for maintaining the shape and integrity of the erythrocyte plasma membrane. The number of sulphydryl groups on the surface of intact erythrocytes from patients with polycythemia vera have been quantitated and compared with those from non-polycythemic erythrocytes. The cells were treated with 6,6' dithionitrotoluene acid (carboxypyrroline-sulfide, CPDS), a thiol blocking reagent which forms a reversible reaction with sulphydryl groups on the plasma membrane surface. The thiol groups were released by the addition of glutathione and measured spectrophotometrically. The differences observed between the two groups will be discussed. (Supported in part by NIH Grant 1 SO8 RR 09171-01)

Syntheses of 1,1,2,2' - Tetramethyl - 1,2' - Disila (2,2) Paracyclopentane. RONALD L. ROE and EUGENE A. KLINE, Tennessee Technological University, Cookeville.

Our starting material, p-chlorobenzylchloride, was made into the benzyl Grignard which was then reacted with dimethylchlorosilane. The product obtained was chlorinated by refluxing with sulfuric chloride, with the chlorine supposedly replacing the hydrogen attached to the silicon. The product obtained was added to a large amount of toluene and two equivalents of sodium and was refluxed for 4 days.

VPC analysis showed little change from products obtained after chlorination. GCMS analysis indicated many products, including some with two and three chlorine atoms, some polymerized material and a small amount of desired product. Another synthesis was proposed.

An Electrophoretic Comparison of Blood and Parotid Venom Proteins of Bufo. JOHN R. REISSER and CHARLES J. BIGGERS, Memphis State University, Memphis.

Blood and parotid venom proteins of five species of toads were studied using vertical block polyacrylamide gel electrophoresis. A gel concentration of 7.5% seemed to provide the best resolution. Plasma and venom contained no components of identical electrophoretic mobility in any of the five species. The venom and plasma of each species contained alpha and beta esterase which appeared qualitatively identical. Wart and parotid venom proteins appeared to be the same. A non-ionic detergent facilitated the handling of the insoluble venom. Hemoglobin of all five species was found to consist of a single band showing identical electrophoretic mobility. Plasma transferrin components consisted of single and double banded electrophoretic patterns of varying mobilities.

Investigation of Improvement in Electrophoretic Separation of Plasma Albumin of the Channel Catfish, *Ictalurus punctatus*.

VIRGIL P. HOLDER and CHARLES J. BIGGERS, Memphis State University, Memphis.

Polymorphism in the channel catfish plasma albumin has been demonstrated by electrophoresis. The objective of this investigation was to attempt to improve on the separation technique. The variables in technique that were investigated were preparation of sample, concentration of sample, length of time of separation and identification of albumins. Addition of bromophenol blue or bromocresol green to the sample prior to electrophoresis obtained similar results. The most suitable concentration of sample was shown to be 5-8 microliters, and a two-hour run achieved the most distinct banding. Specific staining of albumins was shown to be best if the gel was stained with bromocresol green following the run. Staining prior to the run as others had suggested did not specifically identify the albumins.

An Investigation of Migration Habits in Drosophila melano-

gaster and Drosophila virilis. GERTRUDE N. BYRD and CHARLES J. BIGGERS, Memphis State University, Memphis.

Previous investigation suggested that *Drosophila melanogaster* selectively migrates toward bottles which previously contained flies. The objectives of this investigation were to further determine the cause of this selectivity and to determine if *Drosophila virilis* migrates in a similar manner. The variables investigated on the two species were type of medium, addition of yeast, and influence of sex. Results suggest that *D. melanogaster* prefers a molasses medium. Addition of yeast has no observable effect on migration. There is a pronounced tendency of at least 2:1 for each sex to migrate toward bottles which previously contained females. Chi-square analysis provides acceptable probability values ranging from .21 to .88. Experimentation is being continued to obtain additional results.