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ABSTRACTS PRESENTED AT THE ANNUAL MEETING

BOTANY

TOM BYRNE, *Presiding*

Ultrastructure of Somatic and Ascus Septa in Chaetomium brasiliense Batista and Pontual. WAYNE C. ROSING, Middle Tennessee State University.

Septa in somatic tissues of *C. brasiliense* are typical, centrally perforate, plate-like, ascomvcetous septa. One or more Woronin bodies are commonly found adjacent to the pore which ranges from 0.15um — 0.2um in diameter.

A more elabórate pore apparatus is characteristic in ascogenous hyphae, croziers, and at the base of asci. In median sections, the pore rim appears to be coated with u-shaped deposits of electron-dense material. Of the original pore, only a narrow passageway having a diameter of approximately 0.03 um remains. The pore apparatus is interpreted as a centrally perforate, pulley-shaped, electron-dense deposit. It might prevent organelles from moving into the differentiating ascus while allowing smaller nutrient molecules to move freely through.

An Interactive Code for Examining the Frequency Distribution of Experimental Data. D. E. FIELDS AND C. A. LITTLE. Oak Ridge National Laboratory.

We have written an interactive computer program, TERPED, that produces both graphical and numerical descriptions of a set of data based on the user's assumption of either a normal or a lognormal probability distribution. Numerical statistics calculated as the user options are chisquare, Kolmogorov-Smirnov, and Pearson's correlation coefficient. The linearized cumulative-probability distribution of the data may be plotted, together with a least-squares fit, consistent with either the normal or lognormal assumption. Graphical output is via a local computer graphics terminal, or the user may request generation of either pen-and-ink plots or 35 mm slides. Data input may be by named data file or via the user's terminal keyboard. The code is written in FORTRAN and runs on a Digital Equipment Corporation PDP-10 computer; typical central processor-unit execution time is about 0.3 s.

Preliminary Evidence For A Putative Hybrid Sumac. WILLIAM E. HAMMITT, The University of Tennessee.

A putative hybrid between winged sumac (*Rhus copallina* L.) and smooth sumac (*Rhus glabra* L.) is reported for East Tennessee. Five morphological leaf characteristics and photographs of leaves, for both the intermediate and supposed parentts, are presented. Number of serrations per side of leaflet margin and width of rachis proved to be the best differentiating characters. Mean number of serrations for the terminal and fifth (from terminal) leaflets of the putative hybrid were 10.2 and 5.7, respectively. Width of rachis for the hybrid was 3.4 mm., while the parents were 4.9 (*R. copallina* and 1.5 (*R. glabra*). Further field observations and collections, as well as pollen and fruit analysis, will be necessary to determine if the variation observed is the result of natural hybridization or simply species variation.

The Biology of Entomopthora—(Fungi, Zygomycetes). FREDERICK T. WOLF, Vanderbilt University, Nashville.

Based on a survey of the literature concerning the genus *Entomophthora,* the discussion will include a consideration of morphology, life cycles and the characters employed in species delimitation. Methods for the growth in axenic culture of some species will be described, while others have resisted repeated efforts at cultivation. Details of the infection process, pathology of the fungus in the insect host, and environmental control of spore production will be presented. Factors predisposing to the development of natural epizootics will be considered, as well as methods for the large scale production of reproductive bodies in attempts at artificial control of insect populations, and the results of field trials. The prevalence, symptomatology and treatment of a human disease called rhinophysomycosis to *E. coronata* (*Conidiobolus coronattus*) will be discussed.

An Analysis of a Mature Oak Forest, Dickson County, Tennessee. ANTHONY W. MAHONEY and EDWARD W. CHESTER, Austin Peay State University.

A study of the tree flora on a 228-acre tract within Montgomery Bell State Park was. conducted during 1979. The study area, within the Mississippian Plateau Section of the Western Mesophytic Forest Region, is in an excellent state of recovery following cutting 45 years ago. The site elevation varies from 600 to 320 feet and is largely south-facing slopes bissected by deep, narrow ravines. The area is considered typical and representative of the original Western Highland Rim forests found on such sites.

A total of 3664 stems were sampled, using a modified Quarter Method along predetermined compass bearings. Thirty-seven species from 22 genera were sampled. Standard statistics wre calculated using FORTRAN and SPSS programs for each of two slope aspects, the ridges, and the ravines. Thirteen species comprise 91 percent of the Importance Values with *Quercus alba* having the highest Importance Value on all slope aspects.

Investigations of the Algal Communities of the Lower Red River, Montgomery County, Tennessee. LARRY D. CARPENTER and EDWARD W. CHESTER, Austin Peay State University.

Eleven stations were sampled from five depths on the Red River, Big West Fork Creek and the Cumberland River. Quarterly samples were taken from Summer, 1977 through Spring, 1978. Major parameters involved were phytoplankton identification and quantification, chlorophyll *a* concentrations and C-14 primary productivity analysis. The algal flora included 149 taxa. Seasonally, the summer flora yielded the largest standing crop (avg. 10 million cells per liter), was most diverse with 91 taxa, an dwas dominated by blue-green algae (Cyanophyta). Centric diatoms (Order Centrales) dominated the smaller fall and winter floras while pennate diatoms (Order Pennales) dominated the spring. Cell counts and chlorophyll *a* concentrations were highest at a depth of 0.5 m while production was greatest at the surface. Production as well as algal standing crops increased at most downstream stations and reacted at points below municipal outfall.

A Method for the Quantification of Forest Island Landscape Patterns. GEORGE W. BOWEN, University of Tennessee and Oak Ridge National Laboratory.

A method for quantifying the patterns of isolated forest islands in a matrix of non-forest cover is presented. Six variables, density, cover, mean distance, median size, dissection index, and skewness are used to describe the size and shape distributions of forest islands with respect to a given study area. Existing landscapes, measured from maps and aerial photographs, are then compared with hypothetical island landscapes composed of circles of uniform size. The differences between the actual and hypothetical landscapes provide the basis for describing landscape patterns.

In an application of the methodology, factor analysis is used to defiine the variation among examples of selected landscapes in several counties in Ohio. The probable causes of the variation are interpreted in terms of relief, topography, soils, and past and present land use dynamics.

First Report of Azolla Megaspores from Tennessee. V. M. BATES and E. T. BROWNE, JR., Memphis State University.

Recently, two megasporocarpic collections of *Azolla* were made in West Tennessee. Historically, most collections made from this area are sterile or bear only microsporocarps.

Megasporocarps were collectted from ditches along the southern tip of Reelfoot Lake and from Grassy Lake at Shelby Forest Wildlife Management Area. In light of the taxonomic problems with *Azolla*, the specific identification is uncertain. Scanning electron micrographs of megasporocarps from Tennessee appear significantly different from those found in Illinois.

Effect of Decapitation and Dark Period on Callus Induction and Growth in Glycine max (L.) Merrill. P. S. KAHLON and S. M. BHATTI, Tennessee State University.

Soybean cultivars Davis, Forrest, Miles, Pickett and Tracy were used as a source of explant. Callus was induced from cotyledons using modified Murashige-Skoog (MS) medium. This callus was then subcultured on MS medium modified with auxins, cytokinins and coconut water. Callus kept under continuous dark period before subculturing produced the same amount of callus as the control which was kept under fluorescent light. However, the callus kept in dark produced much more compact callus with dark green color compared to the callus that was kept under continuous light. In a separate experiment apical meristem was removed from 4 weeks old seedlings 11 days before using hypocotyl for callus induction. Callability varied considerably in different cultivars after decapitation. Forrest produced more callus when apex was intact while Davis and Miles produced the same amount of callus with and without apex.

Effect of Growth Hormones on Callus of Glycine max (L.) Merrill. S. M. BHATTI and P. S. KAHLON, Tennessee State University.

The objective of this study was to determine the interaction of different hormone combinations on callus growth and development. Soybean cotyledons of cultivar Pickett were used as a source of explant and callus was induced on modified Murashige-Skoog (MS) medium and sub-cultured again on this medium. The third subculturing was done on MS media modified with Naphthaleneacetic acid (NAA), 2,4-dichlorophenoxyacetic acid (2, 4-D), 6-furfurylaminopurine (kinetin), gibberellic acid (GA) and coconut water. No increase in weight of callus was observed when NAA, GA and coconut water were used alone. These calli turned brown and died. Callus also turned brown and died within 3 weeks when coconut water + GA was used. In all other treatments some growth was observed. Best growth was recorded when MS medium was modified with auxins + coconut water or auxins + kinetin. Gibberellic acid did not produce any beneficial effect on callus growth.

Effects of Coconut Milk on Callus Initiation From Cotyledonary Segments of Soybean (Glycine max (L.) Merrill) K. N. PANDEY and P. S. KAHLON, Tennessee State University.

The present investigation was carried out to study the effects of coconut milk on callus initiation from cotyledonary segments. Surface sterilized seeds of various genotypes were placed into 125m1 Erlenmyer flask containing 50 m1 basal medium. Cotyledonary segments were excised on third day and inoculated on B-5 and Miller's medium supplemented with 0, 0.1, 0.5, 1.0 and 2.0 mg/1 2, 4-dichlorophenoxyacetic acid (2, 4-D). Each concentration of 2, 4-D was also supplemented with 5% coconut milk. The results showed that media supplemented with coconut milk and 2,4-D produced higher frequency of callus particularly at lower concentrations. However, the callus growth was larger, more chlorophyllous and of compact texture at each concentration of 2, 4-D, supplemented with coconut milk as compared to calli produced on media supplemented with 2, 4-D alone. Medium supplemented with coconut milk alone did not show any effect on callus initiation.

Bacitracin Inhibition of Hormone Stimulated Pea Epicotyl Elongation. BENJAMIN P. STONE, Austin Peay State University.

Bacitracin was used to inhibit IAA and GA stimulatted cell elongation in pea epicotyl sections. Glycoprotein synthesis was assayed and the relationships of hormone stimulated cell elongation and glycoprotein synthesis will be discussed. Plant lectin interaction with hormone stimulated growth will be discussed.

CHEMISTRY

FRANK PINKERTON, *Presiding*

Presence of Several Unidentified Bands in the Nonsaponifiable Fraction of Bovine Lens. HELEN E. CHANDLER and BARBARA ALBERS-JACKSON, Tennessee Technological University.

Alkaline hydrolysis of bovine lens yields two lipid fractions: the saponifiable fraction which contains primarily fatty acids, and the nonsaponifiable fraction which contains primarily sterols. The nonsaponifiable was subjected to thin layer chromatography using the following solvent system: petroleum ether: diethyl ether: glacial acetic acid (70:30:1). Fractions were visualized using iodine vapors. In addition to cholesterol, several unidentified fractions were observed. Several possibilities were, the intermediate of cholesterol biosynthesis and, alcohols of fatty acids.

Extraction of Clorophyll-Related Pigments from Sediment Layers of a Texas Blue-Green Alagal Mat. JIMMY H. DAVIS, CHRISTINE MENZEL, and GAD CROCKER, JR., Union University.

Core samples were taken from blue-green alagal mats which occur in saline basins adjacent to Baffin Bay, Texas. Five samples were taken from each core. The pigments were extracted with acetone and chromatographed on sucrose with petroleum ether and chloroform as eluents. Visible spectroscopy was used to determine the pigments present in the eluted fractions while atomic absorption/emission spectroscopy was employed to determine the concentration of the metal ions present. Preliminary results suggest that pheophytin and carotene are the major pigment components. Their distribution between the layers will be discussed.

Proton Magnetic Resonance Spectrum of HDO. MARTIN V. STEWART, ROY W. CLARK, and SHARON A. CHURCHILL, Middle Tennessee State University.

The proton magnetic resonance spectrum of HDO does not ordinarily show spin-spin coupling due to rapid chemical exchange. In dilute acetone solution, however, the exchange rate is sufficiently reduced to afford a triplet (J_{HD} =1.1 ± 0.1 cps) 0.030 ± 0.003 ppm upfield from the H_2O absorption as reported in the early literature from a 40 MHz instrument. These values were not measured directly, but were derived through line-shape analysis of a partially resolved spectrum. On a modern 90 MHz instrument, we observe the triplet directly to obtain results virtually identical with the older values cited above.

Studies of the Reactions of Naphtho[1,2-c] [1,2,5] *oxadiazole and its Derivatives.* A. C. KOVELESKY, Middle Tennessee State University.

The naphtho[1,2-c][1,2,5]oxadiazole structure thus required to conduct this study was known prior to the beginning of this work. Several reports of its derivatives have been published in the literature but it has not been fully studied as far as the synthetic aspects are concerned. Substituents, like methoxy, hydroxy, and acetoxy, were also substituted at various positions on the ring. The use of sodium acetate and acetic anhydride was investigated as a method of ring closure to form the oxidazole system.

The reactions to the studied are typical aromatic substitution reactions, such as halogenation, nitration, Friedel-Crafts acylation and alkylation. These results will be compared to the results of the corresponding analog as well as to phenanthrene. Initial experiments on the oxygen analog indicate that either an additional product or a substitution product resulted depedning on the reaction conditions.

The resulting products will be identified by their spectral data, x-ray crystallography and elemental analysis.

Synthesis of Difunctional Heterocycles Using Disilylheterocycles. FRANK H. PINKERTON, Department of Chemistry, Carson-Newman College.

The established facile cleavage of monosilylheterocycles has been extended to include disilylheterocycles. In this regard the reactivity of 2,6-bis(trimethylsilyl)pyridine, 2,5-di(trimethylsilyl)-pyridine, and 2,5-di(trimethylsilyl)-1-methylimidazole was investigated in the synthesis of difunctional heterocycles. Emphasis is placed on the selective reactivity of the Si-C bonds and the carbonyln reagents.

ENGINEERING SECTION

HALL C. ROLAND, *Presiding*

Reductions in the Thermal Resistance (R—Value) of Residential Insulations Due to Vertical Loading. DAVID W. YARBROUGH and JAMES H. WRIGHT, Tennessee Technological University.

Thermal insulating materials commonly used in residential attic spaces have been studied to determine the effect of R—Value of installing a second layer of insulation. Fiberglass loose-fill, rock wool loose-fill, cellulosic loose-fill and fiberglass batts have been subjected to vertical loadings of up to 3.0 lb/ft^2 and the resultant decrease in thickness measured. The equilibrium thickness and density under compression were used to calculate R—Values. Realistic vertical loadings can result in reductions of up to 30% of the original R—Value.

Revised Model and Heat Transfer Calculations for the OC—5 Capsule. HALL C. ROLAND and AMIR MOBASHERAN, University of Tennessee.

In a previous presentation the heat transfer modeling and calculations for a series of praphite irradiation creep tests were discussed. These included a bench test which was constructed and operated to determine emissivity characteristics of a tungsten reflector operating near graphite.

In this discussion a new heat transfer model for the capsule is discussed, together with modifications to the HEATING5 code and the preparation of additional computer codes to help in modeling and data input.

GEOLOGY-GEOGRAPHY SECTION

MELVIN O. SMITH, *Presiding*

The Need For a Sinkhole Floodplain-Hazard Designation in Urban Areas with Karst Terrain. PHILLIP R. KEMMERLY, Austin Peay State University.

Sinkhole terrains, in general, pose two major problems for the urban planner. Sinkholes frequently are marked by chronic drainage problems because they are efficient collectors of surface runoff. Flooding of sinkholes may result during periods of heavy or prolonged rainfall. Sinkholes can collapse. Some 15 percent of the nation karst landscapes or is underlain by soluble rocks. A methodology is developed for establishing a new flood-hazard designation termed the sinkhole floodplain.

Four New Mississippian Echinoderms. H. HULL RUSH, Austin Peay State University.

Echinoderm debris forms the bulk of Mississippian carbonate beds of the Northwest Highland Rim in Tennessee. There has been, however, little taxonomic study of the fauna. From Cheatham County near Nashville to Stewart County of the Tennessee-Kentucky border, identifiable echinoderm remains are occasionally found most can be referred to known taxa. Four recently discovered species from this region seem to be new: one new blastoid can be tentatively referred to Pentremites, and a new crinoid can be referred to *Echinocrinis*. Two other species seem to represent new genera, one of which must be referred to new taxa of higher rank. It is concluded that the occurrence of these new species in relatively accessible terrain indicates the need for further work in that area.

Residual and Second Derivative Mapping Techniques as Appiled to the Ripley South Quadrangle, Lauderdale Co., TN. SHARON WILSON, Vanderbilt University.

During the summer of 1979, the Ripley South Quadrangle was surveyed as a part of Dr. Richard G. Stearn's gravity survey of West Tennessee. A fairly prominent linear trend was observed in the area of the Rift Zone, as proposed by Hildenbrandt and others, and was postulated to be a fault zone. Residual and second derivative techniques are explained and used to filter the gravity of this area. After filtering, a definite, narrow high block is resolved, striking parallel to the edge of the Rift. It is assumed that this high is a fault block, perhaps part of the edge of the Rift itself. Further surveying with resistivity, closely spaced gravity, and drilling is planned to test this assumption.

Physical Geography of the Mexican Oil Fields. RALPH O. FULLERTON, Middle Tennessee State University.

There are four major areas of oil and gas production in Mexico: the Northeastern Area, the Central Gulf Area, the Bay of Campeche Area, and the Baja California Area. The Northeastern Area, part of the Gulf Coast geosyncline, is primarily a gas-producing region. The Central Gulf Area consists of massive limestones and, to a degree, is also part of the Gulf Coast geosyncline. This region is a major producer of oil and gas. In the Bay of Campeche Area, the physical geography is complex. Consisting of two sub-regions, this area is presently the major source of Mexican oil. In the Baja California Region, two basins are possible areas of oil and gas resources. Off-shore drilling is occurring here, but PEMEX has not released the results of the tests.

Mississippian Stratigraphy of the Northwestern Highland Rim In Tennessee—Reappraisal at Dickson. M. W. BRADLEY and E. F. HOLLYDAY, U. S. Geological Survey.

The principal Mississippian lithologies of the northwestern Highland Rim in the Dickson aera, Tennessee, as mapped are: (1) fine-grained to silt-sized carbonate rocks (Fort Payne Formation), (2) medium- to coarse-grained, fossil-fragmental limestone (Warsaw Limestone) and (3) interbedded fine- and coarse-grained carbonate rock (St. Louis Limestone). Prior to 1964 these lithological associations and index fossils were used at scarce outcrops to identify and map the three formations. The published maps show the formations to be flat lying and laterally continuous.

Test drilling in 1980 indicated abrupt lateral changes in lithology implying abrupt changes in the depositional environment. Test-well data revealed that the coarse-grained, fossil-fragmental limestone grades laterally first into the interbedded coarse-grained and fine-grained lithology and then into the fine-grained carbonate. In addition, any one of the lithologies can occur within any of the three formations greatly complicating the identification of formation boundaries and prediction of ground-water occurrence.

Preliminary Report: Field Investigation of the July 27, 1980, Northern Kentucky Earthquake. D. J. REINBOLD and G. V. GIESE-KOCH, University of Kentucky.

Shortly before 3 p.m. EDT on July 27, 1980, an earthquake centered approximately 50 km east-northeast of Lexington, Kentucky, rocked a considerable portion of the eastern United States. The instrumental location of the epicenter, determined by the National Earthquake Informatin Service, is 38.2°N-83.9°W. Focal depth has been estimated to be about 15 km, and a local magnitude of 5.3 was calculated from instrumental recordings. Our field evaluations of the damage indicate that the maximum Modified Mercalli intensity was a weak VII.

The authors conducted a field survey of the damage during the last week of July 1980. Towns visited included Bethel, Ewing, Flemingsburg, Judy, Maysville, Mount Sterling, Sharpsburg, and Tilton. The purpose of the field survey was (1) to obtain firsthand reports of damage, in order to eliminate uncertainties in the assignment of intensity and (2) to make a distinction between structural damage (damage to load-bearing members) and architectural damage (damage to parts that serve to enhance the aesthetic aspects) to buildings.

The field survey showed that most of the building damage was limited to minor cracking and falling of plaster and stucco, chimney damage above the roofline, and cracks in outer brick and block walls. A very interesting observation was that damage was most extensive in Maysville, some 50 km north of the epicenter, and most of the damage was confined to a relatively flat area downtown. The soft alluvial material underlying the downtown area may have amplified the ground motion, which could explain the extensive damage this far from the epicenter.

Eocene Faulting as Determined by Earth Resistivity, Lauderdale County, Tennessee. R. G. STEARNS, SHARON WILSON, J. L. MILLER, and SUSAN NAVA, Vanderbilt University.

Earth resistivity surveys indicate that faulting has occurred as recently as Eocene time at the East edge of the Reelfoot

Rift. These surveys supplement gravity data that indicates offset of the Cretaceous-Paleozoic surface at depth. An earth resistivity profile was run across the sharpest gravity anomaly just east of Henning.

A profile of 8 Wenner soundings indicates an offset of about 75 feet in Eocene clays and sands. Faulted Eocene is covered by about 50 feet of undisturbed surficial alluvium and loess. The data was used for Barnes layer calculations and curve fitting. Barnes layer profiles show the near-surface undisturbed layers to be underlain by deeper discontinuous and steely-dipping layers; but with this technique depth definition is poor. Curve fit interpretation gives a better depth estimate (and therefore fault offset estimate) and permits a preliminary estimate of lithology.

The resistivity models suggest a fault down on the east side about 75 feet. This sense of movement is opposite that of the buried rift which is down on the west.

MATHEMATICS SECTION

ALVIN TERMAN, *Presiding*

Waiting Times and Generalized Fibonacci Sequences, S. A. PATIL, Tennessee Technological University and V. R. R. UPPULURI, Oak Ridge National Laboratory.

Suppose we have a multinomial distribution with k possible outcomes, A. B. . . ., K, and associated probabilities $\pi_1, \pi_7, \ldots, \pi_k$.

At each of the independent trials, one of the outcomes is observed. In this paper the waiting time to observe (for the first time) a succession of r outcomes of a specific type is considered. For the homogenous multinomial process ($\pi=1/k$), the porbability distribution of this waiting time is shown to be related to generalized Fibonacci numbers. In the special case of a homogenous Bernoulli process ($k=2$, $\pi_1=\pi_7=1/2$), the probability distribution of the waiting time to obtain r successes in a row is related to the r^{th} order generalization of the Fibonacci sequence. These probability distributions are also expressed in terms of binomial coefficients. For some special cases explicit probability distributions and the associated Fibonacci numbers are computed using these formulae in terms of binomial coefficients.

Applications are indicated to the problems of rare events, and a problem in biochemistry.

Another Real Paradox, ANDREW SIMOSON, King College.

The paper deals with a paradox inherent in the real number system.

The paradox is basically this. Suppose two termites are devouring a block of wood. Is it possible for each of the termites to consume half of the wood? More precisely, is it possible for each of the termites to consume half of the wood in each splinter of that block? The answer to the first of these questions is, not surprisingly, "Yes." But, paradoxically, the answer to the second is, "No!" There must exist a splinter in that block of wood which is almost entirely consumed by only one of the termites.

The paper defines this intuitive problem utilizing precise symbolism and proves that it is impossible for each of the termites to consume half of each splinter.

An Oscillation Theorem for a 2nd Order Differential Equation with Delay. V. M. SAKHARE, Tennessee State Univ.

A sufficient condition for all bounded solutions of the delay equation $y''(t)-p(t)$ Sign $y(g(t)|y(g(ti)|^{\delta}=0$, $0<\delta\leq 1$, to be oscillatory is given.

The Geometric Mean of Positive Operations. WILLIAM N. ANDERSON, JR., East Tennessee State University.

The class of positive semidefinite Hermitian operators on a vector space serves as a natural setting for generalizing operations defined or the positive real numbers. For applications to both quantum mechanics and electrical network theory it is desirable to generalize the concept of geometric mean. The scalar definition cannot be directly applied, since the class of Hermitian operators is not closed under multiplication. In this talk we discuss a number of proposed generalizations and how they relate to the applications.

Eudoxus-Father of the Infinite. JOHN KINLOCH, East Tennessee State University. A brief historical look at the Greek mathmetician Eudoxus, second only to Archimedes in terms of significant and lasting classical mathematical output. In particular, we examine Eudoxus' contributions in introducing infinitary processes which ultimately led to the calculus.

A Shōgun of Mathemattics. ALVIN TIRMAN, East Tennessee State University.

In the XVI and XVII centuries mathematics in Japan evolved from ground zero arithmetic to an alternative of the calculus. In this paper the author reviews the mathematical developments by retracing the work of the leading Japanese scholar, Seki Kowa.

GN operational results in n variable i. M. K. JAIN, University of Tennessee, Martin.

We have used the following general result to obtain some new results:

If $\int_0^\infty \cdots \int_0^\infty K(x_1, x_2, \ldots; p_1, p_2, \ldots, p_n) \cdot f(x_1, x_2, \ldots, x_n)\, dx_1 dx_2 \cdots dx_n = \psi(p_1, p_2, \ldots, p_n)$ is an integral Transform in n variables, then

$$\int_0^\infty \cdots \int_0^\infty K(x_1, x_2, \ldots, x_n; L_1, L_2, \ldots, L_n)\, \varphi(y_1, y_2, \ldots, y_n) \cdot f(x_1, x_2, \ldots, x_n)\, dx_1 dx_2 \cdots dx_n = \psi(L_1, L_2, \ldots, L_n)\, \varphi(y_1, y_2, \ldots, y_n),$$

where L_i is an invertible linear operator associated with y_i for $i=1, 2, \ldots, n$,

This is a new technique which can be used to obtain the results which can then be analyzed for their validity as well as for the determination of the conditions under which these results would be valid.

MEDICAL SCIENCES SECTION

CHARLES W. HARLAN, *Presiding*

Demonstration of Tumor-Protective and Tumor-Facilitating Fractions from 3 M KCl-Solubilized Tumor Extracts. K. Y. PAK and J. C. CARTER, Memphis State University.

Extracts with 3 M KCl or S37 (pleomorphic sarcoma) in DBA/1J mice contained two fractions with opposing immunobiological activity. The 60% $(NH_4)_2SO_4$ supernatant fraction induced tumor protective activity and the pellet fraction enhanced tumor growth. Similar results were observed for the 40% $(NH_4)_2SO_4$ supernatant but with a lesser degrees of protection; the 40% $(NH_4)_2SO_4$ pellet did not show any evidence of the enhanced growth effect. The 3M KCl extracts of CaD2 (mammary adenocarcinoma) in DBA/2J mice behaved differently compared to S37, neither their 40% and 60% pellet and supernatant imposed any protective and enhancing effect on tumor growth. The original 3 M KCl extracts showed weak protective effect on tumor growth compared to controls. These indicate the complexity of 3 M KCl extracts in terms of their protective and enhancing effect on tumor growth and illustrate the controversies that appear in the literature concerning the behavior of 3 M KCl extracts.

Surgical Procedures and Techniques in Pre-Columbian Peru. JOHN M. PAV and DENISE I. PAV, Hospital of St. Raphael, New Haven and East Tennessee State University.

Well preserved mummies and a wealth of realistic pre-Inca Mochica pottery yield an accurate picture of pre-Inca everyday life including diseases and surgical procedures. Some of the operations will be described and documented by slides of

mummies, surgical instruments, and by pre-Inca pottery. Material for this presentation was obtained in the Museum of Medical Arts in Lima, various Peruvian and North American museums of art and archeology and from European private collections.

Heavy Metal Concentrations In Upper Eastern Tennessee. R. DEAN BLEVINS, East Tennessee State University.

The levels of contamination by the heavy metals zinc, cadmium, mercury, copper, lead, and manganese of the major streams and fishes taken from these streams of Upper Eastern Tennessee will be presented. These levels of contamination are compared with other waterways and their fishes. The literature is reviewed to find if these levels of heavy metals could affect the health of fish which live in the streams as well as the health of humans who consume them. It was found that heavy metal levels are sufficiently high in some areas of Eastern Tennessee to affect the health of aquatic life. The use of fish to monitor the levels of heavy metals as an alternative to grab samples of water will be discussed. It was found that levels of mercury in fish muscle reflected mercury pollution of a stream; whereas, grab samples of water did not.

Amelioration of Adriamycin-Induced Cardiotoxicity by Butylated Hydroxytoluene. M. WHEAT, R. DOTSON, D. ROSENDALE, S. SHEPARD, R. BURTON, V. BIVENS, L. BEACH, R. O'BANNON and J. P. DAUGHERTY, Lee College and University of Alabama Medical Center.

Adriamycin is an anticancer agent effective against a wide range of human tumors. The major side effect of adriamycin therapy which limits its usefulness is cardiotoxicity. The caddiotoxic effect is cumulative, and may result in death due to congestive heart failure. Although the mechanism of adriamycin-induced cardiotoxicity is not yet known, it has been proposed that this toxicity may be mediated by a free-radical mechanism. Therefore, we have examined the effects of BHT (a free radical scavenger) on adriamycin-induced lethality in male (C57B1/6J $\times$ DBA/2J) mice. The injection of BHT (40 mg/kg) 30 min prior to adriamycin injection (12.5 mg/kg) decreased mortality from 90% (ADR alone) to 48% (ADR + BHT); $P < 0.01$ by the chi^2 test. In addition, the administration of BHT decreased the effect on heart weight by adriamycin. Adriamycin caused a decrease in the ventricular weight which was largely prevented by BHT injection prior to adriamycin injection. Also, BHT administration did not alter the metabolism of adriamycin as judged by the excretion of metabolites in the urine. Thus, it appears that BHT protects against adriamycin-induced cardiotoxicity. Additional studies are needed to further evaluate the potential significance of this research in improving the therapeutic use of adriamycin. (Supported in part by NSF SOS grant #79-05652.)

Decrease in Serum Glucose Levels by Ascorbic Acid in a Diabetic. CHARLES E. CLARK and M. ROBIN RIDDLE, Tennessee State University.

Ascorbic acid in doses of 250-2000 mg per day taken orally decreased the amount of blood sugar in a 22 year-old juvenile-onset diabetic. The subject's insulin dosage was kept constant at 25 units. The serum glucose levels were reduced from an initial value of 118 mg/dl to 76 mg/dl on the 56th day of the experiment. Concomitantly with the decrease in serum glucose, the serum ascorbic acid values increased.

PHYSICS-ASTRONOMY SECTION

JAMES M. COOK, *Presiding*

The Technical Advancement of Solar Energy Conversion. M. C. LU, Walters State Community College.

Due to the limited resources and environmental problems associated with the present fossil and nuclear energy, many efforts have been made to seek alternative power source from the sun. In the process of converting solar energy for practical use, solar cells have been studied as a major way to achieve this purpose. The present paper is to make a brief review of this development. It discusses the principles of converting sunlight into electricity, the functions of photovoltaic cells, and the different kinds of cells exploited today. A special emphasis is placed on the silicon cells because of its advancement in the technology of devices and good prospect in the future.

A Microcomputer-Based High-Resolution Digitization and Image Processing Program. S. R. GLANDON and D. E. FIELDS, Oak Ridge National Laboratory.

We have developed an interactive digitization program for the TRS-80 microcomputer. This program is useful for entering data to a computer from a survey plot, photograph, map, graph, or X-ray shadowgram. Either a light pen or a keyboard-controlled cursor is used to enter a map or a sketch directly from the cathode ray screen by tracing the contour of interest from a transparency overlay. The program MAGIC (Map Analysis and Graph Interpretation Code), contains options for tracing, erasing, and shading, and contains algorithms for determining areas, perimeters, overlap areas, and distances in user-defined units. Cassette tapes are used for storing digitized data for future access. Images are represented and processed as TRS-80 "high-resolution" graphics pixels. The program is coded in the Level II Basic language.

Brownian Motion in a Linear Potential. JOEL L. DAVIS, The University of Tennessee at Chattanooga.

The motion of a particle interacting with a Brownian fluid and a constant force is solved exactly. An example of such motion is that of an ion in a gas of neutral molecules and in a region of constant electric field. Another example is that of sedimentation.

This system is modeled by a scholastic differential equation. The Brownian forces are represented by a fluctuating force that has a stochastic average of 0 and a second time correlation function proportional to a δ function.

The results give a constant drift velocity as expected. The mobility, however, is independent of the force which is a result contradicted by experiment. It is conjectured that this Brownian motion model is not sufficiently complex.

SCIENCE-MATHEMATICS TEACHERS SECTION

WILLIAM PAFFORD, *Presiding*

Short-Term Science Training at Oak Ridge. R. J. CLOUTIER, Oak Ridge Associated Universities.

The U.S. Department of Energy sponsors training programs at several locations throughout the U.S. One location is Oak Ridge where short-term courses related to energy production, its use, and its health and environmental effects are presented. The courses, ranging from a few days to a few weeks, are designed to complement and extend the programs at the student's own institution by introducing the students to topics and lecturers who are not available at their institution. Many of the programs are laboratory oriented and provide the students with an opportunity to use specialized equipment not generally available. These programs are presented at no cost to the participants and serve best the smaller colleges and universities. This paper will describe the programs to be presented this academic year and how to register to attend.

Elementary School Science—Yesterday, Today and Tomorrow. DAVID ASHBY and JACK RHOTON, Kingsport City School System.

Effective science programs for elementary schools depend on a variety of factors: inservice education programs for teachers, sufficient teacher resources, proper science equipment or materials, and most important, a commitment by the local school system to the improvement of science teaching at all levels.

Elementary school science has been placed on the "endangered subjects" list. Indeed, available data on science teaching in the elementary school would suggest that it may be in the danger zone. The purpose of this paper will be to take a look at the status of elementary science, based on available data, and to provide an overview of the elementary school science program in the Kingsport City School System.

Ward's Solo-Learn System Units as Supplementary Learning Aids in a Collegiate Biology Course for Non-Majors. PHILIP M. MATHIS and JAMES R. KEMP, Middle Tennessee State University.

During 1978-79 eighteen relevant titles from Ward's Solo-Learn System (WSLS) weer used to supplement regular lecture/laboratory instruction in selected sections of Biology 100 at Middle Tennessee State University. Student achievement in WSLS-supplemented sections was not significantly different from that achieved by non-supplemented sections. Evaluation of WSLS units by student users coupled with the achievement data suggests the need for (1) better ways of stimulating learner perserverance and (2) better ways of utilizing WSLS units and other self-study materials.

Energy Education—An Historical Perspective. W. E. BAIRD, West High School, Knoxville.

As we enter the decade of the 80's, we must take up the task of revising the User's Manual for the planet. A look at population trends, land use trends, and the prime sources and uses of energy make it imperative that our children be taught new rules for ethics and conservation since many of the old ones no longer apply. For most of the 2-5 million years of human history, the population was kept stable at less than one-half billion by the action of war, famine, disease and pestilence. The global population has now grown, however, to a 4.5 billion figure. At the current growth rate of 1.9%, we should see a doubling within 36 years which, the World Health Organization predicts, is the approximate holding capacity of the planet.

Compressing the one billion year history of life on earth into a scale of one year can be a useful teaching tool for improving perspective on energy use. On such a scale, life began on January 1, the present on this scale is midnight, December 31. Based on this scale, petroleum reserves will be depleted at 12:00:04 A.M. and coal reserves at 12:00:18 A.M.

The first half of the 20th century has been one of cheap, available energy. Exponential growth of both uses of finite resources and population make it essential to incorporate energy education into every classroom level. The children must be told of the coming changes in the rules and operating accumptions for the User's Manual of the planet Earth.

The Apparent Behaviors of Children with Learning Problems. PAUL H. LU, Walters State Community College.

The major purpose of education is to help individuals develop a wholesome personality. For school pupils this means a balanced growth in all areas including at least the mental, physical, emotional and social aspects. A school psychologist plays an important role in helping school carry out this goal. In practice, however, the educators and school psychologists usually pay more attention to the mental and emotional problems and overlook the youngsters' physical and social development, especially their common physical habits in daily life. The purpose of this paper was to report some of the inappropriate physical habits as observed by the author during his work as a school psychologist in a county school system in Eastern Tennessee. Through continuing observations and hundreds of testing interviews during a period of five years, it was found that nearly half of the pupils had inappropriate sitting postures such as writing with eyes close to the paper, kneeling on the chair, or other hyperactivities. It was also noticed that many youngsters did not have proper habits of eating, sleeping, and elimination. These improper habits will certainly affect their learning efficiency, physical fitness and general health. Since a child's physical development is the foundation of his/her future life in all aspects, the school psychologists, educators, and parents should work together to correct and prevent the formation of such improper habits.

ZOOLOGY SECTION I

LEONARD ROBERTSON, *Presiding*

Morphology and Chemical Composition of the Arsenic Inclusion. E. M. B. SORENSEN and N. K. R. SMITH, Memphis State University and The University of Texas Health Science Center at San Antonio.

High voltage electron microscopy and scanning transmission electron microscopy data show that the arsenic inclusion is composed of a series of bead-like structures which appear to be aligned linearily and coiled throughout the nucleus of hepatocytes of fish poisoned with arsenic. Bead diameter varies from 0.2 to 1.0 μm; generally beads of roughly the same size are found in the same nucleus. High magnification, high voltage electron microscopy data indicate that the beads of the inclusion lack a membrane and may be composed of small regular subunits. Beads appear to spiral in a regular fashion.

Electron probe X-ray microanalysis data of the arsenic inclusion indicate the presence of arsenic and sulfur in a set ratio to one another. The possible significance of these findings is discussed in terms of the physiological status of the vertebrate.

Morphometric Analyses of Subcellular Structures Formed in the Vertebratte Liver Following Arsenic Exposure. L. L. WENZ *and* EMB SORENSEN, Memphis State University.

Green sunfish (*Lepomis cyanellus*) environmentally exposed to arsenic wastes from a chemical firm, developed two subcellular hepatic structures, the necrotic body and the fibrous body. Necrotic bodies are 6 μm membrane-delimited structures containing vesicles, profiles of electron dense material (EDB) and laminar whorls of endoplasmic recticulum (ER). This structure may represent an accumulation of the products of degeneration or necrosis. The fibrous body (about 0.7 μm in diameter) is a membrane-bound structure containing parallel arrays of fibrous material. Morphometric analyses of the surface density of vesicles and endoplasmic reticulum within the necrotic body yielded mean values of .0912 and .3608^{-1}, respectively. The volume densities of vesicles, EDB, and ER in the necrotic body were .15, .06, and .19, respectively, at confidence levels greater than 96%. The total liver volume occupied by both the necrotic body and the fibrous body increased as the level of arsenic on the liver increased.

Hematology of Striped Bass from Three East Tennessee Reservoirs. MARK S. TISA, The University of Tennessee.

A total of 41 adult striped bass (*Morone saxatilis*) were collected by electrofishing during the spring of 1980 from Cherokee, Norris, and Watts Bar Reservoirs and in the summer of 1980 from Cherokee Reservoir for hematological analyses. Microhematocrits ranged from 29-41%. The range of values within each of the collections was less than 7%. Hemoglobin concentrations varied from 6.6-11.5 g/100 ml and correspond with microhematocrits. Hemoglobin values within individual collections also had small ranges varying only 2%. All total protein values fell between 3.8 and 5.4 g/100 ml. Osmolality ranged from 299-395 mOsm/kg and correspond relatively well with chloride values (117-167 mEq/l). Glucose and cortisol varied somewhat between reservoirs and within individual collections (68-146 mg/100 ml and 0.03-9.0 ug/100 ml respectively). A number of significant differences between collections for blood constituents other than total protein suggest some type of lake and seasonal dependence.

Spring and Summer Temperature Selection By Sonic-Tagged Smallmouth Bass in a Quarry Lake. CHARLES C. COUTANT, Oak Ridge National Laboratory.

Adult smallmouth bass, *Micropterus dolomieui,* were tagged with temperature-sensing ultrasonic transmitters in order to determine their temperature preferences in the field. Studies were conductd in Lambrt Quarry on the Oak Ridge DOE Reservation. In spring, fish selected nearly the warmest water available in the top two meters. In summer, they selected 23-27°C with a pronounced movement toward deeper water as fish followed these isotherms in the warming lake.

Temperature and the Cortisol Stress Response in Salmonids. RICHARD J. STRANGE, The University of Tennessee.

Juvenile chinook salmon (*Oncorhynchus tshawytscha*) were acclimated to 12 C water and subjected to a thermal shock consisting of an increase in water temperature to 20 C within 20 minutes which was maintained for two weeks. Thermally shocked salmon sampled daily for 4 days and every 2 days thereafter had no appreciable difference in plasma cortisol concentration compared to control fish kept at the 12 C acclimation temperature, though, no short term (less than 1 day) response would have been detected by this sampling scheme.

In a second experiment, juvenile cutthrat trout (*Salmo clarki*) acclimated to either 12 C or 22 C were stressed by confining them in small perforated buckets suspended in water at their respective acclimation temperature. Both temperature groups showed a similar, moderate increase in plasma cortisol from

near 0 ng/ml to around 100 ng/ml within an hour subsiding to basal levels within a few days. The fish acclimated at 22 C seemed to show a more erratic cortisol response, however, this may have been an artifact of sampling different confinement buckets.

Comments on the Distribution and Habitat of the Mole Salamander (Ambystoma talpoideum) in Tennessee. A. FLOYD SCOTT, WILLIAM H. REDMOND, and DEBBIE ROBERTS, Austin Peay State University, and Office of Natural Resources, TVA.

Recently acquired data combined with a review of historical information suggest *Ambystoma talpoideum* is more widely distributed in Tennessee that previously portrayed. Specimens from 26 sites scattered in all but two of the state's seven major physiographic regions are now known. Common environs of the species include forested swamps, lower bottomland hardwoods, shrub swamps, and dead-woody swamps.

Systox Modulation of Ethyl Alcohol Hypnotic Action. ALEXANDER C. WELLS, Tennessee State University.

A study of the influence of systox administration on the hypnotic action of Ethyl Alcohol in adult, Swiss Albino male ICR mice has been carried out. Varying dosages of systox were given to groups of mice orally (o.r.) pursuant to prior intraperitoneal (i.p.) administration of either atropine sulfate or atropine methyl bromide. Dose range for the systox was 0.5-1.0 mg/kg. Following administration of the systox 3.0 g/kg of Ethyl Alcohol was given i.p. and the time from loss of righting reflex was determined in the individual mouse. Control animals were hydration controls, physiological saline being used as a "sham" injection in place of drug administration according to the need created by experimental design. Time sequence of drug administration, measured in time before giving the Ethyl Alcohol, was as follows: atropinium agent (60 min.); systox (30 min.); ethyl alcohol (0 min.). The results obtained appear to show that systox, given pursuant to atropine methyl bromide, extends the hypnotic action of Ethyl Alcohol. This systox effect was not yielded when atropine sulfate was given in place of the atropine methyl bromide in this system. The results demonstrate that systox, at adequate dosage is capable of significantly enhancing the hypnotic effect of ethyl alcohol above control level when its administration is preceded by atropine methyl bromide ($p<0.01$) but not when its administration is preceded by atropine sulfate. These results appear to indicate that a central nervous system (CNS) active, receptor active cholinergic agent (systox) can modulate ethyl alcohol hypnotic action by enhancing that action. The differtial effects of atropine sulfate and atropine methyl bromide on that modulation strongly support a CNS locus of action for systox in producing this effect.

Microorganismal Invasion of Erythrocytes in Plethodon glutinosus. D. I. PAV, G. MUSIL and J. L. ROBERTSON, East Tennessee State Univ.

During TEM examination of long bones in the lungless salamander, *Plethodon glutinosus*, numerous red blood cells were found to be infected by a microorganism falling in the range of a small bacterium or a large rickettsia. The microorganisms were encapsulated forming a distinct protrusion on the surface of the erythrocyte. On higher magnification the matrix of the capsule and the surfaces of the microorganisms showed little bodies resembling bacteriophages. Positive morphological identification proved impossible though five different micro-biologists were consulted. Subsequent bacteriological investigation of different specimens of the same species, using diverse media, failed to show any yield of importance. This paper, documented by electronmicrographs, is presented to seek the advice and/or suggestions of investigators experienced in salamander research.

Development of Long Bones in Desmognathus quadramaculatus. D. I. PAV, L. J. ROBERTSON and L. S. WHITE, East Tennessee State University.

Development of long bones has been studied in *Desmognathus quadramaculatus*, an aquatic salamander species native to eastern Tennessee. Seven relative age groups, ascertained by snout-to-vent length and ranging from immature to mature stages, were used in this investigation. In each specimen, six limb bones, the humerus, ulna, radius, femur, tibia, and fibula were dissected, measured in length and width, histologically prepared and cytomorphologically examined. Special emphasis was given to the epiphyseal plates and the subsequent endochondral bone formation. Well developed epiphyses with functional epiphyseal plates were observed even in the most immature specimens. Humeri and femora showed early trabeculation which became extensive in the more mature age groups. In the remaining long bones, trabeculation was found only in the most mature class in distal ulna. All epiphyseal plates remained open through the mature stages but in the long bones producing trabeculation they were substantially reduced in length.

ZOOLOGY SECTION II

FLOYD FORD, *Presiding*

Tardigrades From Rattlesnake Spring, Bradley County, Tennessee. C. Y. HOWARD and D. R. NELSON, East Tennessee State University.

Five replications of samples from 11 habitats plus five miscellaneous samples were collected within a 305 m radius of the main spring at Rattlesnake Spring, Bradley County, Tennessee in September 1977. The samples were examined to survey the diversity of tardigrade species in the area. Fifteen species representing eight genera (*Diphascon, Doryphoribius, Echiniscus, Hypsibius, Isohpysibius, Itaquason, Macrobioius,* and *Milnesium*) were identified. Two of these specimens are new to science. New records for Tennessee and North America were established.

The frequency of each tardigrade species in each habitat and in the total area sampled was calculated. Three of the 15 species (*Macrobiotus hufelandii, M. tonollii,* and *Macrobiotus* n. sp.) were relatively abundant. Significant positive associations of species found between *Macrobiotus* ll. sp. and *M. hufelandii* and between *Macrobiotus* n. sp. and *M. tonollii.*

Descriptions and distribution records of the 15 tardigrade species are given, and photographs of representative individuals and eggs are presented. Possible limiting factors affecting tardigrade distribution and habitat associations are discussed.

Population Study of Tardigrades from Brush Creeek Tributary, Washington County, Tennessee. T. C. WILLIAMS and D. R. NELSON, East Tennessee State University.

To investigate aquatic tardigrade populations, substrate samples were collected every five weeks over a twelve month period at three sampling areas in a stream that runs through the campus of East Tennessee State University, Johnson City. Three species of tardigrades (*Macrobiotus pullari, Isohypsibius augusti* and *Hypsibius dujardini*) comprised the dominant populations. *Diphascon higginsi* and *Macrobiotus intermedius* were accidental inhabitants of the stream. One species (*Isohypsibius*) was considered as a new species. Seasonal trends in population changes in the three dominant species were investigated. The species disappeared for five to six months during the summer and fall but began recolonizing the area during midwinter and were present through spring. Frequency distributions of body lengths and buccal tube lengths were used to determine periods of ecdysis.

Two New Species of Water Mites (Acarina: Arrenuridae, Genus Arrenurus, Subgenus Micruracarus) with Redescriptions of Two Closely Related Species. JAMES L. WILSON, Tennessee State University.

Two new species of water mites of the genus *Arrenurus*, subgenus *Micruracarus*, are discussed. *Arrenurus avicaputus* is discussed from specimens taken in Robertson County, Tennessee and Wayne County, Georgia. *Arrenurus stenochondrus* is discussed from specimens taken in Shelby and Obion (perhaps Lake) Counties in Tennessee and Ascension Parish in Louisiana. Due to incomplete descriptions and diagrams which resulted in misclassification both *Arrenurus lyriger* Marshall, 1908 and *Arrenurus muttkowski* Marshall, 1940 are redescribed and discussed.

Positional Value and Pattern Formation in Hydra Oligactis: Polar Coordinates v.s. Positional Information. JAMES A. ADAMS, Tennessee State University.

The existence of positional values is studied in grafted *Hydra oligactis.* This investigation is also aimed at determining if

Hydra's pattern regulation conforms to the "positional information" model or the " polar coordinates" model.

Two groups of grafted hydras are used, one with gastirc and budding regions reversed (gbr-reversal), and a second having only gastric region reversal (g-reversal), All animals have one early stage bud.

The results of this study support the notion that positional values exist along the oral-aboral axis of the *Hydra's* body. Furthermore, there appears to be a specific position in *H. oligactis* which specifies bud detachment.

The occurrence of secondary (2°) head regenerates on the reversed graft piece of gbr-reversal animals eliminates the possibility of polar coordinates. The fact that g-reversal animals regenerate significantly fewer 2° heads argues strongly for the existence of positional information controlling head formation.

Toxicity of Acridine, A Synthetic Fuel Component to Tetrahymena. T. W. SCHULTZ and J. N. DUMONT, Oak Ridge National Laboratory.

Cytotoxic effects of acridine, an organic component of synthetic fossil fuel products, were investigated. Populations of the common fresh-water ciliate *Tetrahymena pyriformis* were exposed to various concentrations from 0 to 40 mg/L, and their behavior, respiration, cytology and growth were examined. The 24-hr LC_{100} and 24 hr LC_{50} were determined to be 35 and 30 mg/L, respectively. Little, if any, sublethal alterations were noted in respiration, ultrastructure, cell size and glycogen and protein content. However, at 30 mg/L cell size and glycogen content are significantly reduced. Population growth, however, is altered at concentrations as low as 2.5 mg/L. The most striking toxic response to acridine is cytolysis which is preceded by shape alteration and contractile vacuole dysfunction. Cytolysis may result from weakening of membrane and pellicle by the partitioning of the hydropholic acridine into highly lipid membranes.

Hookworms from the Liver of "Ole Diamond." S. PATTON and M. MCCRACKEN, University of Tennessee at Knoxville.

On September 10, 1980, "Ole Diamond" a 33 year old, 6 ton African elephant (*Loxodonta africana*) died at the Knoxville Zoological Park. In the course of necropsy, 11 nematodes were recovered from the intrahepatic bile ducts. The worms were fixed in alcohol-glycerin and subsequently identified as *Grammocephalus* sp Railliet and Henry, 1910 (Nematodes: Ucinariidae) because the anterior end was bent dorsally and had a well-developed buccal capsule with ventral cutting plates at the oral margin and 3 lancets within the cavity. Also an intestinal diverticulum was evident.

Pathogenicity of *Grammocephalus,* the bile duct hookworm, was reported by Basson et al. (1971, Onderstepoort J. Vet. Res. 38 (4):240) in free-living African elephants of the Kruger National Park. In "Ole Diamond" the bile ducts were dilated and thickened with an irregular luminal surface. The ducts contained numerous bile stones along with the nematodes.

Investigation of Minytrema Melanops Mortality in Woods Reservoir Near the Coal-Fired Flow Facility. JUDY A. COOPER, University of Tennessee Space Institute, Tullahoma.

The Department of Energy MHG Coal-Fired Flow Facility is located on Woods Reservoir at the University of Tennessee Space Institute. Part of the role of UTSI as participants in the DOE program is to document environmental aspects of coal-fired MHB. This document reports the finding of UTSI in investigating a fish kill on Woods Reservoir. The results show the fish mortality to be of natural causes, in no way attributable to CFFF operations.

Occasionally seasonal fish kills have occurred in Woods Reservoir during the past several years with minimal documentation of causative factors. During the early spring (April 1980) approximately one hundred fish of a single species *Minytrema melanops* (spotted sucker) died near the embayment of Rollins Creek. An investigation was conducted to determine the cause of death. Inasmuch as only a single species was involved it was assumed that the kill resulted from an infectious or parasitic disease rather than from pollution. This view was substantiated by an examination of the water quality data during the period. Specimens were examined macroscopically and microscopically for external and internal pathogens. Heavy infestation of the myxosporidian spore *Myxosoma sp.* was found localized in the gills of the fish. Scanning electron photomicrographs revealed a heavy infection by the spores and this, coupled with the stress of spring spawning, was concluded to cause the death of *M. melanops.*

COLLEGIATE DIVISION

RICHARD RARIDON, *Presiding*

Membrane Structure and the Fluid Mosaic Model. TIMOTHY D. THOMAS, Belmont College.

Every cell is surrounded by an incredibly thin envelope that plays a vital role in the life of cells. This is the plasma membrane. It was once believed to be a rather entity that defined cell boundaries and kept cell contents from spilling out, however, research has proven the plasma membrane is a dynamic structure having remarkability and selectivity. The functions of a membrane include: provide shape for the cell, separate compartments, develop electrical properties and provide a matrix for marcomolecules.

Because of increasing objections during the 1960's re-examination of lipidprottein interactions led to a new model, the fluid mosaic. The fluid mosaic model's major chemical components are lipids with hydrophobic and hydrophilic regions on the molecule, cholesterol is required to act as a stabilizer between lipid molecules. Intrinsic proteins are the only proteins required to maintain membrane structure. Studies by Glaser and Singer found that these intrinsic proteins are largely globular in shape rather than spread out as monolayer.

The Singer and Nicolson fluid mosaic model states the lipids framework is the foundation of the membrane with proteins attached or embedded within the membrane. These proteins retain the capacity to move laterally in the fluid lipid phase. Interactions which hold the membrane together are lipid-lipid, protein-lipid and protein-protein.

Hydrostatic Model of Stellar Structure. CHARLES BRADLEY EAST, The University of Tennessee at Chattanooga.

The standard approach to stellar structure is to start with equilibrium hydrostatics, ignore the spherical geometry intrinsic to the problem, and assume the ideal gas law for the equation of state of a one-component fluid of which the star is composed. This basic model is then embellished by including energy production, transport, and other refinements. In this paper, we consider only the basic model and explore the influence of including a more realistic spherical geometry as well as equations of state other than the ideal gas law. The resulting equations are studied numerically. We shall present comparisons between the plane and spherical geometries and between the ideal and imperfect gas models.

An Investigation of Mathematical Models for the Addition Reaction of Chlorine to Oleic Acid. KATHLEEN L. MOORE, Covenant College and ERIC T. LANE, The University of Tennessee at Chattanooga.

Several mathematical modeles were explored in an attempt to describe the thermometric titration of the addition reaction of chlorine to oleic acid. This procedure measures the heat given off by the reaction as it progresses. A titration curve is produced which corresponds to solution temperatture vs. oleic acid concentration; the equation which describes this curve is the rate equation for the reaction. Numerical integration techniques are used to fit mathematical models such as

$$\frac{d\,Cp}{dt} = K_A\,(C_A{}^0 - Cp)\,(pt - Cp).$$

The best model yet found is an approximate solution to the rate equation which takes into account an observed autocatalytic effect of the chlorine.

Quasi-Isothermal Drying of Sol-Gel Synroc Microspheres. KEVIN P. CROSS and DEWAYNE A. LEE, Oak Ridge National Laboratory.

Sol-gel technology is being applied to the solidification of radioactive wastes. Various crystalline ceramic waste forms (i.e., Synroc—a titanate-based waste form) are being made by internal gelation using urea and hexamethylenetetramine as gelation additives. Processing of the gel spheres proceeds through drying, calcination, and sintering. Gel spheres have been analyzed by thermogravimetric and mass spectrometric