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ABSTRACTS OF PAPERS PRESENTED AT THE ANNUAL MEETING

GENERAL SESSION
FRIDAY, NOV. 17, 10:30 AM
PHYSICS-MATHEMATICS BUILDING AUDITORIUM
NORMAN CAMPBELL, CHAIRMAN

The Late Butler Act; Evolution in Tennessee. Arthur W. Jones, University of Tennessee. After 42 years the Tennessee Anti-evolution Law was finally repealed by the 1967 legislature. Several influences brought about repeal: pressure through legal proceedings to have the law declared unconstitutional; efforts by individual legislators to persuade their colleagues that the law served no useful purpose; and, not least, the educational process including the teaching of evolution in the colleges of Tennessee for many years, editorials favoring repeal in nearly all the newspapers, and resolutions on the subject by local medical and other professional societies, state college science teachers, and emphatically, the Tennessee Academy of Science. Intellectual progress in Tennessee, however, has not reached the point where evolution itself is a popular theory; and high school teachers, here as elsewhere, will teach biology at some risk. The Academy and the colleges should encourage the teaching of evolution at every appropriate level.

Mycotoxins: A New Food Problem. Benjamin J. Wilson and A. Wallace Hayes, School of Medicine, Vanderbilt University. Mycotoxins are poisonous metabolities produced by many common fungi that may grow on moist food materials. Both man and domestic animals have been victims of mycotoxic diseases. Except for the notorious ergot of cereal grains, little recognition or attention was afforded these substances until the present decade. Among those discovered in recent years are sporidesmin, a liver toxin from *Pithomyces chartarum;* zearalenone, an anabolic-uterotrophic factor from *Gibberella zeae*:; islanditoxin, a potent cyclic peptide from *Penicillium islandicum;* aflatoxins, hepatotoxic-carinogenic difuranocourmarins from *Aspergillus flavus;* slaframine, a parasympathomimetic alkaloid from *Rhizoctonia leguminocola;* ochratoxin A from *A. ochraceus;* and several others currently under study. Among the latter is a tremorgenic substance produced by *A. flavus* and several other aspergilli and penicillia.

Of all these toxins the best known are the aflatoxins which have caused moldy feed diseases of swine and dogs in southern states. Foods found contaminated with aflatoxins throughout the world include several basic commodities consumed by man.

The Brown Recluse Spider and Loxoscelism in Tennessee. H. B. Reed, Jr., Middle Tennessee State University. A total of 51 specimens of the brown recluse spider (*Loxosceles reclusa*), collected in Middle Tennessee during the period from July 31 through September 24, 1967, were examined. About 60 additional substantiated reports of occurences were analyzed. Reports of occurence of the spider were validated for 8 counties of West Tennessee, 16 counties of Middle Tennessee, and 3 counties of East Tennessee. However, the spider probably occurs in most of the 95 counties of Tennessee. The spider is known to have occurred in both West and Middle Tennessee as early as 1958. All habitats observed by the author or reported to him were within or near buildings. Search of several rock piles, two cliffy areas, and the area underneath two bridges and one football stadium yielded no indications of the spider. One confirmed case of brown recluse spider bite (loxoscelism) and about 12 suspected cases which had not previously been reported in the medical or scientific literature were recorded.

The Road To a Theory. Frederick L. Culp, Tennessee Technological University. Among most nonscientists there appears to exist the belief that science advances in more or less random fashion, being highly dependent on fortuitous discoveries in no way predictable. By judicious selection of events, a good case for this view can be made, particularly when emphasis is placed on the discovery of phenomena alone. However, the development of theoretical understanding has a history reflecting considerable order and purpose. The present paper is intended to illustrate this order by briefly tracing the development of the theory of quantum electrodynamics, starting with Newton's theory of light and ending with the work of Tomonaga, Feynman, and Schwinger in 1948. Only the highlights of this development are discussed.

SECTION MEETINGS
FRIDAY, NOV. 17, 2:00 PM

BOTANY SECTION
PHYSICS-MATHEMATICS BLDG., ROOM 207
HERMAN O'DELL, CHAIRMAN

A Comparative Study of the Quadrat, Random Pairs, and Variable-Radius Methods in an Oak-hickory Stand. Philip Mathis, Middle Tennessee State University. The purpose of this study was to compare the quadrat, random pairs, and variable-radius methods in terms of the length of time involved in procuring sufficient data to estimate accurately the composition of a forest stand. A 6.32 acre stand was selected and a complete

census of trees was taken. The stand was then sampled by each method being studied, thus, estimating composition of the stand in density, dominance, and frequency measurements. The method which could be performed in the least amount of time and which deviated less than 15 per cent from the true measurement as determined by the census, was considered the best method for making that particular measurement. The results revealed that each method studied was particularly suitable for making some specific phytosociological measurement, but that no single method was entirely suitable for making all of the measurements necessary to characterize a forest stand.

Recent Extensions in the Range of the "robust" Golden Aster, Chrysopsis sp. Paul L. Hollister, Cumberland College. Since the extensive survey in 1964, one covering over 3000 miles of highways in five states, casual observations have been made. During these trips no evidence of any decreases have been found. Similar probes into favorable areas in 1967 have yielded significant findings especially near the Kentucky-Tennessee state line. In 1967 along three state highways, roughly parallel to the state line, there are thousands of these asters. Between 1958 and 1965 no asters were found along these same roads. As discovered in 1964, the areas with greatest numbers are within fifty-five miles of Putnam County. Known extensions of the range of this *Chrysopsis* within Tennessee are along two state roads, Interstate 40, U.S. 70, and especially along the Tennessee Central Railway.

Vegetation Analysis of Rattlesnake Ridge, Unaka Mountain, Unicoi County, Tennessee. John Payne, The University of Tennessee. During the Spring and early Summer, 1966, floristic and vegetation samples were obtained. Seventy-two vascular plant families; 194 genera, and 264 species were determined on about 1800 acres. Vegetation samples were taken in spruce, hemlock-hardwood, heath slick, pine, oak, and intermediate communities. One primary hemlock-spruce stand was sampled.

Response of Astragalus tennesseensis to Shading and Competition in Relation to Soil Moisture. Carol Caudle and Elsie Quarterman, Vanderbilt University. *Astragalus tennesseensis* Gray is a herbaceous perennial legume endemic to the cedar glades of Middle Tennessee and northern Alabama. In the cedar glades it is usually restricted to the transition zone between open glades and glade woods, where soil moisture and light intensity are intermediate. An investigation to determine the factor(s) restricting *A. tennesseensis* to its habitat included experiments on shading and competition in relation to different levels of soil moisture. When watered daily, seedlings produced more growth at high than at intermediate and low light intensities. Seedlings grown for 10 weeks on 3-, 6-, and 9-day watering cycles, however, produced more growth at intermediate than at high or low light intensities. Seedlings competed well when soil moisture was not limiting but competed poorly when soil moisture was limiting. The inability of *A. tennesseensis* to tolerate heavy shading and low soil moisture are believed to be the factors restricting it to the transition zone.

The Vegetation of the Marshall Forest. H. R. DeSelm, University of Tennessee and Lewis Lipps, Shorter College. The plot method was used to examine the forest vegetation of Georgia's first Natural Landmark—the 100 acre Marshall Forest. Three plant communities occur—Pine-Oak on the gentle south-facing slope with dense subsoil, Chestnut Oak on the upper north-facing slope, and Mixed forest on the ravine slopes. The distribution of pine is discussed in light of soil character and periodic catastrophy.

Distribution Studies in Halesia Ellis (Styracaceae). Edward W. Chester, Austin Peay State University. Field and herbarium studies indicate that *Halesia* is a genus of eastern Asiatic-eastern North American distribution. *Halesia carolina* L., the most widely distributed species, ranges from middle Alabama and Georgia to West Virginia and southern Ohio, Indiana, and Illinois. Disjunct populations are found in Arkansas and Oklahoma. *Halesia diptera* Ellis and *H. pariflora* Michx. appear to be confined to the Atlantic and Gulf Coast states. *Halesia macgregorii* Chun is of limited distribution in southeastern China. The known fossil record indicates a distribution which was once much wider. Several records, all of Tertiary age, are available from northwestern United States (including Alaska) and from Germany and The Netherlands. The distribution data indicate that *Halesia* was a member of the Arcto-Tertiary forests.

Two Uncommon Troubles of Ground Phlox (P. subulata L.) in Tennessee. E. L. Felix, Knoxville, Tennessee. Sparseness of flowers, normal otherwise, on shorter than normal plants having double width non-evergreen leaves was observed in 1966 and 1967 in a localized but increasing area of a bed containing normal white ground phlox. Such undesirable plants should be characteristic of normal white ground-phlox and absence of disease symptoms suggest possible seedling variance, especially well known in respect to flower color in ground phlox. Such undesirable plants should be removed immediately on recognition before further multiplication.

Vegetable growth, flowering, and fruiting of dodder, identified as *Cuscuta pentagona* Engelm., were profuse this year in some beds of ground phlox. Removal of the dodder and pinching off of the phlox beyond the points of visible attachment failed to control it.

The Flora and Floristic Relationship of Chilhowee Mountain. R. Dale Thomas, Northeast Louisiana State College. An investigation of the plants of Chilhowee Mountain was undertaken to increase the knowledge of the flora and vegetation of the mountains adjoining the Smokies and the Valley and Ridge Province and is based principally on field work done by the author from 1962 to 1966. During the study the author collected a total of 893 different kinds of vascular plants on Chilhowee Mountain; including 110 families, 429 genera, 870 species and 23 varieties or forms. These plants

included: 619 plants common to the Smokies, Cumberlands, and Chilhowee, 156 plants occurring on the Smokies and Chilhowee, 60 plants on the Cumberlands and Chilhowee, and 58 plants from Chilhowee but not known from the Cumberlands or Smokies.

Several noteworthy collections are discussed. During the course of the study 379 new county collection records were made: 192 from Blount County and 187 from Sevier County. One collection, *Xerophyllum asphodeloides,* was new to the state.

Acid-soluble Phosphate Compounds in the Corn Root Tip. Byron H. Wise, Biology Department, Memphis State University. Studies of plant metabolism (e.g., the glycolytic sequence) have been restricted by the lack of convenient methods of estimating the well-recognized organic phosphate compounds. Among the problems met with in plant preparation are these: (a) the P-compounds are present in low concentrations, and (b) the interfering substances are present in high concentrations, and are difficult to remove. The author used ion-exchange chromotography to separate a number of sugar phosphates and a few nucleotides in an trichloroacetic acid extract of the primary root tip of the three-day-old corn seedling, and estimated these substances by colorimetry, fluorimetry, UV spectra, and purified enzymes. The result seemed to confirm the idea that meristematic tissues catabolize glucose via the Embden-Meyerhof pathway.

A Taxonomic Survey of the Flowering Plants along the Buffalo River in Perry County, Tennessee. R. W. McGowan and R. Barry Fox, Memphis State University. This survey deals with the flowering plants collected along a 11½ mile stretch of the Buffalo River in Perry County, Tennessee. Six stations were selected along the river from Sugar Hill Bridge to Linden, Tennessee. These stations were selected as representative of the various habitats along the river. Collecting at the stations was done every two weeks during the period from 1 April 1967 to 15 October 1967, and ecologic and geologic descriptions were prepared.

Feedback Inhibition of Threonine Deaminase in a Pseudomonad Species. B. Drake and V. Feisal, Biology Department, Memphis State University. Feedback inhibition of threomine deaminase was studied in a *Pseudomonad* designated as C12B. Investigation with crude cell-free extracts revealed (1) concentrations of isoleucine necessary to inhibit the threonine reaction from 0 to 100% at substrate concentrations of 0.4M, 0.2M, and 0.1M threonine, (2) enzymatic activity at different pH, in which pH 9 was determined as optimum, and (3) enzymatic activity at different temperatures, at which 40° C was determined to be optimum. It was noted that, as substrate concentration was decreased, the amount of isoleucine required to inhibit the reaction by 100% was also decreased. Higher concentrations of isoleucine were required to completely inhibit the reaction at pH higher than 8. Enzymatic activity was greater under alkaline conditions, as activity ceases at a pH below 8.

Protein, RNA, DNA and Phosphatase Activity of a Pseudomonad Species, as Affected by Various Concentrations of Sodium Lauryl Sulfate. R. Mischak and V. Feisal, Memphis State University. When C-12-B, a Pseudomonad capable of metabolizing aliphatic and aromatic detergents, was grown in the presence of increasing concentrations of the biodegradable surfactant sodium lauryl sulfate, extensive distortions of the normal growth patterns were observed. The total crop was reduced. The specific growth rate was modified. The maximum stationary phase of growth was completely eliminated from the growth cycle. The distortions were shown to result from permeability alterations initiated by the sodium lauryl sulfate. The normal levels of RNA and DNA throughout the growth cycle were altered only by high concentrations of sodium lauryl sulfate. However, protein and phosphatase activity were significantly affected by much lower concentrations. The evidence suggested that permeability modifications resulting from exposure of C-12-B to sodium lauryl sulfate were responsible for intracellular environmental alterations which favored a reduction in RNA, DNA, protein, and phosphatase activity.

A Floristic Survey of the Summer and Fall Vascular Flora of Montgomery County, Tennessee. David L. Scott, University of South Alabama, and William H. Ellis, Austin Peay State University. A floristic survey was conducted to determine the species composition of the summer and fall vascular flora of Montgomery County, Tennessee. Data were obtained from published records, from the author's collections, and from an inventory of the herbaria of Austin Peay State University, Vanderbilt University, and the University of Tennessee. Keys for the identification of families, genera, and species were constructed and a checklist was compiled including citation data for each specimen used in the study. It was concluded that 742 species of summer and fall vascular plants have been collected within the study area. These represent 473 genera belonging to one hundred and ten families. Of these, four families, eight genera, and thirty-two species were reported from Montgomery County for the first time.

The Germination Pattern of Three Winter Annuals. Carol Caudle, Vanderbilt University and Jerry M. Baskin, University of Florida. Germination of seeds of three winter annuals, *Sedum pulchellum* Michx (Crassulaceae), *Arenaria patula* Michx. (Caryophyllaceae), and *Leavenworthia crassa* Rollins (Cruciferae) was studied. Germination tests were performed on freshly harvested and one-, two-, three-, four-, and five-month old seeds at six constant temperatures ranging from 5 to 30°. Freshly-harvested seeds of all three species exhibited high temperature (20-30°) dormancy, but germinated at lower temperature (10-15°). This high temperature dormancy was gradually overcome with aging, as five-month old seeds of all three species gave

good germination at 25° The temperature-sensitive reactions are interpreted as ecological adaptations which allow the plants to pass the hot, dry summer in the dormant condition.

Effect of Actinomycin-D and Gibberellic Acid upon Protein and RNA Synthesis during Germination of Photosensitive Lettuce Seed. Benjamin P. Stone, University of Tennessee. A study was undertaken (1) to observe the effects of antinomycin-D upon the germination response in seeds of *Lactuca sativa L.* var. Grand Rapids; (2) to determine the interaction between act-D and the plant growth substances: gibberellic acid, kinetin and benzyl adenine; and (3) to estimate the effect of act-D upon protein and RNA synthesis by use of ^{14}C-leucine and ^{14}C-uracil, respectively.

Act-D at a concentration of 15 and 20 μgm/ml totally inhibits the germination response to red and white light respectively. The addition of gibberellic acid (100 ppm) to the germination medium containing 5 or 10 μgm/ml of the antibiotic increases the germination response to red or white light. Kinetin or benzyl adenine was ineffective in reversing the inhibitory effect of act-D upon germination.

Protein, RNA and DNA synthesis in ungerminated seeds were studied by following the incorporation of ^{14}C-leucine or ^{3}H-leucine, ^{14}C-uracil and thymidine methyl-^{3}H, respectively, into a cold trichloroacetic acid (TCA) precipitate. The amount of labeled precursors incorporated into a TCA precipitate was determined by a liquid scintillation spectrometer using single or double isotope counting procedures. In seeds stimulated to germinate by white light the rate of protein and RNA synthesis in the presence of act-D remains constant during the time course of germination. In the absence of the antibiotic an increase in the rate of protein and RNA synthesis occurs at the 12th and 15th time interval, respectively. Far-red light has an intermediate effect between act-D and white light upon these processes. The presence of gibberellic acid in the germination medium act-D (10 μgm/ml) increases the level of RNA synthesis.

Actinomycin-D at a concentration of 100 μgm/ml inhibits incorporation of thymidine-methyl-^{3}H into ungerminating seeds whereas seeds treated with white light or far-red indicated incorporation by the 17th hour time interval.

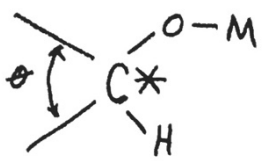
A Preliminary Biosystematic Study of Erythronium americanum Ker. in the Southeastern United States. B. Eugene Wofford, University of South Alabama and William H. Ellis, Austin Peay State University. Variations in the yellow flowering species of the genus *Erythronium* (Liliaceae) in the southeastern United States, have recently been given considerable taxonomic importance. The existence of these variations between and within single populations of *Erythronium americanum* were suggested to the author and served as a basis for the study. Particular biosystematic emphasis was placed on the purple and yellow anther color forms of *Erythronium americanum.* Inferences were made from geographical, ecological, cytotaxonomical, anatomical and morphological data compiled from fresh material and herbarium specimens. Statistical analyses were employed where they seemed pertinent. The results of this preliminary investigation indicated that two distinct biotypes of *Erythronium americanum* exist and are best distinguished on the basis of anther coloration. Although it now appears that these two biotypes should be placed in the taxonomic category of forma, formal taxonomic recognition will not be presented until variations are studied sufficiently throughout the entire range.

Chemistry Section

NEW SCIENCE BLDG. ROOM 220

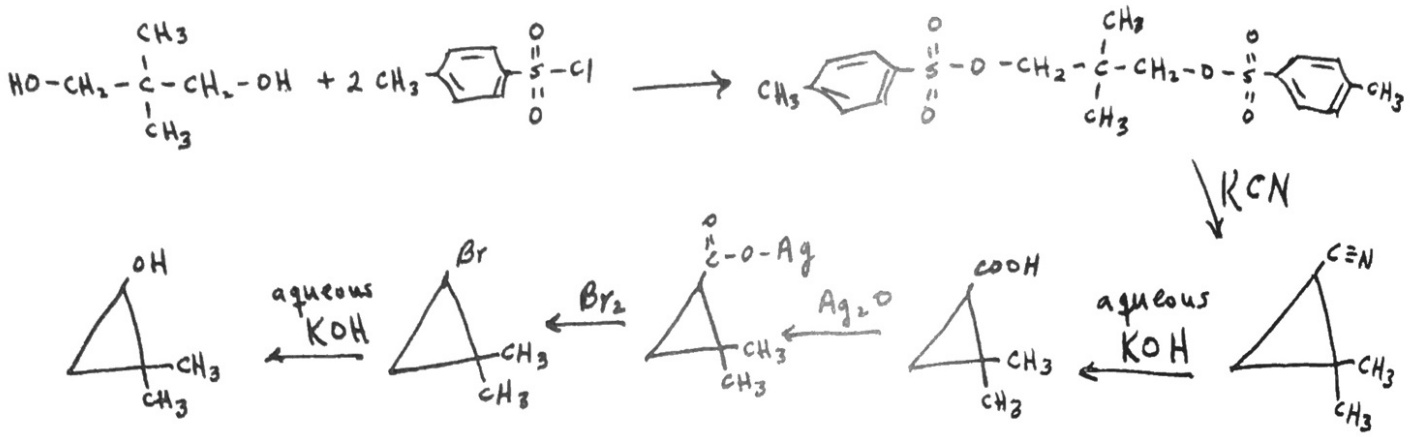
LLOYD A. KING, CHAIRMAN

An Investigation of s-Character Effects on Carbanion Stability. R. T. Swindell and R. Dickinson, Tennessee Technological University. Recent studies indicate that hydrocarbon acidities may be dependent upon the s-character of the carbon-hydrogen bond. This work involves an investigation of the acidities of a series of compounds in which unsaturation is not a factor. In order to avoid experimental difficulties associated with unsaturated hydrocarbons, compounds of the type I have been chosen for study. Here, C* is an asymmetric carbon and -O-M is an activating group (probably benzoate) which can serve to activate the C-H bond.



The s-character of the C-H bond will be varied by selecting compounds with differing bond angles (Θ) and thus different s percentages. Two compounds selected for initial study are derivatives of 2-butanol (~sp^3) (II) and 2,2-dimethyl-cyclopropanol (~sp2.28) (III). Since the acidic hydrogen is bound to an asymmetric carbon, the configurational stability of the carbanion is to be determined by observing the rate of racemization during a base-catalyzed hydrogen exchange.

Current work is directed toward synthesis of III via the following route:



The 2,2-dimethylcyclopropanol will be resolved by recrystallization of its brucine salt. The benzoate ester will then be prepared from one optical isomer and the rates of racemization observed.

Photochemistry of 7-Substituted Cycloheptatrienes. R. T. Swindell and T. Chao. Efforts to prepare certain 7-substituted cycloheptatrienes are discussed. The photolysis of one of these compounds 7-acetoxycycloheptatriene is also discussed.

The Chemiluminescence of Cyclic Hydrazides. R. T. Swindell and B. W. Peace, Tennessee Technological University. For many years, certain cyclic hydrazides have received attention due to their marked chemiluminescence during oxidation. Although several mechanisms have been suggested for this phenomenon, none appear to be entirely satisfactory. The present study is an attempt to determine the effect of conjugation on the chemiluminescence of cyclic hydrazides. The hydrazide of maleic acid has been prepared and groups containing double bonds will be added to the unsaturated carbons. All prepared hydrazides will be subjected to conditions known to bring about chemiluminescence in 5-aminophthalhydrazide (luminol), one of the most strongly chemiluminescing compounds known.

Atomic Absorption Analysis of Ferrocene Copolymers. Larry F. Thompson and V. Allen, Tennessee Technological University. Precise analysis of certain metals in a variety of sample subtrates is routine using atomic absorption techniques. The determination of metals such as iron in macromolecular systems is also routine in solutions of low viscosity. It was found that the resolution using a standard multielement lamp was too insensitive for precise analysis. When a special iron lamp was used, improved resolution gave a sensitivity of one PPM iron, suitable for analysis of dilute polymer solutions. Copolymers of ferrocene and selected aldehydes were prepared and analyzed for iron content both by atomic absorption spectroscopy and by redox titration. From the standpoint of sensitivity and time per analysis, the atomic absorption technique is superior, especially for routine analysis. Certain ramifications of this method are discussed including its application to the determination of the number-average molecular weight of macromolecules prepaved via anionic catalysis with lithium ferrocyl.

Reaction of 5, 5'-Dithiobis (2-nitrobenzioc Acid) with Base and with Iodine. S. K. Airee, O. E. Millner, and H. Hartwig The University of Tennessee at Martin, Martin, Tennessee. The aromatic disulfide 5,5'-dithiobis (2-nitrobenzioc acid), nbSSbn, has found considerable use for the determination of mercapto groups in biochemical samples. This use is based on the fact that each -SH group that reacts with this reagent liberates one nbS^- anion which can be determined spectrophotometrically. The same nbS^- anion is produced also by the decomposition of nbSSbn at higher pH. The stoichiometry studies made of the alkaline hydrolysis indicate that $nbSO_2$–is also produced besides nbS^-:

$$2\text{nbSSbn} + 40H^- = 3\ \text{nbS}^- + \text{nbSO}_2^- + 2\ H_2O$$

Another way $nbSO_2^-$ can be produced from nbSSbn is by oxidation with iodine; the ratio of reacted iodine to nbSSbn was found to be approximately three, which corresponds to:

$$\text{nbSSbn} + 3I_2 + 4\ H_2O = 2\ \text{nbSO}_2\text{H} + 6\ \text{HI}.$$

Geology-Geography Section

PHYSICS-MATHEMATICS BLDG. ROOM 211

ROBERT C. MILLICI, CHAIRMAN

A Possible Organic Remain in the Mount Rogers Group Near Big Hill, Virginia. Otto C. Kopp, Department of Geology, University of Tennessee. The presence of a dark film with some linear marking led the author to collect and examine a small chip of rock collected in the Mount Rogers Group. Three distinctive features can be observed: (1.) The film is neither structureless, nor does it have the dendritic pattern noted for many surface stains. (2.) The pattern of the linear markings continues, where the film disappears, as if impressed on the surface of the rock. (3.) There appears to be a generally six-sided "cellular" texture to portions of the dark film. Perhaps this specimen is just an unusual inorganic stain, but, if it is organic, the degree of cellular organization seems quite advanced for the late

Precambrian age assigned to the Mount Rogers. Several alternative explanations may be considered. Paleontologic study for any organic affinities and analysis of the composition of the film should determine whether it is organic. If organic, the reason for its preservation in the Mount Rogers may be difficult to answer.

Preliminary Report on Zinc Values in Water Wells and in Soils in the Paris Landing and Surrounding Areas of Tennessee. R. E. Hershey Tenn. Div. of Geology and J. M. Wilson, Tenn. Div. of Water Recources. Routine well water sampling by the Tennessee Division of Water Resources disclosed the presence of zinc in ground water in the Paris Landing area. An atomic absorption spectrophotometer was used to analyze the water and subsequently soils and rock samples. The highest value of zinc in water was 41 ppm in the Kaiser well near Paris Landing. Other zinc values in well water in this area ranged from 0 to 22 ppm. The only high value obtained outside this area was in water from a well near Manleyville, which had 12 ppm zinc. Rock samples from a water observation well drilled adjacent to the Kaiser well contained more than 600 ppm zinc. Several lines of soil rock samples and well water samples were taken to establish a background value of zinc in ppm. The samples were collected at approximately 10-mile intervals along east-west lines from Nashville to Como in the northern part of the State, from Lawrenceburg to Bolivar in the south, and along several intermediate lines. Samples were also taken on north-south lines along both sides of Kentucky Lake. The average zinc content of these soil samples was 69 ppm. Zinc values in excess of 200 ppm were found in soil and rock samples ranging in age from Cretaceous to Mississippian, all collected within about 10 miles of Kentucky Lake.

An Anhydrite Occurrence in Nashville, Tennessee. R. E. Hershey, Tenn. Div. of Geology and J. T. Wilcox, Vanderbilt University. A pod of anhydrite approximately 100 by 15 by 3 feet has been uncovered during quarrying operations at the Menefee quarry in Nashville. This is believed to be the first significant occurrence reported in Tennessee. Anhydrite previously found at this locality in small nodules and partial replacement of stromatoporoids was thought to be celestite because of its "typical blue celestite" color and because of a positive flame test for strontium (now believed to be due to contamination of the sample). Chemical, x-ray diffraction, and optical analyses prove the material to be anhydrite. Tests for strontium were negative. The large pod of anhydrite is in the upper part of the Bigby limestone facies of the Bigby-Cannon Limestone. The relationship of the pod to the surrounding beds suggests that the anhydrite is of primary origin or at least that it was deposited before the overlying beds. Some secondary anhydrite is present as nodules and as partial replacement of stromatoporoids. The abundance of anhydrite and the conformable relationship of the deposit with the overlying limestone beds indicate an evaporite condition at least part of the time during deposition of the Bigby-Cannon Limestone.

Mathematics Section

PHYSICS-MATHEMATICS BLDG. ROOM 218

RONALD SIRCY, CHAIRMAN

Ring of Endomorphism of a Directed Abelian Group. Emery G. Gathers, The University of Tennessee at Martin. This paper has presented the preliminary definitions and theorems on partially ordered abelian groups. The procedure that was used in putting a partial order on a ring of endomorphisms was to consider a ring $E(G)$ of all endomorphisms of a directed abelian group G, and define an endomorphism positive if it carries the positive cone $P(G)$ of G into itself. The partially ordered ring of endomorphisms of a directed abelian group has been illustrated by nine examples. In each example the ring of endomorphisms has been shown to be directed or not directed. If the ring of endomorphisms was directed, then it was determined to be a lattice or not a lattice.

Let G be an abelian group with a directed order and $E(G)$ its ring of endomorphisms. Let $P_1(G)$ and $P_2(G)$ be two cones in G such that $P_1(G)$ is a subset of $P_2(G)$ and each $P_i(G)$ is directed. Let $P_1(E(G))$ and $P_2(E(G))$ be cones induced by $P_1(G)$ and $P_2(G)$ respectively.

This paper also has shown that if $P_1(G)$ is a subset of $P_2(G)$ and $[P_2(G) - P_1(G)] \cup (O)$ does not contain a directed order, then $P_1(E(G))$ need not be a subset of $P_2(E(G))$.

Finally, the conjecture that if $P_1(G)$ is a subset of $P_2(G)$ and $[P_2(G) - P_1(G)] \cup (O)$ contains a directed order, then $P_1(E(G))$ is not a subset of $P_2(E(G))$ has been supported by four examples. However, this conjecture has not been proven or disproven.

The Moments of the Truncated Bivariate Normal Distribution. S. A. Patil, Tennessee Technological University. The truncated bivariate normal distribution is taken with the density function

$$f(x,y,\varrho)=\frac{1}{P(-d,-d,\varrho)\,2\pi\sqrt{1-\varrho^2}}\exp\frac{-\frac{1}{2}(x^2+y^2-2xy)}{(1-\varrho^2)}\quad\begin{matrix}-\infty<x\leq -d\\ -\infty<y\leq -d\\ d\geq 0\end{matrix}$$

where $P(-d,-d,\varrho)$ = probability of the set $(-\infty < U \leq -d, -\infty < V \leq -d)$

U, V are standardised bivariate normal random variables with correlation coefficient ϱ.

For this distribution the mean $= E(X)$, the second moment $= E(X^2)$ and the product moment $= E(XY)$ are obtained

$$E(X)=\frac{-(1+\varrho)\,\Phi\left(-d\sqrt{\frac{1-\varrho}{1+\varrho}}\right)\Phi(d)}{P(-d,-d,\varrho)}$$

where $\Phi(x)$ = probability of the set $-\infty < U \leq X$. U is standard normal random variable and

$$\Phi(d) = \frac{e^{\frac{-d^2}{2}}}{\sqrt{2\Pi}}$$

$$E(X^2) = 1 - \frac{\sqrt{1-\varrho^2}}{2\Pi} \frac{1}{P(-d,-d,\varrho)} \frac{\Phi(d\sqrt{2}}{1+\varrho} + 2d\Phi(d)\,\Phi\left(-d\sqrt{\frac{1-\varrho}{1+\varrho}}\right) \Big/ P(-d\,-d,\,\varrho)$$

$$E(XY) = \frac{1}{\varrho} E(X^2) - \frac{(1-\varrho^2)}{\varrho\ P\ (-d,\,-d,\,\varrho)} \left[P(-d,-d,\varrho) + \Phi(d)\Phi\left(-d\sqrt{\frac{1-\varrho}{1+\varrho}}\right)\right]$$

These quantities are used to find the variance of X and correlation coefficient of X and Y. The method for higher moments is indicated.

Some Things I Never Knew Until Now About Mathematics. W. W. Graham, Vanderbilt University. The title was suggested by a short newspaper column of some years back. The title of this column was something like "Things I Never Noodle Now." So many topics of mathematics have been introduced in recent years earlier in the life of a student that an undergraduate textbook of today resembles a text which I studied in graduate school. Consequently, over the years I meet and teach concepts and topics which I never studied. In addition such subjects as programming for a computer was not taught anywhere when I was in school for the very good reason that computers were non-existent then. The discussion, then, is a listing and some comments about things I didn't know when I was an undergraduate or even after graduate school but have learned since that time.

A Problem in Signal Detection. Horace E. Williams, Vanderbilt University. Many real world problems involve the detection of signals (or responses) generated by the presence of absence of certain postulated events (such as the presence of absence of an airplane in a certain zone). From the output of a detector or detectors of the signals one wishes to infer the events giving rise to these signals. Some fairly well known principles of Statistical Information theory are helpful in establishing a model for inferring such events.

Medical Sciences Section

NEW SCIENCE BLDG. ROOM 317

BRYANT BENSON, CHAIRMAN

Experimental Production of Cerebral Edema by Chronic Brain Abscess in Dogs. S. B. Strang, University of Tennessee Medical Units, Memphis, Tennessee. Under sterile surgical conditions 10 mongrel dogs had a burr hole placed in the skull 1 cm. posterior to the external auditory meatus and 1 cm. from the midline on the right side. A sterile 1 cm. polyethylene tube was stereotaxically inserted through a #13 gauge guide needle into the parieto-temporal region of the right cerebral hemisphere to a depth of 1.5 cm. In eight animals the tube contained *Straphylococcus aureus* (10^7 organisms per ml) and was plugged at both ends with gelatin. The control animals received a similarly plugged tube without organisms. Two experimental animals were sacrificed weekly, and edema was observed grossly through thick serial sections of the whole brain. Hematoxylin and eosin sections exhibited gliosis in the area of the abscess. Cajal's gold sublimate stain revealed an increase in the volume and an alteration in the staining properties of the astrocytes throughout the affected hemisphere. (Supported by NIH Grant GM 00202-09 and NB 06826).

Fine Structure of Cyst Wall Formation in Acanthamoeba sp. Gus Tomlinson, George Peabody College for Teachers. The fine structure of cyst wall formation in *Acanthamoeba* sp. was investigated from initiation to completion by means of electron microscopic technique, including preparation of samples by freeze etching. Striking ultrastructural changes in the nucleus, nucleolus, and cytoplasm were found to precede the formation of the cyst wall. The appearance of 80 A. granules embedded in the plasma membrane appeared to signal the onset of encystment. A complex transport network consisting of interconnecting vacuoles and microtubules was found to arise shortly after initiation of encystment but disappeared in later stages of the encystment process. Cyst wall fromation *per se* began with the appearance of a 120 A. "Glycocalyx—like" structure at the periphery of the cell which appeared to be repeated concentrically with time to form a lamellar arrangement as the cyst wall thickened. Correlation of ultrastructural and enzymological data suggests strongly that sequential enzyme induction occurs during the encystment process.

Isolation of Nuclei Using Reoriented Gradients[1]. L. H. Elrod, N. G. Anderson, L. C. Patrick and J. C. Shinpaugh, Oak Ridge National Laboratory[2]. Zonal centrifugation in large hollow rotors has been developed as a general method for separating particles ranging in size from whole cells to protein molecules. Most of these methods involve loading and unloading the rotor dynamically (i.e., during rotation). In some instances it is advantageous to load and unload the rotor statically. Such is the case for the isolation of whole cells and nuclei where sometimes expensive and often very viscous gradient materials are used. In a previous study gradients made with D_2O were used, however liter quantities were needed for each experiment. Using

[1]Work performed under the joint N.I.H.—A.E.C. Molecular Anatomy Program sponsored by the National Cancer Institute, The National Institute of Allergy and Infectious Diseases, and the U. S. Atomic Energy Commission.

[2]Operated by Union Carbide Corp. for the U. S. Atomic Energy Commission.

a small plastic reorienting gradient rotor mounted in a low speed centrifuge, the effect of carefully controlled acceleration and deceleration techniques, gradient design, and the effects of reorientation of density gradients have been studied on resolution. A simple method for separating nuclei from rat liver homogenates on a rate basis is presented.

Calibration of a Whole-Body Counter for Quantitating Total Potassium in Human Subjects. Harold D. Hodges, C. C. Lushbaugh, and William D. Gibbs[1]. The whole-body counter calibration method reported involves the use of a series of compartmented water phantoms to simulate human subjects of various sizes and body builds, and known amounts of natural potassium to obtain correction curves for counting efficiency with subjects of varying size and shape. In the whole-body counter used in this study, counting efficiency is primarily dependent upon average body thickness rather than upon total body weight. A brief description of the whole-body counter is given and the accuracy of the method discussed.

[1]Medical Division, Oak Ridge Institute of Nuclear Studies, an operating unit of Oak Ridge Associated Universities, Inc., Oak Ridge, Tennesee, under contract with the United States Atomic Energy Commission.

Biochemical and Pharmacological Investigation of Fixation of Abnormal Reflexes in the Rat. Gene C. Palmer, Rodman Davenport, and James W. Ward, Vanderbilt School of Medicine. Lesions placed in the right anterior cerebellum of rats resulted in asymmetrical postural extensions of the hind limbs with varying degrees of flexion observed in the ipsilateral limb. Mid-thoracic section of the spinal cord within 45 minutes of the cerebellar lesion resulted in a disappearance of the asymmetry. If the cord was sectioned after 45 minutes the asymmetry persisted. This "fixation time" may result from neuronal metabolic changes induced by synaptic activity. Inhibitors of RNA (actinomycin) and protein synthesis (puromycin) increased fixation time to 83 minutes. Adrenergic and cholinergic blocking agents (eserine, large doses, and reserpine) increased fixation to 60 minutes. An inhibitor of GABA formation (methionine-sulfoximine) and eserine, small doses, decreased fixation to 37 minutes. No significant changes in total RNA, DNA, phospholipid, or protein were detected during fixation. Results from H^3 uridine and H^3 leucine incorporation indicated possible deficits in RNA and protein syntheses during fixation. (Supported by USPHS Training Grant T1-GM-85).

Column Chromatography of Carbohydrates in Physiological Fluids[1]. R. L. Jolley and M. L. Freeman, Oak Ridge National Laboratory[2]. A rapid analytical procedure for carbohydrates in physiological fluids is being developed at the Oak Ridge National Laboratory. An automated carbohydrate analyzer is used to chromatograph borated physiological fluids on strongly basic anion exchange resin, detecting eluted carbohydrates by sulfuric acid—phenol colorimetry. Normal and diabetic human urine, blood plasma and serum have been chromatographed and significant differences established. As many as 38 peaks are indicated in the complex urine chromatograms, of which 14 peaks have been tentatively identified using co-chromatographic techniques. Plasma and serum chromatograms consist of a major glucose peak and traces of several other sugars. Melibiose has been used as an internal standard in chromatograms to determine recovery, resolution, and reproducibility. With present technique the lower limit of detectable sugar in physiological fluids is in the 0.1 microgram range.

[1]Research supported by National Institute of General Medical Sciences and U. S. Atomic Energy Commission.

[2]Operated for U. S. Atomic Energy Commission by Union Carbide Corporation.

The Influence of Erythrocytes on the Distribution of Flow in the Isolated Perfused Guinea Pig Heart. John M. Ginski and Jan M. Hornbuckle, College of Basic Medical Sciences, University of Tennessee. In attempt to establish a criterion for adequate perfusion of the isolated heart, coronary flow and total tissue potassium concentration changes were studied in response to modifications of the composition of the perfusion fluid. The modifications consisted of the addition of: (M.W. 60-90,000) to a concentration of 1.2% and homologous erythrocytes to a maximum of 108 x 10^6 RBC/ml. Erythrocytes significantly increased the coronary flow. In the perfused control the coronary flow was 5 ml/g/min; the addition of erythrocytes even in the smallest increment increased the flow to 10 ml/g/min in dextran and non-dextran containing perfusion fluids. Plotting potassium concentration against the erythrocyte concentration produces a sigmoid-like curve with the inflection points approximately 30 x 10^6 RBC/ml and 53 x 10^6 RBC/ml. This data suggests that fluctuations in potassium concentration may reflect variations in flow distribution patterns induced by the physical presence of erythrocytes within the cardiac microcirculation.

Influence of Triamterene on Potassium Secretion in the Nephron of Dogs. C. T. Spalding and B. V. Rama Sastry, Dept. of Pharmacology, Vanderbilt University School of Medicine. The distal tubular cation exchange mechanism has been implicated in the potassium sparing action of triamterene. We studied the effect of triamterene on renal transport of potassium in the dog by free-flow clearance and stop-flow techniques. Triamterene (3-18 mg/Kg, i.v.) administered to dogs under mannitol-sodium sulfate diuresis did not alter the glomerular filtration rate (GFR) or renal plasma flow (RPF). Clearance of potassium was depressed, and the maximal depression was observed within 10 min; the magnitude and duration of depression were dose related. Triamterene increased the clearance of sodium and chloride at low doses (6 mg/Kg) but not at higher doses (12-18 mg/Kg). After administration of triamterene (12 mg/Kg, i.v.) stop-flow patterns indicated: 1) a marked depression (71%) of the distal tubular secretory peak of potassium; 2) a reduced reabsorption of sodium in the same distal area; 3) a proximal shift of the sodium trough and the potassium peak. These results suggest that triamterene produces a major portion

of its potassium sparing effect by inhibiting its distal tubular secretion. (Supported by U. S. Public Health Service).

Functionally Active Electron-Transport Systems in Human Blood. Claude Marmasse, University of Tennessee, Knoxville. The evidence of a functionally active electron-transport system in human blood subjected to freezing has been previously demonstrated. This system specifically interacts with methylene blue. The oxidation-reduction potential, E_h, of fresh human blood has been measured in an haematological buffer after addition of traces of methylene blue. E_h reflects the physiological and psychological conditions of the subject. A decrease in E_h is correlated with an increase in metabolism induced by administration of tri-iodothyronine. Anxiety, associated with the collection of the blood, decreases E_h (although anxiety induced under hypnosis seems to increase this potential). The amplitude of the variations observed easily attains or surpasses 60 mV. Such large variations in the case of *one* biological system are not very likely to be due to a 2-electron system; even for a 1-electron system they correspond to a rather large variation of the ratio [Red] / [O_x]. On the other hand the possibility of dealing with a complex mixture of electroactive systems cannot be ruled out, as experiments of selective poisoning with cupric ions show that there is more than one electron-transport system in human blood which can be monitored.

The Control of Lipolysis in Adipose Tissue. J. D. Corbin, Vanderbilt University. We have employed the intact rat epididymal fat pad and the isolated fat cell preparation in order to obtain evidence that there is a correlation between cyclic-AMP levels and lipolysis in adipose tissue. The release of glycerol and cyclic-AMP levels increase after addition of epinephrine and caffeine to the incubation medium, and insulin inhibits this stimulated accumulation of cyclic-AMP, although there is no concomitant decrease in glycerol release. The explanation for insulin not affecting lipolysis has been put forward that although insulin decreases cyclic-AMP levels in the tissue, the concentration of cyclic-AMP does not fall below that which maximally stimulates the tissue lipase. This hypothesis gains support from the observation that insulin antagonizes both lipolysis and cyclic-AMP levels if the tissue is stimulated by a low concentration of epinephrine alone. *In vitro* basal lipolysis is higher in adipose tissue from fasted-refed rats than normal fed rats. There is an eight-fold increase in cyclic-AMP levels in fasted-refed adipose tissue if maximally stimulated by epinephrine and caffeine when compared with normally fed rats and apparently no change in the maximum tissue lipase activity. These data argue against a change in the tissue enzyme lipase but support the hypothesis that either the adenyl cyclase, which catalyzes synthesis of cyclic-AMP, is induced or that the phosphodiesterase, which inactivates cyclic-AMP, is repressed by fasting-refeeding. If our hypothesis of a small rate-limiting range of C-AMP concentrations is correct, insulin should inhibit cyclic-AMP accumulation after stimulation by large doses of lipolytic hormones without affecting lipolysis and further increases in the cyclic-AMP level should not increase the lipolytic activity. Otherwise one would still be working in the rate-limiting range of cyclic-AMP concentrations. In support of this hypothesis we have found the same maximum lipolytic activity whether we employed the lipolytic stimulators epinephrine, norepinephrine, ACTH, high concentrations of theophylline, or lipolytic hormones plus theophylline. The tissue cyclic-AMP concentrations would be expected to be very different under stimulation by these different agents. Our evidence offers strong support to the hypothesis that cyclic AMP is a major rate-controlling factor in lipolysis.

A New, Sensitive Bioassay for FSH in Serum. Bryant Benson, Sandy Sorrentino[1] and James S. Evans, The University of Tennessee Medical Units. No current bioassay for follicle stimulating hormone (FSH) is reported to be sufficiently sensitive to estimate the serum FSH content of intact rats. A variation of the Steelman-Pohley assay, utilizing the synergism between FSH and human chorionic gonadotrophin (HCG), is under development in our laboratory. In the assay 2.4 ml of serum containing 20.0 I. U. of HCG is injected intraperitoneally into weanling, female rats over a three day period. The ovarian weights of these recipient animals is compared to littermate controls given standard FSH preparations and an estimation of serum FSH made. A linear log. dose response curve has been obtained for FSH standards between 1.0 and 125.0 μg admistered in dilute (0.5%) bovine serum albumin in 0.9% saline. The dilute albumin-saline mixture was established as an injection medium since no augmentation was observed when the standards were given in undiluted serum from hyprophysectomized rats. The bioassay is sensitive enough to detect the variation in serum FSH in the normal cycling female rat.

[1]Supported by NIH Grant GM 00202-09.

Serum FSH Dynamics in Intact and Unilaterally Ovariectomized Rats. James S. Evans, Bryant Benson and Sandy Sorrentino[1], The University of Tennessee Medical Units. Serum follicle stimulating hormone (FSH) was determined by bioassay in intact, cycling, female rats and rats unilaterally ovariectomized. Maximum secretion was observed in intact animals during proestrus, a minimum during estrus followed by an increase in late diestrus. Following removal of the left ovary the remaining ovary was seen to hypertrophy reaching a maximum at 12-14 days postoperatively. Serum FSH increased markedly during the first four days following unilateral ovariectomy, decreasing to preoperative levels between 20-24 days postoperatively.

The early increase in serum FSH following removal of one ovary is postulated to be related to the concomitant decrease in circulating estrogen that may partially release the hypothalamicopituitary system from feedback control. As the remaining ovary increases in

[1]Supported by NIH Grant GM 00202-09.

size, and is stimulated to secrete estrogen, the feedback control is restored and serum FSH levels return to pre-operative levels.

Depression of Ovarian Weight and Serum FSH by Melatonin in Intact and Unilaterally Ovariectomized Rats. Sandy Sorrentino[1] and Bryant Benson, The University of Tennessee Medical Units. The effects of melatonin, a pineal substance, on reproduction are controversial. This investigation was conducted primarily to determine the antigonadotropic activity of melatonin. Initially we demonstrated that daily injections of 10 mg. melatonin intraperitoneally for 28 days significantly decreased ovarian and pineal gland weights of one month old rats. Melatonin also significantly lowered serum FSH levels. Uterine weight and incidence of estrus as evaluated by vaginal smears were also depressed, but not significantly. Secondly melatonin caused a significant, partial blockage of "compensatory" ovarian hypertrophy in unilaterally ovariectomized rats and a depression of serum FSH levels. The remaining control ovary hypertrophied 53% over the intact ovarian weight, whereas the melatonin treated group hypertrophied only 34% Thus exogenous melatonin has some antigonadotropic activity. It should not however be identified as the pineal hormone until further, more extensive investigations have been carried out.

[1]Supported by NIH Grant GM 00202-09.

Physics and Astronomy Section

PHYSICS-MATHEMATICS BLDG. ROOM 310

FREDVRICK L. CULP, CHAIRMAN

Opportunities for Physicists in Medicine. R. L. Tanner, College of Medicine, University of Tennessee. There is a recognized need for physicists at all levels of training in clinical and teaching areas of medicine. Radiology, which probably is the most obvious area, offers positions which are both challenging and well-compensated. The types of tasks faced by physicists in these areas are numerous; ranging from the instruction of medical personnel, to advising physicians concerning clinical treatment, to performing both basic and applied research of a strict physical nature on systems having biological significance. The training requisite to the successful pursuit of a career in the field of medical physics is presently available at both undergraduate and graduate levels. Early in their college work, students should be informed of the opportunity in these areas and counselled as to the proper training required.

The Separated Achromatic Doublet. Marvin Tidwell, Tennessee Technological University. A derivation to determine the spacing of a separated achromatic doublet is presented which shows explicitly that, for a given spacing, there are any number of pairs of wave-lengths for which the system is achromatized.

A New Approximation for Calculating Distribution Functions. A. A. Khan, Tennessee Technological University. An approximate method for the determination of the distribution function g has been proposed. The pair of equations:

$$g = e^{-\beta\Phi} (1-\infty N)^{-\frac{1}{\infty}}$$

and

$$\tilde{N}(k) = \frac{n[\tilde{G}(k)]}{1 + n[\tilde{G}(k)]}$$

determine g. The N is the contribution due to nodal diagrams, $\tilde{N}(k)$ and $\tilde{G}(k)$ are the Fourier transforms of N and (g-1) respectively, Φ (r) is the pair potential, n is the density of particles. The $\propto$ is an unknown function of r, $\beta\Phi$ and n. Here $\propto$ is regarded as a parameter. For $\propto$ equal to -1 the above pair of equations reduce to the Percus Yevick integral equation and for $\propto$=O to CHNC integral equation. There are two advantages in introducting the parameter in the present form rather than the forms suggested earlier: (1) The calculation of Φ from experimentally determined $\tilde{G}(k)$ is much simpler and (2) a smaller variation of $\propto$ would be required to cover the same range of densities and temperatures.

The Preparation of Calcium Metal Within an Electromagnetic Isotope Separator During Operation[1]. E. W. McDaniel, J. O. Younghanse, K. A. Spainhour, J. G. Tracy, L. O. Love. Fifteen grams of ~99.999% ^{40}Ca has been collected in the Oak Ridge National Laboratory Electromagnetic Isotope Separators to be used as a diluent for highly enriched ^{46}Ca prior to its reactor irradiation for the production of ^{47}Ca, which is used in cancer research. Since only 35-70 μg of the ^{46}Ca is irradiated each time, the use of a diluent to minimize handling losses is desirable, and ^{40}Ca highly depleted in ^{44}Ca is ideal for the purpose. For calutron processing of calcium the metal is the desired feed and ordinarily its preparation presents no problem, however when the element has been isotopically enriched, yield and isotopic dilution become important. This metal conversion problem has been solved by reducing calcium oxide to metal as needed within the separator. The method is to mix CaO and fine aluminum powder in the ratio of two to one and elevate the temperature to ~1000°C for operation. The metal vapor from this reaction is satisfactory for good separator performance, and the reaction goes to ~95% completion which makes the technique very useful when precious feeds are being processed.

[1]Research sponsored by the U. S. Atomic Energy Commission under contract with the Union Carbide Corporation.

Transuranium Elements. Gobind Kumar, Tennessee Technological University. The irradiation of uranium with slow neutrons results in a number of radioactive substances (isotopes of uranium) that produce trans-uranium elements after a beta emission. These man-made elements have very short half lives and were unknown prior to 1940. Since that time eleven trans-uranium elements have been prepared and identified.

A brief survey of the nuclear reactions involved for synthesising these elements is presented. A key step to the discovery of new synthetic elements is the study of the position of these transuranium elements in the periodic table of chemical elements. An attempt is made to answer a natural question: What is the heaviest element which can be produced by synthetic methods?

A Possible Role of Adsorption in Thermal Transpiration. Frederick L. Culp, Tennessee Technological University. An equation predicting the thermomolecular pressure difference to be expected when two gas-containing chambers of different temperatures are joined by a capillary is developed for the case where the mean free path is small compared to the radius of the capillary. The equation contains a factor f which represents the probability of a molecule being adsorbed after it strikes the capillary wall.

By assuming the ratio of the probability of a molecule being reflected to the probability of its being absorbed is proportional to the ratio of the mean free path to the capillary radius, it is found that the equation can be successfully extended into the pressure region where the mean free path is large compared to the radius of the capillary. Experimental data on four gases (neon, argon, krypton, and carbon monoxide) are shown to fit the equation.

In view of the success of this equation, it appears that the expression for f which results from the analysis should be taken seriously; in which case, the role of adsorption in thermal transpiration can be understood.

Science-Mathematics Teachers Section

(SAT. NOV. 18, 10:00 AM)

PERRYBERRY HALL, ROOM 319

JAMES H. DAVIS, CHAIRMAN

Sex Education. Maggie Jeter, Dresden High School. In America statistics of sexual revolution is sad: at least one teen-age girl in every six becomes pregnant out of wedlock. Illegitimate children are swelling the welfare rolls all across the nation. A recent health study revealed that teen-agers are ignorant about the true meaning of sex and sexuality. In teen-age years communication breaks down and parents have difficulty discussing these sensitive matters with sons and daughters. Enlightened sex education deals with reproduction and sexuality: what makes you a man or woman; the way you think, act, dress and marry. Sex is not something we do, but something we are. Some teen-age girls ask teachers questions after class like, "Is it wrong to have warm strange feelings about boys?" We reply, "Of course you have warm intimate feelings. You want to love and be loved by the other sex. It's life, and it's normal, but you must use self discipline and control over these drives." It is tragic for America to spend billions for education and neglect a subject with such crucial importance for all of life.

Zoology Section

PHYSICS-MATHEMATICS BLDG., ROOM 205

ROBERT E. MARTIN, CHAIRMAN

New Distribution Records for Aquatic Neuropterans, Sisyridae (Spongilla-flies), in the Tennessee River Drainage Area. Billy G. Isom, Tennessee Valley Authority, Chattanooga. Occurence of Sisyridae in the Tennessee River drainage is rare. Examination of literature relative to the aquatic fauna of the area did not reveal a single record for this family. Examination of hundreds of stations throughout the valley over the past 10 years had not revealed a single specimen of this family until 1966. In the course of a study in Elk River, Tennessee, a single, early instar, Sisyridae was found. The specimen was recognized as belonging to the Sisyridae but was too young to determine the genus. In October, 1967, a sample from Tennessee River Mile 296.6, Wheeler Reservoir, Alabama, revealed 6 specimens of *Climacia areolaris* (Hagen) larvae. The largest specimen was 4mm in length. Specimens were found on colonies of Spongilla *sp.* Apparently this family is rare in the Tennessee Valley and not just overlooked due to its secretive habitat and diminutive size.

Fish Habitat and Population Changes Resulting from Impoundment of Clinch River By Melton Hill Dam. Richard B. Fitz, Tennessee Valley Authority. Following impoundment in 1963 several changes in the reservoir fish population were found: percentage of game fish increased in both number and weight; largemouth bass and walleye, absent in preimpoundment samples, appeared in postimpoundment samples, mooneye, the most numerous species in preimpoundment samples, disappeared; growth rate of all speciees except three commercial varieties increased. Surface water temperatures rose slightly; however, they remained cooler than other TVA mainstream reservoirs. Physical features and low basic productivity will limit game fish production. Sport fishing success is expected to be less than that of other mainstream reservoirs.

A Flightless Period in the Life Cycle of the Florida Duck. Terry W. Johnson, Tennessee Technological University. Between August 1, 1967 and September 1, 1967, a total of twenty-seven adult Florida ducks *(Anas fulvigula fulvigula)* were captured at the Merritt Island National Wildlife Refuge, Titusville, Florida. Thirteen of these birds were found in varying stages of a post-nuptial molt which had rendered them flightless. Evidence seemed to indicate that the primary wing feathers were lost first, followed by the secondaries and tertials. The tertial feathers were not molted entirely until after the new primary and secondary feathers began to appear. The molting succession of the axillars and coverts was not determined. All flightless birds were captured at night using a shallow draft air-thrust boat equipped with a portable lighting system. When approached, the birds sought refuge in dense mangrove *(Rhizophora mangle)* or saltgrass *(Distichlis spicata).* In most instances the ducks were found alone. However in one instance, four Florida ducks were encountered,

two of which were captured. These two birds proved to be adult flightless males. The molting ducks were all found in shallow mosquito control impoundments averaging six to twelve inches in depth. Water salinities varied from 7,910.4 ppm — 14,184.0 ppm. The principal emergent vegetation found in these impoundments consisted of saltgrass, with lesser amounts of mangrove, needlerush *(Juncus roemerianus)*, pigweed *(Acnida cuspida)*, and cordgrass *(Spartina backeri)*.

Some Effects of Artificial Sweeteners on Chick and Rat Development. Johnnie M. Rutland and John M. Mallette, Tennessee A. & I. University. This study was undertaken to determine what effects artificial sweeteners have on the development of chick embryos and growing rats. Ten newborn rats from the same litter and 36 dozen of fertilized Rhode Island Red eggs were used in this experiment. The data disclosed such aberrations as severe hemorrhage, stomach tumors, bilateral feather growth, cessation of development, enlarged mesencephalonic growth and lethalness. With increased percentages of calcium or sodium cyclamate, there was an increase in hemorrhaging and abnormality. When compared with the control, the rate injected with the artificial sweeteners exhibited a decreased growth rate as reported by Dr. Neese (1964).

Some Effects of Oral Contraceptives on the Morphology of Isolated Mice Mitochondria. Marian L. Hassell and John M. Mallette, Tennessee A. & I. University. Experiments were conducted with oral contraceptives to observe possible effects of oral contraceptives on isolated mice mitochondria. CF1 Albino mice were used for the experiment. They were fed regularly with tap water and Rat Chow food. The mice were injected subcutaneously for twenty-eight days with one per cent solution according to weight. They were anesthesized with petroleum ether. The liver was removed and stained by Altman's method. An overall autopsy showed signs of uterus irritation in 35 per cent, 4 per cent exemplified blindness in the left eye, 85 per cent had a minimum 5 gram weight increase. The control did not show any of these signs. Approximately 10 per cent of the slides can be expected to show some morphological changes in mitochondria.

Preliminary Studies on Antibody Produced Against Hapten Antigen. Bernard E. Harrell and John M. Mallette, Tennessee A. & I. University. Immunization of mice and rabbits with various preparations of hapten antigens have produced diverse results related to the capacity of experimental animals to synthesize specific immune bodies against these antigens. In mice specific immune responsiveness was detected against DNP-BGG and unresponsiveness was detected against sulfanilic acid and arsanilic acid on days 6-7 of the primary immune response. Specific immune rabbit sera gave positive ring precipitation tests for PABA and sulfanilamide on the fourth day after a third weekly injection.

Some Effects of Alcohol and Nicotine on Pregnant Mice. Martin V. Sherrill and John M. Mallette, Tennessee A. & I. University. The purpose of the present study was to determine some macroscopic as well as microscopic effects of alcohol and nicotine on developing mice. Thirty-six pregnant mice were used in the experiments. The injections of alcohol and nicotine were based on .001 of 1cc per 100 gram body weight. Control animals were either sham injected or uninjected. A variety of pathological changes exhibited in the experimental animals included the following; cirrhosis of the liver, gastric enlargement, excessive hemorrhage in the cephalic region of the body, and a large percentage of stillborns. None of these abnormalitiees have been shown in the control animals.

Notes on the Availability of Eggs of the Ambystoma Species of Salamanders in Tennessee. Glenn Gentry. There are five species of the Ambystoma salamanders native to Tennessee: *Ambystoma opacum, tigrinum, maculatum, taxanum,* and *talpoideum.* All except A. *opacum* lay their eggs in the winter months. Data on egg-laying by all species are included. I have been supplying these eggs to research laboratories for some 26 years, and in developing a dependable source of supply, it necessitated considerable study of the effects of climate, altitude and environment. It was found that about two days of temperatures above 50° F. plus ¼" or more of rainfall were necessary to stimulate egg-laying. Also, that the span of egg-laying was 2½ to 3 months for *A. maculatum,* and 2½ months for *A. tigrinum* at lower elevations, whereas the season is usually about two weeks in the mountainous areas and most other sections of the country. A discussion of these factors, illustrated with slides, attempts to explain the longer season in Tennessee.

Longevity of Hymenolepis microstoma in the Laboratory Mouse. B. D. Tan, University of Tennessee. One hundred male HA/ICR mice approximately 2 months old were infected *per os* with *H. microstoma* cysticercoids (10 c/m). After intervals varying from 15 days to 15 months after infection, groups of 5 to 17 mice were selected at random and autopsies were performed. The results indicate a tendency of the number of worms to decrease gradually with time, a sudden drop occurring at the end of 15 monthhs. During the first year after infection the recovery rates decreased from 98 per cent to 61 per cent. At the end of 15 months, however, the recovery rate was only 20 per cent. Morphologically the worms appear normal from age group to age group. Their average sizes fluctuate between 250 and 300 mm, a normal phenomenon due to periodic apolysis and growth of the worms. It appears that some factor ("ageing"? host response?) is increasingly effective in removing worms from the host. (Supported in part by the U. S./A. E. C. Contract No. 40-1-1749).

Preliminary Studies on the Ecology of Hymenolepis microstoma (Dujardin, 1845). R. G. Litchford, University of Chattanooga[1]. Preliminary investigations on the free amino acid pool of *Hymenolepis microstoma* have been made. The observed amino acids have been studied as effected by parasite age, host age, and host diet.

[1]This work was supported by PHS grant 2E-106 and E-1384 under the direction of C. P. Read, Rice University.

Collegiate Division

SATURDAY MORNING, NOV. 18

BARTOO HALL, ROOM 306 AND NEW SCIENCE BLDG., ROOM 233

RICHARD RARIDON, ROBERT MARTIN, AND ROBERT ZIEGLER, CHAIRMEN

A Population Study of Some Ciliates in a Temporary Stock Pond. Max O. Ley, Jr., University of Chattanooga. Population studies were conducted on some of the Ciliata inhabiting a temporary stock pond. The parameters of ph, water temperatures, turbidity, and pond depth were selected for this series of studies. Large fluctuations in the numbers and relative proportions of each species were observed as affected by these parameters. The fluctuations were most evident from samples obtained close to the shore, near the bottom, and in association with the algal colonies. The relationships of these populations within this biotic community are discussed.

A Breeding Census of the Pileated Woodpecker: A Preliminary Report. William T. Lawhon, Memphis State University. Studies were conducted from December 19, 1966, through May 30, 1967 in Shelby Forest State Park, Shelby County, Tennessee, to determine the breeding status of the Pileated Woodpecker *(Dryocopus Pileatus* L.). The study was directed by Mr. Robert W. McGowan, Associate Professor of Biology at Memphis State University.

Two distinct habitats are found in Shelby Forest State Park: The bluff area, a mixed oak-hickory, beech-maple climax forest and the Alluvium, composed of black gum, sycamore, elm, hackberry and bald cypress. As the study is not complete, the bluff area is the only area of discussion.

Observations were made every week in designated areas and emphasis was placed upon finding nest trees and concentrations of birds. Notes were taken as to the diameter of the trees, height of nest holes, direction of nest holes and type of tree. Seven stations within the designated areas were chosen, because of evidence of new digging and sight records, for return visits. Of the 12,500 acres in the Park, 11,110 acres are designated for study. Of the 11,110 acres, 5,110 acres have been covered and the remaining area will be worked in the Fall and Spring of 1967-68. The results of this study will provide information for further studies in this area.

The Effect of Relaxation Upon Retention. Charles W. Hogan, Richard C. Lord, Charlotte Shelton, and Norma Derrick, Tennessee Wesleyan College. The purpose of this experiment was to investigate the effect of relaxation on retention. Following the evidence of Wolfe (1949) and Sears (1955), we sought to verify the hypothesis that Ss could retain more when they were in a state of induced relaxation than when in a normal, awake state. A group of twenty Ss were chosen from the male general psychology students. Ten Ss were chosen at random to be the experimental group. They were then placed, one at a time, in a state of induced relaxation using the technique of Wolfe and Lazarus (1966). Ss were read, twice, a problem in learning efficiency developed by Graumann (1960) which contained twenty-two points to be remembered. The control group was simply asked to relax and the problem was read to them twice as with the experimental group. When the learning effienciency scores were compared, the experimental group showed a significantly higher over-all score than the control group. Thus, our hypothesis that retention could be improved by induced relaxation was supported.

The Non-Violent Civil Rights Movement: A Study in Collective Behavior. Lyle Yorks, Tusculum College. The civil rights movement in America offers sociologists a unique opportunity to study the processes of collective behavior. If sociology is still a neophyte amongst the science, the specific area of collective behavior is but a fetus. Traditionally, sociology has dealt with organized society, or has at least attempted to place society within a systematic framework. Yet, within this neat and useful framework there is a glaring difficulty. Many times throughout the history of man, elements of society have risen and established, or have attempted to establish, sudden changes in the basic values on which that society exists. At other times the structural organization of groups has momentarily broken down, resulting in the development of mobs and, sometimes, riots. It is evident that some accomodation of such phenonema must be made within the discipline. The study of collective behavior is committed to this difficult task. Useful theory is at a minimum and textbooks in the area have been written for the professed purpose of "providing a baseline from which better maps of the field of collective behavior may be developed."

The purpose of this paper is to go one step beyond the usual presentation of events and their results. Rather, the movement will be segmented and the contribution of each isolated segment will be analyzed separately.

This paper is a case study of a city affected by the movement: Nashville, Tennessee. The research was conducted over a ten week period at Vanderbilt University with the aid of a National Science Foundation Grant. The work is being extended to another southern city this winter. It is hoped that the resulting paradigm will be functional as a guide to further study of the movement over a long period of time; the result of which could be generalized into a general theory of collective behavior.

Color and Directional Cues in Rat Maze Learning. Walter Dobson and Wayne Penniman, Tennessee Wesleyan College. The purpose of this study was to discover if color or direction is dominate in rat maze learning. Saltzman (1940) using a U-maze found that directional descriminations were learned by rats. The purpose of this study was to determine what dominate cue would be selected in a double Y-maze learning

situation when these cues, color and direction, were conflicting. It was hypothesized that if a rat was faced with confllicting cues he would select the cue which led him to the food cup. Subjects were three female rats trained twice daily. Each training session consisted of ten runs. This was continued until they hit two consecutive sessions of eight out of ten correct runs or better. When criterion was reached directional cues were reversed so that left-right responses were reinforced whereas previously right-left responses were reinforced. Color cue remained the same (i. e. red always led the rat to the food cup). All the rats were cautious at first but within four training periods they responded to reinforcement. The reversal situation was tested and the results were substantiated from calculations based on the Chi Square. We have concluded that a prediction can be made regarding the forces which will iniate a rat's response in a trial learning and response experience. This force was found to be visual rather then directional. A Chi Square test, significant at the .01 level, revealed that the color cue was dominant over the directional cue. Therefore, the hypothesis that in the face of conflicting cues rats in a double Y-maze would select the cue that led them to the food cup.

Angular Source Size Determination of Jovian Emission Areas[1]. G. W. Christoph, Austin Peay State University. Long-baseline interferometric studies were made on Jupiter radio emission at the University of Florida Radio Astronomical Observatory in the summer of 1967. Analysis and study have been initiated on data from the type of emission known as spitting bursts. The upper limit has been definitely set at fifteen seconds of arc or about 10% of the size of Jupiter; however, more work needs to be completed including expansion of the baseline. Possible causes of a millisecond delay in the reception of the signal at the southern end of the interferometer are discussed. Statistical information concerning size and separation of spitting bursts as well as computer studies to calculate correlation coefficient of the two signals are included.

[1]Sponsored by the U. S. Office of Naval Research, the U. S. Army Research Office (Durham), the National Science Foundation and the Department of Physics and Astronomy at the University of Florida.

Studies on the Cycloaddition of Diazocompounds to Styrenes. Thomas Colturi[1], Christian Brothers College. Overberger and Anselme have obtained 1-pyrazolines from the 1, 3-cycloaddition of phenyldiazomethane to styrenes. While the reaction of phenlydiazomethane with styrene and p-chlorophenyldiazomethane with p-chlorostyrene yielded trans-3, 5-diaryl-1-pyrazolines, the action of p-methoxyphenyldiazomethane with p-methoxy-styrene gave roughly equivalent amounts of the *cis*-and *trans*-3,5-bis-(p-methoxy-phenyl)-1-pyrazoline.

The currently accepted mechanism for 1, 3-cycloaddition reactions is one that calls for a concerted one step addition. However, the mechanism postulated by these authors for the formation of equivalent amounts of cis-and trans-pyrazolines involves a two step cycloaddition reaction.

[1]Petroleum Research Scholar (PRF 1525-B5) and NSF Undergraduate Research Participant (GU 2935) Summer, 1967.

One criterion for a concerted process is based on little or no rate enhancement with rising polarity of the solvent. Kinetic investigations in our laboratories on the addition of diazomethane to aromatic Schiff bases have revealed that the reaction follows essentially a one step concerted process. Thus, a kinetic investigation of the addition of diazocompounds to styrenes could provide valuable information relevant to their addition mechanism.

Data on the kinetic studies are presented and the results discussed to postulate a suitable mechanism.

Some Effects of Cobalt-60 Gamma Radiation on Transistor Gain. James D. Shavlever, Tennessee Technological University. The effects of gamma radiation, as a simulation of space radiations, on silicon transistors has been investigated. Experimental data on the rate and nature of transistor gain degradation has been obtained. Investigations into the effect of operating current on gain degradation and the influence of thermal annealing on radiation induced damage has been made.

The results of this study indicate that proper selection of transistors and operating conditions can be used to minimize the deterimental effects of radiation environments on transistors for space applications. Experimental evidence suggests that proper applications of radiation exposure and thermal annealing can be used to improve the electrical characteristics of transistors.

A Study of the Equilibrum Between Tris (N,N,N',N'-Tetramethylmalonamide) Cobalt (II) Perchlorate and Tetrakis (N,N,N',N' - Tetramethylmalonamide) Cobalt (II) Perchlorate. Bruce A. Fisher, Lincoln Memorial University. When tris (N,N,N',N'-tetramethylmalonamide) cobalt (II) perchlorate is dissolved in pure N,N,N',N'-tetramethylmalonamide, the solution changes from the pink color of the original compound to a greenish-blue, indicating that a reaction has taken place involving a change in the structure of the cobalt compound. An hypothesis was formulated that the structure had changed from the octahedral to the tetrahedral form. An attempt was made by studying the spectra of the compounds to study the equilibrium involved in this change. A definite answer has not yet been found, but two possible structures have been discussed in the paper.

Aquatic Algae from Shelby County. Marguerite Wagner, Antoinette Smith and Therese Mangold, Siena College. Several samples of water from selected stations on the Wolf River, Nonconnah Creek, McKeller Lake and the Mississippi River were collected and counted to reveal the kinds and numbers of aquatic algae present. The diatoms were the most abundant; seven genera of diatoms, Bacillariophyceae, and one of

Xanthophyceae were identified. Three genera of Cyanophyceae, twenty of Chlorophyceae, two of Euglenales were identified. Many of these have been isolated into unialgal cultures for further study.

Who Pays for the College Marriage? Julialynn Greene, John Horesco, and Jim Moshev, Tennessee Wesleyan College. This study was conducted to compare the effects of the financial burdens of college couples at Tennessee Wesleyan College in Athens, Tennessee, with national surveys and studies. The hypothesis was that all couples at Tennessee Wesleyan College do receive parental aid for educational purposes. The main concern was: if parents pay for the college marriage, what effects will this have upon the marriage?

The students in the case study were divided into three groups: I-wife as the student, II-husband as the student, III-couple as the students. The subsidy was prevalent in cases I and III. However, case II conflicted with the hypothesis, for a newlywed was the only member in this group receiving aid. Although valid only in these selected cases, this study has lead to several proposals and ideas for further research in this same area.

The Absorption of Eastern Immigrants in Israel. Charles R. Schiffman, Southwestern at Memphis. The population of Israel may be roughly divided into two segments. The older group is predominantly Western both in cultural orientation and technology. To this group has recently been added a large number of immigrants from the Muslim Near East. These immigrants possess an Eastern culture and are technologically backward. If Israel is to remain one nation, the two cultures will have to be brought together. Many problems are inherent in this situation. Some of the problems are physical, such as housing, language, and employment. Other problems are psychological, brought on by the abrupt cultural and social changes in the lives of the Easterners. One particular problem is the high incidence of juvenile delinquency among the Easterners. This is caused by the dissolution of traditional authority due to unemployed fathers, working mothers, and the loss of strong religious values. The Easterners can be successfully brought in to the mainstream of modern life if social planners will remember that their goal should be cultural fusion rather than cultural replacement. By building on the basic culture with imagination and creativity, a structure can be erected that will incorporate the best of both worlds, and be acceptable to all segments of the population. Principles and methods involved in this process can be made applicable to most cases of planned cultural change.

Rate Studies on the Cycloaddition of Diazocompounds to Styrenes. Thomas Colturi, Christian Brothers College. Studies in our laboratories on solvation effects in the 1,3-cycloaddition reaction of diazomethane to Schiff bases (Anils) have revealed that these effects are of general significance in all cycloaddition reactions. The rate increases obtained in the presence of protic and dipolar aprotic solvents could be employed to advantage for the synthesis in high yields of 5-membered heterocycles through 1,3-cycloaddition reactions. This suggested a convenient method for the synthesis of aryl substituted pyrazolines by the addition of diazomethane to styrenes and stilbenes. However, Overberger et al. have recently observed that the addition of p-methoxyphenyldiazomethane to p-methoxystyrene gives rise to a mixture of cis-and trans-isomeric pyrazolines. The reaction involves participation of a structure of p-methoxystyrene with a highly nucleaphilic carbon-carbon double bond as a result of mesomeric effects. In view of this, the addition of diazomethane to substituted styrenes could be expected to be α- or β- oriented, and lead to 3- or 4-substituted pyrazolines. A kinetic investigation has been carried out to determine the direction of addition of diazomethane to styrenes. Second order rate constants indicate that while β-addition is the general rule, in the case of p-methoxystyrene, α-addition takes place. The abnormal α-addition could be used to advantage in the synthesis of the rarely available 4-substituted pyrazolines.

Molecular Orbital Calculations by SCF Method. Peter Pierini and George Copeland, Christian Brothers College. A discussion of the semi-empirical self-consistent field theory method of solving molecular orbitals in terms of linear combination of atomic orbitals will show its advantages over previous Huckwell methods. The major assumptions such as the zero differential overlap and neglect of the penetration integrals and the deviations from pure quantum mechanics by substitutions of empirical data such as ionization potentials, electron effinities and inter-atomic radii give an insight into the methods operation. The actual results of calculations of the method on carbonyl compounds are compared to spectral data and shown to be in rather good agreement. The adaptability of the self consistent field theory to computer calculations and the length of running time compared to other methods of molecular orbital determination will be given. Finally, a fairly comprehensive evaluation of the method and improvements such as the incorporation of Mullikan integrals to compensate for the zero differential overlap approximation and the use of Lowdin orbitals show how the method can be extended from its present form. A detailed representation of the theory and application of the method including digital computer program in Fortran IV will be offered in a test of the method at a later date.