

## ABSTRACTS OF PAPERS PRESENTED AT THE ANNUAL MEETING

GENERAL SESSION  
FRIDAY, NOV. 22, 10:30 AM  
University Center Ballroom

*AEC Special Fellowship Program*, Granvil C. Kyker, Oak Ridge Associated Universities.

*The Isolation, Identification and Systematic Significance of Isoflavonoid Compounds in the Genus Baptisa*. William H. Wilson, White Station High School, Memphis.

*Resource Management and Research Opportunities in Land Between The Lakes*. Raymond W. Nall, Biologist, Land Between The Lakes.

*Some Foliose and Fruticose Lichens in Land Between The Lakes*. Haskell C. Phillips, Austin Peay State University.

*Pharmacological Control of the Mind*. Emmett S. Manley, The University of Tennessee Medical Units.

### SECTION MEETINGS

FRIDAY, NOVEMBER 22, 2:00 PM

#### BOTANY SECTION

CLAXTON EDUCATION BUILDING, ROOM 103  
PHILLIP WATKINS, CHAIRMAN

*A Preliminary Report on the Aquatic Algae from Selected Sites in Shelby County*. Sister Adrian Marie Hofstetter, O.P. and Therese Mangold, Siena College. Samples taken from twelve stations on the Mississippi River and its tributaries in Shelby County were assayed for the number and kinds of phytoplankton present by the Sedgwick-Rafter counting cell technique, by culturing and by special frustule preparation of the diatoms. Eleven genera of Myxophyceae, seven genera of Euglenophyceae, fifty-eight genera of Chlorophyceae, one genus of Xanthophyceae, and two genera of Dinophyceae were identified with certainty. The genera of Bacillariophyceae will be described in another report. (This investigation is supported under the Department of the Interior Grant OWRR B004-TENN and a National Science Foundation Undergraduate Research Participation Grant, GY4336, to Christian Brothers College.)

*Dimorphism in Cladosporium werneckii*. M. R. Houston, K. H. Meyer, Nancye Thomas and F. T. Wolf, Department of General Biology, Vanderbilt University. *Cladosporium werneckii*, the cause of *tinea nigra palmaris*, is a dimorphic organism, which may grow either as a mold or as a yeast. The organism has been grown on a variety of media and under a variety of conditions, and the mold- or yeast-like character of the resulting growth was determined. Nutritional factors, particularly

cysteine, are of great importance in determining yeast-phase growth, and temperature is of minor importance. *C. werneckii* is a microaerophilic organism, and can be grown in an atmosphere of nitrogen or carbon dioxide. When grown in an atmosphere of carbon dioxide, it has the morphology of a yeast; under nitrogen or oxygen it grows as a mold.

*Trends in an Old-Growth Forest Remnant in Unglaciated Southwest Illinois*. G. T. Weaver and W. C. Ashby, The University of Tennessee and Southern Illinois University. Thirty-eight arboreal taxa 2.6" dbh and over occurred in the stand in 1967. Hickories (*C. ovata*, *C. glabra* and *C. ovalis*), dominating 12.6"-20.0" dbh class and oaks (*Q. velutina*, *Q. rubra*, and *Q. alba*), dominating 20.1"-48.5" dbh class, were the major canopy species. *Acer saccharum*, dominating all diameter classes between 0.5" and 12.5", formed a dense understory throughout the stand. Mortality rates were low for *A. saccharum* and *C. ovata* and high for *Q. rubra*, *Sassafras albidum*, and *Ulmus rubra*. Of the several taxa represented in the small reproduction class, only *A. saccharum* was growing into larger classes. Oak regeneration was poorly represented and *Liriodendron tulipifera* regeneration was absent.

Between 1956-1967, no compositional changes occurred in the canopy (trees 12.6" dbh and over). Density increased from 39 to 46 stems/acre and basal area increased from 87 to 103 ft<sup>2</sup>/acre. Density changes within diameter classes suggested recovery from disturbance. *C. glabra*, *C. ovalis*, *Q. velutina*, and *Q. rubra* decreased in importance. *A. saccharum*, *C. ovata* and *Ulmus* spp. increased in importance.

The rapid ingrowth of *A. saccharum* apparently began about the year 1900 and will continue in the future. Continued decline of oaks and hickories is indicated. The ingrowth of *A. saccharum* could indicate release from fire, or result from short term or long term climatic shift. Better evidence for the latter cause is available.

*Variations in Secondary Plant Succession*. H. R. DeSelm and David W. Smith, The University of Tennessee. During the summer of 1967 a study was made of 30 fields ranging in age since abandonment of 1-70 years. They occurred on rolling Great Valley topography on at least 11 geologic mapping units and 7 soil series. The vegetation passed through forb, grass, vine, and thicket stages and by 60-70 years was pine-hardwood or hardwood dominated in ratio of about four to one among the oldest plots.

*Soil Algae from Fall Creek Falls State Park, Bledsoe and Van Buren Counties, Tennessee*. Martha Frances Langford, Middle Tennessee State University. This investigation represents an exploratory study of the soil algal flora of Fall Creek Falls State Park, Bledsoe and

Van Buren Counties, Tennessee. From 86 unialgal isolates, 10 new chlorophycean species, including one new genus, were isolated into axenic culture and were compared with similar previously described forms whenever the latter were available in culture. The physiological and cultural attributes were studied in this study so that the information would be available for comparison with the data obtained in previous studies of this type. The judgments exercised as to the delimitation of the new taxa described herein were based primarily on morphological criteria. The newly described taxa are *Heterochlamydomonas lobata* sp. nov., *Heterochlamydomonas rugosa* sp. nov., *Radiosphaera tennesseensis* sp. nov., *Spongiochloris striata* sp. nov., *Radiosphaeropsis* gen. nov., *Radiosphaeropsis lobata* sp. nov., *Radiosphaeropsis tennesseensis* sp. nov., *Radiosphaeropsis vegetata* sp. nov., *Spongiosphaera dilatata* sp. nov., *Spongiosphaera macropyrenoidosa* sp. nov. and *Spongiosphaera tennesseensis* sp. nov.

*Forest Communities in the Ridge and Valley Province of East Tennessee—A preliminary report*. W. H. Martin, The University of Tennessee. Forty-five stands of relatively undisturbed forests have been located in six counties of the Great Valley of eastern Tennessee in an attempt to relate stable forest communities and individual tree taxa with geologic formations and soil properties. The underlying rock strata in the area are limestone, shale, and sandstone. The residual soils developing from this parent material are the substrates of 95% of the study areas; over 40% of the stands are associated with soils developed from dolomitic limestone, which is the prevailing bedrock. The composition of these forests and their relation to soils and geologic formations will be discussed.

*Recent Changes in the Distribution of the Kentucky Coffee Tree, Gymnocladus dioica*. P. L. Hollister, Cumberland College. The writer met this species, officially, along a small flood plain near Carlinville, Illinois. In Wilson County, Tennessee, it was found by accident along a mid-slope of a hill locally called Old Egypt some six miles south of Lebanon, the county seat. Later, it was found, essentially in pure stand, about three-fourths of the way up the south-eastern side of Jennings Knob, a hill some six miles south-east of Lebanon, this in 1940. A visit to the same spot in July, 1968, revealed this species has extended itself completely around the summit of this pyramid-shaped peak.

*Chromatographic Comparison of Three Species of Vernonia: Compositae*. G. E. Hunter and B. K. Burch, Tennessee Technological University. The flavonoid compounds from leaves of three North American species of *Vernonia* compared chromatographically and spectrophotometrically are strikingly different from each other. Methanolic extracts from leaves of *Vernonia lettermanii* yielded the fewest flavonoid compounds. Six compounds consisting of flavonol di- and tri-glycosides and their aglycones in addition to a minute trace of a flavone aglycone were isolated. Leaves of *V. altissima* yielded ten detectable flavonoids including flavonol di- and tri-glycosides and their aglycones, all similar to those of the former species. Three flavone aglycones were also

present in easily detectable amounts. A strikingly different complex of ten flavonoids were found in leaves of *V. marginata*. No flavonols were detected and the glycosylation level was lower, with principally mono-glycosides and aglycones of flavones present. One compound interpreted as a glycoflavone, a flavonoid group not found in the other two species, represents another marked biochemical distinction for *V. marginata*.

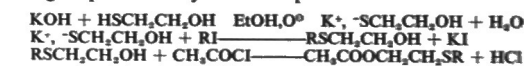
*A Flavonoid Study of Pycnanthemum: Labiatae*. R. Keith Carr, Tennessee Technological University. Morphological data alone are insufficient to classify species of *Pycnanthemum* because of intraspecific polymorphism and interspecific hybridization. Flavonoid compounds from methanolic leaf extracts have been analyzed by two-dimensional paper chromatography for many of the species. Each shows a distinct flavonoid pattern. This information can be used to supplement morphological data for classifying *Pycnanthemum* or for determining the parental species of interspecific hybrids.

#### CHEMISTRY SECTION I

McCord Science Building, Room 101

ROBERT T. SWINDELL, CHAIRMAN

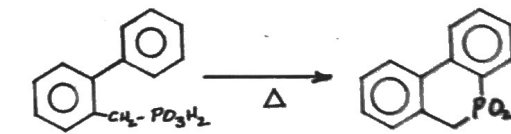
*Preparation of 2-alkylthioethyl acetates and their enzyme inhibitory activity*. D. P. Claypool, J. G. Beasley and R. C. Lewis, Memphis State University and University of Tennessee, Medical Units. The 2-alkylthioethyl acetates were prepared in the course of a synthetic program to prepare sulfur analogues of acetyl choline for testing of their enzyme inhibition. These precursors of the desired compounds were prepared by the following sequence of synthetic steps:



Where R=methyl through decyl

When these compounds were tested in  $1 \times 10^{-5} \text{M}$  solution in a weakly (HCl) acidic isolated horse serum acetyl choline system by the method of Beasley *et al.* enzyme inhibition was observed. The results of these tests and further studies will be reported in the literature at an early date.

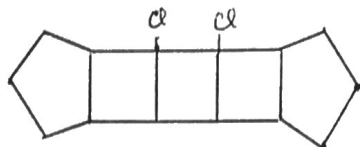
*The Preparation of Organophosphorus Heterocyclics by Thermal Cyclization*. Charles N. Robinson and William A. Pettit, Memphis State University. In 1962, E. R. Lynch reported the cyclization of *o*-phenylbenzylphosphonic acid to 9-hydroxy-9,10-dihydro-9-phosphaphenanthrene-9-oxide.



This preparation has been repeated and extended in an attempt to prepare the ylid. The thermal cyclization reaction has also been used to prepare a number of other new hetero systems.

**The Hydrolysis of  $\alpha$ -nitrobenzhydryl chloride.** Dennis G. Norten and Carl D. Slater, North Dakota State University and Memphis State University. The rates of neutral and alkaline hydrolysis of  $\alpha$ -nitrobenzhydryl chloride have been established at 30.0°, 49.6°, and 60.0°, and activation parameters for the process have been calculated. The mechanism of this reaction can be discussed in reference to these parameters and to related observations.

**Photolysis of 7,7-Dichlorobicyclo [4.1.0.] Heptane.** R. T. Swindell, T. Chao and T. Chou, Tennessee Technological University. Irradiation of an ether solution of 7,7-dichlorobicyclo [4.1.0.] heptane for ten hours produced four photoproducts. The major photoproduct was isolated by gas chromatography and was shown to have an empirical formula of  $C_7H_8Cl_2$ . This compound is saturated and may well be a dimer of the following type:



This and other possible structures for the product will be discussed.

**Photolysis of Ethylene Glycol Sensitized by Iron Ions.** N. L. Ford and C. L. Lu, Tennessee Technological University. The photolysis of pure ethylene glycol and ethylene glycol in the presence of ferric ions under a variety of experimental conditions was investigated. In the photolysis of pure ethylene glycol, the main photolysis products are acetaldehyde, formaldehyde, and methanol. However, in the case of the photolysis of ethylene glycol in the presence of ferric chloride or ferric sulfate, the main photolysis products are acetaldehyde, formaldehyde, and ferrous ions. With the addition of sodium chloride the photoreaction yields increase. The detection techniques used include spectrophotometric methods and gas chromatography.

**Isolation and Purification of Lipase from *Galleria Mellonella*.** L. C. Byrd and William Spell, Memphis State University. In 1950, Edith Mankiewicz was able to isolate a lipase from an extract of the wax moth. In attempting to purify this enzyme a colorimetric method has been developed for the measurement of enzyme activity. Through the use of an acetone powder made from the larva and extractions of this powder, a twelve-fold increase in enzyme activity has been realized. These and other experiments relating to the purification of this enzyme will be discussed.

**A Study of Basic Proteins in *Escherichia Coli*.** Marguerite B. Cooper and William H. Spell, Memphis State University. There are conflicting reports concerning the presence of histones in unicellular organisms; therefore, a detailed study of the basic proteins of *E. coli* was attempted. Various methods of cell rupture and deoxyribonucleoprotein extraction were used. Concentrations of sodium chloride ranging from 1M to 2M were used for

the extraction of DNAP. The control of degradative enzymes was effected by use of low temperature, pH 8.0, varying concentrations of EDTA, or sodium citrate. Isolation of DNAP was attempted by lowering of salt concentration and by the addition of magnesium chloride. Protein was extracted from DNAP with 0.25 N HCl, precipitated with EtOH, dissolved in  $H_2O$ , and lyophilized. Disc electrophoresis on polyacrylamide gel was performed on each protein and the pattern compared with that of calf thymus histone.

**The Preparation of Some Possible Metabolic and Degradation Products of Endrin.** Thomas M. Brooks, H. G. Albritten, F. B. Schirmer, Jr., Memphis State University. Considerable research has been done on the toxicity and persistency of chlorinated pesticides of the diene group such as chlordane, heptachlor, aldrin, dieldrin, endrin, and telodrin. However, very little is known about the fate of that portion of these pesticides which is not recoverable as a residue from soils, plants, or water run-off. It is important to know whether the pesticide becomes fixed in the soil or is degraded or metabolized to products that elude identification for lack of knowledge of their chemical identity. Endrin, 1, 2, 3, 4, 10, 10-hexachloro-6, 7-epoxy-1, 4, 4a, 5, 6, 7, 8, 8a-octahydro-1, 4:5, 8-endo, endo-bismethanonaphthalene, formed by the oxidation of the compound, isodrin, is commonly used for the control of pests on cotton. This paper deals with the preparation of four likely degradation or metabolic products of this important pesticide. These include two rearrangement products of endrin and one rearrangement product and one hydrolysis product of isodrin. Mention will also be made of attempts to prepare two other compounds.

**The Preparation of Some Possible Degradation and Metabolic Products of Endrin.** Robert S. Straw, H. G. Albritten, F. B. Schirmer, Jr., Memphis State University. Chlorinated pesticides of the diene group such as chlordane, heptachlor, aldrin, dieldrin, endrin and telodrin are widely used in the control of insects. However, little is known about their degradation or metabolic products which result after their application to soils or crops. This paper deals with the preparation and properties of four possible degradation or metabolic products of endrin, 1, 2, 3, 4, 10, 10-hexachloro-6, 7-epoxy-1, 4, 4a, 5, 6, 7, 8, 8a-octahydro-1, 4:5, 8-endo, endo-bismethanonaphthalene, the epoxide of the related compound, isodrin. One of these, the cis-6, 7-diol of isodrin, is a precursor of a number of other potential metabolites. Therefore, it was necessary to determine the best method and optimum conditions for its preparation. Two other potential metabolites, the 6, 7-dialdehyde of isodrin and 6, 7-dihydro isodrin, were prepared. A derivative of the cis diol, its trimethylsilyl ether was also prepared.

#### CHEMISTRY SECTION II

McCord Science Building, Room 102

ROBERT T. SWINDELL, CHAIRMAN

**Recovery and Refinement of the Electromagnetically Separated Stable Isotopes of Sulfur.** E. W. McDaniel,

A. M. Veach, L. O. Love, and J. O. Younghanse, Oak Ridge National Laboratory. The separation, recovery, and refinement of an electromagnetically enriched isotope of low natural abundance are discussed. A detailed description of the chemical recovery of sulfur-33 from an oil-covered metal plate bombarded with 35-keV sulfur ions is given. In the separation process these energetic ions carbonize the oil, thereby providing an absorbant for the  $^{33}S$  as well as protection from low-energy neutral particles which are either rejected during operation or washed away with  $CS_2$  before the separated isotope is chemically recovered. High-purity (>92%) sulfur-33 is used for making pure  $^{33}P$  which is used in biological experiments.

**Reactions of Titanium (IV) Chloride with Dicarboxylic Acids.** Donald Schwartz and Pat Reski, North Dakota State University (now at Memphis State University and Moorhead State College, respectively). Titanium (IV) chloride reacts with many classes of organic compounds to form complexes. In previous work, complexes including titanium (IV) dichlorodiacetate  $[TiCl_2(O_2CCH_3)_2]$  and titanium (IV) dichlorodipropionate  $[TiCl_2(O_2CC_2H_5)_2]$  have been prepared from titanium (IV) chloride and the respective acids. Coordination of the carbonyl oxygens of the titanium atom was postulated on the basis of infrared data. The present study relates to the reactions of titanium (IV) chloride with oxalic, malonic, succinic, glutonic, and adipic acids. Results obtained from the studies with oxalic and succinic acids indicate a titanium-centered octahedral coordination compound with titanium having a coordination number of six. Although molecular weights could not be obtained, monomeric and polymeric models are proposed. The results obtained from the studies with oxalic and succinic acids are in agreement with previous work involving the reaction of titanium (IV) chloride, with aldehydes, ethers and amides.

**The Synthesis of Trifluorophosphazido Compounds.** Max Lustig, Memphis State University. Trifluorophosphazosulfuryl fluoride,  $PF_3=NSO_2F$ , trifluorophosphazophosphoryl fluoride,  $PF_3=NP(O)F_2$ , and trifluorophosphazothiophosphoryl fluoride,  $PF_3=NP(S)F_2$  are prepared by the reaction between phosphorus dichloride trifluoride,  $PF_2Cl_2$ , and sulfuramidic fluoride,  $FSO_2NH_2$ , phosphoramidic difluoride,  $F_2P(O)NH_2$ , and thiophosphoramidic difluoride,  $F_2P(S)NH_2$ , respectively. Some properties of these new compounds, including  $F_2P(S)NH_2$  have been studied.

**Solvent Effects on the Ultraviolet Absorption Spectra of Phosphonitric Chlorides.** C. C. Thompson, Memphis State University. Positions of the electronic absorption bands of phosphonitric chlorides have been reported in the literature at a variety of wave lengths ranging between 175 and 240  $m\mu$ . In this work, the spectra of  $(PNCl_2)_3$  and  $(PNCl_2)_2$  have been measured at 25° C in cyclohexane, isooctane, heptane, methanol, 2-propanol, carbon tetrachloride, chloroform, and water. In the different solvents each of the compounds shows a single broad absorption band with a maximum below 200  $m\mu$ . Based on the assumption that the absorption curves conform to a Gauss function approximate posi-

tions of the band maxima, maximum absorptivities, band widths and integrated band areas in the different solvents have been computed. In general, these bands undergo only relatively minor variations with changes in solvent.

**Chemical Reactivity of Poly(vinyl chloride): I. Effect of Polymerization Conditions.** L. F. Thompson and V. R. Allen, Tennessee Technological University. Vinyl chloride was polymerized in dilute solution in cyclohexane at -78°, -30°, 0° and +30° C using the initiator system, tri-*n*-butylboron plus molecular oxygen. The degree of syndiotacticity was calculated using the methylene deformation infrared absorption bands and was in agreement with reported values from nuclear magnetic resonance analysis. The polymer prepared at the highest temperature contained carbonyl groups probably derived from oxygen termination of a methylene radical or from chain transfer with solvent. Termination via chain disproportionation prevails at the lower temperatures. The carbonyl catalyzes the low temperature photochemical bromination resulting in ca. first-order dependence on the polymer concentration. The presence of the carbonyl group also appears to initiate dehydrochlorination at 220° C. High temperature radical bromination attacks the chloromethylene hydrogen. Chlorination of the polymer containing terminal carbonyl groups resulted in the formation of phosgene.

**Chemical Reactivity of Poly(vinyl chloride): II. Mechanism of Chlorination.** R. D. Young and V. R. Allen, Tennessee Technological University. Poly(vinyl chloride) was chlorinated via a photo-initiated free radical method in *o*-dichlorobenzene at ambient temperature. The chlorine radical was generated using low-energy green light. The chlorinated adduct was precipitated from solution in methanol-water, filtered and vacuum dried. Analysis of the high resolution infrared spectra of the chlorinated product showed selective attack of the methylene hydrogens. A concomitant decrease in intensity of the isotactic methylene deformation absorption band and of the syndiotactic carbon-chlorine stretching band was found. The changes noted in the infrared spectra of the chlorinated polymer will be related to the conformation and configuration of the poly(vinyl chloride) chain.

**A Dipole Moment Study of Diorganotin  $\beta$ -ketoenolate Compounds.** Charles Z. Moore and W. H. Nelson, Middle Tennessee State University. Diphenyl-, dimethyl-, diethyl- and dibutyltin acetylacetonates, dibenzoylmethanates and hexafluoroacetylacetonates have been synthesized, and their structures have been studied in benzene and cyclohexane solution. Polarization measurements obtained at several temperatures show that the complexes possess orientation dipole moments of 2.0-4.0 debyes. It appears likely that the molecules possess structures of the *cis* octahedral type with most exhibiting some distortion from the regular geometry. The distortion appears to vary regularly with the electronegativities of the organic substituents. I.R., U.V. and N.M.R. Spectra have supplemented the dipole moment data. Group moments of the metal-acetylacetonates, metal-dibenzoylmethanate and metal-hexafluoro-

acetylacetonates have been determined in solutions of non-polar solvents. All group moment values obtained are much smaller than those predicted in the literature.

*Electrode Kinetics of Lead and Copper Pyrophosphate Complexes.* Gibson W. Higgins, Memphis State University.

The reductions of lead and copper pyrophosphate complexes were studied electrochemically at mercury electrodes in an attempt to elucidate the mechanisms of the reactions and to determine whether or not the two mechanisms are the same. The reactions were studied in terms of possible adsorption, electron transfer irreversibility, and a slow preceding chemical reaction step, as well as electrical double layer effects. The electrochemical behavior of each reaction is dependent on the degree of protonation of the ligand in each case. Highly charged copper complexes are only reduced after either ion-pairing, dissociation of a ligand, or both. Highly charged lead complexes tend to be directly reduced via a slow electron transfer reaction between the electrode and the ion-paired complex. Experimental values for the change on the reducible species were found to always be less than the stoichiometric values. Rate constants are reported for the various reactions.

*The Determination of Activity Coefficients of KI in Tetrahydrothiophene<sup>-1</sup>, <sup>-1</sup>-Dioxide from Freezing-point Lowering Data.* Jerry H. Jackson and William Zuber, Memphis State University. Sulfolane is the trade name for tetrahydrothiophene<sup>-2</sup>, <sup>-1</sup>-dioxide. Sulfolane has a very large liquid range, 28° C to 284° C. Sulfolane does not decompose upon heating below 180° C or exposure to a large number of inorganic salts. Sulfolane has a moderately high dielectric constant, 4.33 at 30° C, which should have an insulating effect on ions in solution. From their dielectric constants one would predict that the activities of electrolytes would be less for a given concentration in sulfolane than in water.

The object of this research was to study the activities of the 1-1 electrolyte KI in sulfolane and compare its activity to the same electrolyte in water. The values of the activity coefficients for four even concentrations of KI in sulfolane are listed below.

MKI	$\gamma_{\pm}$
0.00100	0.5310
0.01000	0.1319
0.03000	0.0310
0.05000	0.0112

The procedure for doing this and the results obtained will be discussed.

ENGINEERING SECTION  
McCord Science Building, Room 207  
James Womack, Chairman

*Applications of Cybernetics in Engineering, Biology, and Education.* D. A. DeSalvo, Tennessee College of Automation. Cybernetic concepts are used to construct a mathematical model for evaluating the stability of

electronic nonlinear pulse systems, based on the principles of modeling the dynamics of neural networks. A dynamical model of learning processes is also constructed, and the procedures for simulating those processes are described.

GEOLOGY GEOGRAPHY SECTION  
ZIEGLER BUILDING, ROOM 101  
Robert E. Hershey, Chairman

*Recent Deep Drilling in Tennessee.* Anthony T. Staller and Robert A. Manning, Tennessee Division of Geology. Before 1966, only one well in Tennessee had been drilled to the Precambrian basement. Since that time, 10 deep tests (deeper than 5500 feet) have been drilled, including 4 basement tests. All these wells penetrated upper Cambrian (lower part of Knox Group) or older beds. Geographically, these tracts are widely distributed, from the northern Cumberland Plateau westward across the Nashville Dome and onto the south flank of the Illinois Basin in northwest Tennessee.

A recent tabulation of Knox wells in east-central and west-central Tennessee provided reasonably reliable information on the top Knox datum for about 350 wells. Most of these wells penetrated only the upper few hundred feet of the Knox Group, and only 17 wells tested 1500 feet or more of the Knox interval. A number of the deeper wells encountered hydrocarbon shows and/or staining in the Knox carbonates. Lithologic studies and electrical log data indicate that zones of appreciable porosity and permeability are not uncommon in the Knox and pre-Knox section.

A stratigraphic cross section constructed by using logs of some of the recent deep tests illustrates the marked eastward thinning of the Knox Group from more than 5000 feet in Humphreys County to 3000 feet in Scott County. Additional eastward thinning of the Knox is demonstrated by thicknesses of about 2700 feet in the nearest outcrop sections. This thickness pattern indicates that the Nashville Dome was not active until Middle Ordovician time and substantiates the existence of the Waverly arch as proposed by Woodward (1961) as the controlling tectonic feature in southern Ohio and eastern Kentucky in Cambrian and early Ordovician time. A similar pattern of thinning of the basal unit of the overlying Stones River Group ("Wells Creek Dolomite") also supports this contention.

In general, pre-Knox Cambrian rocks thin north-westward from the outcrop belts of East Tennessee. Although correlation of these units is still tentative, several of the deep tests in Central Tennessee have as much as 1500 feet of pre-Knox sediments, that are probably equivalent in age to the Conasauga Group and the Rome Formation of East Tennessee.

The deep test in Pickett County encountered basement rocks some 800 feet higher than did the basement wells in Giles and Rutherford Counties. Regional geophysical surveys show a pronounced positive gravity anomaly and a magnetic "high" in this same area.

It is evident that rocks of the Knox Group and older

Cambrian sediments have not been adequately explored in Tennessee. At present, the south flank of the Illinois Basin and the Cumberland Plateau area would appear most promising for future exploration. Folds, faults, updip pinch-outs, and lateral facies changes observed in these areas suggest possibilities for both structural and stratigraphic-trap accumulations.

*Mineralogy of Heavy Mineral Sands from Selected Localities in West Tennessee.* J. T. Wilcox and Robert E. Hershey, Vanderbilt University and Tennessee Division of Geology. The total heavy mineral content of eighteen sand samples from seven localities in West Tennessee ranges from 0.4 to 17.2 weight percent. An additional sample of recently reworked sand contains nearly 30 percent heavy minerals. The mineralogy and size distribution characteristics of six samples with more than six percent heavy minerals were examined in detail. The 100/150 mesh (149/105 micron) sieve fraction contains over 50 percent of the entire sample in 4 of the 6 highest grade sands. Most of the heavy mineral content is in the minus 170 mesh (88 micron) fraction. In one sample, removal of the plus 150 and minus 400 mesh fractions yields a concentrate containing 45 percent heavy minerals. The major heavy minerals present, in approximate order of decreasing abundance, are ilmenite, leucoxene, staurolite, kyanite, zircon, rutile, monazite, and tourmaline. X-ray diffraction and polished surface data indicate that variations in the magnetic susceptibility of ilmenite are explained partly by differences in extent of weathering and partly by the presence of exsolved magnetite inclusions.

*Pleistocene Marine Molluscan Faunules from the Little Bahama Bank.* James X. Corgan, Austin Peay State University. Forty-three species of marine molluscan fossils are listed from two inland localities on the Little Bahama Bank. Faunules appear to represent reef-related Late Pleistocene organic associations, though the importance of stratigraphic mixing can not be fully evaluated.

Marine Pleistocene fossils have not previously been reported from the Little Bahama Bank. Known fossil faunas confirm the widely held hypothesis that all parts of the Bahama complex have similar geological histories.

*Preliminary Analysis of the Effects of Regional Metamorphism on the Clay Minerals of the Valley and Ridge and Blue Ridge Provinces of Southeastern Tennessee.* Otto C. Kopp, University of Tennessee. This study began as part of a graduate seminar in regional metamorphism in the Spring of 1968. Its purpose was to determine the effects of metamorphism on the pelitic sediments in both the Valley and Ridge and Blue Ridge Provinces. Earlier, Weaver (1961) had recognized perceptible peak sharpening of the 10A illite peak for clay minerals from the Ouachita structural belt and adjacent foreland, due to recrystallization. Preliminary results suggest that peak sharpening does take place as one crosses the structural front between the Valley and Ridge and Blue Ridge Provinces. Sharpness ratios (following Weaver's terminology, but using a slight modification of his method) in general are below 2 in the

Valley and Ridge and above 2 in the Blue Ridge. Of fifty samples analyzed only six do not fit this pattern, even if no consideration is given to other information. For example, one Valley and Ridge sample with a high sharpness ratio contains an obvious high concentration of detrital muscovite.

*Determining the Agronomic Potential of the Huntington, Lindsie, Armour, Egam Soil Association of Maury County, Tennessee.* R. L. Tabor and F. F. Bell, The University of Tennessee. Agronomic potential of land has historically been overestimated. Usually these estimates have been obtained by simply aggregating similar soils into land classes and multiplying the known acreage of each land class by the economic value of the most suitable crop. This procedure ignores the restrictions imposed upon crop production by the soil pattern and other physical features of the landscape. The factors of slope gradient  $\geq 25\%$ , soil erosion loss, field size, and field shape were analyzed, both individually and collectively, to determine their reduction effect upon estimations calculated in the usual way. The average total reduction in agronomic potential for this soil association was 44%. The average reduction for each of the factors investigated was: (1) slope  $\geq 25\%$  zero (then were no slopes  $\geq 25\%$  in the particular soil association), (2) soil erosion loss 21%, (3) field size 14% and (4) field slope 9%. This investigation indicates that crop production potentials in many areas of Middle Tennessee may be greatly overestimated.

*Configuration and Source of Anomalous Magnetic Field near Gordonsville in Smith County, Tennessee.* Maurice Ganster and Richard G. Stearns, The University of Arizona and Vanderbilt University. An anomalous magnetic field occurs in the northeastern part of Middle Tennessee, beginning at Gordonsville in Smith County and extending northward into Macon County. It is about 8 miles wide, at least 25 miles long, and has an amplitude of about 800 gamma (vertical component). It cannot be interpreted to be the result of highly susceptible basement rock at the conventional basement depth of about 5500 feet below the land surface. Although there are many possible interpretations consistent with this anomaly, they all demand a magnetic source close to the earth's surface, perhaps as shallow as 1750 feet. Likely interpretations are that there is igneous rock intrusive into Paleozoic carbonate rock or that there exists a large buried erosional hill or fault block of magnetic Precambrian basement rock.

MATHEMATICS SECTION  
McCord Science Building, Room 214  
Reginald Mazeres, Chairman

*Concerning P-Adic Numbers.* Richard Savage, Tennessee Technological University. The development of the p-adic numbers is sketched both historically and as completions of the field of rational numbers. A few of their interesting properties and applications are then discussed.

*A History of Cantorian Set Theory.* Phillip E. Johnson, Vanderbilt University. Georg Cantor created and

largely developed the theory of sets in approximately the years 1874-1897. This creation was a development of the utmost importance for all of mathematics and for modern analysis in particular. The birth of set theory can now be recognized in a paper by Cantor appearing in 1874. Therein he proved that the cardinal number of the set of real algebraic numbers is the same as the cardinal number of the set of natural numbers, whereas the same is not true of the set of real numbers. In 1878, he proved the independence of the power of the continuum from its number of dimensions. In the next few years he proved a number of the most basic and important results of set theory.

*Analysis of Industrial Work-Loads Using a Markov Chain Model.* Horace E. Williams and Jerry Westbrook, Vanderbilt University. Industrial Engineers are frequently called upon to analyze work flow systems in an industrial process in order to locate departments with bottleneck work loads and departments with slack work loads. Work flow routing may then be readjusted in order to compensate for these findings. A simple markov chain model may be used to help locate steady-state work loads for the system and these incorporated with findings from traditional time study estimates.

*Semigroups that are the Union of Four Disjoint Groups.* Reginald Mazeris, Tennessee Technological University. This paper shows that if  $S$  is a semigroup and  $S$  is the union of four disjoint groups, then either the idempotents form a band or the idempotents satisfy the following conditions: The groups can be arranged so that  $e_1e_2$  is in  $G_3$ ,  $e_2e_1$  is in  $G_4$ ,  $e_3e_4$  is in  $G_1$ , and  $e_4e_3$  is in  $G_2$ , and no one of these four are idempotent.

*A Report of NSF Special Projects.* Ralph C. Boles, Tennessee Technological University. The Tennessee Textbook Commission revised its list of approved mathematics textbooks, effective September, 1967. The revised list of adoptions included four or five texts at each level from which each county selected its texts. This change was viewed with general enthusiasm by higher educators throughout the state since all the recommended texts were more modern and represented a significant improvement in content. The teachers in the public schools, however, were quite concerned. They felt that they were not prepared for the change, and in the majority of cases, this was, indeed, true. Relatively few elementary teachers, for example, had any background in set theory, modular arithmetic, etc. Their concern was not in being able to follow the material in the texts, but in being able to draw on experience to give well chosen answers to students' questions and to supplement the texts with practical examples and illustrations.

It was the purpose of the special projects to alleviate some of this concern and to help create a better learning environment in the classrooms. A series of one-week conferences, extending over a two-year period, were conducted in twelve counties of the Upper Cumberland Region of Tennessee. In the conferences, the texts adopted by the respective counties were discussed along with supplementary material. No college credit

was earned by the participants, but they fulfilled a portion of their required yearly in-service training.

Three hundred-seventy five teachers from Cumberland, De Kalb, Overton, Putnam, and White counties participated in the first project, summer, 1967. Three teams of two professors each visited the counties for one week. One member of each team worked with grades 1-4 and the other with grades 5-8. The daily sessions met for three hours in the mornings and again for three hours in the afternoons. Mathematics teachers in grades 9-12 met at Tennessee Tech for five 6-hour sessions.

The first year, teachers in grades 1-4 met as one group and grades 5-8 as another group. In most counties, each of these two groups was too large for one teacher; and again changes were made for the second year as indicated below. The mathematics teachers in grades 9-12 from all six counties (27) met on the Tech Campus the first year. All the teachers in grades 9-12, not just the mathematics teachers, met as a group in their respective counties the second year. This time it was the wide diversity of interest as opposed to class size that caused concern.

Four hundred-twenty-one teachers from Bledsoe, Clay, Fentress, Pickett, Van Buren, and Warren counties participated in the program the second summer, 1968. This time three teams of two professors each visited each of the counties for one week. Each day's session was limited to three hours, and the Tech consultant met with two separate groups. Grades 1-3 and 7-9 met in the mornings and 4-6 and 10-12 in the afternoons. In addition to the five days with each group, five three-hour follow-up sessions were planned in each county. Three-hour sessions proved far more successful as the participants responded enthusiastically for the entire period.

The projects were funded by the National Science Foundation at a total cost of \$6307 the first year or \$16.82 per participant. The second year amounted to \$9435, or \$22.41 per participant; or 56¢ and 75¢ respectively per instructional hour per participant. Although there is no objective way to measure results, there is no doubt that the benefits received per dollar spent makes this one of the best projects ever funded by NSF.

Professor Ralph C. Boles directed both projects. Professors Ralph C. Boles, Edmond D. Dixon, James M. Doran, Reginald Mazeris, John E. Owen, Jerry R. Powell, Ronald Sircy, and Elbert F. Ward served as staff members.

#### MEDICAL SCIENCES SECTION

McCord Science Building, Room 217

L. H. ELROD, CHAIRMAN

*Variation in Severity of Loxoscelism (Brown Recluse Spider Bite).* H. B. Reed, Jr., and Robert H. Hackman, Middle Tennessee State University, and Frank M. Fesmire, Rutherford Hospital. The brown recluse spider, *Loxosceles reclusa*, has been collected in Tennessee as early as 1939 and is a common indoor dweller in the

western and central portions of the state. Even though many clinical cases of bite by the spider presumably have occurred in Tennessee, previous to this study only three had been described in published literature. Three new contrasting cases occurring in Middle Tennessee are described. In one case a 7 x 8.5 cm. necrotic lesion developed and was surgically removed, followed by grafting. In another case a 4 x 7 cm. region of intense ecchymosis developed, but healing occurred without sloughing or necessity of surgery. In the third case the most pronounced symptom was a small red papule at the site of the bite surrounded by a 1.3 x 2.5 cm. area of induration and erythema. Factors related to variation in severity of the bite and possible mechanisms influencing the characteristic spread of the lesion are discussed.

*A Bioautographic Method for the Detection of Thiamine and Thiamine Metabolites.* M. R. Houston, Ilda McVeigh and W. N. Pearson, Vanderbilt University. A bioautographic method has been devised for the detection of thiamine and thiamine metabolites by use of the fungus *Phycomyces blakesleeanus*. The metabolites are separated by thin layer chromatography and identified by overlaying the chromatogram with an appropriate thiamine-deficient agar medium seeded with the fungal spores followed by an incubation period of 2½ to 3 days. The method is sensitive, easy to perform, fairly rapid, and the results are reproducible.

*High-resolution Column Chromatography of Carbohydrates in Normal Body Fluids.* R. L. Jolley, K. S. Warren, E. Schonfeld, C. D. Scott, and M. L. Freeman, Oak Ridge National Laboratory. Urine and blood serum of eight normal Caucasian males, ages 29 to 38, were analyzed by a high-resolution carbohydrate analyzer being developed at the Oak Ridge National Laboratory. This machine utilizes strongly basic anion exchange resin to chromatograph borated fluids and detects the eluted sugars by sulfuric acidphenol colorimetry. The 24-hr. urine samples contained as many as 48 carbohydrate components, of which 23 were common to all and 17 common to most normals. The mean excretion rate, milligrams of sugar excreted in the urine per day per kilogram of body weight, and per cent standard deviation for the eight normal individuals of selected major carbohydrates is the following: Sucrose 0.32 mg, 35%; Raffinose 0.042 mg, 40%; Maltose 0.22 mg, 36%; Lactose 1.4 mg, 59%; Rhamnose, 0.021 mg, 175%; Ribose, 0.10 mg, 124%; Fructose 0.26 mg, 63%; Arabinose 0.88 mg, 20%; Galactose 0.57 mg, 38%; Xylose 0.41 mg, 64% Mannoheptulose 0.063 mg, 30%; Glucose 0.61 mg, 16%.

The blood sera chromatograms indicated several minor constituents and one major component, glucose, which varied in concentration from 56 to 94 (mean 75) mg/100 ml. (Research supported by the National Institute of General Medical Sciences and the U.S. Atomic Energy Commission.)

*Influence of Cardiac Edema on Norepinephrine Uptake by the Isolated Perfused Guinea Pig Heart.* John M. Ginski and Gretchen M. Reed, University of Tennessee College of Basic Medical Sciences. As previously

reported, perfusion of the isolated guinea pig heart (Langendorff) preparation for 15 minutes with Ringer solution (R) induced a significant cardiac edema. This edema can be prevented using a modified perfusion fluid (MR) containing dextran (M.W. 60-90,000), concentration of 1.2%, and homologous erythrocytes to a maximum of  $108 \times 10^6$  RBC/ml. In this study, ventricular concentrations of norepinephrine (NE) and epinephrine (E) in hearts perfused for 15 minutes with R (perfused control) were significantly less than those of the non-perfused control. Addition of NE to R, 80 µg/L, did not significantly improve the NE and E levels, compared to the perfused control. Increasing the NE to 160 µg/L raised ventricular NE and E to non-perfused levels. Using MR with NE, 80 µg/L, maintained the NE and E concentration at non-perfused levels. This data suggests that cardiac edema may be partially responsible for the inability of failing hearts to maintain their catecholamine stores.

*Altered Glucose Homeostasis in Blinded Rats.* Bryant Benson, Candace W. Miller and Sandy Sorrentino, Jr., The University of Tennessee Medical Units. Our knowledge of the effects of light on metabolism is limited to a photoperiodic effect on fat and carbohydrate metabolism, mediated by the hypothalamic-hypophyseal system (Young *et al.*, *In Diabetes*, Ed. by J. Ostman, Excerpta Medica Foundation, 1968).

For total deprivation of light, adult, male, albino rats were blinded by bilateral, orbital enucleation and all studies conducted four to six weeks postoperatively. These animals exhibited blood glucose levels significantly elevated over those of intact controls in the fed and the 18-hour fasted state, as well as a significantly increased rate of glucose removal in the insulin sensitivity test (133 mU/kg, I.V.). The blind animal also showed an increased tolerance to glucose (1 g/kg, I.V.).

The insulin-like activity of the serum (technique of Rafaelson *et al.*, *Diabetes*, 14:19, 1965) was seen to be increased significantly in the blinded animal over the intact after glucose (625 mg/kg, I.V.), but was decreased in both the fed and the 18-hour fasted, blind rat when no exogenous glucose was given. It is concluded that glucose homeostasis is altered in the blinded state. The mechanism is not known and awaits further study. (Supported in part by USPHS Grant No. AM-11733, and by PHS Training Grant No. GM-00202-10 from the National Institute of General Medical Sciences.)

*Acute Cold-Exposure on the Level of Plasma Thyrotrophin (TSH) and Thyroid Secretory Rate in Rats.* R. C. Tsou and Samuel R. Tipton, The University of Tennessee. The possibility of a change in the sensitivity of the thyroid to TSH with age was studied in 6-week and 18-month old male rats. Acute cold-exposure (5°C, 4 hours) raised the level of plasma TSH in both ages. The response of the thyroid to the cold-induced increase in the plasma TSH seemed to be greater in the young rats. However, in the young rats the cold-exposure did not shorten the biological decay of thyroidal radioiodine significantly as did methimazole (7.0 mg w/w %). The method used to measure the thyroidal response to TSH

did not show the acceleration of the release of thyroidal radioiodine by methimazole. The possibility of a change in the sensitivity of the thyroid to TSH with age is discussed. (This investigation was supported in part by Public Health Service Research Grant AM-07365 from the National Institute of Arthritis and Metabolic Diseases.)

**Morphological Study of Rat Anterior Pituitary Gland *in vitro*: Influence of Hypothalami from Normals and Castrates.** Sandy Sorrentino Jr. and Leonard R. Murrell. The University of Tennessee Medical Units. Morphological changes induced in anterior pituitary gland explants cultured in association (but not in contact) with hypothalamic slices from normal or castrated 350-400 g male Sprague-Dawley rats are described.

Cultures contained explants of normal anterior pituitary (APX) together with slices of hypothalami from (a) normal males, or (b) males castrated 11 days previously, or (c) cerebral cortex (control). Explants, supported by a raft on 1 ml of Trowell's chemically defined T-8 medium, were incubated in 95% O<sub>2</sub>-5% CO<sub>2</sub> at 37° C.

APX, fixed daily and stained with eosin-aniline blue, demonstrated good viability through 5 days. Acidophils were more numerous and granular in all APX than *in vivo*. APX with hypothalami had more acidophils than APX with cortex. Most acidophils, random *in vivo*, were centrally located in cultures. Basophils appeared more numerous, more granular, and larger in APX with hypothalami from castrates; in all other culture groups, basophils were less numerous.

The use of our culture system in obtaining data on hypothalamic regulation of pituitary secretion (not provided by morphology alone) will be discussed. (Supported in part by U.S.P.H.S.-N.I.H. Grants GM-00202-10 and AM-12406.)

**The Effects of X-radiation upon Regenerating Rat Liver Polyribosomes.** Edmond E. Griffin and Samuel R. Tipton. The University of Tennessee. The effects of x-radiation on polyribosomes of regenerating rat liver were studied *in vivo* and *in vitro*. Polyribosomes were isolated in large quantities in a preparative zonal ultracentrifuge using a continuous sucrose gradient. Ultraviolet absorbance profiles (260 m $\mu$ ) and sedimentation coefficients were determined after centrifugation at 40,000 rpm for one hour. Polyribosomes from partially hepatectomized rats exposed to 1500 r of x-rays immediately before killing at 24 hours after surgery showed no appreciable change. When irradiation was carried out between 0 and 18 hours post surgery polyribosomal populations showed a significant shift to lower S values and their ability to carry out protein synthesis was reduced to approximately 60% when exposed to 5,000 r. After exposure *in vitro* to 50,000 r polyribosomes were absent with a concomitant increase in the single ribosome population and almost no protein synthesizing capacity. (This investigation was supported in part by Public Health Service Training Grant T2GM730 from the National Institute of General Medical Sciences and

in part by Contract No. AT-(40-1)-3295 from The Atomic Energy Commission.)

**Growth requirements of *Haemophilus vaginalis*.** W. E. Dunkelberg, Jr. and Ilda McVeigh, Vanderbilt University. A medium, compound of peptone, maltose, dextrose and phosphate buffers, which supports good growth of strains known as *Haemophilus vaginalis*, including the type strain, has been devised. Optimal growth occurred in the medium adjusted to a pH of 6.8 and autoclaved at 112° C for 12 minutes. The organisms grew both aerobically and anaerobically in this medium. They also grew in a semi-defined medium containing enzymatically-hydrolyzed, vitamin-free casein, inorganic salts, carbohydrates, six purine and pyrimidine bases, and the following B-vitamins: thiamine HCl, riboflavin, niacin (or niacinamide), pteroyl-glutamic acid, and biotin. They failed to grow in the medium lacking the purine and pyrimidine bases, but the single omission of any one of the six bases (adenine sulfate, guanine HCl, cytosine, uracil, thymine and xanthine) except adenine sulfate did not affect growth. One strain failed to grow in the absence of adenine sulfate. Since the strains investigated, including the type strain, do not require X and/or V factors or otherwise definable coenzyme-like substances, they do not qualify as members of the genus *Haemophilus* of the basis of its current circumscription. Thus, reconsideration must be given to the classification of the organisms now known as *Haemophilus vaginalis* Gardner and Dukes.

**Measurement of Chicken Plasma Volume Using T-1824 Dye.** L. A. Bruce, University of Chattanooga. In evaluating the T-1824 dye dilution technique on chickens respired with a unidirectional flow device, it was found that low concentrations of dye could be read directly from the plasma without having to use an extraction technique. However, high concentrations of dye (10 mg/kg) in the chicken's circulatory system did not appear to have the same decay time as the low concentration (1 mg/kg). This suggests, therefore, that extrapolating back on the disappearance curve for high concentrations of T-1824 dye is invalid in the chicken.

**Transfer of Small Liquid Volumes.** L. H. Elrod and N. G. Anderson, Molecular Anatomy Program, Oak Ridge National Laboratory. The Molecular Anatomy Program has initiated the development of analytical systems capable of handling the large number of fractions generated by the use of fractionation systems such as zonal centrifugation and column chromatography. An integral part of such analytical systems must be a device or devices for the rapid measurement and transfer of small (20 $\lambda$ -200 $\lambda$ ) liquid volumes for subsequent analysis. Such devices should measure volumes reproducibly independent of air bubbles or changes in density, viscosity, or surface tension. Transfer of liquid from the measuring device to a reaction chamber must be quantitative and without cross-contamination. The device should allow a reasonable number of simultaneous measurements or transfers.

A large number of micropipetting devices are available, and some of these have been examined to deter-

mine their possible applicability in accurate rapid analysis. Detailed experimental results are reviewed. It appears unlikely that modifications of hand-operated devices will prove satisfactory. Rather, new concepts in measuring and transfer of liquids are needed; a few are discussed. (The Molecular Anatomy Program is supported by the National Cancer Institute, the National Institute of General Medical Sciences, the National Institute of Allergy and Infectious Diseases, and the U.S. Atomic Energy Commission.)

#### PHYSICS-ASTRONOMY SECTION

McCord Science Building, Room 12

SARA WOOD, CHAIRMAN

**Some Experiences with a Senior Project Lab.** Lewis B. O'Kelly, Memphis State University. A senior level course in Experimental Physics was instituted at Memphis State University three years ago. The course is restricted to junior and senior Physics majors and is recommended, although not required, for all Physics majors. The student either selects his own or is assigned a project which can be completed in one semester. Projects can be selected from any area of Physics or Astronomy, the only criteria being compatibility with the time and material available. Generally considered as part of the course is the presentation of a paper on the project at the regional meeting of the Collegiate Division of Tennessee Academy of Science.

**Some Considerations on the Surface Structure of Water.** F. X. Hart, The University of the South. Little agreement exists in the literature regarding the orientation of the water molecules at the water-air interface. Some have suggested that the positive, hydrogen end is directed out of the surface toward the air; others the negative end. Only recently has it been possible to obtain a theoretical value for the resultant interfacial potential difference, which indicated that the negative end was directed out. Charge preference in a cloud chamber confirms this result, whereas surface tension studies in an electrostatic field contradict it.

Experiments on evaporation in an electric field and an accompanying current-voltage study furnish additional evidence that the positive end of the water molecule is oriented toward the surface. An alternate explanation for cloud chamber preference and a possible connection between this preference and restricted rotation in liquids are offered.

**Air Ion Density Maxima and the Passage of Cold Fronts.** Philip J. Lorenz, The University of the South. Ion concentrations in the surface atmosphere of an urban area were continually monitored for a period of fourteen months. This included nearly simultaneous recordings of positive and negative small ion densities with some sampling of lower mobility ions. Average daily densities were found to vary in a cyclic manner with a period of several days. Maxima for small ions of either charge frequently occurred immediately after the passage of a cold front. Ion levels were compared to the daily averages of such weather variables as pressure, temperature, relative humidity, sky cover, hours of

sunshine, and wind speed. Except for the obvious relationships of these variables to cold front trends *per se*, no direct effects were observed. Cold front features that might influence air ion densities are discussed. Atmospheric pollution is a possible related factor.

**An Investigation of the Third Excited State of <sup>7</sup>Be by Use of the <sup>7</sup>Li (p,  $\gamma$ ) Reaction.** Sara Wood, Austin Peay State University and F. E. Dunnam, University of Florida. The third excited state of <sup>7</sup>Be appears to be fairly broad and is currently assigned an energy of 6.51 MeV, primarily on the basis of data from the <sup>7</sup>He + <sup>7</sup>He reaction. Various attempts to observe the excitation of this state via the <sup>7</sup>Li (p,  $\gamma$ ) reaction have been partially foiled by the fact that many <sup>7</sup>F (p,  $\gamma$ ) resonances lie in the proton energy region of interest; the high energy gamma rays from this reaction tend to obscure those from the excited state of <sup>7</sup>Be. The <sup>7</sup>Li (p,  $\gamma$ ) <sup>7</sup>Be reaction has been re-examined over a proton energy range of 0.8-1.45 MeV, using 99.32%-enriched <sup>7</sup>Li evaporated onto carefully cleaned Cu backings. High energy gamma rays were observed with a 5 x 5-inch NaI (TI) scintillator shielded with a 13-inch diameter NE102 annulus placed in anti-coincidence. Cascade radiation from the 431 keV first excited state in <sup>7</sup>Be was observed simultaneously. An excitation function of the latter shows a peak at about 1.08 MeV proton energy, corresponding to an excitation on 6.53 MeV in <sup>7</sup>Be. (Supported in part by grants from the National Science Foundation and Austin Peay State University.)

**Single Pion Production in Antiproton-proton Interactions at 2.7 GeV/c.** Robert F. Sears, Austin Peay State University. Interactions of 2.7 GeV/c antiprotons with protons resulting in the following final states have been studied: (1) p<sup>-</sup> p<sup>+</sup>  $\pi^0$ , (2) p<sup>-</sup> n<sup>+</sup>  $\pi^+$ , and (3) n<sup>-</sup> p<sup>+</sup>  $\pi^-$ . This study is based on interactions in 26,000 photographs from the Shutt 20" liquid hydrogen bubble chamber at Brookhaven National Laboratory.

Of the 15,452 events measured, 914 were identified uniquely as final state (1), 884 as final state (2), and 882 as final state (3), with an additional 245 events ambiguous between two or more identifications. In this experiment one interaction corresponds to a 2.71 microbarn cross section. The final states (1), (2), and (3) are found to have cross sections in millibarns of 2.64  $\pm$  0.08, 2.61  $\pm$  0.08, and 2.68  $\pm$  0.09, respectively, including the ambiguous fits.

These final states demonstrate an invariance under the operation of CR, where C is the charge conjugation operator and R is an operator which causes a rotation of 180° about an axis perpendicular to the direction of the incident antiproton in the overall CM. This invariance is expected since the initial p-p state, for an unpolarized beam, is an eigenstate of the operator CR. (Research supported by the U.S. Atomic Energy Commission.)

**Physics: The Program for Teachers.** M. R. Mayfield, Austin Peay State University. A new experimental program has been formulated at Austin Peay State University for the express purpose of markedly increasing the number of qualified high school teachers of physics.

The objectives of this program are to provide: (1) A curriculum which is designed for undergraduates who plan to teach physics as a major field. (2) A method of assuring a continuing supply of good students to take these courses. (3) An unusual summer program designed to provide early teaching experience. (4) A complex of ten high school centers, well-equipped and well-staffed, where student teachers can receive excellent experience. (5) A local resources center for follow-up assistance to in-service teachers. (6) Significantly increased probability that a graduate of the program will actually teach. (7) A method for continuous evaluation of the Program itself and for evaluation of performance of the teachers who participate in it. (Supported in part by the National Science Foundation.)

#### ZOOLOGY SECTION

MCCORD SCIENCE BUILDING, ROOM 202

ARTHUR JONES, CHAIRMAN

*Hormonal Changes in Rats Cross-adapted to Cold Environments and Simulated High Altitude.* J. A. Smoake and Samuel R. Tipton, The University of Tennessee. Rats acclimated to 7° C. were exposed to 10,000 feet of simulated altitude until acclimated. The acclimation to cold interfered with the acclimation to altitude. However, rats acclimated to 10,000 feet simulated altitude and then cross-adapted to cold temperatures displayed the opposite phenomenon, i.e., the previous altitude acclimation slightly facilitated the acclimation to 7° C. The relative activity of the thyroid and adrenal cortex was determined for both cold- and altitude-acclimated rats. By treating non-stressed rats with thyroxine, a response similar to that of cold-acclimated rats could be induced. (A progress report.) (Aided in part by funds from Public Health Service Research Grant AM07365 and NASA Grant NGL-43-001-021.)

*Studies on the Exocrine-Enteric Circulation of Mus musculus.* R. G. Litchford, University of Chattanooga. Studies utilizing L-methionine-methyl-C<sup>14</sup> intraduodenal injections have revealed variations in free pool amino acids of parasitized and non-parasitized mice. The rate at which C<sup>14</sup> appears in peripheral blood and bile following intraduodenal injection of L-methionine-methyl-C<sup>14</sup> has been investigated in parasitized and non-parasitized mice. (This work was supported by PHS grant 2E-106 and E-1384 under the direction of C. P. Read, Rice University.)

*Erythrocyte Measurements of the Salamander Pseudobranchius striatus.* J. R. Freeman, University of Chattanooga. The mean linear dimensions of 100 erythrocytes from five adult *Pseudobranchius striatus* were 48.1 x 23.4 micra and the mean of 15 erythrocyte counts from these individuals was 86,000 cells per cubic millimeter of blood. These cell dimensions were larger than those of other species of salamanders of similar size and were most similar to the dimensions of 48.5 x 24.6 micra as measured in *Siren lacertina*, a much larger animal than *Pseudobranchius*. The erythrocyte count was higher than those of some salamanders which had smaller cells than *Pseudobranchius*.

*An Eco-Physiological Study of Some Members of the Salamander Genus Desmognathus.* James H. Bickert, University of Tennessee. The preference parameters of *Desmognathus* for temperature and soil moisture were studied, and the effect of various acclimation regimes (temperature and photoperiod) on the temperature preference was assessed. In most cases, the mean preferred temperature (MPT) of *Desmognathus* showed a series from *D. quadramaculatus*, to *D. monticola*, to *D. ochrophaeus*, with *D. ochrophaeus* being significantly different from the others. *D. fuscus*, being a lowland species, was considered separately. There was no significant difference between the MPT of animals acclimated to temperatures of either 5C or 20C. Various photoperiod effects on the MPT resulted in the same series as above. There was a tendency to have a decrease in the MPT of all species except *D. quadramaculatus* as the acclimation photoperiod was changed from 6L/18D to 18L/6D.

*D. ochrophaeus*, the smallest and most terrestrial species, had the highest soil moisture preference. *D. fuscus* was next, followed by *D. quadramaculatus*, and *D. monticola*. The size difference among the species coincides with the soil moisture choices, except for *D. quadramaculatus*, the largest and most aquatic species.

*Autoradiographic Study of Protein Synthesis in Grasshopper Neuroblasts.* Ada A. Cole, The University of Tennessee. Embryos of the grasshopper, *Chortophaga viridifasciata* (De Geer) equivalent to 14-15 days development at 26° C, were placed in culture medium containing 10 µCi/ml of one of the following tritiated amino acids: lysine, leucine, or phenylalanine. Following incubation, the embryos were fixed in 50 percent aqueous acetic acid, squashed, and processed autoradiographically. Neuroblasts are significantly labeled after one hour of incubation with each of these amino acids. The uptake of tritiated amino acids into a DNase and RNase insensitive material was inhibited by 10 µg of puromycin dihydrochloride per ml of culture medium, which indicates that the amino acids were not simply taken up by the neuroblast but were incorporated into neuroblast protein. Slight changes in tonicity have no effect on the incorporation of amino acids into neuroblast protein. (This study was supported in part by the Atomic Energy Commission under contract number AT-(40-1)-2575.)

*Revision of the Genus Symphysanodon (Pisces: Lutjanidae) with Descriptions of Four New Species.* William D. Anderson, Jr., University of Chattanooga. The lutjanid genus *Symphysanodon* is redescribed and reported for the first time from the Atlantic. Four new species, two from the western Atlantic and two from the Pacific (one from off Hawaii and the other from off Japan), are described and *S. typus*, from the Pacific and previously the only known species of the genus, is redescribed. Brief comments regarding the phylogeny and zoogeography of *Symphysanodon* are presented.

*The Fishes of the Conasauga River in Tennessee.* Robert Allen Stiles, University of Tennessee. This paper reports the results of a survey of the fishes of the Tennessee portion of the Conasauga River. This river is

unique in that it is the only part of the Alabama River drainage to flow through Tennessee. The survey has been an ongoing project since 1965. This paper contains descriptions and ecological notes on the fishes taken during the survey. Because of the survey, twenty species have been added to the list of fishes occurring in Tennessee. The evidence for and against a past connection or major stream piracy between the Alabama and Tennessee River systems is examined. It is concluded that the dissimilarity between the ichthyofauna of the two systems argues for a long history of mutual isolation except for the minor capture of headwater streams.

*A Census of a Breeding Bird Population in a Virgin Spruce-Fir Forest on Mt. Guyot, Great Smoky Mountains National Park.* Fred J. Alsop, III, University of Tennessee. The introduction of the European Balsam Woolly Aphid into the United States poses a threat to the Fraser fir of this country. A census was conducted in the virgin spruce-fir forests of Mt. Guyot in the Great Smoky Mountains National Park using a spot-mapping method to determine the absolute breeding bird population on a sixty-acre plot before ecological changes were brought about by aphid destruction. The results of this census were compared to findings of other investigations in similar biomes. A trip was made to, and a strip census was conducted on, Mt. Mitchell where the forests have undergone dramatic changes due to the destruction of the trees by man and aphid infestation. The findings on Mt. Mitchell were compared to those of Mt. Guyot to see if any changes in the avifauna could be linked directly to the aphid.

This research was important not only in providing a basis for comparison by future investigators, but also in that censuses in undisturbed spruce-forests are few in general and unique in the Southern Appalachians.

*On Site Experience in the American Tropics—A Training Program of Value to Teacher of Parasitology.* Kenneth D. Burnham, University of Tennessee. The Inter-American Fellowship Program, administered by Louisiana State University School of Medicine and financed by the National Institutes of Health, affords teachers of parasitology, microbiology, and allied fields valuable and current information on diseases and health conditions in Latin America. The opportunity to meet with Latin-Americans engaged in parasitological research, access to specimens and other instructional materials, and some insight into problems of tropical medicine are also provided. Small groups are sent, at various times during the year, to either the Caribbean area (Puerto Rico, Trinidad, Venezuela, and Columbia) or to Mexico and Central America. The duration of the program is approximately ten weeks and *per diem* support and travel arrangements are provided. Some aspects of the conditions encountered in the Caribbean area and of the types of health problems likely to be found will be described utilizing 2 x 2 colored slides.

*Gesundheit! Concerning a nasal tapeworm.* Arthur W. Jones, The University of Tennessee. On January 26, 1968, a ripe tapeworm proglottid, which had been ejected by sneezing from the nose of an 8 year old boy, was brought to the author by Mr. Gilbreath of the

Knox County Health Department. Eggs, resembling those of a taeniid, were fed to a Wistar rat, which, by April 30, had a tapeworm cyst in its liver. The cyst contained a scolex the hooks of which agreed with those of *Hydatigera taeniaeformis* Batsch, 1786, the cat taeniid. The proglottid must have come originally from a large cat with which the human "host" was known to have played. Several similar proglottids were found in the cat's favorite chair. Although human ascarid worms have been observed emerging through the nostrils, this is probably the first report of a tapeworm leaving by this route. This is obviously a case of spurious parasitism, the boy having "passed" a worm that was only briefly his own.

#### COLLEGIATE DIVISION

SATURDAY, NOVEMBER 23, 9:00 AM

MCCORD SCIENCE BUILDING, ROOM 102

RICHARD J. RARIDON, CHAIRMAN

*The Synthesis of Anticholinesterase Agents: Nipecotamide, Nicotinamide and Piperidine Analogs.* Kenneth R. Maloney and Frank C. Minion, University of Tennessee Medical Units. In studies designed to explore the specificities of cholinesterase binding sites, Beasley and his co-workers have synthesized a number of nipecotamide analogs incorporating various alkyl substituents on both the ring and amide nitrogens. All of the derivatives thus far prepared are cholinesterase inhibitors. The study discussed here is an extension of this earlier work and describes the synthesis and proof of structure of some branched chain alkylnipecotamide analogs together with some pyridine, piperidine and nicotinamide derivatives. The investigation was conducted under the directorship of Dr. James G. Beasley.

*Drug Abuse—Amphetamines and Barbiturates.* Morgan Lewis, Southern School of Pharmacy. In the United States, amphetamines abuse has been reported in almost every major city. Amphetamines are CNS stimulants employed in a variety of conditions including obesity, fatigue, parkinsonism, depressive syndromes, behavior disorders, epilepsy, and poisoning by CNS depressants.

In 1962, over 4½ billion doses of amphetamines were produced. Over ½ of this amount reached illegal uses and were distributed to abusers.

Although there seems to be little danger of serious habituation with these drugs, they do produce conditions of hyperirritability, apprehension and perhaps even acute psychosis, tachycardia, tachypnea, and usually severe headaches. Fatalities have been reported.

All barbiturates are derivatives of barbituric acid—a CNS depressant which is addicting. Eight billion 1 gr. doses were produced in 1966.

Barbiturates are used medically in the control of epilepsy, as an anesthetic, as truth serums.

Acute intoxication with barbiturates now accounts for about 25% of all acute poisonings. Abusers exhibit

most of the symptoms of alcohol intoxication. Students taking depressants may stagger or stumble in classrooms. The depressant abuser lacks interest in activity, is drowsy and may appear to be disoriented.

Experimentation shows that all "normal" persons who become accidentally addicted very probably have fundamental emotional problems, because stable, well-balanced individuals reject the unwholesome pleasure provided by those drugs.

**The Sensitivity of the Posterior Tip of the *Habrobracon* Embryo to Ultraviolet Light.** Chester Arthur Heard, Southwestern at Memphis. The pole cells of insects embryos have been the object of much research. Position and Waterhouse irradiated the pole cells of the *Drosophila* embryo with ultraviolet light. They reported that death resulted from pole cell damage because a number of pole cells are incorporated into the midgut rather than becoming germ cells. Hoping to attribute death to pole cell damage, I irradiated the posterior tip of the *Habrobracon* embryo at the following hours of age: .5, 1, 3, 5, 7, 9, 11, 14, 23 hrs. Results indicate that the embryo is very sensitive at 5 hours at which time the pole cells are external to the presumptive blastoderm. Presumably they would be very vulnerable to ultraviolet light (2537A) in this location. However, at 7 and 9 hours the hatchability increases greatly even though the pole cells are still external. My results followed very closely those obtained by Amy, when he irradiated the entire dorsal or ventral surface of the embryo. I therefore concluded that the ultraviolet light sensitivity of the embryo at the developmental stages tested is related to a generalized phenomenon rather than to a specific one associated with the cells of the posterior tip. (This work was supported by a grant from the National Science Foundation Undergraduate Science Education Program).

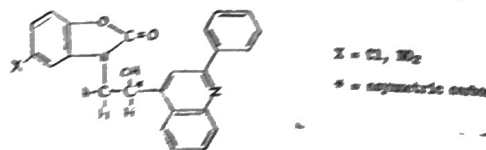
**Effects of Methylazoxymethanol on Mammalian Cells *in vitro*.** Christopher M. Amy, Southwestern at Memphis. Methylazoxymethanol (MAM), the carcinogenic and mutagenic moiety of a compound derived from cycad plants, is being used in treating several types of cultured mammalian cells. The project involves the detection and evaluation of the effects of this agent on cell proliferation, chromosome make-up, and gene activity; treated cultures will also be examined for evidence of malignant transformation. Cell counts, karyotype studies, LDH electrophoretic analyses, and subjective observations are among the techniques being used. Preliminary tests indicate that while high concentrations of MAM are toxic, 10 $\mu$ g/ml of carcinogen may result in some kind of sublethal damage. There is some evidence from LDH isozyme studies that MAM affects protein synthesis at this concentration. In future experimentation, cell cultures treated with MAM will be tested for possible alteration in the normal karyology of the cells, proliferation characteristics of the cultures, and non-continuous culture capacities of primary cell lines. (This work was supported by a grant from the National Science Foundation Undergraduate Science Education Program).

**Identification of Four Bacteria from an Aquatic Lab-**

**oratory Environment.** James S. Wynn, Tennessee Technological University. The bacteria were chosen from twelve colonies growing on Toub no. 36 Algal medium modified by the addition of 0.5 grams per liter of proteose peptone. Three types of colonies were chosen for identification: 1) A gray mucoid colony about 3 mm. in diameter. 2) A golden-yellow mucoid colony about 3.5 mm in diameter. 3) A rough, gray, spreading colony. The first type of colony contained two kinds of bacteria as differentiated by reduction of nitrates to nitrites, both were tentatively identified as *Pseudomonas*. The golden-yellow colonies were identified as *Pseudomonas*. The spreading colonies were identified as *Bacillus cereus*.

**2-Benzoxazolinone Derivatives.** David Moore, David Lipscomb College. Research directed toward the synthesis of new compounds based on the benzoxazolinone structure is reported. One phase of this work is concerned with the production of the quinoline derivatives. Preparation of the starting materials, 2-benzoxazolinone and substituted quinolines, is considered first and then the process of the condensation of the two molecules. Various compounds, one of which is shown below, have been prepared.

(Research was directed by Dr. C. W. Richmond.)



ADDITIONAL ABSTRACTS FROM SPRING, 1968,  
COLLEGIATE SECTION MEETINGS

**Instrumentation in Fluorine Calorimetry.** Jerry Thorntwaite and James Wood, David Lipscomb College. When a compound is burned in a suitable oxidizing agent, such as oxygen or fluorine, in a reaction vessel called a "bomb", the heat liberated in the reaction can be measured by a corresponding temperature change in a fixed mass of water, in which the bomb has been placed. An isothermal jacket calorimeter, operating at 26  $\pm$  .002 $^{\circ}$  C, was assembled for the combustion experiments. The temperature changes were measured with a Hewlett-Packard quartz thermometer (accuracy,  $\pm$ 0.0001 $^{\circ}$  C). Primary Standard National Bureau of Standards benzoic acid, using oxygen as the oxidizing agent, was used to determine the energy equivalent of the calorimeter ( $\epsilon(\text{calor})=2367.2$  cal/ $^{\circ}$  C, Standard Deviation  $\pm$  .53 cal/ $^{\circ}$  C). As a check on the energy equivalent, the heat of combustion of succinic acid in oxygen was found to be -3019.8 cal./g.

Fluorine is often more suitable than oxygen as an oxidizing agent in bomb calorimetry for several reasons: oxidation products of fluorine combustion are often gases, thus making product analysis easier, and there is a higher probability of having the fluoride of a particular element in its highest oxidizing state instead of a mixture of oxidation states, which is difficult to characterize thermodynamically.

In the construction of the system used to fill the bomb with fluorine, the safety of the operator was emphasized. A NaF trap was used to trap out the HF in the fluorine to yield essentially 98% fluorine. An Al $_2$ O $_3$  trap was used to trap out the fluorine being purged from the system.

The ultimate goal in finding the heat of combustion of different compounds, using fluorine as an oxidant, will be to calculate bond energies by making use of a thermochemical cycle. (Acknowledgement is made to the donors of the Petroleum Research Fund, administered by the American Chemical Society, for support of this research).

**A Necessary and Sufficient Condition for Convex Functions.** Robert R. Appleson, Vanderbilt University. The following proof comes out of work I did in the undergraduate seminar, spring semester-1968, under the supervision of Dr. Bjarni Jonsson.

**Definition:** A real-valued function  $f$  defined on the reals is a convex function if  $f(ta + (1-t)b) \leq tf(a) + (1-t)f(b)$ ,  $a < b$ ,  $0 \leq t \leq 1$ . **Proposition:**  $f$  is continuous and real-valued on the reals and  $f((a+b)/2) \leq (f(a) + f(b))/2$ ,  $a < b$ , if and only if  $f$  is convex.

It is fairly easy to show that convexity is a sufficient condition, so this paper will only be concerned with showing that convexity is a necessary condition.

**Proof:** We first claim that if  $n$  is a positive integer and  $x$  is a positive integer  $\leq n$ , then  $f(xa + (2^n - x)b/2^n) \leq (xf(a) + (2^n - x)f(b))/2^n$ ,  $a < b$ . This will be shown by induction on  $n$ . Let  $P_n$  be the above claim.  $P_1$  is true by inspection. Assume that  $P_n$  is true. We will show that this implies that  $P_{n+1}$  is true, i.e.  $f(xa + (2^{n+1} - x)b/2^{n+1}) \leq (xf(a) + (2^{n+1} - x)f(b))/2^{n+1}$ .

$$= f((a + ((x - 2^n)a + (2^n - x)b)/2^n)/2) \\ \leq (f(a) + f(((x - 2^n)a + (2^n - x)b)/2^n))/2$$

This follows from the hypothesis, where we have assumed that  $x \geq 2^n$ . This is appropriate because exactly one of  $x$  and  $2^{n+1} - x \geq 2^n$ . Using the assumption that  $P_n$  is true, we obtain the desired inequality.

Now suppose the proposition were not true, i.e. there

exists  $t$  such that  $f(ta + (1-t)b) = f(ta) + (1-t)f(b) + k$ ,  $k > 0$ ,  $a < b$ ,  $0 < t < 1$ . Since  $f$  is continuous,  $F(t) = f(ta + (1-t)b) - tf(a) - (1-t)f(b)$  is continuous. Therefore there exists an interval  $(t-d, t+d)$  over which  $F(t)$  is positive.

But consider the values  $t = x/2^n$ ,  $n$  a positive integer  $> -\ln d/\ln 2$ ,  $x$  a positive integer varying from 0 to  $2^n$ . Then  $1/2^n = x/2^n - (x-1)/2^n < d$ . Thus there is some value of  $t$  of the form  $x/2^n$ ,  $n$  a positive integer  $> -\ln d/\ln 2$ ,  $x$  a positive integer varying from 0 to  $2^n$ , such that  $x/2^n$  is in the interval  $(t-d, t+d)$ . But this is a contradiction because we just showed in the induction that  $F(t)$  must be non-positive for such values. The proposition follows by reductio ad absurdum.

**Phenanthrene used as a radiomimetic agent to study chromosome aberrations.** Theodore J. Passon, Jr., Tennessee Technological University. It has been known for a long time that certain chemicals have radiomimetic and carcinogenic properties. The male sex hormones are the cyclopenta phenanthrene derivatives which belong to the family of suspected carcinogens. Phenanthrene was used in this study for its possible effectiveness as a radiomimetic agent. Root meristems of onion and rye were treated with 50% phenanthrene in well ground alumina for 24 hours, after which the root tips were fixed in 3:1 Carnoy's for 24 hours. The tissue was hydrolyzed in 6 N HCl and stained with Feulgen's for one hour. It was found in Rye, the control showed out of 227 anaphase cells, a count of 1 aberration—approximately 4%. In the Rye plants treated with 50% phenanthrene, out of 167 anaphase cells 10 aberrations were counted—approximately 6%. In Onion, the control showed out of 466 anaphase cells, 6 aberrations were counted—approximately 1.3%. In Onion treated with 50% phenanthrene, out of 453 anaphase cells 20 aberrations were counted—approximately 4.3%. In both rye and onion, the number of cell divisions had increased considerably over the controls, and a slight radiomimetic effect was evident as measured by the induction of aberrations in the chromosomes, the single and double bridges being more common than the single and double dot deletions.