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ABSTRACTS OF PAPERS PRESENTED AT THE ANNUAL MEETING

GENERAL SESSION

FRIDAY, NOVEMBER 20, 10:00 A.M.

ROOM B

FRAZIER JELKE SCIENCE CENTER

JAMES L. WILSON, *Chairman*

Water and Air Pollution: A Tale of Two Cities. David J. Wilson, Vanderbilt University. The work of the Nashville Committee for Scientific Information on water pollution problems in the Nashville area was described and compared with the work of a similar group in Rochester, New York. In both cases the main emphasis was on the taking of data which demonstrated beyond doubt that certain named polluters were violating the law, and then presented to the public through the news media understandable, accurate reports giving the data and drawing appropriate conclusions as to legal violations, health hazards, effects on recreation and property values, etc. Slides were shown identifying the polluters (industrial and municipal) and illustrating the effects of their discharges on the receiving waters. We note that in carrying out such a program of public education on environmental problems it is essential to earn a reputation of unimpeachible honesty and accuracy in facts and interpretation. The unqualified success of the Rochester program and signs of significant progress on pollution abatement in Nashville indicate that this approach is an effective one.

Biological Studies on Problems of Pollution. Howard H. Vogel, Jr., University of Tennessee College of Medicine.

1. Studies on the life history, behavior, and ecology of the Coconut Crab, *Birgus latro.* We were recently stationed at the Eniwetok Marine Biological Laboratory to study *Birgus latro.* This species is dominant on many tropical islands of the entire Pacific-Indian Ocean. Since problems of radioactivity may be involved, and the crab is edible and delicious, it seemed important to learn more of its behavior and ecology. Reese (University of Hawaii) has worked on its life history. Former investigators have been handicapped by its nocturnal and burrowing habits. We obtained two of the Army's "Night Vision Equipment" (through the Fish and Wildlife Department in Hawaii). This apparatus intensifies starlight 60,000 times and allows excellent night vision. It has many possible important new uses in biology and oceanography. We camped on Glenn Island for approximately four weeks and captured several hundred crabs, marking them with luminescent paint and tape. We placed radioactive tags (^{75}Se) on a few crabs to get homing information. Several other crabs were equipped with radiotransmitters for telemetry experiments on range and territory. We watched crabs open coconuts with their chelae and studied their feeding habits. This species climbs trees well, although we did not observe them cutting down nuts from trees with their chelae (as reported by Darwin). We watched their interaction with other crabs, with other crustaceans, as well as with rats. *Birgus* grows up to two or three feet across the shell. No exact age data exist at present. This species, in its larval glaucothoeal form, retains an ancestral behavior pattern, seeking a shell for protection against dessication and predation—the same pattern seen in the successful hermit crabs. (This research was carried out under the auspices of the United States Atomic Energy Commission.)

2. DDT Residues and declining reproduction in the Bermuda Petrel. In 1968 Wurster and Wingate reported that residues of DDT averaged 6.44 parts per million in eggs and chicks of the carnivorous Bermuda petrel. This indicates widespread contamination of an oceanic food chain that is remote from applications of DDT. Reproduction by the petrel has declined during the last 10 years at the annual rate of 3.25 percent; if the decline continues, reproduction will fail completely by 1978. Concentrations of residues are similar to those in certain terrestrial carnivorous birds whose productivity is also declining. Various considerations implicate contamination by insecticides as a probable major cause of the decline.

3. Studies on the Yellow-billed Tropic bird of Bermuda. Our knowledge of the distribution, migration routes, homing ability, feeding areas, etc. of most of the marine birds is extremely deficient. During the past few years, the use of telemetry and radio-tracking of both birds and mammals has advanced considerably, both in instrumentation and electronics, and methodology. The yellow-billed Tropic Bird is the only common marine bird nesting on the Island of Bermuda. During the period of 1966 to 1970 we studied this species, using radioactive bands, to determine nesting and incubation habits of the adults. The method proved successful for studies on care and feeding of the young. The objective of the present study is to place radio transmitters on a small sample of the adult birds and follow them from their burrows in the limestone cliffs, by boat and/or plane, to determine their distribution, feeding grounds, homing abilities, and time at sea away from the nesting area.

The Effects of Pollutants on Hemoglobin of Pomoxis annularis. Glenda Ayres, Waverly, Tennessee. This project made use of the wastes industries often send out which kill fish in rivers. It determined the toxic effects of industrial wastes on the hemoglobin of *Pomoxis annularis.* A series of experiments were planned using various concentrations of combined waste discharged from industries diluted in clean water. The resulting concentrations varied from twenty-five to seventy-five percent. First the *P. anularis* were placed in clean water for a period of forty-eight hours. Then a series of slides were made to determine an estimate of the normal count of erythrocytes. To make the slides, the gill of *P. annularis* was scored with a sterile lancet and blood drawn through a pipette to a predetermined level. An equal amount of blood was placed on each slide. Then the blood stains were observed under the microscope and an estimate of the number of erythrocytes was made for each slide. An average was found for this set of slides. This procedure was repeated using one-fourth pollution to three-fourths water, one-half pollution to one-half water, and three-fourths pollution to one-fourth water, to determine the effect on the number of erythrocytes. The resulting observations established the hypothesis that as the pollution increased, the number of erythrocytes decreased causing asphyxiation of *P. annularis* since there was insufficient hemoglobin to transport oxygen and carbon dioxide through the fish. Potential influencing factors noted were the erythrocytes enlarged, the cytoplasm receded from the membrane, and the nuclei enlarged. These aspects present a basis for further investigation in this field.

Cross-Flow Filtration of Sewage Effluents. H. A. Mahlman and K. A. Kraus, Oak Ridge National Laboratory. Cross-flow filtration is designed as a separation process in which suspension or colloidal solutions flow under pressure tangentially past a porous support with hydrodynamic conditions adjusted such that excessive cake buildup is prevented. We are investigating the criteria for a process wherein preliminary sewage effluent would be the feed stock and a reusable water would be the product. Progress regarding operating conditions such as pressure, cross-flow velocity, and additives are discussed. Product quality is evaluated on such criteria as removal of turbidity, organic carbon, and phosphate. Product fluxes of .5 cm/min (1 cm/min = 354 gpd) and greater have been obtained and maintained in laboratory experiments. A brief description of a mobile cross-flow filtration loop now under construction will be presented.

SECTION MEETINGS

FRIDAY, NOVEMBER 20

BOTANY SECTION

FRAZIER JELKE SCIENCE CENTER, ROOM B

G. E. HUNT, *Chairman*

The Great Need for Commercially Available Microscope Slide Preparations Illustrating the Polygonum-type of Embryo Sac Development. Edward T. Browne, Jr., Memphis State University. In over 70% of the investigated Angiosperms the *Polygonum-type* of embryo sac development is reported to occur. However, no biological supply company or other supplier of prepared botanical microscope slides sells preparation illustrating this type of development of the female gametophyte in flowering plants. The reasons for this are largely economic, and practically all commercial suppliers have large stocks of the much rarer *Fritillaria*-type of development since species of *Lilium* and *Fritillaria* in which this type occurs are readily available in cultivation or in the wild. College teachers of general botany, plant morphology and embryology must use only these slides or make their own illustrating the *Polygonum*-type of development, a very time-consuming undertaking. Investigations are under way to find a species in which this type occurs which would, at the same time, yield a sufficient number of preparations that this would be economically feasible. Characteristics of such a species will be discussed in some detail.

Ecological Variations in the Cuticular Features of Polygonum pensylvanicum L. G. K. Sharma, University of Tennessee at Martin. *Polygonum pensylvanicum* L. is found in varied habitats in the Appalachian Highlands in Giles county, Virginia, where this study was made in 1969. Several populations of this plant species were collected along an altitudinal gradient representing a wide range of ecological conditions. Cuticular and morphological studies of these populations were made for possible taxonomic and ecological relationships. Stomatal frequency, stomatal index, epidermal cell frequency, stomatal development, wall pattern, stomatal size classes, subsidiary cell complex, and trichome size and frequency were studied. Plant size and vigor, leaf length and width, internodal length, and inflorescence color and length were the main morphological features studied. Ecological variations are discussed. The constancy of some features suggests their taxonomic importance, while the variation of others seems to be of ecological significance. (Supported by NSF Postdoctoral Fellowship at the Mountain Lake Biological Station, University of Virginia)

Forest Communities of the Great Valley of East Tennessee W. H. Martin, Eastern Kentucky University. The Ridge and Valley physiographic province in Tennessee is characterized by alternating ridges and valleys underlain by numerous rock units. Variation in soils is also high; at least 76 soil series have been documented in counties included in this study. The diverse topographic features and soils provide equally diverse habitats for plant establishment and survival. The dominants in stable plant communities are deciduous tree taxa; fifty-two deciduous tree taxa were recognized in this study; compared with other studies in deciduous forests, this is a floristically diverse area. Forest communities on rolling to flattened topography are a complex dominated by *Quercus alba;* codominants vary depending upon site and soil characteristics. *Quercus alba* is the major tree taxon in this region and has the greatest ecological amplitude. Communities are dominated by *Quercus prinus* or *Liriodendron tulipifera* where there is greater relief and/or topographic diversity. Other communities occupying less area are recognized; apparently these taxa have specific site requirements. Statistical evaluation of relationships between taxa and site characteristics will be discussed.

The Delineation and Prediction of Forest Cover and Site Parameters by Multispectral Remote Sensing on Wilson Mountain, Morgan Co., Tennessee. Paul F. Krumpe, H. R. DeSelm, Clifford C. Amundsen, University of Tennessee. Seventy millimeter Kodak Ektachrome Aero type 8442 and Ektachrome Infrared AERO, Type 8443, film emulsions have been utilized in a multi-spectral arrangement to delineate several deciduous forest tree species by Autumn color differentiation and foliage characteristics. A photo interpretation key for identification of dominant overstory trees is being developed and used to determine community types and taxa based on defined criteria. The estimation and predictability of community parameters are dependent on film interpretation of crown closure, species density, crown and bole size classes, and evergreen shrub cover. Ecological site characteristics have been inferred from dominant species and community types, topographic position and aspect, and other site parameters including rock cover, log cover, minor topography, and soil characteristics. This study is based on acquired ground truth data and its purpose is to provide a means for the prediction of forest cover types and site parameters in areas devoid of ground control. Comparisons of acquired interpretation data with current ground control and previous studies will enable predictive equations to be developed.

Some Anatonical Aspects of Fusarium Wilt of Cowpeas.* W. D. Forrest and M. L. Hare, Memphis State University and Mississippi State University. *Vigna sinensis* (cowpea) is plagued by numerous pathogenic fungi that cause devastating annual losses in yield. One organism that contributes most significantly is *Fusarium oxysporum* f. *tracheiphilum,* race 1. The physiological and anatomical manifestation of resistance and susceptibility is not truly understood. The object of this study was to obtain an insight into the relationship of internal plant structure with disease establishment and symptom expression. A complete anatomical study of both root and stem of *V. sinensis* was undertaken. Examination of slide preparations revealed that tyloses formation was not significantly different when the susceptible and resistant cowpeas were compared. The susceptible variety had a much greater number of vascular elements within the stem and root than did the resistant cultivars. Discoloration of vascular elements was shown, in many cases, to precede the advance of actively growing fungus mycelium. Progression of mycelium was blocked within the vascular tissues of the resistant cowpea root system, whereas within the susceptible cultivars, hyphae were observed continuously throughout the entire plant. The fungus retarding mechanism of the root system could not be explained on an anatomical basis. (This investigation is from a section of an in-progress dissertation with the Botany Department of Mississippi State University).

The Effect of Ethionine on Lettuce Seedling Hypocotyl Elongation. Meta S. Harker, T. W. Merrell, and B. P. Stone, Austin Peay State University. Ethionine severely inhibited elongation of Grand Rapids seedling hypocotyls, while addition of methionine to ethionine-treated seedlings resulted in reversal of ethionine-induced inhibition of elongation. The GA_3 enhancement of lettuce seedling hypocotyl elongation was nullified in the presence of ethionine. The Inhibition of GA_3 enhancement by ethionine was restored by the addition of methionine. Adenosine triphosphate had no effect on hypocotyl elongation and did not reverse the ethionine inhibition. Ethionine inhibited the incorpation of L-Leucine-4,5-^3H into the seedlings during the 36 to 48 hour time interval of elongation. Leucine incorporation was severely depressed in the GA_3, ethionine, and methionine treated seedlings. The data suggest that protein synthesis is not required for GA_3 stimulation of hypocotyl elongation in lettuce seedlings. The presence of 6-benzyl-amino purine reversed the inhibition of hypocotyl elongation by ethionine and partially restored GA_3 stimulation of hypocotyl elongation inhibited by ethionine. 5-fluorodeoxyuridine inhibited hypocotyl elongation. The effect of the addition of uracil, methionine, and thymidine to FUDr-treated seedlings will be described.

Induction of Photosensitivity in New York Lettuce Seeds. Melinda B. Mills and B. P. Stone, Austin Peay State University. The exposure of dark germinating New York lettuce seeds to continuous far-red light for 24 hours results in the induction of photosensitivity. The germination response of the 24 hour far-red treated seeds to repeated red or far-red light regimes is similar to the classical photosensitivity of Grand Rapids lettuce seeds. Induction of photosensitivity does not occur in New York lettuce seeds soaking in the presence of chloramphenicol during the 24 hour far-red light exposure. 5-Bromouracil, 5-fluorouracil, 2-thiouracil, ethionine, and cycloheximide do not prevent the induction of photosensitivity.

Inhibition of Growth and Nucleic Acid Synthesis in Lemna purpusilla by Abscisic Acid. James D. Ownby, The University of Tennessee at Knoxville. The effects of abscisic acid (ABA)

on growth, DNA, RNA, and protein snythesis in *Lemna pusilla* were investigated. Growth was almost completely inhibited by 1 ppm and 5 ppm ABA. At 0.1 ppm ABA, the plants began to recover spontaneously from the inhibitor on the 4th day of treatment. A short period of growth exceeding that of the control was then observed, after which normal growth occurred. As determined by the percent of incorporation of ^{3}H-thymidine and the ^{14}C-uracil into DNA and RNA respectively, inhibition of the rate of DNA synthesis by 5 ppm ABA was 40%, most of which occurred during the first 8 hours of treatment. Inhibition of the rate of RNA synthesis by 5 ppm ABA was 60%, most of which occurred over the first 24 hours exposure to ABA. No significant decrease in the percent of 3H-leucine incorporated into protein was detected during the first 48 hours of treatment.

The Effects of IAA and GA_3 on Protein Synthesis in the Abscission Zones of Bean Petiole Explants. Stephen M. Hutchinson and Gordon E. Hunt, The University of Tennessee at Knoxville. The questions to which these experiments were directed were: what are the effects of exogenous growth substances, indoleacetic acid and gibberellic acid (GA_3) on the rate of protein synthesis in the abscission layer of leaves. 10 mm surface sterilized pulvinal sections of bean leaves were implanted in 1% water agar and treated by the addition of buffered agar containing IAA or GA_3. Protein synthesis was scored by incubating 1 mm thick abscission zone slices in tritium labeled leucine for three hours in the dark at 30°; both the hot alcohol soluble and insoluble activity were measured. The activity in the insoluble fraction, in counts/minute/mg was considered a measure of protein synthesis and the activity of the soluble cell extract plus that of the insoluble fraction was considered a measure of tissue absorption. Treatment with 1 PPM IAA resulted in a 4-fold increase over the control in abscission zone insoluble leucine activity while 400 PPM IAA decreased leucine incorporation to less than 0.1 of the control. Over a period of 72 hours with the most effective IAA concentration the uptake of labeled leucine almost directly parallel changes in apparent protein synthesis. Although IAA treatment showed an effect on protein synthesis the data did not differentiate whether this was due to an increase in leucine uptake or on protein synthesis *per se*. Gibbrellic acid treatment showed somewhat similar results but after 3 day treatment even greater leucine uptake relative to leucine incorporation.

CHEMISTRY SECTION

Frazier Jelke Science Center, Room A

D. P. Claypool, *Chairman*

A Study of Water Quality on the J. Percy Priest Reservoir. Mildred B. Perry and Haskell C. Phillips, Austin Peay State University. Biophysical criteria including temperature, dissolved oxygen, pH, Secchi disc turbidity, biological oxygen demand (BOD), and hardness on the J. Percy Priest Reservoir were documented and evaluated. The study began October 13, 1968 and extended to June 18, 1969. Throughout the investigation the lake was sampled monthly with the exceptions of December 1968 and February 1969 when inclement weather prevented field work. The reservoir was found to meet minimum permissible criteria as established by the National Technical Advisory Committee in 1968 and the Tennessee Stream Pollution Control Board, 1967 with respect to data collected within the bounds of this investigation.

Electron Acceptor Strength of 9-Dicyanomethylene-2, 4, 7 trinitrofluorene. C. C. Thompson and D. D. Holder, Memphis State University. Molecular complexes of 9-dicyanomethylene-2, 4, 7-trinitrofluorene (DTF) with hexamethylbenzene, fluorene, phenanthrene, anthracene, fluoranthene, and pyrene show charge-transfer absorption in the 400 to 700 nm region. Association constants and other thermodynamic properties of these complexes in 1, 2-dichloroethane have been computed from spectroscopic data collected at 15 and 35°C. Trends in complex stabilities as reflected by heats of formation closely parallel the changes in association constants, but vary widely from the order predicted on the basis of intermolecular transition energies. Results obtained for DTF complexes are compared with the corresponding interactions of 2, 4, 7-trinitrofluorenone.

Ionic Contributions to the Ground States of Molecular Complexes. R. R. Cantrell, D. D. Holder and C. C. Thompson, Memphis State University. The valence-bond approach to the bonding in electron donor-acceptor complexes advanced by Mulliken describes the overall wave function in terms of a resonance interaction involving "no-bond" and dative structures. The importance of the dative term in the ground states of these complexes has received considerable attention in recent years. It now appears that the degree of charge-transfer has been overestimated in many cases. Various methods for computing the dative contribution are described together with new experimental information regarding the bonding forces in complexes of 1, 3, 5-trinitrobenzene, tetracyanoethylene, and 9-

E S R Spectra of Complexes with Metal Ions which are d^2 Systems. Joel Selbin, Louisiana State University, June B. White, Keith Dismuke, and Bryan Zeutenhorst, Union University. Previous to this work, the only ESR study of d^2 complexes have been recorded at low temperatures (77° and 4.2°K) on V_2O_3 doped in Al_2O_3, CdS, or ZnS crystal lattices. The difficulty in obtaining spectra was that the spin-spin interactions between the two unpaired electrons was so great as to completely obscure the Zeeman effect and nuclear-spin—electron-spin interaction. In the complexes reported here, the spin-spin interaction has been reduced and the other interactions can be observed. The <g> values were calculated and the deviations from the full electron values and the deviation of the nephelauxetic ratio from unity are used to provide information which suggest a possible explanation for the reduced spin-spin interaction.

Metal ions used for the preparation of the complexes are V^{3+} and Cr^{4+}. A number of ligands were used, selected for the variation in right structure around the metal ions.

Recovery and Refinement Chemistry of Electromagnetically Separated Stable Isotopes. J. O. Younghanse, W. C. Davis, H. R. Gwinn, L. O. Love and F. M. Scheitlin, Oak Ridge National Laboratory. A general discussion of the chemical techniques employed in the recovery of stable isotopes from the receiver pockets and the subsequent purification and refinement of the isotopic material. Detailed procedures are given for a few of the elements along with a consideration of special chemical conversions and fabrications required by users.

Electret Heterocharges in Stearone and Doped Stearone Wax Discs. R. W. Clark and T. E. Chatman, Middle Tennessee State University. Electret heterocharges have previously been most extensively studied using carnauba wax, the complex nature of which obscured the chemical species responsible for the effects. In this study 18-pentatriacontanone, commercially known as stearone, is used as an electret material. After extensive zone refining the stearone does show the heterocharge effect, storing about 0.123 microcoulombs of charge after two hours exposure to a 2000 volt/cm field. Stearone electrets containing octadecane, stearic acid, methyl stearate, 1-octadecanol, and sodium stearate in concentrations of 10% and 30% were formed and discharged under similar conditions to that of the pure stearone electrets. The addition of octadecane did not significantly affect stearone's ability to store charge. The addition of other solutes increased the charge stored and/or changed the thermal discharge kinetics of stearone electrets. In particular the 10% by weight 1-octadecanol electret exhibits an unusual shape of thermal discharge curve if the electrometer input impedance is matched to the internal impedance of the electret. Many of the solution electrets showed more distinctly the two maxima previously observed by Bickford for carnauba wax electrets. The relationship of the function group introduced the wax into the shape of the resulting thermal discharge curve is demonstrated, but explanations are withheld pending further evidence.

An Alternative Synthesis of Perfluoracyl Halides and Anhydrides from Perfluorocarboxylate Salts. A Synthetic Study. Guy E. Graves, Max Lustig, Memphis State Univeristy. Phosphorus (III) difluoride halides and phosphorus (V) oxy-and thiodifluoride halides (halide = Cl^-, Br^-, I^-) have been used to prepare perfluoroacyl halides from perfluorocarboxylate salts. An intermediate ester is former in the case of reaction (I) and the reactions are believed to proceed as follows:

$$R_fC(O)O^- + PF_2X \longrightarrow R_fC(O)OPF_2 + X^- \quad (1)$$

$$X^- + R_fC(O)OPF_2 \longrightarrow R_fC(O)X + \ldots$$

$$R_fC(O)O^- + P(E)F_2X \longrightarrow R_fC(O)X + POEF_2^- \quad (2)$$

Where Rf=CF_3, C_2F_5 and F; X=Cl, Br, I; and E=O, S. On the other hand, when pyrosulfuryl difluoride or pyrophosphoryl tetrafluoride are used as substrates, reaction with the perfluorocarboxylate salts produces the corresponding anhydrides.

$$2R_fC(O)O^- \quad S_2O_5F_2 \longrightarrow (R_fC=O)_2O + 2SO_3F^- \quad (3)$$

$$2R_fC(O)O^- + P_2O_3F_4 \longrightarrow (R_fC=O)_2O + 2PO_2F_2^- \quad (4)$$

The latter method, reactions (3) and (4), is selective because the corresponding non-halogenated salts are unreactive, however, they do react according to (1).

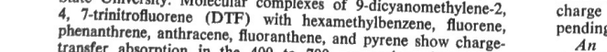
Metal Carbonyl Complexes of Cyanodithioformate. Larry J. Epley and Larry Houk, Memphis State University. Several new transition metal carbonyl complexes have been synthesized from the previously unstudied cyanodithioformate ligand ($N{\equiv}CCS^-_2$). Reactions with a variety of metal carbonyl halides have yielded both monodentate and bidentate products, e.g., $C_5H_5Fe(CO)_2SC(S)CN$ and $C_5H_5Mo(CO)_2S_2C_2N$. Molecular structure and relative bonding strengths of the deeply colored compounds will be discussed from infrared and NMR data.

Some Group IVA Alkylmetal Difluorodithiophosphates. D. W. McKennon and Max Lustig, Memphis State University. Difluorodithiophosphoric acid, HPS_2F_2, has been found to react with alkylmetallic compounds of some group IVA elements by replacing an alkyl group in the case of trimethlytin chloride and triethylgermanium chloride and either a hydrogen or dialkylamine group with trimethylsilane and N, N-diethylaminotrimethylsilane. The new compounds difluorodithiophosphatodimethyltin chloride, $F_2P(S)\text{-}S(CH_3)_2SnCl$, difluorodithiophosphatodiethylgermanium chloride, $F_2P(S)S(C_2H_5)_3GeCl$, difluorodithiophosphatotrimethylsilane, $F_2P(S)SSi(CH_3)_3$, have been prepared. Spectral data such as infrared and nuclear magnetic resonance are discussed.

1-Chloro-1-Nitro-1-(p-X-Phenyl) ethanes. Lester W. Harrison and Carl D. Slater, Memphis State University. A series of titular compounds has been synthesized, and the solvolytic behavior of each in 80% ethanol, 50% ethanol, and 90% formic acid has been investigated. The kinetic data thus obtained will be utilized to comment on the possibility of nitro group asssitance in the ionization of the chloronitro compounds, and on the ramifications of the use of both Hammett ρ values and Winstein-Grunwald m values as criteria of mechanism in reactions that possibly involve carbonium ions.

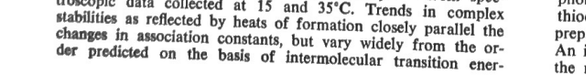
Preparation of Sulfilimines and Their Analogous Compounds, Jitrenda J. Shah and D. P. Claypool, Memphis State University. Several N-p-tolylsulfonylsulfilimines are known. These are called Iminosulfuranes) sulfilimines. We have prepared a new chloramine (N-chloro-N-sodio-p-ethyl benzene sulphonamide). We have tried the action of N-Chloro-N-sodio-p-ethyl benzene sulphonamide with series of alkyl-alpha-toluene sulphide, Diakyl sulfide, Triphenyl-phosphine, Triphenyl arsine, Triphenyl stilbine and Tri-o-, m-, -p-- tolyl phosphine and have obtained the corresponding sulfilimines, phosphinimines, arsinimine and stilbinimine.

Structure of the new chloramine (N-chloro-N-sodio-p-ethyl benzene sulphonamide) is:

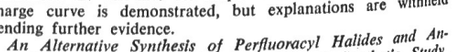


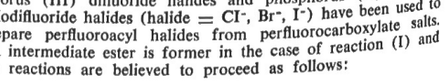
(1)

The general structure of these sulfilimines is



(2)





3

Where R_1=R_3 and P, As & Sb replace S in these compounds the following analogous have been prepared:

(C_6H_5P-, (C_6H_5)$_3$ As-, (C_6H_5)$_3$ Sb-, ($C_6H_4CH_3$)$_3$P-)o-,-m-,-p-).

Sulfilimines: IR. UV & NMR Spectroscopic Studies. Jitrenda J. Shah and D. P. Claypool, Memphis State University. The physical properties of several N-p-tolylsulfonyl-sulfilimines were studied by means of infra-red, ultraviolet and NMR spectroscopic determination. No one has studied the physical properties of N-p-ethylbenzenesulphonylsulfilimines. We have examined IR, UV & NMR spectra of various N-p-ethylbenzenesulphonylsulfilimines. All known sulfilimines have four strong characteristic IR absorption bands at around 930-980, 1070-1090, 1134-1140 and 1260-1280 cm-1 respectively. We also get the same four strong characteristic IR absorption bands in the same regions. Chloramine-T has four characteristic bands at 1255 (Vas SO_2) 1130 (Vs SO_2), 1083 & 929 cm-1. We find that the new chloramine (N-chloro-N-sodio-p-ethyl benzene sulphonamide) has four characteristic bands at 1250(Vae SO_2), 1090 & 935cm-1.

GEOLOGY-GEOGRAPHY SECTION

Frazier Jelke Science Center, Room 104-East

W. D. Hardeman, *Chairman*

Facies and Bed Thicknesses of Carbonate Rocks. David N. umsden, Memphis State University. Bed thicknesses in terrigenous clastics have long been observed to follow a lognormal distribution but data on carbonate facies are lacking. Studies of facies intervals, as determined by detailed thinsection analysis, and bed thicknesses, as described in field notes, for the Bird Spring Group and Callville Formation (Pennsylvanian and Permian) of southern Nevada has revealed they too follow a strongly lognormal trend. This is true for separate facies (F_1. micrite; F_2. micrite with scattered floating fossils; F_3. biomicrite; F_4. biopelsparite) and for all carbonate intervals considered as one facies. The universiality of a lognormal population distribution in sedimentary beds precludes the use of Markov chain analysis in which tallies are made at equal intervals along a vertical section.

A Conceptual Model of Mississippian Carbonate Rock Variation in Southern Tennessee. Richard E. Bergenback, University of Tennessee at Chattanooga. Field studies of some carbonate rocks of Mississippian age located in Hamilton and Marion Counties, Tennessee, plus cursory laboratory studies, have resulted in a lithostratigraphic conceptual model that purports to explain the vertical and lateral variation in these carbonate rocks as a series of transgressions and regressions. These localized interpretations are made in the light of a regional model of Carboniferous sedimentation as presented by John C. Ferm (1967).

Interpretation of A Regressive Sequence of Detrital Rocks of Carboniferous Age Exposed at Norwood Cove, Sand Mountain, Alabama. Robert L. Wilson, University of Tennessee at Chattanooga. Carboniferous age rocks are well exposed along Alabama State Highway 117 on the West side of Sand Mountain near Stephenson, Alabama. Detailed studies of these rocks has indicated that the Sequence begins with an orthoquartzitic sandstone containing marine fossils and ends with a massive

orthoquartzic sandstone that is interpreted as an ancient beach.

A Biostratigraphic Study of Ordovician Strata Along I-40 Between Cookeville and Lebanon, Tennessee. George D. Stanley, Jr. and Raman J. Singh, University of Tennessee, Chattanooga. Continuous outcrops of Ordovician strata along I-40 were examined for establishing a biostratigraphic framework. Generally three "formations", Leipers, Catheys, and Bigby-Canon Limestone, have been recognized in the Nashville dome area. These are allegedly distinguished by the presence of unconformities, distinct lithology and diagnostic fossils. Based on the details of lithology, modern workers find the division to be unwarranted. Similarly, large collections of megafossils show that their distribution does not follow the "formation" boundaries. Instead three assemblage zones are recognized which in descending order are: 1. extending up to 100 feet below Chattanooga Black shale, 2. extending from 100-230 feet, and 3. extending from 230-370 feet. A grant from the Tennesseee Academy of Sciences towards the project undertaken as a Senior Thesis (Stanley) is gratefully acknowledged.

Problems in the Geologic Evaluation of Proposed Landfill Sites in Tennessee. Stuart W. Maher and Robert A. Miller, Tennessee Division of Geology. There are now few properly located and managed sanitary landfill sites in Tennessee. However the Tennessee Solid Waste Disposal Act of 169 requires that the Tennessee Department of Public Health evaluate all existing community disposal sites in the State by July 1, 1971, close any operation deemed non-acceptable, or require alterations to comply with standards, and assist in locating acceptable new sites. The Division of Geology is assisting the Division of Environmental Sanitation in the geological evaluation of the existing sites, and in the location of new ones. Preliminary investigations of sites throughout the State have shown that numerous problems exist in finding locations that meet the requirements of maintaining environmental quality, safety of operation, accessibility, material suitability, and ease of daily maintenance. These problems are complicated by the fact that little research has been carried out on the nature of landfill leachate, and in the general field of geological criteria for site location. Some specific areas of concern in recent site studies in East and Middle Tennessee have been karst development, depth to the main water table, and the presence of perched water tables, joint enlargement, flood-prone areas, and material workability.

Upper Knox Stratigraphy of Middle Tennessee. Alan K. Stagg, Frederick T. Fischer, and James H. DeGroodt, The New New Jersey Zinc Company, Murfreesboro. Extensive core drilling by The New Jersey Zinc Company in Middle Tennessee and portions of Southern Kentucky has provided abundant information on the Upper Knox Dolomite of Lower Ordovician age. Excepting two astrobleme (?) structures of very limited areal extent, the Knox in this region is known only in the subsurface. That portion of the Knox encountered in drilling is tentatively correlated with the redefined Mascot Formation and the upper part of the Kingsport Formation of East Tennessee. The Mascot Formation is subdivided into lower, middle, and upper members. The predominant lithologies of the Mascot are light to medium colored, finely crystalline dolomite with interbedded limestones or limestone equivalents. Two sandstone units are especially well-developed in portions of Smith County and adjoining areas. The underlying upper portion of the Kingsport Formation is characterized by limestone or limestone equivalents with interbedded light to medium colored, finely crystalline dolomites. Observed thickness of the Mascot Formation varies from a minimum of 612 feet in Cannon County to a maximum of 841 feet in west-central Rutherford County, Tennessee. The greatest variation in thickness is the result of removal of Upper Mascot by pre-Chazyan erosion. Variations in thickness of the Middle Mascot depend primarily upon the presence and thickness of limestone beds. Sufficient data for the entire Kingsport Formation are not yet available to permit subdivision of this formation. Dissolution related to pre-Chazyan karstification was responsible for the formation of extensive breccias in the Mascot and Kingsport.

Paleokarst Phenomena and the Post-Knox Unconformity of Middle Tennessee. Ray C. Gilbert, Alan D. Hoagland, and Jerry W. Jones, The New Jersey Zinc Company, Murfreesboro. More than 500 exploration holes drilled by The New Jersey Zinc Company in Middle Tennessee penetrate the unconformity at the top of the Knox and provide abundant information on the Knox paleoaquifer. Pre-Middle Ordovician relief here was about 125 feet based on measurements from key beds in the overlying Murfreesboro Formation and in the Upper Knox. Initial post-Knox depositions (Wells Creek) is a shaly magnesian limestone from 0 to more than 50 feet thick with an arenaceous basal conglomerate. Wells Creek material is thickest in paleotopographic lows and is locally found in cracks as much as 150 feet below the Knox surface.

Paleosinks are evidenced by rubble breccia zones which are found locally just below the unconformity. Although widely spaced holes do not reveal the detailed interconnecting relationships, these zones are part of a complex of breccia-filled dissolution areas which extend to depths in excess of 900 feet below the paleosurface. The paleokarst system has not been delimited, but it occupies a large part of the Central Basin and may have been contiguous with the similar paleokarst system of East Tennessee. In Middle Tennessee as in East Tennessee, the pervasive permeability developed by the Knox paleoquifer was a significant factor in the localization of the zinc deposits.

Hydrologic Investigation of the Middle Tennessee Zinc District. Frederick T. Fischer, Alan D. Hoagland, and C. Ron Sykes, The New Jersey Zinc Company, Murfreesboro. Exploration by New Jersey Zinc in Middle Tennessee has resulted in the discovery of a major zinc deposit in the Knox Dolomite. This flat-lying formation is unconformably overlain by 500 ft. or more of Middle Ordovician limestone and is essentially without outcrop in Middle Tennessee. About 800 ft. of uppermost Knox is a low-yield aquifer which, as is characteristic of carbonate rocks, is composed of an intricate network of water zones, in part a vestige of an extensive paleokarst system. The Middle Ordovician sea reintroduced saline water into the Knox which over much of the Central Basin yields artesian salt water. Present meteoric recharge along the eastern Highland Rim is responsible for the high piezometric surface. To prevent the capture or degradation of surface and potable ground water, New Jersey Zinc cements all exploration drill holes. Pumping capacity for mine drainage, the effect of salinity on mining equipment and underground environmental conditions, all require early evaluation. Although data are not yet sufficient to permit estimates of expected mine water, extensive underground development in the Knox may be expected to yield significant inflow. Over a period of time with continued pumping, gradual freshening of mine water is anticipated.

Magnetic Gravity, and Structural Patterns of a Part of North Central Tennessee and Adjacent Kentucky. Richard G. Stearns and James F. Baxter, Vanderbilt University; John M. Colvin, Jr., J. Fred Landers and Associates; and Robert W. Johnson, Jr., Tennessee Valley Authority. Gravity anomalies typically have a width of about 4 miles and amplitude of 4 to 15 milligals. Magnetic anomalies are 1 to 4 miles wide and up to 15 miles long with amplitudes up to 1,000 gamma and gradients to 500 gamma per mile. The eastern half of the area is characterized by north-trending gravity and magnetic anomalies, with a northeast-trending structural grain; farther west geophysical features trend northeast where the structural grain breaks up. No data are available to assess the relation of surface structure to mineral deposits buried over 1,000 feet, but areas of characteristic structural patterns are related to geophysical pattern areas. Geophysical features probably reflect basement hills or fault blocks which may be related to zinc deposits. A possible, but unlikely, hypothesis is that some anomalies mark Paleozoic mafic intrusions which served as direct metal sources. More likely, they are buried hills or fault blocks and could have been sources of metal, if leached by water. Also, bending and fracturing over these deeper features could have promoted (1) circulation of mineral-bearing water through the ore-bearing Knox Formation and (2) fracturing and brecciation in the Knox where significant volumes of ore minerals could have been deposited. Steep magnetic gradients indicate shallow basement rock, perhaps as close to the land surface as 3,000 feet.

MATHEMATICS SECTION

Math-Biology Building, Room 225

R. P. Savage, *Chairman*

A Convolution Result, M. K. Jain, University of Tennessee at Martin. We have derived the following general convolution result for n integrals:

$$\text{If } {}_0\int^{\infty} \prod_{i=1}^{n} F_i(x\,\alpha_i)\,dx = \phi(\alpha_1,\alpha_2,\ldots\ldots,\alpha_n),$$

$$f_i(p_i) = {}_{-\infty}\int^{\infty} K_i(p_i,x_i)\,F_i(x_i)\,dx_i,$$

$$i=1,2,\ldots,n$$

$$\text{and if } r^{n-1} \prod_{i=1}^{n} K_i(p_i,r\alpha_i) = \Psi(p_1,p_2,\ldots,p_n;\ \alpha_1,\alpha_2,\ldots,\alpha_n)$$

$$\text{is independent of } r \text{ , then}$$

$$\prod_{i=1}^{n} f_i(p_i) = \int_{\theta_1=0}^{\pi} \ldots\ldots\ldots \int_{\theta_{n-2}=0}^{\pi} \int_{\theta_{n-1}=0}^{2\pi}$$

$$\phi(\alpha_1,\alpha_2,\ldots,\alpha_n)\cdot$$

$$\cdot (r^{1-n}J)\ \Psi(p_1,p_2,\ldots\ldots,p_n;\ \alpha_1,\alpha_2,\ldots,\alpha_n) \prod_{i=1}^{n-1} d\theta_i$$

$$\text{where } dj = \left(\prod_{i=1}^{n-j} \operatorname{Sin}\theta_i\right) \operatorname{Cos}\theta_{n-j+1},\ j=2,3,..,n-1,$$

$$\alpha_1 = \prod_{i=1}^{n-1} \operatorname{Sin}\theta_i,$$

$\alpha_n = \operatorname{Cos}\theta_1$ and J is the Jacobian of coordinate transformation $x_i = r\,\alpha_i$, i=1,2,...,n.

The condition of the result is valid for Mellin transform under restricted parameters. A result due to Ramanujan is its particular case. We have not yet probed but it seems possible to obtain similar result for convolution transform of more than one variable defined by the author.

Is Phagocytosis of Carbon an Exponential Process? William Cantrell and E. E. Elko, University of Tennessee Medical Units. When the disappearance of collodial carbon from the blood of rats was measured over a period of more than one half-life, it became evident that the process is not adequately represented by a negative exponential function. During the second and subsequent half-lives removal of carbon accelerated, if the process is regarded as exponential. The form of these curves is the result of two opposite tendencies: the tendency for a constant amount of carbon to be removed per minute, and the tendency for the system to become saturated by the load already removed.

Some Implications of Advanced Placement with Credit. Ralph C. Boles, Tennessee Technological University. Advanced placement with credit implies that a University or College must establish rules and regulations that determine (a) number of credits, (b) grade, (c) time and place of advanced placement examinations and (d) administration policies that give all students an equal opportunity for advanced placement independent of the student's choice of curriculum. The entering freshman student at Tennessee Tech has an opportunity to pursue a course of study requiring a technical sequence of Mathematics courses or a nine-hour non-technical sequence depending on his choice of curriculum. Consider two students equally well prepared in high school mathematics. One may enter a curriculum requiring non-technical mathematics and by passing advanced placement examinations be advanced placed receiving three to nine hours credit toward graduation. The second student entering a curriculum requiring the technical mathematics sequence would be denied any credit toward graduation even if he passed the advanced placement examination. The only difference being the student's choice of curriculum. Logic indicates that if college or university credit is to be awarded based on high school achievement that such credit should be awarded independent of a student's choice of curriculum.

MEDICAL SCIENCES SECTION

Frazier Jelke Science Center, Room 113-West

James S. Bell, *Chairman*

Prevention of Mouse Mammary Tumors by Immunosuppressive Treatment with Actinomycin-D and X-radiation. James M. Mason and B. R. Jennings, University of Tennessee Medical Units. A single immunosuppressive dose of 4 ug actinomycin-D and 100r of x-radiation given to female mice at age 6-8 weeks delayed the appearance of spontaneous mammary tumors for 18 days, whereas five such treatments given weekly effectively suppressed antibody synthesis for at least 40 days and prevented the formation of these tumors. There was a correlation, even when only untreated mice were considered, associating the ability to respond to antigenic stimulation with sheep erythrocytes by production of high titered antisera with animals in which breast tumors later appeared. Mouse IgG has been demonstrated on the tumor cells using immunofluorescence. Five weekly treatments with actinomycin-D and radiation slowed the growth of palpable tumors only to a slight degree and had no effect on the rate of appearance of new tumors in mice already possessing a palpable tumor.

Cardiovascular Serial Literature: Publication Patterns. K. Suzanne Johnson and John M. Ginski, University of Tennessee College of Basic Medical Sciences. In fiscal 1967, 5,860 papers appearing in 789 journals were reported to N.H.I. Excluding abstracts, the number of original journal articles was 4,500. This study reports the attempt of collating the original journal articles under 41 subject categories. Each category represents a specific area of cardiovascular research. Applying the concept of "diminishing returns", the limit of journals in each category was set at 14 and journals containing only 2 papers a year were excluded. So limited, the 41 categories contained 109 journal titles; 88 were covered by *Current Contents* and 96 were indexed by *Index Medicus.* Twelve of those not covered by either service were proceedings. Proceedings were frequently used outlets for transmitting current information but the information in them is virtually irretrievable.

Supported by Training Grant LM-00102 from the National Library of Medicine, U. S. Public Health Service.

A Histological and Histochemical Study of the Dog Zygomatic Salivary Gland. A. G. Berry and M. T. Scott, Meharry Medical College. Zygomatic glands from eight dogs (seven adults and one puppy) were fixed in 10% neutral buffered formalin. Paraffin sections were stained with hematoxylin and eosin, Mallory's aniline blue, toluidine blue and eosin, PAS, Mayer's mucicarmine and Alcian blue. Examination of representative sections revealed that the zygomatic gland in the dog consisted of parenchymal tissue and a supporting tissue network and is divided into lobules by connective tissue septae which coursed through the gland from a thin connective tissue capsule. The acini contained a mucin-positive material and the nuclei of the acinar cells were basally located. Intralobular, interlobular and excretory ducts were observed. Striated ducts were absent. Mast cells were observed within the connective tissue septae and surrounding some of the acini and blood vessels. An area of highly coiled series of ducts, as reported by Shackleford and Klapper (62), was confirmed. Complete development of the gland in the new-born puppy had not occurred. Fully developed acini were mucin-positive.

Concentrations of Natural Lithium in Animal Tissue. John Wittrig and E. J. Anthony, Murfreesboro VA Hospital and Middle Tennessee State University. Concentrations of naturally occurring lithium were measured by atomic absorption spectrophotometry in selected tissues of 26 woodchucks, 30 rabbits

and four cats. Comparisons between smooth and striate muscle concentrations were made in tissues ashed according to standard ashing procedures. Particular attention was paid to the neuroendocrines with the finding of significantly higher amounts of lithium in thyroid, adrenal and pituitary tissue samples of all species. Rubidium, calcium, copper and magnesium were also measured in some samples.

Spectral Analysis of Involuntary Ankle Oscillations in Normal Humans. R. R. Rietz and R. N. Stiles, University of Tennessee Medical Units. Each human subject was seated with the heel of one foot elevated and the leg supported by the ball of the foot. During maintenance of this position, a tremor (mean peak amplitude for 5 subjects: 0.001 g's; 1 g equals 980 cm/sec^2) was detected by an accelerometer taped to the knee. After the heel was raised slightly and then abruptly allowed to fall to its former position, an exponentially damped oscillation occurred lasting 3-5 cycles. After the subject executed this maneuver for an average of 133 times, the induced oscillations no longer damped out but became sustained (ankle clonus) for a number of minutes (mean peak amplitude for 5 subjects: 0.34 g's). Spectral analysis of sixteen-second records by a PDP-12 digital computer showed the main frequency band of the tremor, damped oscillations, and clonus to have an average center frequency (for 5 subjects) of 7.6, 5.8, and 6.1 Hz, respectively.

Research supported in part by Research Grant NS-08692 from The National Institute of Health.

A Study of Rat Liver L-Threonine Dehydratase. H. G. Ghazarian and R. Borchers, The University of Nebraska. Rat Liver biodegradative *L*-threonine dehydratase (*L*-threonine hydrolyase, deaminating: EC-4.21.6) has been purified 55 fold in 30 percent yield by fractionation with ammonium sulfate, chromatography on Sephadex G-200, ion exchange chromatography on DEAE-Sephadex A-50 at pH 8.0, and rechromatography on DEAE-Sephadex A-50 at pH 6.8. Routine inclusion of 30 percent glycerol in all the buffers used throughout the procedures described was found to produce the optimal conditions for prolonged stabilization of the enzyme and for controlled column operations. The enzyme was found to be stereochemically restricted in its catalytic activity to the hydroxy-amino acids *L*-threonine and *L*-serine. The enzyme, however, catalyzed the dehydration of *L*-serine at approximately 23 percent the rate of *L*-threonine dehydration. The amino acids *L*-serine, *D*-serine and *D*-threonine were all inhibitory to *L*-threonine dehydration.

Comparative Serum Protein Analysis of Immune Response of a Guinea Pig and a Rabbit That Have Been Administered with the Same Antigen. Cromwell P. Msuku, Meharry Medical College. The object of experiment was to demonstrate, but the use of a microzone procedre for serum protein analysis, any changes in serum that can be observed and/or calculated in a rabbit and a guinea pig which have been administered with M. bal stored at 37°C (Dead bacterial cells). Lack of an effective dose of the antigen and the smallness of the animal population used were sources of error which can be improved on in future experiments. The results of the experiment were, however, consistent with the results of other experimenters in demonstrating the difference between the guinea pig serum and the rabbit serum.

Conversion of Thiocyanate to Cyanide In Vivo. Jiwhey Chung and John L. Wood, University of Tennessee Medical Units. It has been known for some time that, in the presence of thiocyanate ion, the erythrocyte releases cyanide. A search has been made to identify an enzyme in erythrocytes which might catalyze the reaction. Fractionation of an hemolysate yielded no such enzyme; instead the thiocyanate-oxidizing activity remained in fractions containing hemoglobin. The oxidation of thiocyanate by hydrogen peroxide is catalyzed by hemoglobin which was weak peroxidase activity. The kinetics of the reaction show that oxyhemoglobin is more active than methemoglobin. The products of the oxidation are cyanide and sulfate. Cyanide disappears in the system because it reacts with intermediate products of the oxidation of thiocyanate. Some of the physiological properties of thiocyanate can be explained by its conversion of cyanide by various body peroxidases.

Meperidine Metabolism During Labor And Its Effect On The Infant. J. C. Morrison, W. L. Wiser, W. D. Whybrew, E. T. Bucovaz, and S. A. Fish, The University of Tennessee College of Medicine and the City of Memphis Hospitals. Meperidine has been widely used as an obstetric analgesic agent. Many reports have shown that a high incidence of depressed infants appear, whether premature or full term, when delivery is two to three hours after the administration of meperidine to the mother. Studies in our laboratory indicate that the *in vivo* metabolic pattern of meperidine is closely related with infant depression. Three patterns related to the rate of meperidine metabolism emerged. These metabolic patterns were significant only in those cases in which labor continued for more than 60 minutes after meperidine administration. No infant, whether full terms or premature, showed signs of depression when delivery was during the first hour following the administration of meperidine. The data support the proposal that the most significant factor relating infant depression to meperidine administration is the length of time that the patient is in labor following the injection of the compound.

Adaptive Changes In Enzymic Activities Associated With Oxalate Production In Aspergillus niger. James L. Harrison and W. E. Jefferson, Jr., University of Tennessee Medican Units. *A. niger* produces very little oxalate during growth in submerged cultures but forms this acid in large amounts when transferred to nitrogen-free media containing any of a variety of carbohydrates or intermediates in carbohydrate metabolism. After transfer, there is a period of 6 to 8 hours during which oxalate is formed at a very slow rate although substrate is consumed and $C0_2$ produced. After this lag period, there is a rapid increase in oxalate formation which is not associated with a change in the rate of substrate utilization. Data will be presented which indicate that this adaptive change in metabolism is accomplished through the increased activities of two enzymes, pyruvate carboxylase and oxaloacetate hydrolase.

Effect of Increasing Limb Inertia on Voluntary Motion in Parkinsonian Patients. R. S. Pozos and R. N. Stiles, University of Tennessee Medical Units. Parkinson's disease is characterized primarily by a 4-5 Hz hand tremor or poverty of voluntary movement (bradykinesia, rigidity). Patients with 4-5 Hz tremor were unable to voluntarily extend and flex their hands at slow frequencies of 2-3 Hz. Patients with poverty of voluntary movement, but apparently normal tremor, were able to voluntarily oscillate (extend-flex) their hands for only short periods of time at maximum frequencies of 2-3 Hz. The addition of 500 grams to the hands of patients in both groups allowed each to voluntarily oscillate at low frequencies (2-3Hz) for several minutes. (Motion of the hand was detected by an accelerometer. Wrist extensor and flexor EMG's were simultaneously recorded. Spectral analysis was performed by a PDP-12 computer.) These data suggest that a change in limb inertia of patients in either group dramatically improves their ability to perform voluntary extension-flexions of the hand.

Research supported in part by Research Grants HE-05612 and NS-08692 from the National Institutes of Health.

High-Resolution Column Chromatography of UV-Absorbing Constituents in Normal Body Fluids. Robert L. Jolley, Charles D. Scott, and Norman E. Lee, Oak Ridge National Laboratory. Urine and blood sera from eight normal Caucasian males, ages 29 to 38, were analyzed by a high-resolution UV-analyzer being developed at the Oak Ridge National Laboratory. This machine utilizes strongly basic anion exchange resin to chromatograph physiological fluids, and detects the separated UV-absorbing constituents by continuous colorimetry. The 24-hr composite urine samples contained as many as 93 chromatographic peaks. Excretion rates (mg kg^{-1} day^{-1}) determined for selected major peaks are as follows: pseudouridine, 0.72; N-methyl-2-pyridone-5-carboxamide, 0.14; 7-methylxanthine, 0.25; hypoxanthine, 0.052; 3-methylxanthine, 0.084; 1-methylguanine, 0.036; 7-methylguanine, 0.086; xanthine, 0.053; 1-methylxanthine, 0.25; uric acid, 2.9; orotic acid, 0.048; homovanillic acid, 0.024; phenylacetylglutamine, 2.7; hippuric acid, 2.7; vanilloyl glycine, 0.059; *m*-hydroxyhippuric acid, 0.82. Chromatograms of the blood sera indicated the presence of up to 16 UV-absorbing constituents. Concentrations (mg/100 ml) for the four major peaks are: creatinine, 0.7; uracil, 0.08; hypoxanthine, 0.1; uric acid, 5.0. (Research supported by National Institute of General Medical Sciences and U.S. Atomic Energy Commission).

The Effect of Splenectomy on Mammary Tumorigenesis by 7, 12-Demethylbenzathracene (DMBA) in the Sprague-Dawley Rat. Ruth Owen Marlin and George M. McCormick, The University of Tennessee Medical Units. Recently Huggins and associates demonstrated hormone-dependent mammary adenocarcinomas appeared in female rats following intragastric instillation of either 3-Methylcholanthrene (3-MC) or 7, 12-Dimethylbenzanthracene (DMBA). Such adenocarcinomas are histologically malignant, but seldom metastasize. Kim reported that splenectomy and/or thymectomy of 3-MC fed W/Fu rats induced tumors which metastasized in the primary host, and after transplantation to isologous hosts. The present study was designed to ascertain whether metastatic mammary cancers could be induced by DMBA in Sprague-Dawley female rats following splenectomy. These experiments are incomplete, and metastases have not yet been observed. Preliminary data indicates that splenectomy increases tumor incidence and the mean number of tumors/animal, while decreasing the latent period of tumor induction. (Supported by Grant No. IN-85E from the American Cancer Society.)

Mammary Gland Tumors Produced in Aging Rats by 7-12-Dimethylbenzanthracene (DMBA). George M. McCormick, The University of Tennessee Medical Units. The experiments of Huggins showed that hormone-dependent mammary adenocarcinomas would appear in all female Sprague-Dawley rats fed 20 mg. DMBA at 50 days of age. In the present study, 90-day-old S-D rats were fed 20 mg. DMBA, and observed weekly for mammary tumors. At autopsy (365 days of age) all rats were found to have mammary adenocarcinomas of varying histologic types. Also found were several fibroadenomas; nodular masses of sclerosing adenosis; intraductal hyperplasia, papillomatosis and intraductal carcinoma, and numerous mixed tumors composed of any and all arrangements of all the preceding. Such rats exhibited breast lesions which were more analagous to human breast lesions, in which a number of varying histologic patterns may be found within a single mammary gland. (Supported by Project No. 208 of the Jane Coffin Childs Memorial Fund for Medical Research.)

Rat Pituitary Autografts Stimulated by Porcine Hypothalamic Extract. J. S. Evans, University of Tennessee Medical Units. The influence of hypothalamic extract on the cytology and secretory activity of rat pituitary autografts was assessed by infusing them continuously in the local vascular supply for 14 or 28 days. This treatment induced the appearance of large PAS+ cells in the grafts, the ovaries contained large follicles, uterine weight was increased and vaginal smears changed from a diestrous to a cornified type. The height of the thyroid epithelium was significantly higher than in other treatment groups. These changes were not observed in animals bearing pituitary grafts infused with other materials (extracts of cerebral cortex, vasopressin and oxytocin)or in hypophysectomized animals infused intravenously with hypothalamic extract. These results suggest that the hypothalamus contains specific neurosecretory materials (distinct from vasopressin and oxytocin) which not only release hormones from the anterior pituitary gland, but stimulate their synthesis and this stimulation is reflected in cytological changes.

PHYSICS-ASTRONOMY SECTION

FRAZIER JELKE SCIENCE CENTER, ROOM 145-WEST

L. B. O'KELLY, *Chairman*

An Advanced Lidar System For Aerosol Analysis. Vernon D. Brown, Memphis State University. A description of the development of a more complete lidar atmospheric probing system than any developed to date is given. The system will consist of a truly monostatic lidar receiver as well as a bistatic receiver. The uniqueness of the monostatic system will permit the following:

(a) Low level measurements

(b) True backscattering signal measurements

(c) Fairly accurate measurements of the indicent laser power on a given air sampling volume, with the sampling volume normally selected being 100 ft. thick. This can provide the most accurate information to date on the light that is backscattered from a sampling volume.

The truly monostatic system is made possible through the implementation of a pulsed photomultiplier technique that provides near nanosecond switching of the photomultiplier. The bistatic system will provide one with the ability to make measurements of the degree of polarization and the ellipticity of the angularly scattered light. These measurements will provide basic information about the aerosol distributions for the selected scattering volume.

The Separated Stable Isotope and Radioisotope Programs at Oak Ridge National Laboratory. L. O. Love, L. T. Newman, W. A. Bell, W. K. Prater and G. M. Banic, Oak Ridge National Laboratory. The Isotopes Division of the Oak Ridge National Laboratory provides isotopes separated by the electromagnetic method, radioisotopes made by neutron irradiation from reactors or by proton irradiation in the ORNL 86-Inch Cyclotron, and isotopes both radioactive and stable recovered from fiission products. These unique materials are made available through sales and approved AEC loans in forms suitable for use in various physical research and medical programs to both U.S. and foreign customers. An Isotopes Division Information Center keeps track of the uses, properties and availability of isotopes and published a journal, "Isotopes and Radiation Technology", devoted to papers of interest in this field. The growth in the use of both stable and radioisotopes as diagnostic tools in biology and medicine and their use in power sources and basic research are some of the gratifying results of the work.

Interaction of Neutrons with Organic Scintillators. D. J. Corbett and D. W. Jones, Memphis State University. For many years organic scintillators have been used in neutron spectroscopy depends primarily upon elastic scattering collisions between the incident neutrons and the protons in the scintillator. A continuous distribution of recoil protons is produced in these scattering collisions. After the non-linear energy response of the scintillator has been taken into account, the recoil proton pulse height spectrum collected in a pulse height analyzer can be differentiated to obtain the energy spectrum of the incident neutrons. Certain perturbations are, however, produced in the recoil proton energy spectrum by secondary reactions. These preturbations serve to complicate the analysis of the recoil proton energy spectrum. The secondary reactions consists of (1) second scattering collisions between neutrons and protons, (2) loss of recoil protons through the end of the scintillator, (3) elastic and inelastic neutron scattering collisions with carbon atoms of the scintillator, and (4) (n, α) reactions with carbon atoms. The effect or these perturbations has been calculated using the Sigma-5 computer at Memphis State University and will be discussed in detail in this paper. Methods will also be suggested for removing the effect of these perturbations from the recoil proton energy spectrum.

Some Experiments to Introduce the Physics Student to the Oscilloscope. Lewis B. O'Kelly, Memphis State University. All physics students at Memphis State are given instruction in the use of the oscilloscope as part of their laboratory work. Some examples of its use in both elementary and advanced labs is given.

Vacuum Spark Phenomenon. Michael M. Rodgers, Memphis State University. The emitted radiation verus time (with nanosecond resolution) from a transient plasma has been observed in both the visible and the ultraviolet regions. A d c vacuum spark breakdown produced these plasmas, while a special pulsed photomultiplier system and Tektronix 519 oscilloscope equipped with a camera recorded the radiation intensity verus time. Two different elements, copper and aluminum were used as electrode materials with a comparison of their emitted radiation being made for the time period ranging from 40 to 120 nanoseconds after breakdown. The pulsed photomultiplier system was employed to increase the tube's gain factor by a few orders of magnitude.

ZOOLOGY SECTION I

FRAZIER JELKE SCIENCE CENTER, ROOM B

J. T. DARLINGTON, *Chairman*

Some Effects of Calcium Cyclamate on the Morphology and Microflora of the Adult Male Rat Intestine. John M. Mallette and Hattie Phillips, Tennessee State University. The purpose of the present study was to determine the effects of orally administered calcium cyclamate on the morphology and microflora of the adult male rat intestine. Eighteen male rats were used in this experiment, three of which served as controls. The experimental animals were given dosages of calcium cyclamate in their drinking water. The controls were given tap water. The experimental animals exhibited lower fecal bacterial counts and a greater tendency towards bleeding than did the controls. Histological examination of the cecum and ascending colon showed little positive indication of microanatomical changes due to the drug. The increase in coagulation time noted in the experimental animals coupled with the lessening in number of intestinal bacteria might indicate that the number of Vitamin K producing organisms was being lowered by the intake of calcium cyclamate causing a deficiency of the blood clotting factor Prothrombin.

Some Effects of Monosodium Glutamate on Developing Chick Embryos. John M. Mallette and Henri Etta Baltimore, Tennessee State University. Since monosodium glutamate has been suspected in causing abnormalities in newborn mice, this study attempts to reveal that there might be a possibility of malformations in the chick embryo from the beginning of development when exposed to the drug. Two criteria for determining embryonic response to monosodium glutamate were employed. They were: (1) mortality rates (2) types and incidences of malformations of the experimental embryos as compared to the controls. Six hundred fertile eggs were used in this experiment. Four hundred and twenty eggs were experimentals and the remaining one hundred and eighty were controls. The abnormalities observed in the experimentals were; (1) exposed viscera, (2) absence of eyelids, (3) failure of the brain to develop, (4) distended liver. These malformations were found in 55.7% of the experimentals, 1.5% of the uninjected controls and 0.2% of the controls injected with water.

Some Effects of Amphetamines on Developing Avian and Rodent Embryos. John M. Mallette, Jimmie Walls III and Dorothy J. Taylor, Tennessee State University. The purpose of this study was to show some possible effects of amphetamines when injected into fertile chick eggs as well as pregnant rats before the differentiation of tissues into organs. Amphetamine sulfate, as well as metamphetamine hydrochloride were obtained by prescription from a Nashville Apothecary. A total of six hundred fertile eggs and twenty pregnant rats were used in this study. Of these 500 eggs were used as experimentals and the remaining 100 used as controls. Sixteen rats were used as experimentals and four were used as controls. The major abnormalities found in both experimental groups were, (1) enlarged cerebral hemispheres, (2) brain hemorrhages, (3) enlarged hearts, (4) limb deformaties. None of these abnormalities were seen in the controls.

Comments on the Validity of the Crotalid Genera Trimeresurus and Bothrops. H. R. Brock, Jr., Ragsdale Science Center, Atlanta Zoo. The recent history of herpetology has experienced several attempts to combine the snakes of the crotalid genera *Trimeresurus* and *Bothrops* into one genus on the basis of their obvious similarities. Maslin (1942) explored differences in the cranial osteology of the two as possible evidence for their separation. The work of Maslin is reviewed and examples of each genus are shown that represent various similarities and differences which could be used for separation of the two genera.

Little Debbie Insults Her Environment. R. G. Litchford, C. Coppert, D. Cress, J. Elmore, T. Prestwood, W. M. Riddle, M. S. Stanley, & A. Zielke, The University of Tennessee at Chattanooga. A historical resumé ofserious stream pollution as a result of baking processes will be given. Photographs of the treatment facilities will be presented.

Radioisotope Tagging and Tracing Techniques in Ethological Research. Michael J. Harvey, Memphis State University. The use of radioisotopes to tag individual animals so they can be relocated with the aid of a radiation detecting device is a useful tool for studying various aspects of the behavior of small animals in the field. Thus far this technique has been used primarily in students of movements, home range, and activity patterns. Cobalt-60 (half-life 5.3 years) and Tantalum-182 (half-life 115 days), both strong gamma emitters, have been used most frequently for this purpose. Both are available in the form of minute pieces of wire which can be attached externally to an animal by various methods or injected subcutaneously with a hypodermic needle and plunger apparatus. A tag with an activity of less than 100 microcuries is adequate for most purposes. A 100 microcurie tag is approximately 2-5 mm long and less than 1 mm in diameter.

The Parasitic Reduction of Initial Progeny of Female Tribolium confusum by Hymenolepis microstoma. A. L. Hammond, A. W. Jones, R. A. Prudhon and B. D. Tan, University of Tennessee, Knoxville. Fifty 4 mm. larvae of *Tribolium confusum* were infected with *Hymenolepis microstoma*, paired with uninfected mates and placed on an enriched diet of whole wheat flour and 5% yeast at 28-29° and 55 R.H. Fifty controls were placed on the same diet and fifty on an unenriched diet of white flour. The adults were separated from their progeny on the 25th day and the number of pupae and imagoes counted on the 40th day. (An additional count was made on the unenriched controls on the 50th day.) Infected females produced significantly fewer initial progeny at the 40 day level than the infected males. The controls on the enriched flour produced significantly more progeny than the controls on the unenriched flour. The parasites may have caused a depletion in nutritional reserves of both sexes which decreased fecundity more in females than males, presumably because nutritional reserves are more critical for reproduction in females than in males.

Is Extensive Preinfection Starvation of the Host Unnecessary in Tribolium - Hymenolepis (flour beetle - tapeworm) experiments? E. W. Fuson and A. W. Jones, University of Tennessee, Knoxville. In order to determine how best to infect flour beetles with larval tapeworms, we compared duration of starvation with duration of feeding of beetle larvae as to rate and degree of infection. Beetles pre-starved for 24 hours and exposed to randomly spread tapeworm eggs acquired parasites at a steady rate over a period of from 2 to 64 hours. Beetles starved for from 0 to 64 hours before feeding and allowed to feed for 24 hours thereafter acquired equal numbers of parasites, irrespective of the starvation period. Thus it appears that *Tribolium* larvae feed on cestode eggs with the same voracity regardless of the duration of preinfection starving. Forty-eight or more hours of starvation, commonly observed by experimentalists using tapeworms, may not be necessary to insure adequate infection levels.

Effects of Hymenolepis microstoma Infections on Two Genetic Strains of Tribolium castaneum. S. P. Dunkley, A. W. Jones and R. A. Prudhon, University of Tennessee, Knoxville. Fifty adult "small type" *Tribolium castaneum* (from the Population Genetics Institute, Purdue University) and 50 adult *T. castaneum*, "wild type", were starved for 24 hours and exposed to approximately 780 *Hymenolepis microstoma* eggs per beetle. Fifty adult *T. confusum* were treated in the same manner and used as a control. The beetles were allowed to feed on the tapeworm eggs for 24 hours and then were placed in flour. After 10 days the beetles were examined for tapeworm cysticercoids. Forty-nine of the 50 *T. castaneum* small type were dead and contained no identifiable cysticercoids. The one surviving *T. castaneum* small type contained 5 cysticercoids. The *T. castaneum* wild type had an average of 13.5 cysticercoids per beetle. The control *T. confusum* had an average of 2.9 cysticercoids per beetle. The death of the *T. castaneum* small type indicates that size of the host may be a factor in the effect of the parasite.

Cytological Analysis of Cold-Induced Mitotic Blockage in Grasshopper Neuroblasts. Marshall E. Reese, Jr., Ralph E. Stephens, and J. Gordon Carlson, The University of Tennessee at Knoxville. Studies by M. E. Gaulden have shown that embryos of *Chortophaga viridifasciata* (DeGeer) kept at 11°C show no development over a period of several months. Experiments were designed to study the effect of this temperature on mitosis. After 13 days development at 26°C, embryos were placed in a refrigerator at 11°C. At 4-day intervals three embryos were removed and the mitotic stage of each visible neuroblast in three segments was determined in hanging-drop cultures. After 40 days exposure to 11°C, over 99% of the cells were found to be in interphase, as identified by nuclear morphology. The per cent of cells in telophase and in midmitosis (prometaphase, metaphase, and anaphase) decreased steadily and reached zero after 16 and 20 days, respectively and all prophase stages except very early prophase after 40 days. These results may be due to (1) differential temperature sensitivities of the various mitotic stages and (2) prophase reversion.

This study was supported in part by Atomic Energy Commission Contract AT-(40-1)-2575.

ZOOLOGY SECTION II

FRAZIER JELKE, SCIENCE CENTER, ROOM C

R. L. AMY, *Chairman*

Patterns of Sex Difference in Recombination Frequency in the Mouse. W. St. Amand, University of Mississippi. A review of genetic linkage data in the mouse suggests that sex differences in recombination, which may be in either direction, are constant in sense in any particular linkage group. In linkage group XIV, which shows more recombination in females than in males, analysis of data for eight gene pairs provides evidence that sex difference is regularly distributed over long segments. It is therefore unlikely that sex differences can be explained on the basis of localized chromosomal condensation as has been proposed and suggests rather that the chromosome as a whole is the operative unit.

Horseflies and Deerflies: Friends or Foes? James T. Goodwin, Memphis State University. Horseflies and deerflies are listed as important pest forms as a result of the blood-feeding habits of the females and the fact that these females have been implicated in the transmission of numerous diseases. Considerable economic loss is associated with control and preventative programs operated against these flies. The research studies which have led to the present categorizing of these flies as pests is reviewed and is followed by the presentation of recent observations and generalizations that give strong indications that the active larval stages of tabanids may be very beneficial.

Fetal Hemoglobin Variants in Small Rodents. R. R. Tanner and C. J. Biggers, Memphis State University. Hemoglobin samples of golden hamster, C-57, Balb-C, C-3H, A-2G, DUB/ICR, *Peromyscus polionotus*, and *P. leucopus* were subjected to cellulose acetate strip and vertical polyacrylamide gel electrophoresis and stained for hemoglobin. Samples of fetal, newborn, and adult hemoglobins were compared. The existence of C-3H fetal hemoglobins was verified. *P. leucopus* appeared to have a fetal hemoglobin consisting of a single band which migrated more slowly than the adult hemoglobin. All other species showed no variation from the adult.

Cage Culture of Channel Catfish, Ictalurus punctatus, in Herb Parson's Lake, Fayette County, Tennessee. Padge Beasley, Jr. and Bill A. Simco, Memphis State University. Methods of intensive culture of channel catfish in the United States have significantly improved since 1960. Culturing of channel catfish in floating cages has been investigated primarily within the last five years. In the summer of 1970 a cooperative cage culture project was initiated involving Memphis State University, The Tennessee Game and Fish Commission and the Bureau of Sport Fisheries and Wildlife, Stuttgart, Arkansas. Approximately 6000 channel catfish fingerlings were stocked at various densities in eight floating cages (1.8 m², National Pressed Steel, Memphis) at Herb Parson's Lake, Fayette County, Tennessee. Fish were fed a commercial floating fish pellet at a rate of 3% of their body weight per day. Fish were harvested in late October 1970. Observations on feeding behavior, feed efficiency, cage design, disease, body composition of harvested fish, and other aspects of cage culture are discussed.

Diurnal and Seasonal Variations in Blood Chloride Concentrations in Channel Catfish, Ictalurus punctatus. Kenneth B. Davis and Bill A. Simco, Memphis State University. Measurements of diurnal rhythms are often reported as a function of the photoperiod under which the test animals were held. Many studies, particularly of laboratory animals, indicate a rather constant phase relationship between the rhythm and the photoperiod. Recent studies have shown that diurnal rhythms of pituitary prolactin, blood corticosterone, and blood sodium and potassium in white-throated sparrows exhibit seasonal phase-shifts. This study was designed to measure diurnal variation in the blood chloride concentrations in different seasons. Channel catfish were held on natural photoperiods in indoor concrete raceways at the Fish Farming Experiment Station in Stuttgart, Arkansas. Blood samples from the caudal vein were taken every six hours beginning at sunrise on September 19, October 23 and February 26. Blood chloride concentrations were determined from 50 ul of plasma with a Buchler-Cotlove Automatic Chloride Titrator. The results may help explain seasonal physiological changes which are due to seasonal phase-shifts of endogenous rhythms with respect to the photoperiod.

Tissue Composition of Channel Catfish Fed Diets Containing Three Levels of Protein. Bill A. Simco and Kenneth B. Davis, Memphis State University, and W. H. Hastings, Bureau of Sport Fisheries and Wildlife. Fifty channel catfish were stocked in 18 ten-ft diameter pools for a period of approximately three months in the summer of 1970. Triplicate tests were run using feeds containing 20, 30 and 40 per cent protein fed at the rates of 2, 3, and 4 per cent body weight per day. On termination of the experiment fish were sacrificed from each test group. Entire carcases were weighed, dryed in a vacuum oven and the fat determined by soxhlet extraction with petroleum ether. The fat free dry residue was ashed and the total protein was estimated by total nitrogen determination by the Kjeldahl method. The results of these analyses and their significance to the gain made on each test diet are discussed.

Feeding and Activity of the Pirateperch, Aphredoderus sayanus. Nick C. Parker, Memphis State University. In an attempt to learn something of the pirateperch's activities and life cycle a total of fourteen fish have been observed in aquaria over a two year period. The greatest number of fish held at any one time has been four. Fish were laboriously collected from heavy vegetation or other cover in still or gently flowing waters. Visual observations were made in aquaria, with some aquaria being surrounded by cardboard shields containing observation windows. In a shielded aquarium the photoperiod was kept natural by use of photoelectric relay light controls. Nocturnal observations were made under a red light. Only live food was taken and ranged from mosquito larvae and amphipods to meal worms and earthworms. Activity of fish in an aquarium was recorded by use of photoelectric relay units. Activity patterns were circadion in nature and responded to not only light/dark but also to varying wavelengths. Vertical movements were studied by employing four photo-electric relay units at various depths (top, bottom, and two intermediate) registering activity simultaneously on a four track recorder. Pirateperch were active primarily at night and on the bottom.

Cytological Analysis of Cold-Induced Mitotic Blockage in Grasshopper Neuroblasts. Marshall E. Reese, Jr. Ralph E. Stephens, and J. Gordon Carlson, The University of Tennessee at Knoxville. Studies by M.E. Gaulden have shown that embryos of *Chortophaga viridifasciata* (DeGeer) kept at 11°C show no development over a period of several months. Experiments were designed to study the effect of this temperature on mitosis. After 13 days development at 26°C, embryos were placed in a refrigerator at 11°C. At 4-day intervals three embryos were removed and the mitotic stage of each visible neuroblast in three segments was determined in hanging-drop cultures. After 40 days exposure to 11°C, over 99% of the cells were found to be in interphase, as identified by nuclear morphology. The per cent of cells in telophase and in midmitosis, prometaphase, metaphase, and anaphase) decreased steadily and reached zero after 16 and 20 days, respectively and all prophase stages ex-

cept very early prophase after 40 days. These results may be due to (1) differential temperature sensitivities of the various mitotic stages and (2) prophase reversion. (This study was supported in part by Atomic Energy Commission Contract AT-(40-1)-2575).

The Fecundity of Mosquito Fish in Four East Tennessee Ponds. C. W. Holland, Middle Tennessee State University. Collections of *Gambusia affinis affinis* (Baird and Girard) were made during the spring and summer of 1969 from four sites in the Knoxville area. Total length, time of capture and fecundity were recorded for 1107 pregnant female mosquito fish. There was a positive and highly significant relationship between fecundity and total length. In general, the greatest fecundity per unit length increase occurred in late spring and early summer and the highest mean fecundity was in middle and late spring.

An Ultraviolet Microbeam Study of the Developing Habrobracon Embryo. Robert L. Amy, Southwestern At Memphis. Eggs of virgin specimens of the ectroparasitic wasp *Habrobracon juglandis* were exposed to a 50-μ UV microbeam (2570 Å; 2.1^{-8} ergs/μ^2/sec) in an effort to determine the relative sensitivity of the developing embryo to such treatment. For purposes of study, the embryos were marked off into 60-μ segments (numbered 1 to 10 from anterior to posterior) and irradiated on their ventral, lateral or dorsal surfaces on segments 1, 3, 5, 7 and 10. Subsequent observations were made to determine the numbers of embryos hatching following irradiation at each of these sites, with the lowest hatchability percentages being interpreted as an indication of the highest sensitivities. At 2, 3 and 23 hours of age, embryos irradiated on segment 7 showed the greatest sensitivity (hatchabilities ranged from 1 to 2%; at 7 and 12 hours segment 5 proved most sensitive (0 to 4%). The most resistant sites were located on segment 10 (62 to 98%) except for the 23-hour embryo which was most resistant on segment 1 (81%). No consistent pattern of surface sensitivity was discernible. Developmental events occurring in the embryo at each of the irradiation sites are considered in attempting to account for the observed hatchability differences.

COLLEGIATE DIVISION

SATURDAY, NOVEMBER 21, 9:00 AM

FRAZIER JELKE SCIENCE CENTER, ROOM C

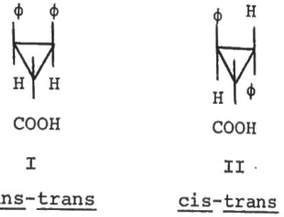
R. J. RARIDON, *Chairman*

Preliminary Comparison of Trematode Population in Lepomis cynellus from Clean and Polluted Water. Walter R. Walton and Myrtle M. Fleming, Lee College. *Lepomis cynellus* were examined from small fresh water ponds and fish hatchery tanks for a monogenetic trematode *Cleidodiscus sp.* The rate of infection was higher in fish from confined hatchery tanks than those found in ponds. Two groups of *Lepomis cynellus* were moved to the laboratory for controlled clean and polluted water studies. Group number I was maintained in clean water and changed daily; group II remained untouched throughout the observation. The average number of *Cleidodiscus sp.* found in the gills of *Lepomis cynellus* contained in the polluted water increased at a rapid rate, while trematodes in the clean water group reached what seemed to be a peak of infection and remained close to that number per fish throughout the study.

Electrophilic Aromatic Nitnation of Certain Benzene Derivatives with Sulfur Containing Substituents. Richard W. Miller and H. M. Gilow, Southwestern at Memphis. It was of interest to investigate the nitration of C_6H_5X (where X = SO_2CH_3, SO_2CF_3, $SOCF_3$, and SCF_3) in order to get a better understanding of the electronic interaction of these substituents and the aromatic ring in electrophilic aromatic nitration. The starting materials were synthesized according to published procedures. Nitration of $C_6H_5SO_2CH_3$ and $C_6H_5SO_2CF_3$ in concentrated sulfuric acid results primarily in *meta*-substitution but some *ortho* and *para*-substitution is also observed. The more reactive systems, $C_6H_5SOCF_3$ and $C_6H_5SCF_3$, result in more *ortho* and *para* and less *meta*-substitution as expected. Nitration of $C_6H_5SO_2CH_3$ and $C_6H_5SO_2CF_3$ in concentrated sulfuric acid were found to follow second order kinetics. Partial rate ractors were calculated. Results indicate that the substituent groups, SO_2CH_3 and SO_2CF_3, effect the aromatic nucleus due to their strong inductive electron withdrawal, and/or field effect and considerable π(p-d) overlap. The SCF_3 substituent seems to have considerable π(p-p overlap. The $SOCF_3$ substituent may have π(p-p) overlap, some π(p-d) overlap, as well as some inductive electron withdrawal.

Dimethylsulfoxide as a Transport Medium of Radioiodine in the Parasitic Wasp Embryo. Stephen Paul Busby, Southwestern at Memphis. The object of this study was to investigate the use of dimethylsulfoxide (DMSO) as a transport medium of radioiodine into the eggs of *Bracon hebetor*. Haploid eggs at the 22-hour stage of development (at 23°C.) were immersed for one hour in solutions of I^{131} or I^{125}, containing concentrations of DMSO varying from 5% to 25%. The eggs were then washed and their chorions were punctured to facilitate penetration of histological reagents. After fixation, sagittal sections were cut and autoradiograms prepared by the liquid emulsion (Kodak NTB_3) dipping method. DMSO proved to be suitable as a carrier of the tracer through the relatively impermeable chorionic membrane; a 10% solution provided optimal transporting capability. No specific incorporation of radioiodine into embryonic structures was observable due to the masking effect of the free pool of tracer present. (This work was supported by a grant (GY-7522) from the National Science Foundation (Undergraduate Research Participation Program).

Cyclopropanecarboxylic Acids. Paul T. Cullum and John C. Craig, Jr., David Lipscomb College. The anisotropy of the benzene ring has been known for some time. Compounds such as the 2, 3-diphenylcyclopropane-1-carboxylic acids.



(I=trans-trans and II=cis-trans) are particularly interesting because they provide a structural mechanism whereby the NMR chemical shift variations of the acidic hydrogen may be studied. In acid (II) the acid proton may be in the face the cis phenyl ring and thereby experience a diamagnetic shift. In acid (I) the acid proton would be expected to have a chemical shift typical of carboxylic acids. The chemical shift of isomer I was -1.25_τ. The data give the anticipated results, i.e. an up field shift of 0.89_τ for the *cis-trans* isomer. A temperature study showed no significant difference in the rate of change of the chemical shifts of each isomer. (see table).

TABLE

Temperature Study of Shift of Acid Proton of 2, 3-Diphenlycyclopropanecarboxylic Acids

Isomer	T	τOH
trans-trans	46°	−1.25
	51°	−1.16
	63°	−1.08
	70°	−1.04
cis-trans	43°	−0.36
	62°	−0.04
	72°	0.04

A Comparison of X-Ray and UV Sensivities in The Habrobracon Embryo. Reuben Ry Tipton III, Southwestern at Memphis. Haploid embryos of the parasitic wasp *Bracon hebetor (Habrobracon juglandis)* were subjected to ionizing radiation at

3, 8, and 15 hours of age. A minimum of 250 eggs were subjected to X-rays (140 KVP) at each age tested, an equal number of embryos served as controls. Resulting data were plotted on semi-logarithmic paper, according to the dosage used and number of embryos observed hatching. The plots were interpreted in terms of the classic "target theory" of inactivation and the appropriate LD_{50} were determined. At three hours exponential plot results, suggesting single-hit killing; however, at 8 and 15 hours the plots were sigmoidal suggesting that many hits are required for inactivation. These plots are identical, either being exponential or sigmoidal, to those shown in a similar ultraviolet study. The relative sensitivities are very similar at 3 and 8 hours for both types of radiation, but differ greatly at 15 hours of age. My results confirmed Kelly's ('50) LD_5s for X-ray inactivation at 3 and 15 hours but were significantly different at 8 hours.

Kelly, E. M. 1950. Effects of X-rays on eggs and differential susceptibility of haploid and diploid prepupae and pupae of *Habrobracon juglandis* (Ashmead). Unpublished thesis, University of Delaware, 22 pp. This work was supported by a grant (GY-7522) from the National Science Foundation (Undergraduate Research Participation Program).

Effects of DDT on the Growth Rate of Chlamydomonas eugametos and C. reinhardii. Allen Warner Phelps Jr., Southwestern at Memphis. *Chlamydomonas eugametos* and *C. reinhardii* were grown in liquid media containing various levels of DDT. Ethanol was used as a carrier because of the low solubility of DDT in water. Accordingly, an ethanol control was carried along with the normal control. The experiments were concluded when the first cultures approached maximum density (approx. 1 x 10^6 cells/ml). At this time, samples were plated in order to determine the viable cell count for each level of DDT. The data were analyzed by an analysis of variance. The results indicate that low levels of DDT may have a stimulatory effect on both species. This work was supported by a grant (GY-7522) from the National Science Foundation (Undergraduate Research Participation Program).

Correlation of Rates of Benzylic Bromination with Reactivity Indices. R. Roark, Southwestern At Memphis. Measurements are being made of the rates of bromination of arylmethanese relative to toluene. The current brominating agent is bromine, and other agents are being considered for the future. Several parameters that may be interpreted as reactivity indices have been calculated for the parent hydrocarbons and the corresponding radicals, using both Huckel—and SCF—MO methods. Attempts will be made to correlate the experimentally measured relative rates of bromination with some of these parameters, even though perfect correlation for any one parameter is not expected. The results of these convulations will be applied to an explanation of the reaction mechanism — in particular, the electronic structure of the transition state.

SCIENCE-MATHEMATICS TEACHERS SECTION

SATURDAY, NOVEMBER 21, 9:00 AM

FRAZIER JELKE SCIENCE CENTER, ROOM B

BETTY GURLEY, *Chairman*

Science Teacher Education for the 1970's. Bernard W. Benson, University of Tennessee at Chattanooga. A prospectus of the new *Guidelines for the Preparation of Secondary School Teachers of Science and Mathematics* was presented with the permission of David H. Ost. Coordinator, AAAS Teacher Education Project. This document, presently in preliminary form, will be available thru AAAS in 1971. It is intended to give direction to preservice education programs and to serve as a basis for evaluating existing programs. State academies of science are encouraged to consider the report and determine appropriate steps for implementation including a) endorsement by the group; b) aid to teacher education institutions and state education agencies; and c) development of performance objectives in mathematics and science and in education.

Innovations in Science Teaching. Ray A. Palmer, Jackson State Community College. A brief description of the Audio-Tutorial System of Teaching biology was presented. This "Systems approach" allows the student to progress at his own convenience and rate and allows much more student-instructor interaction than a conventional system of teaching biology. Statistics were presented to substantiate the success of the program at Jackson State. The success of any such systems approach to learning is largely dependent upon a faculty who are in accord with the philosophy of such approaches to learning and who are willing to strive to make such approaches succeed.

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TERTIARY AND QUATERNARY STRATIGRAPHY IN HENRY AND NORTHERN CARROLL COUNTIES, TENNESSEE*

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ABSTRACT

In Henry and northern Carroll Counties, Tennessee, the Tertiary bedrock formations are covered extensively by a thick mantle of Tertiary (?) and Quaternary surficial deposits. Consequently, the bedrock formations are poorly exposed, and lithologic and stratigraphic relationships are not clearly understood. The Tertiary sediments make up the Clayton, Porters Creek, Wilcox and Claiborne Formations. The Clayton Formation is a nearshore marine sand and clay that cannot be mapped separately from the underlying McNairy Sand (of Cretaceous age) because of lithologic similarities and inadequate outcrops. The Wilcox and Claiborne Formations consist of nonmarine and nearshore marine sand, silt and clay that, in large part, lack distinguishing characteristics. However, these formations can be subdivided on the basis of gross lithologic differences and stratigraphic position. The Porters Creek Clay, which separates the underlying Clayton from the overlying Wilcox and Claiborne, is the only distinctive unit. It consists of a thick body of deeper water marine clay and sand. The Tertiary (?) and Quaternary surficial deposits make up the high-level fluvial deposits and the present flood-plain alluvium.

INTRODUCTION

The present report is a byproduct of a geologic quadrangle mapping project of the U. S. Geological

*Publication authorized by the Director, U. S. Geological Survey.